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Non-Communicable Diseases in India

Celebrating 101 Years

Bridging the thought divide

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Foreword

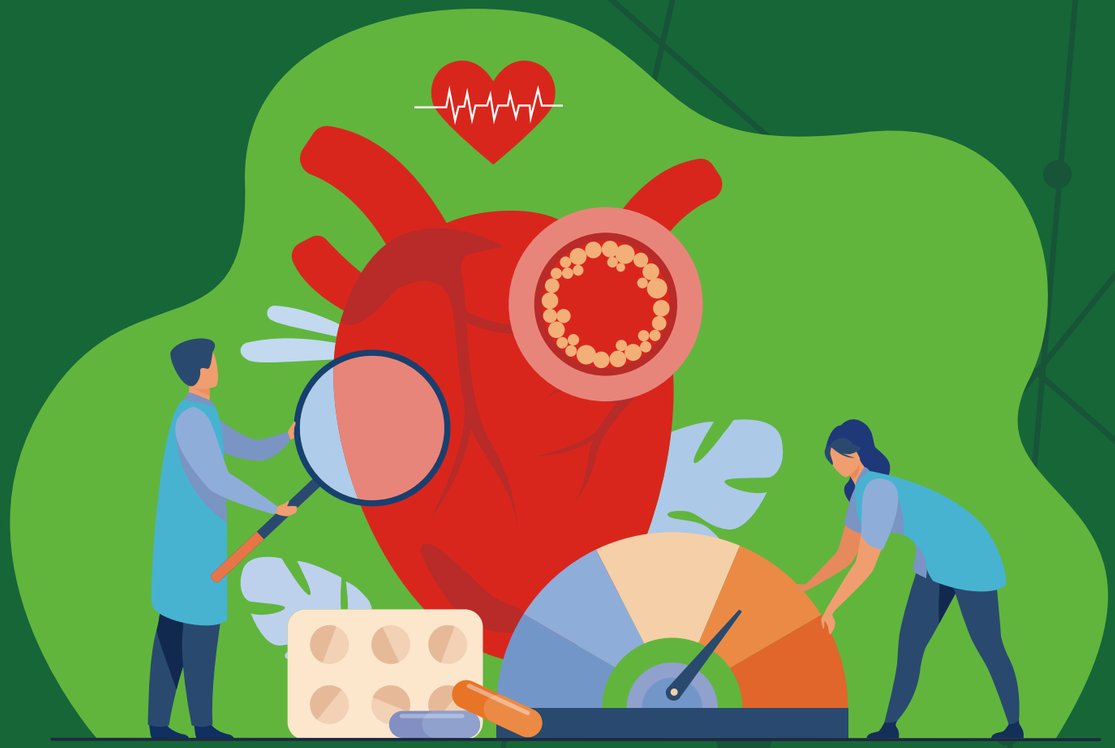
Non-communicable diseases (NCD) account for a significant burden of disease in the world, with a higher mortality burden in developing countries. This detailed study on NCDs in India gives many highly relevant insights for policymakers, medical professionals, and all concerned citizens. This study is unique because it delves into NCD analysis at the state level, giving greater nuance to the findings and an opportunity to tailor responses more suited to local conditions than it would be possible at the national level.

One statistic that stands out—also confirmed by WHO—is the relationship between premature NCD mortality and country income levels—85% of premature adult NCD deaths occur in low and middle-income countries.

Another alarming statistic reported by this study is that 2/3rd individuals suffering from NCDs are in the most productive age group of 26 to 59 years. Sedentary lives, stressful work, and unhealthy diets are primarily responsible for this group's spike in NCDs. With the pandemic-induced work-from-home and job losses, these factors may end up causing even more damage.

This has grave implications of economic costs for the country, not only because of mortality and years of healthy lives lost but also because of India's health infrastructure. India needs to significantly increase health expenditure across the spectrum, including medical education, health infrastructure, pharmaceutical research and enrolling all citizens in health schemes.

Vineet Agarwal
President
ASSOCHAM



Introduction

The subject of health and well-being, while always crucial, has taken centre-stage due to COVID-19. The pandemic has brought medical terms like 'co-morbidity' or 'underlying causes' into mainstream discussions. NCDs have thus been thrust into greater national consciousness along with an understanding of health implications of having 'lifestyle diseases' or NCDs. Further, the large-scale internal migration witnessed during and after lock-down showed us the vulnerability of large numbers of citizens and an acknowledgement that NCDs cut across social and income levels to affect the whole population in various ways.

Along with millions of internal migrants, India traverses its journey to economic prosperity and in the process, as lifestyles change rapidly, citizens are exposed to several NCDs that they are ill-equipped to combat. Among other interventions required, this calls for overhaul and upgrades the country's entire health infrastructure. This study attempts to understand the prevalence of NCDs and social profile of suffering households, to better understand risk factors and identify preventive, curative and awareness measures to reduce this burden.

Good health cannot be taken for granted, and each of us has a role to play in ensuring the country's collective good health. The government has taken several measures to combat the coronavirus pandemic across the health sector spectrum. It is imperative to sustain this momentum even beyond the pandemic and work toward bringing down the curve of rising NCDs in India.

Deepak Sood
Secretary General
ASSOCHAM

“Good health cannot be taken for granted, and each of us has a role to play in ensuring the country's collective good health.”

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The landscape

The burden of the Non-Communicable Diseases (NCD) in India with a population of the over 1.3 billion is huge. NCDs in India contributed to 6.3 million deaths in 2017, which is about 15.3 percent of overall global deaths due to NCDs.

Though affliction of NCD progresses with age the risk of the disease burden creates a clear and present danger to the demographics of India which is young and becoming upwardly mobile due to their increasingly sedentary lifestyle, changing pattern of dietary choices and rapid urbanisation.

Non-Communicable Diseases, commonly referred to as NCDs, are "diseases or conditions that occur in, or are known to affect, individuals over an extensive period of time and for which there are no known causative agents that are transmitted from one affected individual to another."[1] They are of long duration and generally slow progression. The WHO has estimated that, by 2020, NCDs will account for 80% of the global burden of disease, causing seven out of every 10 deaths in developing countries with roughly half of those deaths occurring prematurely to persons younger than 70 years of age.[2]

WHO also sees a clear relationship between premature NCD mortality and country income levels. In 2016, 78% of all NCD deaths, and 85% of premature adult NCD deaths, occurred in low and middle-income countries (LMICs). Adults in low and lower-middle-income countries faced the highest risk of dying from an NCD (21% and 23% respectively) – almost double the rate for adults in high-income countries.

The burden created by early mortality and the years of healthy life lost have substantial economic costs for society.[3] While NCDs impact productive years of life of youth, it also pushes many people especially in India into poverty due to high cost of medical treatment.

NCDs continue to be a worrisome public health problem in India, being responsible for a major proportion of mortality and morbidity. *The burden of the NCDs in India with a population of the over 1.3 billion is huge. NCDs in India contributed to 6.3 million deaths in 2017, which is about 15.3 percent of overall global deaths due to NCDs. In the last 27 years India has witnessed sweeping epidemiological transition. As compared to 1990s when there was a 40 percent chance of people dying of NCDs, the risk of people dying with NCDs is more than 1.5 times today. Global burden of disease reports that in 2017, 63.5 percent of 9.9 million deaths in India occurred due to NCDs.[4] In 1990s, top five individual causes of disease burden were all communicable diseases whereas in 2017, three of top five causes are NCDs.*

As India traverses its journey of economic progress, the risks of the burden of NCDs remain large with its huge poor and impoverished population. The burgeoning middle class which is transitioning to relative prosperity is undergoing significant lifestyle changes, which accentuates the risks of NCD's attributable to such changes.

Objectives of the Study

In this context it is imperative to analyse the rising NCD in India and understand the profile of the population across those who contracted NCDs and to derive probable reasons for the epidemic. National-level data can obscure disparities across India's varied landscape, so a detailed understanding of health challenges at the state level is necessary to ensure that policies are responsive to the specific context of each state.

To address various knowledge gaps, a comprehensive nation-wide survey was undertaken covering population across different socio-economic strata from **all states** of the country regarding prevalence of key NCDs, distribution of NCD risk factors among the population and determinants of NCDs. The study also sought information on prevention steps and treatment- seeking behaviour of individuals suffering from NCDs in India to provide direction for policy formulation. Analysis of the causes of the NCDs, specially connecting risk factors and development of particular NCDs can provide insights for priorities for prevention, research, and policy development.

The key objectives of the study are:

1. To measure the prevalence of key non-communicable diseases and social profile of suffering households
2. Understanding illness profile, awareness and knowledge of individuals about NCDs
3. Understand exposure of population to risk factors related to environmental, other controllable risks, dietary risks, and lifestyle risks and their correlation with specific NCDs
4. Understanding the preventive steps and treatment-seeking behaviour of individuals
5. Provide suggestions on how to improve health consciousness among citizens and steps to be taken by regulators

Kantar Public was commissioned to undertake this national level survey. The study was conducted across 21 state clusters spanning all of India covering a population of 233672 individuals for prevalence estimation with 44672 persons being covered for detailed prevalence tool estimation and 14722 covered for the lifestyle tool. In addition, 673 public health offices over 21 states were covered for this study to understand other public health effects. The research design was approved by Institution Review Board (IRB) for structure and ethical considerations leading to the basis of conclusion. The data collection was done on two levels using two different survey tools to achieve the research objective. Details of survey design and data collection is explained in the Annexure-I of the report.

Prevalence of NCDs in India

The findings of the survey suggest that prevalence of having any NCDs among the population is 116 per 1000 population in India.

- The risk of having NCDs among population is almost 4 times as they move from age of 25 years toward fifties.
- Every 4th Person in population aged 50 years or above has a high risk of having a NCD.
- Population with age 70 years and above have the highest risk of having a NCD, where every two out of five persons have some kind of NCD.
- Sedentary lives, stressful work and unhealthy diets are largely responsible for NCDs in the working age group.
- Diabetes and hypertension show higher prevalence in age group 50 and above.

Recent estimation of overall prevalence of NCDs from this survey highlights that prevalence of NCD among the population has doubled in the last five years. The age profiling of the population expectedly reveals that risk of NCDs increases with age and is significantly high for the older population.

However, globally it is estimated that a significant proportion (75%) of premature adult deaths (occurring in those aged 3069 years) were caused by NCDs, demonstrating that NCDs are not solely a problem for older populations.

[1] Introduction to NCD Epidemiology, WHO, 2011
[2] WHO, Non-CommunicableDiseases Country Profiles 2018.
[3] World Bank and IHME 2016
[4] Global Burden of Disease Collaborative Network. Global Burden of Disease Study 2017 (GBD2017) Results. Seattle, United States: Institute for Health Metrics andEvaluation (IHME), 2018.

This survey shows that more than 2/3rd of the individuals suffering from NCDs are in the *most productive-life age groups*, i.e. between 26 59 years. Sedentary lives, stressful work and unhealthy diets are largely responsible for NCDs in the working age group. Diabetes and hypertension show higher prevalence in age group 50 and above while brain/ neurological disorders show higher prevalence in the age group 35 years and below.

Overall prevalence of all digestive diseases among the population suffering from a NCD is 24.3 %.

Prevalence of cancer among the population with NCDs is 6.9 percent and increases over the age of 50 years. The most common cancers in India are breast, cervix and oral. Throat cancer, mouth cancer and kidney cancer are also common and prevalent. Respiratory diseases that are prevalent in 14.9 % of population having any kind of NCDs shows higher prevalence in people aged above 60 years.

The survey began with selecting top eight NCDs in India as per Global Burden of the Disease 2017 which estimates the prevalence of NCDs among Indian population and attributable DALYS, YLDs and deaths due to specific NCDs:

- Cardiovascular Diseases
- Chronic Kidney diseases
- Respiratory diseases
- Diabetes Mellitus
- Neoplasms/cancers
- Mental/Neurological disorders
- Skin and sub-cutaneous diseases

This is significant for national public health budgets as life expectancy of Indians continues to improve. Life expectancy in India is currently at an average of 69 years, with wide variation among different states.

Key NCDs and Their Prevalence

The survey findings affirm that these eight NCDs are top ranking in terms of prevalence where the largest prevalence is of Hypertension among the population with 3.6% respondents are suffering from this metabolic disorder.

Digestive diseases were the second most prevalent NCD among the respondents at 3.2% while cancer was the least prevalent NCD at a mere 0.1%. WHO estimates that 26% of mortality due to NCD in India is caused by hypertension. [5]

Prevalence of NCDs by Disease Type

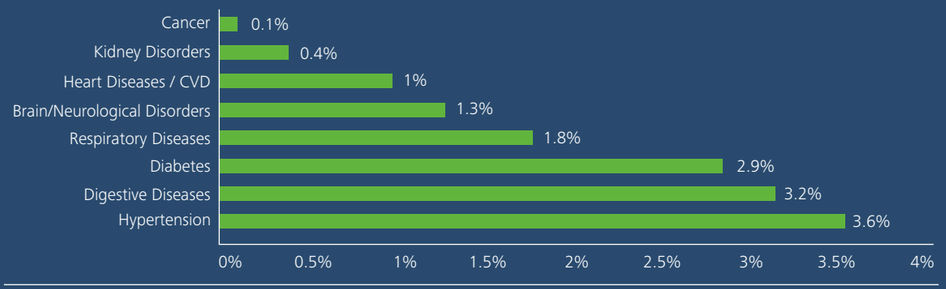


Figure E-1 Source: *TARI Research team based on primary survey by Kantar Public*

[5]Noncommunicable diseases country profiles 2018/ page 106

WHO says *"Hypertension, also referred to a raised blood pressure, is a major risk factor for coronary heart disease, chronic kidney disease, and ischaemic, as well as haemorrhagic stroke. If left uncontrolled, complications from raised blood pressure include heart failure, peripheral vascular disease, renal failure, retinal haemorrhage, visual impairment, stroke and dementia.*

Although, in the majority of cases, the exact cause of raised blood pressure is unknown, several modifiable risk factors increase its likelihood, such as a high salt intake, being overweight or obese, the harmful use of alcohol, physical inactivity, stress, air pollution and smoking." The global NCD target for hypertension is a 25% relative reduction in the prevalence of raised blood pressure by 2025.

Hypertension is understood to be triggered by stress while stress itself is the body's physical, mental and emotional response to changes including those arising from lifestyle, urbanization, migration etc.

Apart from medication to control hypertension, there are several known methods of non-medical interventions to combat underlying stresses leading to hypertension.

Some of these are behavioral and attitudinal changes, healthy eating and living habits, having positive social interactions, etc.

High prevalence of NCDs is generally associated with **co-morbidity,** that is, many a time two or more diseases may affect a person together. Presented below is the correlation matrix for the 8 diseases under consideration of the survey. The survey responses showed that while some NCDs had high co-morbidity with each other, some others were less correlated.

Correlation Matrix of Non-Communicable Diseases (%)

Diseases	Heart diseases	Cancer	Diabetes	Respiratory Diseases	Hypertension	Brain / Neuro-logical Disorders	Kidney Disorders	Digestive Diseases
Heart disease	100	5.3	4.4	5.6	6.2	4.1	6.5	2.5
Cancer	0.7	100	0.4	0.3	0.2	0.3	1.2	0.3
Diabetes	12.6	9.9	100	7.4	19.3	5.5	10.2	6
Respiratory Diseases	10	3.6	4.6	100	7.8	5.8	7.7	7.9
Hypertension	22.3	6.4	24.3	15.6	100	12.2	12.6	14.6
Brain / Neurological Disorders	5.3	2.8	2.6	4.3	4.4	100	7.9	3.2
Kidney Disorders	2.6	3.9	1.4	1.7	1.4	2.4	100	1.7
Digestive Diseases	8	6.8	6.7	14.1	12.9	7.7	13.6	100

Figure E-2 Source: *TARI Research team based on primary survey by Kantar Public*

Figure E-2, shows that hypertension has the highest co-morbidity with almost all NCDs. This suggests that controlling or reducing hypertension will have a cascading effect on controlling or reducing many NCDs. Diabetes, Kidney and Digestive disorders are the other diseases that follow hypertension in their relative simultaneous occurrence in morbidity. This co-existence is followed by diabetes and respiratory disorders. On the other hand, cancer and kidney disorders have lower co- morbidity.

Key Risk Factors

A risk factor may be defined as an aspect of lifestyle or behavior, hereditary characteristic, environmental exposure etc. that is associated with an increase in the occurrence of a particular disease, injury or other health condition.[6] The risk factors are typically classified into three groups by WHO;[7] out of the three broad categories, behavioural risks form the largest part(41%) followed by metabolic risk factors (37%) and the remaining are environmental/ occupational risk factors (21%).

Environmental Risk Factors	Metabolic and Physical Activity related Risk Factors	Behavioural Risk Factors
■ Air pollution (ambient particulate matter, household air pollution, Ozone) ■ Occupational risks ■ Other environmental risks (Lead, Radon) ■ Wash (unsafe water, unsafe sanitation, handwashing)	■ High blood pressure ■ High fasting blood glucose ■ High LDL cholesterol ■ Impaired kidney function ■ High body mass index (overweight & obesity) ■ Low bone mineral density ■ Low physical activity	■ Malnutrition ■ Dietary risks ■ Tobacco consumption ■ Alcohol and drug use ■ Unsafe sex ■ Sexual abuse and violence

Figure E-3Source: *IHME*

As this survey captures individual responses, those risk factors have been covered and analysed that an individual can observe, perceive or indulge. Metabolic risk factors such as high blood pressure, high fasting blood glucose, high LDL cholesterol, low bone mineral density and impaired kidney function that require clinical measurement and cannot be measured by individuals themselves were not captured in the survey. Environmental risk indicators such as air pollution are measured by perception level of exposure to these risk indicators.

[6]Principles of Epidemiology, CDC, 2006.
[7]Institute for Health Metrics and Evaluation(IHME), 2017, WHO collaboration Results, Seattle, United States

Ranking of prevalence of key risk factors

The following table presents summarized prevalence of key risk factors in adescending order, that is, the highest risk factors are at the top of the tablefollowed by lower ranked risks:

Rank	Ranking of Risk Factors	Prevalence
1	Air Pollution	76.00%
2	Low physical activity	66.50%
3	Diet low in legumes	55.00%
4	High stress levels	44.00%
5	Diet low in milk	41.00%
6	Diet low in seafood omega-3 fatty acids	39.00%
7	High consumption of trans-fats	37.00%
8	Diet low in fruits	36.00%
9	Diet low in calcium	30.00%
10	Household air pollution	29.00%
11	High BMI (overweight & obesity)	24.00%
12	Pollution at workplace	20.00%
13	Diet low in whole grains	17.00%
14	Low occupational physical activity	16.20%
15	Chewing tobacco	16.00%
16	Diet high in sugar-sweetened beverages	16.00%
17	Tobacco consumption	15.00%
18	High leisure activity	10.00%
19	Alcohol consumption	9.00%
20	Diet high in red meat	6.00%
21	Low sleep	3.80%
22	Diet low in vegetables	1.6%

Figure E-4 Source: *TARI Research team based on primary survey by Kantar Public*

Following are the key survey findings related to prevalence of key risk factors among adult population:

Environmental risk factors

Air pollution is perceived to be the most prevalent risk factor among surveyed population with NCD. Air pollution is non-controllable risk factor (by individuals) that is more pervasive as compared to other risk factors. It is all around us; no matter how affluent an area one lives in, it is hard to escape. It includes ambient particulate matter, household air pollution and ozone. Air pollutant particles deeply affect human circulatory and respiratory system by slipping past our body's defenses damaging our brain, heart and lungs.[8] Air particulate matter (PM) pollution, PM2.5 and Pm10 particles can penetrate deep into lung passageways and are most harmful to health.

In relation to air pollution at workplace, Survey results show that such prevalence among total surveyed population is 20.1%, who witness pollution on daily basis or most of the days. These individuals are likely to be those who are exposed to outside air pollution, while working such as field workers, shopkeepers, working labours and sales professionals who extensively travel for their work.

Highest exposure to air pollution can be observed in age group between 36-50 years, where 30% of population between 36-50 years have higher exposure to air pollution as compared other age groups. Women and young population who are not working have higher exposure to household air population.

In relation to household air pollution, results highlight that one-third of younger population (17-35 years) is exposed to household air pollution, which is higher than other age groups. Air pollution affects pregnant women and kids, which lead to pneumonia, reduce birth weight, lung growth, aggravates asthma and adversely affects brain development in children.[9]

[8]Medlineplus.gov.(2019). Health Risks of an Inactive Lifestyle: MedlinePlus. [online] Availableat: https://medlineplus.gov/healthrisksofaninactivelifestyle.html [Accessed 12Sep. 2019].
[9]Brockmeyer S., Amedeo D.,(2016), How air pollution alters brain development: the role ofneuroinflammation, Translational Neuroscience, NCBI

Exposure to household air pollution from cooking fuel is 3.5 times more than other smoke/pollution inside the house. Our survey shows that 24% of individuals are exposed to household air pollution from cooking fuel as compared to 6.8% from other smoke/pollution inside the house. Exposure to house air pollution from both causes can be observed higher in younger population group.

Metabolic and Physical Activity related Risks:

Metabolic syndrome represents a cluster of risk factors that include high obesity, higher levels of triglycerides (TGs), increased stress levels/ blood pressure, lowers levels of HDL and elevated levels of blood glucose. High prevalence and incidence of metabolic syndrome and individual metabolic risk factors among the population is significantly associated with lower levels of physical activity and sedentary activity.[10]

A study highlights that people with metabolic syndrome were 1.32 to 1.79 times more likely to die of all causes than those without metabolic syndrome.[11]

Major risks in this category are high body-mass index (BMI) or obesity, high stress levels, low sleep and low physical activity. India, even though a middle-incomecountry, suffers from both under-nutrition and obesity.

- *Survey results highlight that 66.5% of population have prevalence of low physical activity while between 17 -50 age groups, level of low physical activities is pervasive.*
- *This risk of NCDs among the productive age group of 17-35 years gets compounded many-fold when poor dietary habits with high trans-fat and sugar is added to the mix.*
- *However, the greatest risk in this category is of low physical activity.*

Survey results point that 24.1% of adult population are either overweight or obese. Further, prevalence of obese people increases with age.

High stress level is an important lifestyle risk factor for NCDs, which may highly correlated with high blood pressure. Survey results highlight that 44% of population have prevalence of risk of high stress. Further, it can be observed that stress gradually increases with increase in the age.

Survey results highlight that 66.5% of population have prevalence of low physical activity while between 17 - 50 age groups, level of low physical activities is pervasive. This risk of NCDs among the productive age group of 17-35 years gets compounded many-fold when poor dietary habits with high trans-fat and sugar is added to the mix. However, the greatest risk in this category is of low physical activity.

Survey results show that 10% of population have prevalence of risk of high to very high leisure activity. Older population have higher leisure activity but the relative weights of leisure activities between people below the age of 35 and those between 36 to 50 years are not significantly different, making the younger population low on physical activities and hence prone to NCDs.

Survey suggests that most Indians do not have a sleep deprivation.

Behavioral risk factors:

Intoxication such as tobacco, alcohol and substance abuse are behavioural risk factors that vary among individuals. The survey covered all three types of intoxication and found that substance abuse responses were almost negligible, perhaps because as compared to tobacco and alcohol there is lower social tolerance for substance abuse.

Survey results highlight that 26.2% of adults (aged 17 years and above) consume tobacco in any form. Tobacco consumption is highest among middle aged adults between 36 to 50 years comprising of working population.

[10]Park, S. K., &Larson, J. L. (2014). The relationship between physical activity and metabolic syndrome in people with chronic obstructive pulmonary disease. *The Journal of cardiovascular nursing*, 29(6), 499–507.
[11]Guize L, Thomas F, Pannier B, Bean K, Jego B, Benetos A. All-cause mortality associated with specific combinations of the metabolic syndrome according to recent definitions. Diabetes Care. 2007;30(9):2381–2387.

Chewing tobacco in India is available in different forms such as paan, paan masala, khaini, zarda and gutka.[12] Chewing and smokeless tobacco consumption is associated with several NCDs such as oral cancers, cardiovascular diseases, low birth weight and mental illnesses.[13]

About 85% of adults are non- smokers and not exposed to relative risks of having an NCD associated with smoking; this survey shows that 16% of adult population having an NCD shows the prevalence of risk of consumption of tobacco.

Men and women are advised by WHO not to drink more than 14 units per week to keep health risks to a low level – 1 unit is equal to 10 ml or 8 g of pure alcohol. Regular drinking of alcohol more than limits over a long period of time can result in higher BMI and metabolic risk of higher blood pressure.

Survey results show that prevalence of alcohol consumption is 9% of adult population. Consumption of alcohol decreases with increase in the age of population but prevalence risk increase.

Dietary risks essentially include diets sub-optimal in calcium, low in whole grains, vegetables, seafood omega-3 fatty acids, polyunsaturated fatty acids, nuts and seeds, milk, fruits, fibre, trans-fatty acids and high in sugar-sweetened beverages, sodium, red meat, processed meat.

The survey finds that among dietary risks, low consumption of legumes i.e. proteins and low calcium intake are the highest risks. Dietary risks are the largest contributing factor to years of life lost due to mortality and morbidity caused by NCDs in 2015 in India, at 19.1% of all identified risks.

Overall, more than half of individuals surveyed suffer from high dietary risk factors that cause NCDs in form low consumption of legume, milk, fruits, whole grains, vegetables, milks etc. Further, such consumption of is

[12]Thakur, J. S., & Paika, R. (2018). Determinants of smokeless tobacco use in India. *The Indian journal of medical research*, 148(1), 41–45.
[13]World Health Organization. Report on the global tobacco epidemic, 2008: The MPOWER package. Geneva: WHO: WHO; 2008.

higher among younger age group and shows decreasing trend for higher ages. This is in line with latest Lancet Study, points that intake on legumes is highest among adult population which decreases with age.[14]

Consumption of sweetened beverages, excessive processed and fried food (foods with high trans-fats) are other key contributing factors for NCD's among young adults.

Survey also shows low calcium intake for 30% of the population and balance show a moderate intake, Older population are more vulnerable to calcium deficiency.

However, poor diet is not the sole cause as large number of deaths occur each year due to consumption of adulterated foods. According to WHO,[15] unintentional poisonings kill an estimated 355,000 people globally each year. Two-thirds of these deaths occur in developing countries where "such poisonings are associated strongly with excessive exposure to, and inappropriate use of, *toxic chemicals.*"

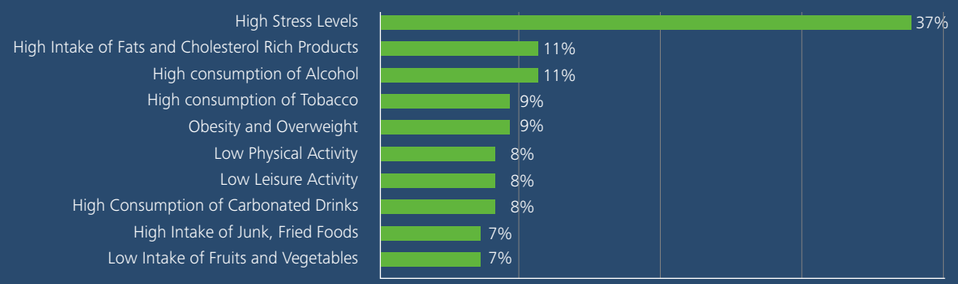
Specific NCDs and their associated Risk Factors

A risk ratio (RR), also called relative risk, compares the risk of a health event (disease, injury, risk factor, or death) among one group with the risk among another group. It does so by dividing the risk (incidence proportion, attack rate) in group 1 by the risk (incidence proportion, attack rate) in group 2. The two groups are typically differentiated by such demographic factors as sex (e.g., males versus females) or by exposure to a suspected risk factor (e.g., did or did not eat red meat). Often, the group of primary interest is labeled the exposed group, and the comparison group is labeled the unexposed group.[16] The strength of association i.e. the relative risk percentages of the risk factors with which they are causing the NCDs were calculated using Multinomial (polytomous) logistic regression, relative risk ratio.

Heart Diseases: Key Risk Factors

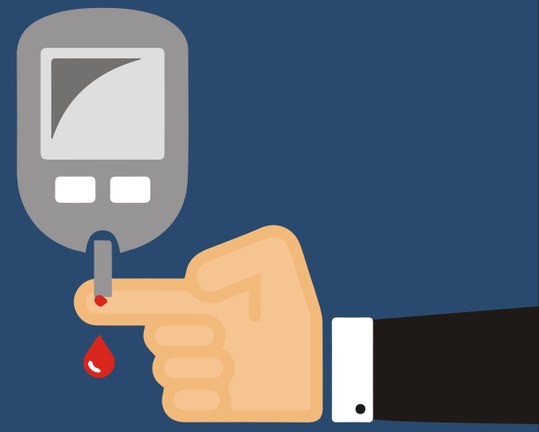
Heart disease occurs when plaque develops in the arteries and blood vessels that lead to the heart. This blocks important nutrients and oxygen from reaching your heart. Plaque is a waxy substance made up of cholesterol, fatty molecules, and minerals. Plaque accumulates over time when the inner lining of an artery is damaged by high blood pressure, cigarette smoking, or elevated cholesterol or triglycerides.[17]

Relative Risk of Developing Heart Diseases



Source: *TARI Research team based on primary survey by Kantar Public*

[14]Healtheffects of dietary risks in 195 countries, 1990–2017: a systematic analysis forthe Global Burden of Disease Study 2017; Lancet 2019; 393: 1958–7
[15]Non-Communicablediseases and Environmental Determinants, WECF - Women in Europe for a CommonFuture, 2013
[16]Cdc.gov.(2019). Principles of Epidemiology | Lesson 3 - Section 5. [online] Availableat: https://www.cdc.gov/csels/dsepd/ss1978/lesson3/section5.html [Accessed 16Sep. 2019].
[17]Healthline. (2019). Heart Disease Causes and Risk Factors.[online] Available at:https://www.healthline.com/health/heart-disease/causes-risks [Accessed 16 Sep.2019].



With 37% of relative risk percentage, high stress levels topped the chart in our analysis, when analyzing the relative risk percentage of the risk factors causing heart diseases. Our research found that if an individual is suffering from the high stress levels then his or her risk of getting a heart disease is 37% higher than the individual who is not suffering from high stress levels.

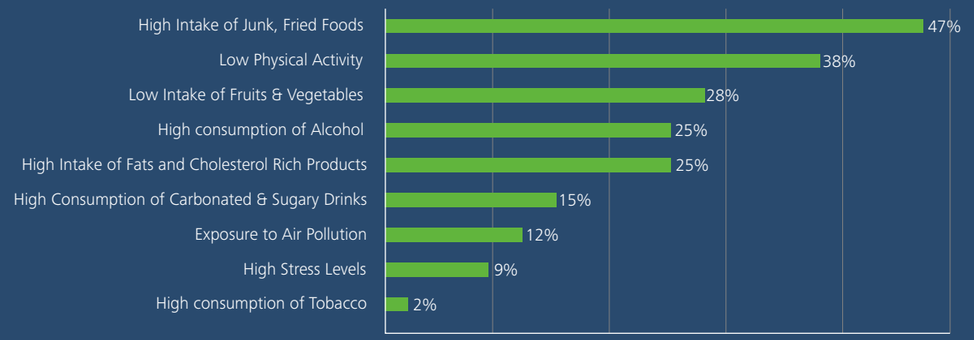
Diabetes: Key Risk Factors

Diabetes is a disease that occurs when blood glucose, also called blood sugar, is too high. Blood glucose is the main source of energy and comes from the food we eat. Insulin, a hormone made by the pancreas, helps glucose from food get into cells to be used for energy. Sometimes the body doesn't make enough—or any—insulin or doesn't use insulin well. Glucose then stays in the blood and doesn't reach cells. Over time, having too much glucose in the blood can cause health problems. Although diabetes has no cure, one can take steps to manage your diabetes and stay healthy.

With 47% of the relative risk percentage, high intake of Junk and fried foods seem to be affecting diabetes the most in our analysis. The people who consume high quantity of junk and fried foods in their diet are at 47% greater risk of developing diabetes as compared to those who take less quantity of junk and fried food in their diet.

Low Physical activity with 38% of relative risk percentage is the next significant one. People who have low physical activity are 38% more likely to develop diabetes as compared to those with higher physical activities. As stated before, low physical activity and high body mass index are often positively associated, which enhances the risk. The other contributing factors are poor diet , high consumption. of alcohol etc.

Relative Risk of Developing Diabetes

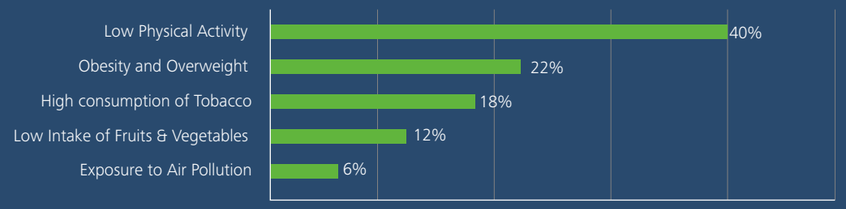


Source: *TARI Research team based on primary survey by Kantar Public*

Cancer: Key Risk Factors

Cancer, also called malignancy, is an abnormal growth of cells. There are more than 100 types of cancer, including breast cancer, skin cancer, lung cancer, colon cancer, prostate cancer, and lymphoma. Symptoms vary depending on the type.[18]

Relative Risk of Developing Cancer



Source: *TARI Research team based on primary survey by Kantar Public*

Low physical activity increases chances of developing cancer in a significant manner by enhancing the relative risk up to 40%. Obese or overweight individuals enhance the relative risk by 22% of developing cancer. The third associated risk is high consumption of tobacco.

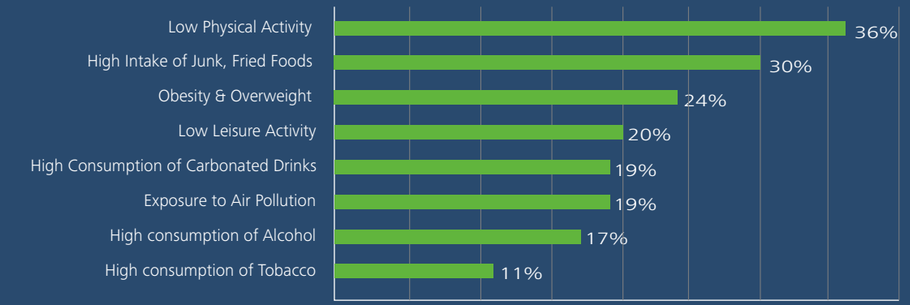
Overall prevalence of cancer among the population with NCDs is 6.9 percent and its prevalence increase over the age of 50 years. The most common cancers in in India are breast, cervix and oral. Throat cancer, mouth cancer and kidney cancer are also common and prevalent. Further analysis shows that risk of Esophageal cancer, Lung Cancer and Throat cancer can be quite high in the early part of life, that is, in the age group of 18-25 years.

[18]WebMD. (2019). Cancer. [online] Available at:http://www.webmd.com/cancer/default.htm [Accessed 29 Sep. 2019].

Hypertension: Key Risk Factors

High blood pressure or hypertension means that your heart must pump harder and the arteries must carry blood that's flowing under greater pressure.

Relative Risk of Developing Hypertension



Source: *TARI Research team based on primary survey by Kantar Public*

Amongst the risk factors analyzed for developing chances of hypertension, low physical activity came to be affecting hypertension the most, by as much as 36%.

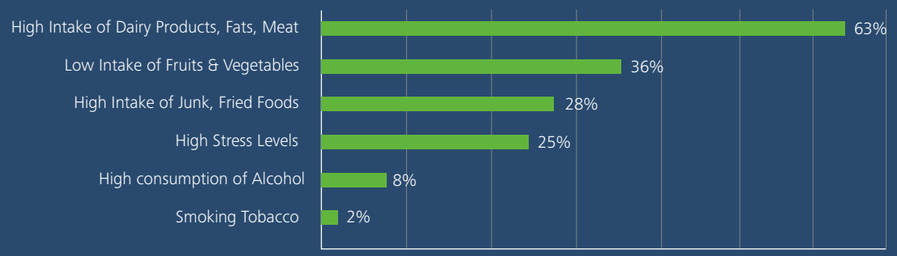
High intake of Junk and Fried foods was not very far from low Physical activity and it accounts for increasing the chances of developing hypertension by 30%.

Digestive Disorders: Key Risk Factors

Digestive diseases are disorders of the digestive tract, which is sometimes called the gastrointestinal (GI) tract. In digestion, food and drink are broken down into small parts (called nutrients) that the body can absorb and use as energy and building blocks for cells.

Overall prevalence of all digestive diseases among the population suffering from an NCD is 24.3% where three common digestive diseases including Constipation (8.2 %), Dyspepsia or indigestion (5.4%) and Gastritis (5.6 %) together account 19.2% prevalence of digestive disorders. Further, it can be observed that prevalence of digestive diseases is quite high in age groups 18- 25 years and 26-35 years in comparison to their average prevalence.

Relative Risk of Developing Digestive Disorders



Source: *TARI Research team based on primary survey by Kantar Public*

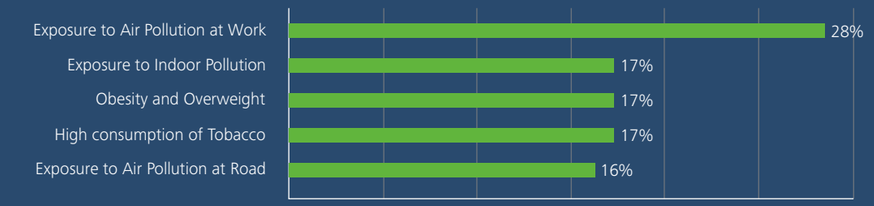
High intake of dairy products, fats and meat affect digestive disorders the most, increasing their chances by 63%. Low intake of fruits and Vegetables increased the chances by 36% and high intake of Junk and Fried foods increased the chances of developing digestive disorders by 28%.

Respiratory Diseases: Key Risk factors

Respiratory disease is a type of disease that affects the lungs and other parts of the respiratory system. Respiratory diseases may be caused by infection, by smoking tobacco, or by breathing in secondhand tobacco smoke, radon, asbestos, or other forms of air pollution.

Respiratory diseases that are prevalent in 14.9% of population having any kind of NCDs shows quite higher prevalence in people aged above 60 years. Asthma and Acute Respiratory Infection are more prevalent in this age group whereas respiratory diseases including Pneumonia and Cystic Fibrosis have relatively higher prevalence in population below 35 years of age group.

Relative Risk of Developing Respiratory Diseases



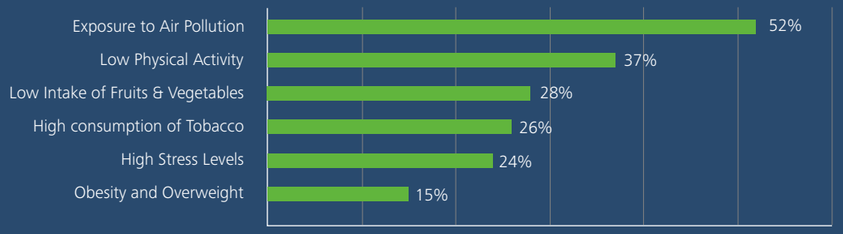
Source: *TARI Research team based on primary survey by Kantar Public*

Exposure to Air Pollution at work was found to be affecting the respiratory diseases the most, increasing the chances of developing respiratory diseases by 28%. Exposure to indoor air pollution increased the chances by 17%.

Skin Diseases: Key Risk factors

Skin disease refers to any of the diseases or disorders that affect the human skin. They have a wide range of causes. Acne Vulgaris and Contact Dermatitisare are the most common diseases skin diseases. Many uncommon skin diseases have a prevalence rate of 2.9% in the overall skin disease prevalence of 6.9 percent in the population suffering from any NCD. Further, prevalence of skin diseases is quite higher in the younger population, particularly in age group 18-25 years, which decreases with increase in age. Acne vulgaris, Skin cancer, Contact Dermatitis Actinic Keratosis and Psoriasis are common skin diseases in younger population.

Relative Risk of Developing the Skin Diseases



Source: *TARI Research team based on primary survey by Kantar Public*

Exposure to Air Pollution came to be affecting the skin diseases the most, increasing the chances by as high as 52%. Also, low Physical activity increased the chances of developing skin diseases by 37%.

Prevalence of NCDs in Indian states

India has a varied geographical area with different topography, environmental conditions and dietary habits. Analysis of prevalence of NCDs among geographies and states shows significant variation. This survey was carried out on the national level covering all regions and 21 state clusters.[19]

Odisha has the highest prevalence of NCDs (272 per 1000 population), while Gujarat has lowest prevalence (60 per 1000 population). Population of the northern, central, and western regions of the country has prevalence lower than the nation average while prevalence is quite high in the lesser developed regions of India including eastern and north-east regions. The other states with NCD prevalence higher than the national average were Andhra Pradesh, Telangana and West Bengal.

Thus, prevalence of NCDs is higher in the lesser developed regions of India, suggesting that respective state governments must devise specific strategies to tackle NCDs.

Other highlights: Factors causing NCDs

The most risk vulnerable age is the transition from 18-25 group to 26-35 group, which is also the prime working age population.

Age factor:

The survey findings highlight that prevalence of NCDs increases after 18 years and shows quantum leap when an individual crosses the age of 35 years. The most risk vulnerable age is the transition from 18-25 group to 26-35 group, which is also the prime working age population. The risk drops slightly in the transition to age group 36-45 years.

This is an alarming but not unexpected trend emerging from earlier studies. The demographic profile of India, where nearly 65% of population is below 35 years of age, the burden of NCD's is long lasting, both in terms of health and economic costs. The rapid changes in lifestyle linked to urbanization, rising income and consumption levels, societal changes due to nuclear families and working couples, reduced physical activities fans this risk, which needs constant attention and addressal.

Urbanization, with overcrowded towns and cities and attendant breakdown in civic infrastructure, could be a major factor of stress which could trigger hypertension.

Gender:

The different roles of males and females in the household lead to different levels of exposure to environmental risk factors and pollutants, an important contributing risk factor to NCDs. The Survey finds that males are more prone to contracting NCDs than females except for Hypertension and neurological disorders which are more prevalent in women.

[19]Andhra Pradesh (AP) includes both AP and Telangana, Maharashtra includesGoa, Assam and Tripura represent NE cluster

Rural and Urban divide:

The study finds overall prevalence of NCDs among the rural and urban population remains the same with no significant difference. The two diseases which are more prevalent in urban areas were hypertension and diabetes, which may be linked to migration, living conditions and other factors that affect people due to urbanization.

Household size:

Results of prevalence survey show that prevalence of NCDs is highest in smaller families with household size up to 4 family members. Nuclear families lack the social safety net of larger joint families, perhaps leading to higher stress as each member has to handle higher work load for day-to-day living.

Awareness and Knowledge of NCDs

The survey results highlight that there is marked lack of awareness and knowledge about NCDs among the population.

Across almost all diseases, except skin diseases, digestive disorders and cancer, more than 40% of the respondents suffering from these diseases were not aware of suffering from their respective diseases for **more than 3 years.** Knowledge levels of respondents about suffering from any NCDs were directly correlated with time taken in diagnosis. Across all diseases, more than 60% respondents stated that they were diagnosed of their NCD after 1 year of suffering.

There is marked lack of awareness and knowledge about NCDs among the population with average undiagnosed period of over 3 years

Survey findings point that nearly 60% of the people knew about the disease through allopathic medical practitioners while 15% to 18% approached AYUSH practitioner or a "non-licensed doctor ('quack')" for their disease diagnosis.

Professor Dr A Haldar of All India Institute of Medical Sciences (AIIMS) feels that education on eating habits (energy intake, dietary fibre, salt, sugar, saturated/ trans fat, etc), physical activity and weight management, environmental pollutants, substance use, blood pressure, thrombogenesis, stress management, etc should be started from early schooling as behaviour established during early life has life-long consequences to the onset of NCDs in later life. Therefore, it is essential to develop preventive programs focusing on school going population and equivalent age groups. Poverty and illiteracy are closely linked with NCDs hence all efforts as well as investment must be directed to improve the level of awareness and education of each individual.

A person's knowledge and awareness about NCDs is an important part of any population based preventive strategy. While on the hand one, there are continuous efforts running globally to reduce the burden of NCDs, it is extremely important to understand that lack of awareness exacerbates the problem of NCDs since a large number of cases in India go unreported and untreated due to lack of knowledge of their existence.

Way Forward

India is a rapidly transiting economy where the fast pace of change, not always positive, is leading to breakdown of conventional wisdom in matters of nutrition and health. Increasing urbanisation, growth of food processing sector leading to consumption of convenience foods, influence of global lifestyles, unplanned explosion of growth of towns and cities are some of the causes exacerbating the rapid rise in NCDs.

Significant Public Expenditure on Healthcare

WHO Assistant Secretary General in the Foreword of

Non-Communicable Diseases Country Profiles 2018 highlighting the growing menace and interventions required for controlling NCDs, points that "without significant investment, 15 million will continue to die each year from NCDs in the prime of their lives, between the ages of 30 and 70." The country needs to substantially increase investment as a percentage of GDP in healthcare infrastructure including health centres, hospitals, medical colleges, research institutes and laboratories. To enable coverage of predictable and long-term costs of treatment, national programmes to extend financial protection should be based on schemes that entail compulsory enrolment and be financed through taxation.

Awareness and Penetration of Health Insurance Coverage

Although the advancement in medical technology has made it possible to cure diseases that were once considered incurable, this is occurring in a setting where health expenditures are growing rapidly led by an unregulated private sector and where health insurance and pension coverage are still limited.

It is important to spread awareness of the benefits of health insurance in times of medical emergencies. Being uninsured is associated with 2-7-fold higher odds of catastrophic levels of out-of-pocket costs.[20] It is imperative to cover low income and vulnerable households under Universal Health Insurance scheme of Government of India.

Greater Awareness about NCDs

The awareness about the role of risk factors in the causation of NCDs is relatively poor in India. More efforts need to be put in to increase knowledge in the community regarding NCDs and its mitigation. Efforts should be made to establish surveillance mechanism at the community level to monitor, evaluate, and guide policies and programmes.

Empowerment of the community through effective health education, use of trained public health personnel along with provision of free health care and social insurance would prove beneficial in effectively controlling the growing prevalence of NCDs. Awareness about good lifestyle habit must be taught from school level onward to ingrain the values of health, fitness and disease-free living.

Preventive Checks are Key for Fight Against NCDs

Findings of this study highlight that for most of the NCDs symptoms are not evident until complications set in. This shows the importance of preventive health check-ups for taking necessary actions and early detection and treatment if conditions of specific NCDs are setting in. The battle against NCDs is half won if symptoms are detected early because it is very difficult to successfully and completely manage the conditions and fully cure it after being diagnosed with a disease.[21]

Several employers in the formal sector make it mandatory for employees to undergo annual health check-ups. Such check-ups must be extended to the vast informal sector through special camps or as part of government's healthcare system.

State Specific Policy Intervention for NCDs

The results on prevalence of NCDs in this study also shows that different NCDs have significant heterogeneity and variation across different states. Due geographical diversity, climatic conditions, and dietary habits in various states of India, the pattern, distribution of diseases and their determinants vary significantly, thereby effecting the choice and delivery of evidence-based prevention and control interventions. Accordingly, effective efforts to improve population health in each state require systematic knowledge of the local health status and trends.

[20]Jan S, Laba TL, Essue BM, Gheorghe A, Muhunthan J, Engelgau M, Mahal A, Griffiths U, McIntyre D, Meng Q, Nugent R, Atun R. Action to address the household economic burden of non-communicable diseases. Lancet. 2018 May19; 391(10134):2047-2058. doi: 10.1016/S0140-6736(18)30323-4. Epub 2018 Apr 5. Review. PubMed PMID: 29627161.
[21]Preventive healthcare: Going beyond an apple aday, Available at https://www.financialexpress.com/opinion/preventive-healthcare-going-beyond-an-apple-a-day/1273032/

Being a country of diversities, one size fits all principle will not fit for implementation of interventions in Indian states. The focus should be on specific measures that work in each state to reduce the increasing incidence of the major NCDs of states to reduce the health burden.

Regular Monitoring of Risk Factors and NCDs

Chronic diseases can be drastically prevented if their underlying risk factors are controlled. These risk factors are measurable and largely modifiable, and thus continuing surveillance of the levels of risk factors is of fundamental importance in NCD control.

Regular monitoring of NCD risk factors is crucial for developing strategies and policies to inhibit growing burden of NCDs in the country. In India, most national or regional surveys do not capture data about all risk factors related to NCDs. National Family Health Survey NFHS (IIPS, 1998-99; 2007; 2015-16) and GATS (2015-16) even though cover most of the states and UTs, fail to cover all the risk factors.[22] Moreover, these surveys lack regular periodicity. Regular monitoring of all risk factors associated with NCDs is a perquisite for deriving national /state level strategy about a particular risk factor and NCDs.[23]

Measures to reduce NCDs should therefore be focused on preventing and controlling the risks attributed to these diseases in an integrated manner. A first step in this direction is identifying the related risks and intervention at all levels, from communities, governments, private organisations and non-government organisations. A comprehensive composite assessment of all major diseases and risk factors across all states of India, providing estimates over an estimated period of time, is needed for an informed health system and policy development.

Effective Dealing with Lifestyle and Modifiable Risk Factors

From the analysis of risk factors and its association with NCDs, it is clear that low physical activity, high consumption of fast foods and high stress, are the risk factors which have been found to have the most significant role in causing major non-communicable diseases. These factors have become integral aspects of modern-day lifestyle of people in the contemporary age and hence requires a conscious effort to break unhealthy habits.

Another interesting factor is the urban-rural discrepancies that exist in physical activity in India. Rural India has a strong agricultural economy while many urban jobs require less physical labour that involve mainly desk-based activities. According to a study by the World Bank,[24] the difference in physical activity is further exacerbated by the urban population's reliance on public or private means of transportation rather than walking. The rising scarcity of open spaces like parks or (playgrounds),[25] also a consequence of rapid urban growth and limited urban planning, add to the problem. Other sedentary behaviours, such as watching television or playing video games, are more common in cities, where electricity and the internet are more accessible.

It is recommended that people should reduce such sedentary lifestyle or should find a balance to neutralize the effects of this lifestyle to keep their body healthy and away from diseases.

Managing Dietary Risk Factors through Effective Food Policy

Undernutrition and overnutrition pose a significant challenge in India, both swelling the burden of NCDs[26] with malnutrition and obesity paradoxically co-existing in India. Dietary risks are the largest contributing factor to years of life lost due to mortality and morbidity caused by NCDs in 2015 in India, at 19.1% of all identified risks.

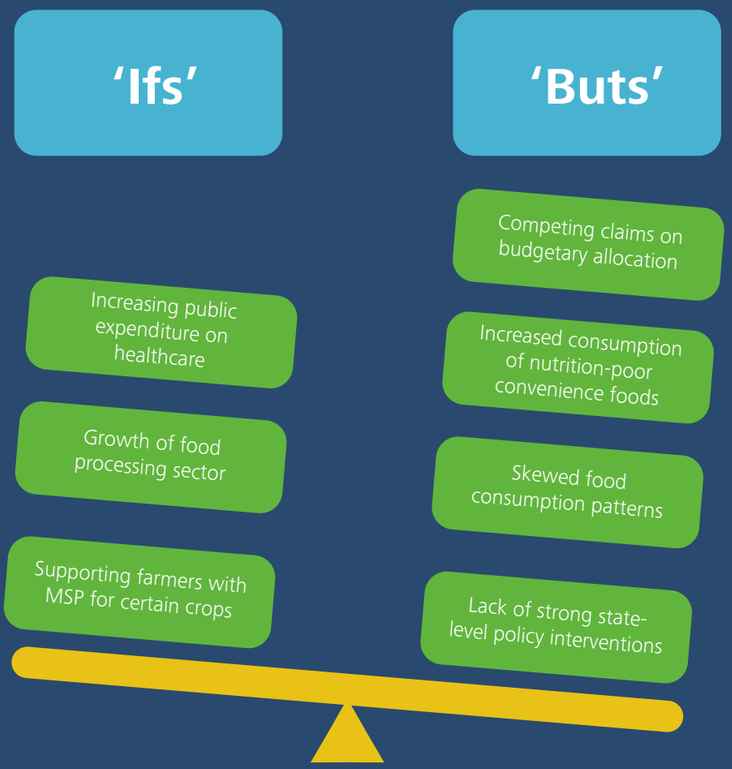
Unhealthy diets, malnutrition, and NCDs are closely linked, which are logical consequences of modern-day food systems. While focus to eliminate hunger has resulted in easy access to cereal foods, a diet rich in

[22]Nethan, S., Sinha, D., & Mehrotra, R.(2017). Non-Communicable Disease Risk Factors and their Trends in India. Asian Pacific journal of cancer prevention: APJCP, 18(7), 2005–2010.
[23]Indian Council of Medical Research, Public Health Foundation of India and Institute of Health metrics and Evaluation. India: Health of the Nation's States - The India State- Level Disease Burden Initiative. New Delhi: ICMR, PHFI, and IHME, 2017
[24]India's transport sector: the challenges ahead. In The World Bank. Washington, DC: World Bank. 2002
[25]Sudhakar, P. (2013).Urban expansion vs. green cover /parks. Eco News, 19(1), 5-7.
[26]NNMB Technical report No. 27, 2017, National Institute of Nutrition

protein, vitamins, and minerals such as fresh fruits and vegetables and legumes and pulses have not reached everyone.[27] Agricultural economics, international trade, rural development & urban planning, food and public distribution system drives the food supply system and guides what reaches the population at which price and what quantity. The driving factor of high risk of low pulses consumption are agriculture production economics and public distribution system. Pulses are not included in the food public distribution system and therefore fail to reach low income and vulnerable sections of society. All components of a national food policy must be re-visited and re-vamped with a holistic approach toward nutrition and preventive healthcare.

India needs to strike the right balance among competing claims and constituencies to arrive at a point where economic growth and a healthy population need not be at cross purposes or a contradiction.

At the same time, it would be a shame if, in the march toward modernity, prosperity and economic advancement India were to lose the wealth of ancient wisdom that believed in harmony of human life with the environment, other creatures and responsibility toward future generations.



[27] Health effects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017; Lancet 2019; 393: 1958–7

1.

Non-Communicable Diseases (NCDs): An Alarming Menace

Non-Communicable Diseases (NCDs): An Alarming Menace

The human body is known to become weaker and more vulnerable to diseases with age. Non-Communicable Diseases, commonly referred to as NCDs, are "diseases or conditions that occur in, or are known to affect, individuals over an extensive period of time and for which there are no known causative agents that are transmitted from one affected individual to another."[28] NCDs are a growing menace and inflict a global crisis. It has attracted attention in recent years as its affects persons irrespective of gender and age, every country irrespective of income, and due to alarming socio-economic burden that they impose.[29] The WHO estimated that, by 2020, NCDs will account for 80% of the global burden of disease, causing seven out of every 10 deaths in developing countries with roughly half of those deaths occurring prematurely to persons younger than 70 years of age.[30]

With rapid urbanization, industrialization, rapidly deteriorating environment and sedentary lifestyles, the world is paying a heavy price with remarkable load of NCDs.[31] Globally, every three of four people die because of NCDs. In 2017, NCDs were responsible for 41.1 million of the world's 55.95 million deaths.[32] NCDs such as cardio-vascular diseases (CVDs), cancer, diabetes and chronic respiratory diseases are the leading global cause of death and are responsible for 70% of deaths worldwide.[33] Smoking, alcoholism, low quality diet, physical inactivity are some of the established risk factors of NCDs. These risk factors have 80% contribution in the development of NCDs.[34] The WHO points that if "business as usual" attitude prevails the time is not far when mortality due to NCDs would rise to 55 million.[35]

The burden created by early mortality and the years of healthy life lost have substantial economic costs for society.[36] The estimated cost of $47 trillion on the account of NCDs over next twenty years on the global economy is quite huge and pervasive.[37] The premature deaths, people dying in their productive age between 15 and 69, occurring because of NCDs are 16.17 million. 21 leading causes of the NCDs account for 79.5 percent years lived with disability (YLDs) and 62.1 percent of the disability adjusted life years (DALYs) in 2017. While NCDs impact productive years of life of youth, it also pushes many people into poverty due to high cost of medical treatment.

Burden of NCDs: Global and India (%)

Attributes	Global		India	
	NCDs (Million No.)	NCD Share in All Causes (%)	NCDs (Million No.)	NCD Share in All Causes (%)
DALYs	1550.9	62.10	269.2	56.00
Deaths	41.1	73.40	6.3 1	63.50
YLDs	678.3	79.50	113.7	73.20
YLLs	872.6	53.00	155.5	47.80

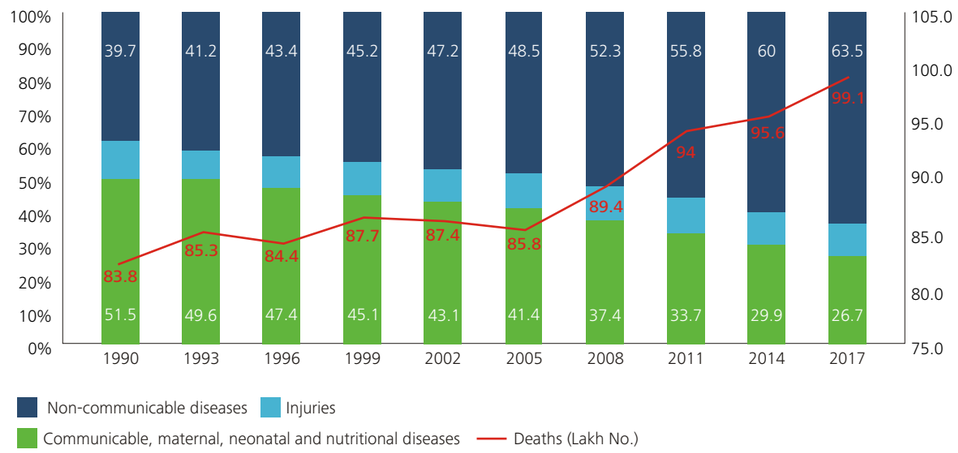
Source: *Global Burden of Disease Study 2017 (GBD 2017)Results*

[28]Introduction to NCD Epidemiology, WHO, 2011
[29]WHO.Preventing chronic diseases: a vital investment. Geneva: World Health Organization, 2005
[30]WHO, Non-Communicable Diseases Country Profiles 2018
[31]Sanjiv Kumar, Preetha GS. Health Promotion: An Effective Tool for Global Health. Indian Journal of Community Medicine 2012;37(1):5-7.
[32]Global Burden of Disease Collaborative Network. Global Burden of Disease Study 2017 (GBD 2017) Results. Seattle, United States: Institute for Health Metrics and Evaluation (IHME), 2018.
[33]Noncommunicable Diseases Progress Monitor 2017
[34]WHO,Regional Office of South East Asia. Strengthening Partnerships for Integrated Prevention and Control of Noncommunicable Diseases: a SEANET-NCD Meeting Chandigarh, India. 15-19June 2009.
[35]WHO, Non-CommunicableDiseases Country Profiles 2018
[36]World Bank and IHME 2016
[37]Kundu MK, Hazra S, PalD, Bhattacharya M. A Review of Non-Communicable Diseases (NCDs) burden, its socio-econ-omic impact and the strategies for prevention and control of NCDs in India. Indian J Public Health 2018; 61: 302-04

NCDs have been the leading cause of fatality in wealthy countries in last five decades and are emerging to be the major cause death in low and middle-income countries.[38] The WHO points that burden of NCDs is highest among low and middle-income countries. In these countries, NCDs account for 78 percent of deaths and 85 percent of premature deaths.[39] The impact of NCDs is also highest in these counties as most of the population in these countries is poor people, who are vulnerable to risk factors leading to NCDs along with fact that they have little access to health facilities or financial resources for treatment. More than 90 million people living in the low-income countries are pushed into poverty due to incurring healthcare expenditure on NCDs.[40]

NCDs continue to be an important public health problem in India, being responsible for a major proportion of mortality and morbidity. The burden of the NCDs in India with a population of the over 1.3 billion is quite huge. NCDs in India contributed to 6.3 million deaths in 2017, which is about 15.3 percent of overall global deaths due to NCDs. In the last 27 years India has witnessed sweeping epidemiological transition. As compared to 1990s when there was a 40 percent chance of people dying of a NCDs, the risk of people dying with NCDs is more than 1.5 times today. Global burden of disease reports that in 2017, 63.5 percent of 9.9 million deaths in India occurred due to NCDs.[41] In 1990s, top five individual causes of disease burden were all communicable diseases whereas in 2017, three of top five causes are NCDs.

Burden of NCDs: Global and India (%)



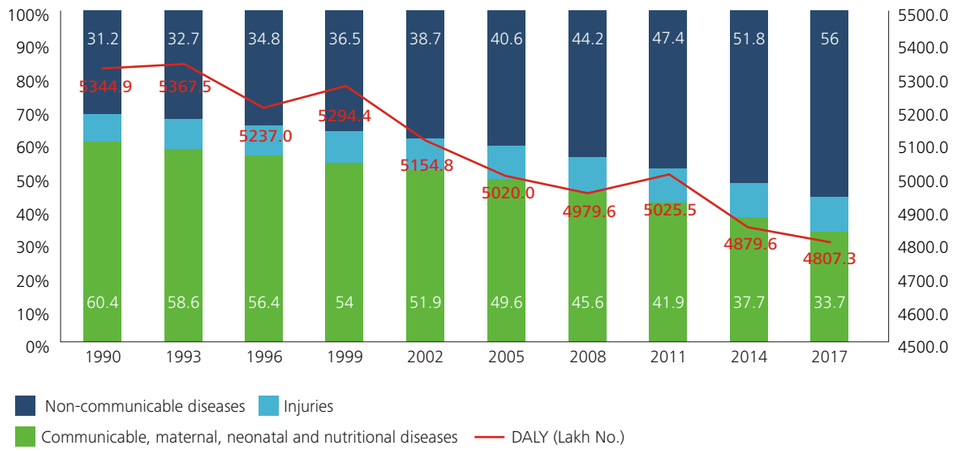
Source: *Global Burden of Disease Study 2017 (GBD 2017)Results*

[38]WHO, Regional Office of South East Asia. Strengthening Partnerships for Integrated Prevention and Control of Noncommunicable Diseases: a SEANET-NCD Meeting Chandigarh,India. 15-19 June 2009.
[39]WHO, Non-Communicable Diseases Country Profiles 2018
[40]WHO (2010), The WHO Global status report on noncommunicable diseases 2010, Chapter 2: NCDs anddevelopment, Available at: https://www.who.int › nmh › publications › ncd_report_chapter2
[41]Global Burden of Disease Collaborative Network. Global Burden of Disease Study 2017 (GBD 2017) Results. Seattle, United States:Institute for Health Metrics and Evaluation (IHME), 2018.

NCDs attributed for 269.2 million DALYs in India, that is about 1/6th (17.4 percent) of the global DALYs in 2017. Global burden of disease data shows that even though the DALYs have declined over the years, NCDs have shown continuous upsurge in the DALYs during these years. The worrying part is that NCDs account for 21 of the leading causes of years lived with disability (YLDs), as they result in 113.7 million years of living with disability for the Indian population (73.2 percent of YLDs). The major loss is in most productive years of life, between 15-69 years, where Indians with this disability (YLDs) account for 90.35 million years.

A World Economic Forum and Harvard study has estimated a total economic loss of $ 3.55 trillion on account of four major NCDs in India, including diabetes, cardiovascular disease, chronic respiratory diseases and cancer, during the period 2012-2030.[42] However, effects of the NCDs in India are quite different in socio-economic context as compared to wealthy nations. The impact of NCDs is inequitable with evidence of a reverse in the social incline of risk factors and higher implication for households having low levels of earnings.[43] Research provides evidence that people with lower socio-economic status having lower educational background and occupational activities have higher correlation with risk factors and NCDs.[44] Poor people have higher vulnerability to risk factors, such as poor dietary intake, in early part of their life and they are exposed to additional risk factors over a period of time leading them to NCDs.[45] The cost of NCDs treatment is difficult to bear by the poorer population, thereby putting them into financial distress or poverty.

Contribution of Major Disease Groups to Total DALYs in India (1990-2017) (%)



Source: *Global Burden of Disease Study 2017 (GBD 2017)Results*

[42]Economics of Non-communicable Diseases in India, A report by the World Economic Forum and the Harvard School of Public Health, November 2014
[43]Kundu MK, Hazra S, Pal D, Bhattacharya M. A Review of Non-Communicable Diseases (NCDs) burden, its socio-economic impact and the strategies for prevention and control of NCDs in India. Indian J Public Health 2018; 61: 302-04
44Gupta R, Deedwania PC, Sharma K, Gupta A, Guptha S, Achari V, et. Al. Association of educational, occupational and socio-economic status with cardiovascular risk factors in Asian Indians, A cross sectional study. PLos One 2012; e440098
45WHO (2010), The WHO Global status report on noncommunicable diseases 2010, Chapter 2: NCDs and development, Available at: https://www.who.int › nmh › publications ›ncd_report_chapter2

1.1 Objectives of the study

In this perspective, it is imperative to analyse rising NCD in India and understand the profile of the population across those who contracted NCDs and to derive probable reasons for the same. The risk factors for many of these conditions are associated with lifestyle related choices, both environmental and genetic factors.

With almost one-fifth of the world's population living in India, the health status and the drivers of health loss are expected to vary between different parts of the country and between the states. National-level data can obscure disparities across India's varied landscape, so a detailed understanding of health challenges at the state level is necessary to ensure that policies are responsive to the specific context of each state. While the central government policies have significant influence on health initiatives across the country, health is a state subject in the Indian federal structure, with the majority of public spending on health from the state budgets. Accordingly, effective efforts to improve population health in each state require systematic knowledge of the local health status and trends.

In India, there is no regular system for collecting data on non-communicable diseases (NCDs) - which can be said to be of adequate coverage or quality. A report by the NITI Aayog highlighting such issue points that there is lack of availability of acceptable quality data to address critical areas such as NCDs and financial risk protection in a health index for its states.[46] Many studies have been conducted on NCDs using survey data at district level or the state level. However, it is difficult to generalise the findings at national level considering the vast geographical and socio-economic diversity of more than 1.3 billion population of India. The report on India: Health of the Nation's Statesby Institute of Health metrics and Evaluation (IHME, 20017) emphasises for requirement greater local data for robust sub national estimates.[47]

In this perspective, a comprehensive national level survey was undertaken covering population across different socio-economic strata from all states. This survey attempts to fill the knowledge gap regarding prevalence of key NCDs, distribution of NCD risk factors among the population and determinants of NCDs. Along with this information, prevention steps and treatment- seeking behaviour of individuals suffering from NCDs in India can provide direction for policy formulation. Analysis of the causes of the NCDs, specially connecting risk factors and development of particular NCDs can provide insights for priorities for prevention, research, and policy development.

The key objectives of the study are:
1. To measure the prevalence of key non-communicable diseases and social profile of suffering households
2.Understanding illness profile, awareness and knowledge of individuals about NCDs
3. Understand exposure of population to risk factors related to environmental, other controllable risks, dietary risks, and lifestyle risks and their correlation with specific NCDs
4. Understanding the preventive steps and treatment-seeking behaviour of individuals

1.2 Research Approach and Methodology

Kantar Public was commissioned to undertake this national level survey. The study was conducted across 21 state clusters spanning all of India. The data collection was done on two levels using two different survey tools to achieve the research objective.

Kantar Public was commissioned to undertake this national level survey. The study was conducted across 21 state clusters spanning all of India covering a population of 233672 individuals for prevalence estimation with 44672 persons being covered for detailed prevalence tool estimation and 14722 covered for the

[46]Ministry of Health and Family Welfare, World Bank, Niti Aayog. Healthy states, progressive India- Report on the ranks of the states and union territories. New Delhi,India: 2018.
[47]Indian Council of Medical Research, Public Health Foundation of India and Institute of Health metrics and Evaluation. India: Health of the Nation's States - The India State- Level Disease Burden Initiative. New Delhi: ICMR, PHFI, and IHME, 2017.

lifestyle tool. In addition, 673 public health offices over 21 states were covered for this study to understand other public health effects. **The research design was approved by Institution Review Board (IRB) for structure and ethical considerations leading to the basis of conclusion. The data collection was done on two levels using two different survey tools to achieve the research objective.**

Details of survey design and data collection is explained in the Annexure-I of the report.

A. For Prevalence estimation

Key Informed Member (preferably head of the household/ chief wage earner who are key decision makers) of the household above the age of 17 years is included.

B. For understanding correlation between NCDs and Life-Style factors

This survey included individuals aged 17 and above covered in the prevalence survey and having NCDs. The main objective of this part of survey is to understand their exposure to risk factors associated with NCDs and develop causation of these risk factors with specific NCDs.

Prevalence tool	To measure the prevalence of NCDs in India. It consists of questions related to prevalence of major NCDs that have been considered for the study and basic demographic profile. This tool, other than measuring prevalence of NCDs, would help create sampling frame for selection of respondents for main tool in order to understand the association/ correlation of the NCDs with risk factors	Key informed member above the age of 17 years and available at the time of survey	• Location of respondent • Age and name of all members of household • Present illness profile of every member • Social profile: rural/ urban; male/ female; household size
Main tool	To understand prevalence of risk factors and their association/c orrelation of specific NCDs Knowledge and Treatment of	Individual adult more than age of 17 years suffering from NCD and exposed to risk factor	• Dietary habits, smoking and drinking habits, exposure to pollution, illness history of the respondent • NCD illness profile, knowledge and treatment

2.

Understanding Illness profile, Awareness and Knowledge about NCDs

Understanding Illness profile, Awareness and Knowledge about NCDs

NCDs represent the iceberg phenomenon of the disease spectrum. The hidden portion of iceberg is however, brought out by community-based surveys such as the current survey. This section of the report is based on the main survey covering a population of 10500 individuals aged 17 years who suffer from one or more NCDs and above across all the states having one or more non-communicable disease to have better insights about their disease and treatment of these diseases. The sample weights were accounted in the survey module to adjust for adequate data representation. The analysis here, therefore, is based on weighted 10538 individual observations.

In this section, the analysis primarily focuses on understanding age profile of population with key NCDs and the illness profile of diseases within these specific categories of NCDs. Further, it focuses on how long it takes for people to get their NCD diagnosed and how they came to know about their disease.

2.1 Age Profile of Population with Key NCDs

The age profile of 10538 individuals with NCDs shows that more than 2/3rd of the individuals are in the most productive life age groups, i.e. between 26-59 years. Sedentary lives, stressful work and unhealthy diets are largely responsible for NCDs in the working age group. Young respondents below the age of 25 were the least affected by NCDs, in all reported diseases except brain/neurological disorders and skin diseases. A large section of the respondents aged 60 and above have respiratory diseases, cancer, hypertension and diabetes - all associated with old age.

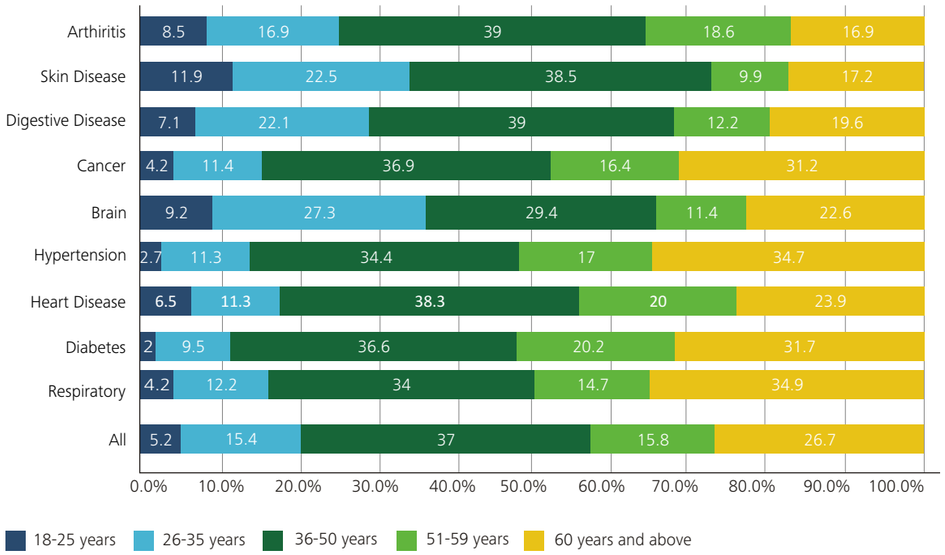
Diabetes, the most common metabolic disorder, was found to be most prevalent NCD (25.2%) among the population with NCDs. It is well documented that diabetes affects relatively older persons more than the young, for possible reasons such as high stress, low physical activity, unhealthy diet, low metabolism etc. This is reflected in the diabetes age profile of population where 31.7% of people are in age group of 60 years and above. However, the risk of diabetes in the population is certainly very high over the age of 35 years as maximum respondents (36.2%) suffering from diabetes are in the age group 36-50 years.

Hypertension also known as high blood pressure (HBP) is a long-term medical condition in which the blood pressure in the arteries is persistently elevated. Hypertension being another metabolic disorder is also quite prevalent (19.7%) among population with NCDs. Respondents with hypertension were largest from the older age group of 60 years or more (34.7%), followed by those between 36-50 years. Unhealthy diet with high amounts of salt, low physical activity are commonly known causes of hypertension and are known to affect persons as they become older.

Cancer and heart diseases are among most chronic NCDs that have low prevalence but resulted in most number of deaths (3.5 million) in 2017.[48] Cancer has a prevalence of 6.8 % among population with NCDs and show a higher penetration of 31.2 % in the population aged over 60 years. Similarly, heart diseases have a prevalence of 7 % among population with NCDs but relatively higher penetration of 58.3 % in the working age group of 36 59 years shows work, stress and lifestyle factors influence this population.

[48]Global Burden of DiseaseStudy 2017 (GBD 2017) Results

Age Profile of Respondents under Broad Diseases (%)



Source: *TARI Research team based on primary survey by Kantar Public*[49]

[49]Numbers within brackets shows number ofindividuals suffering from that disease

Respiratory diseases that are also among major causes of deaths in India have a prevalence of 15.1% among the population affected by NCDs. Higher penetration of 34.9% of respiratory diseases can be observed among population suffering from respiratory diseases in the age group 60 years or above, indicating that ill effects of the pollution and lifestyle factors show their effect over a span of time.

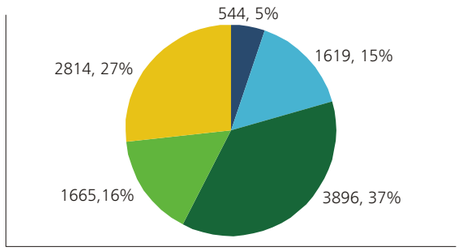
Brain/neurological dis-orders are prevalent among 3.9% of population suffering from NCDs. A penetration level of 36.5% in younger people aged between 18 to 35 years suffering from brain disorder suggests younger people being uncertain about their future develop unnecessary stress leading to such disorders.

Digestive diseases are quite prevalent (22.7%) among the population with NCDs and relatively higher penetration of 70% may be observed in age group of 18 to 50 years with such diseases. Disorders of the gastrointestinal tract may be caused by unhealthy diets-low in fiber, high alcohol consumption, and low physical activity. Skin diseases were found to be prevalent in 6.1 percent of population suffering from any kind of NCDs. Further, among population having skin diseases, their penetration was observed to be relatively higher (34.4%) in younger population aged between 18 to 35 years. Arthritis, an NCD related to knee joints, have relatively very low prevalence (0.6%) among the population with NCDs.

2.2 Illness Profile of Population with Key NCDs

This section of the report sheds light on the specific disease profile within key diseases and provides analysis on prevalence on these disease profile within a given age profile of population having an NCD as shown below in the chart.

Age Profile of Respondents (%)



Source: *TARI Research team based on primary survey by Kantar Public*

Diabetes, Hypertension, Brain/ neurological disorders (stroke) and Arthritis are some of the key diseases which do not have greatly different disease illness profile. As mentioned earlier, diabetes and hypertension show higher prevalence in age group 50 and above while brain/ neurological disorder show higher prevalence in the age group 35 years and below.

Illness Profile of Diseases

Disease type	18 - 25 years	26 - 35 years	36 - 50 years	51 - 59 years	60 years and above	All
Diabetes	9.9%	15.8%	26.1%	33.5%	31.4%	26.2%
Brain	7.0%	6.9%	3.1%	2.8%	3.3%	3.9%
Hypertension	10.3%	14.5%	18.3%	21.2%	25.6%	19.7%
Arthritis	0.9%	0.6%	0.6%	0.7%	0.4%	0.6%

Source: *TARI Research team based on primary survey by Kantar Public*

[83] Trade and investment liberalization and Asia's non-communicable disease epidemic: a synthesis of data and existing literature. Phillip Baker, Adrian Kay and Helen Walls, http://www.globalizationandhealth.com/content/10/1/66

[85] The Potential Impact Of Free Trade Agreements On Public Health, Undp, Unaids Issue Brief | 2012

Overall prevalence of all digestive diseases among the population suffering from an NCD is 24.3 % where three common digestive diseases including Constipation (8.2%), Dyspepsia or indigestion (5.4%) and Gastritis (5.6%) together account 19.2% prevalence of digestive disorders.

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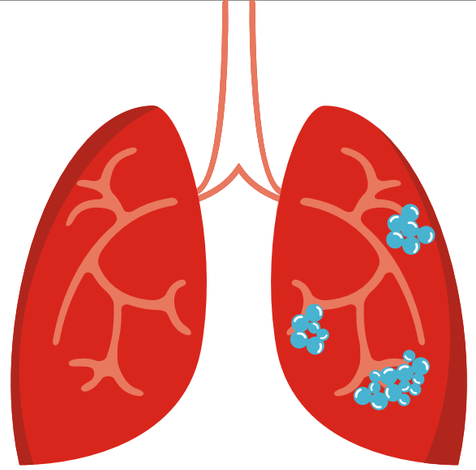
Illness Profile of Digestive Diseases

Disease type	18 - 25 years	26 - 35 years	36 - 50 years	51 - 59 years	60 years and above	All
Constipation	9.0%	12.0%	8.8%	6.4%	5.9%	8.2%
Irritable bowel syndrome (IBS)	0.6%	0.3%	0.6%	0.4%	0.3%	0.4%
Anal disorders	2.4%	1.3%	1.1%	0.5%	0.5%	0.9%
Diverticular disease	0.4%	0.2%	0.2%	0.1%	0.1%	0.1%
Colitis	0.4%	0.1%	0.2%	0.7%	0.1%	0.2%
Viral gastroenteritis	1.1%	0.4%	1.1%	0.4%	0.8%	0.8%
Cyclic vomiting syndrome	0.2%	0.1%	0.1%	0.1%	0.2%	0.1%
Dyspepsia (indigestion)	7.5%	6.7%	5.9%	5.5%	3.7%	5.4%
Gallstone	3.1%	3.3%	1.7%	0.6%	0.6%	1.6%
Gastritis	7.5%	9.6%	5.3%	3.4%	4.5%	5.6%
GI bleeding	0.4%	0.1%	0.1%	0.0%	0.0%	0.1%
Any other	2.4%	1.2%	0.5%	0.4%	1.0%	0.8%
Digestive Disease	**34.9%**	**35.5%**	**25.3%**	**18.2%**	**18.0%**	**24.3%**

Source: *TARI Research team based on primary survey by Kantar Public*



Overall prevalence of cancer among the population with NCDs is 6.9 percent and its prevalence increase over the age of 50 years. The most common cancers in India are breast, cervix and oral. Throat cancer, mouth cancer and kidney cancer are also common and prevalent. Further analysis shows that risk of Esophageal cancer, Lung Cancer and Throat cancer can be quite high in the early part of life, that is, in the age group of 18-25 years.

Illness Profile of Cancer

Disease type	18 - 25 years	26 - 35 years	36 - 50 years	51 - 59 years	60 years and above	All
Throat cancer	1.5%	1.8%	1.4%	1.9%	2.0%	1.7%
Bladder Cancer	0.2%	0.3%	0.3%	0.5%	0.4%	0.4%
Breast cancer	0.4%	0.2%	0.7%	0.4%	0.4%	0.5%
Cervical Cancer	0.2%	0.2%	0.7%	0.9%	0.7%	0.6%
Esophageal cancer	1.1%	0.2%	0.2%	0.2%	1.1%	0.5%
Kidney Cancer	0.2%	0.7%	0.9%	1.1%	1.1%	0.9%
Liver cancer	0.2%	0.4%	0.5%	0.6%	0.7%	0.5%
Lung Cancer	0.9%	0.3%	0.6%	0.4%	0.6%	0.5%
Mesothelioma	0.2%	0.3%	0.3%	0.0%	0.1%	0.2%
Mouth cancer	0.9%	0.7%	1.1%	0.9%	1.0%	1.0%
Cancer	**5.7%**	**5.3%**	**6.9%**	**7.0%**	**8.0%**	**6.9%**

Source: *TARI Research team based on primary survey by Kantar Public*

Respiratory diseases that are prevalent in 14.9 % of population having any kind of NCDs shows quite higher prevalence in people aged above 60 years. Asthma and Acute Respiratory Infection are more prevalent in this age group whereas respiratory diseases including Pneumonia and Cystic Fibrosis have relatively higher prevalence in population below 35 years of age group.

[83] Trade and investment liberalization and Asia's non-communicable disease epidemic: a synthesis of data and existing literature. Phillip Baker, Adrian Kay and Helen Walls, http://www.globalizationandhealth.com/content/10/1/66
[85] The Potential Impact Of Free Trade Agreements On Public Health, Undp, Unaids Issue Brief | 2012

Illness Profile of Respiratory Disease

Disease type	18 - 25 years	26 - 35 years	36 - 50 years	51 - 59 years	60 years and above	All
Pneumonia	2.8%	2.5%	1.5%	1.4%	1.0%	1.6%
Asthma	5.1%	4.6%	6.8%	6.5%	11.4%	7.5%
Cystic Fibrosis	0.6%	0.9%	0.4%	0.2%	0.6%	0.5%
Acute Respiratory Infection	3.7%	4.0%	4.8%	5.6%	6.5%	5.2%
Respiratory	**12.1%**	**12.0%**	**13.5%**	**13.8%**	**19.5%**	**14.9%**

Source: *TARI Research team based on primary survey by Kantar Public*

Prevalence of skin diseases is quite higher in the younger population, particularly in age group 18-25 years, which decreases with increase in age.

Acne Vulgaris and Contact Dermatitisare are the most common diseases skin diseases. Many uncommon skin diseases have a prevalence rate of 2.9% in the overall skin disease prevalence of 6.9% in the population suffering from any NCD. Further, prevalence of skin diseases is quite higher in the younger population, particularly in age group 18-25 years, which decreases with increase in age. Acne vulgaris, Skin cancer, Contact Dermatitis Actinic Keratosis and Psoriasis are common skin diseases in younger population.

Illness Profile of Skin Disease

Disease type	18 - 25 years	26 - 35 years	36 - 50 years	51 - 59 years	60 years and above	All
Acne vulgaris	5.3%	1.3%	0.6%	0.3%	0.2%	0.8%
Skin cancer	0.6%	0.5%	0.3%	0.4%	0.3%	0.4%
Atopic Dermatitis	0.6%	0.3%	0.4%	0.1%	0.2%	0.3%
Contact Dermatitis	0.6%	1.0%	0.8%	0.5%	0.8%	0.8%
Hives	0.6%	0.5%	0.7%	0.4%	0.4%	0.5%
Psoriasis	0.9%	0.4%	0.3%	0.2%	0.1%	0.3%
Actinic Keratosis	0.9%	0.2%	0.1%	0.1%	0.0%	0.1%
Vitiligo	0.2%	0.1%	0.3%	0.1%	0.1%	0.2%
Any other	5.1%	4.6%	3.0%	1.9%	1.8%	2.9%
Skin Disease	**14.7%**	**8.9%**	**6.4%**	**3.8%**	**3.9%**	**6.2%**

Source: *TARI Research team based on primary survey by Kantar Public*

2.3 Awareness and Knowledge of NCDs

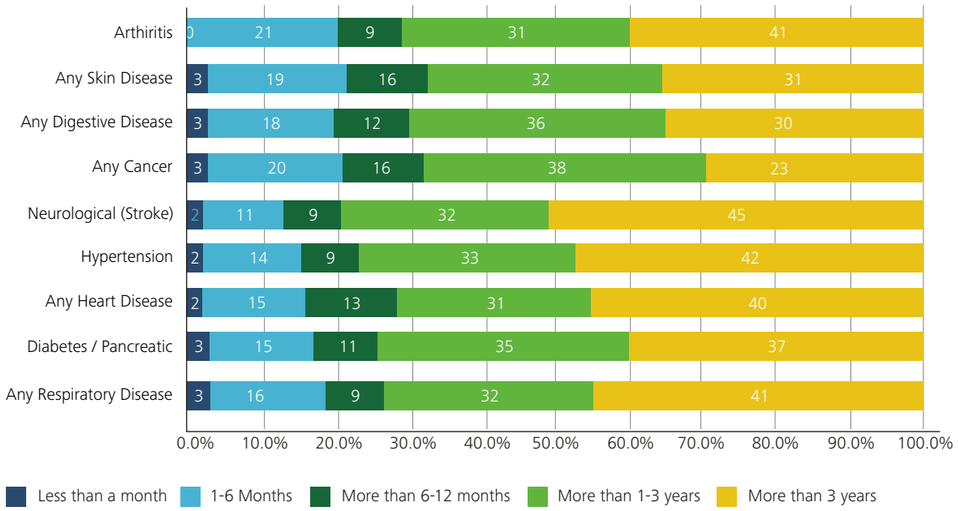
This sub-section provides insights on how long it takes people to be aware about the kind of NCD they are suffering from and different channels through which they got know about it. Results here are presented for nine broad disease categories and results for specific diseases under these categories are provided in the Annexure III of the report. The survey results highlighted that there is marked lack of awareness and knowledge about NCDs among the population.

How Long It Takes People to Be Aware About Their NCD

The survey results showed that across almost all diseases, except skin diseases, digestive disorders and cancer, more than 40% of the respondents suffering from these diseases stated that they were not aware of having their respective diseases for more than 3 years. In these diseases, symptoms are quite visible and observable which should lead to early detection.[50]

Overall the knowledge levels of respondents about suffering from any NCDs were directly correlated with time taken in diagnosis. Across all diseases, more than 60% respondents stated that they were diagnosed of their NCD after 1 year of suffering. As it can be seen from results, it is difficult for people to be aware about specific NCDs at an early stage as symptoms may not be quite visible or observable. It is therefore important that people should undergo regular preventive medical tests and visit a certified medical practitioner so that they about their diseases in early stages to have quicker treatment and better control.

Time Taken to know about NCD (%)



Source: *TARI Research team based on primary survey by Kantar Public*

[50]Refer to Annexure III for results on specific diseases under these broad disease categories

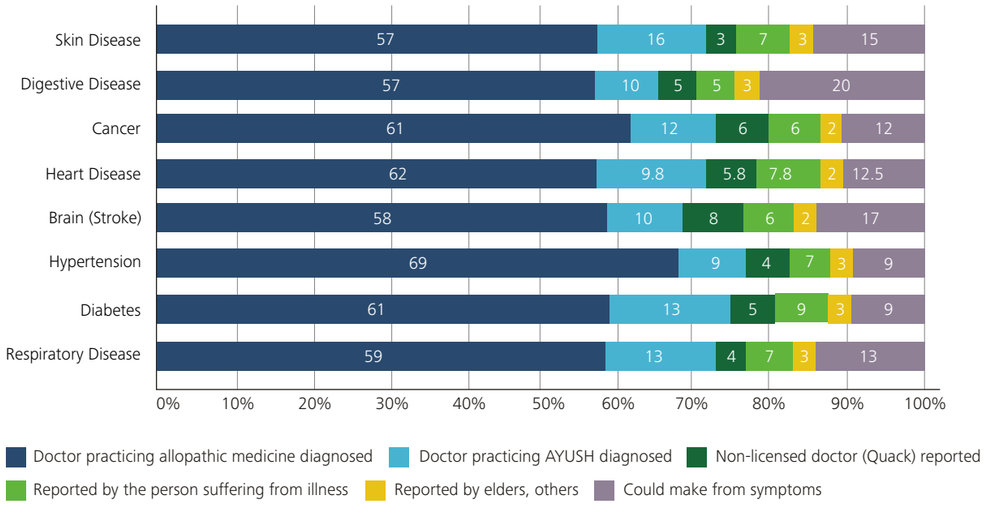
Overall the knowledge levels of respondents about suffering from any NCDs were directly correlated with time taken in diagnosis. Across all diseases, more than 60% respondents stated that they were diagnosed of their NCD after 1 year of suffering.

How People Know About Their NCD

Survey covered questions about various channels ranging from doctor practicing allopathic medicine or AYUSH to reporting by non-licensed doctors ('quacks') or elders or others etc. through which people get to know about their disease.[51] Survey findings point that nearly 60% of the people knew about the disease through allopathic medical practitioner while 15% to 18% approached AYUSH practitioner or a non-licensed doctor for their disease diagnosis.

Results highlight that about 20-25% percent people suffering from various NCDs could identify their disease based on symptoms either through reporting by person suffering from disease/ elders/ others or through own self-assessment of symptoms. Further, knowledge of disease based on symptoms is relatively higher (more than 25%) in cases of skin diseases, brain/ neurological disorders and digestive diseases, where symptoms can be easily observed but with the help of a medical practitioner.

How People know their NCD (%)



Source: *TARI Research team based on primary survey by Kantar Public*

Individual's knowledge and awareness about NCDs is an important part of any population based preventive strategy. While on the hand one, there are continuous efforts running globally to reduce the burden of NCDs, it is extremely important to understand that lack of awareness exacerbates the problem of NCDs since a large number of cases in India go unreported and untreated due to lack of knowledge of their existence.

[51] Refer to Annexure III for results on specific diseases under these broad disease categories

3.

Prevalenceof Key Risk factors Causing NCDs

Prevalenceof Key Risk factors Causing NCDs

NCDs in India such as cardiovascular diseases, respiratory diseases, cancers, diabetes, digestive disorders, skin diseases, neurological disorders - the leading causes of mortality in India are triggered due to several, and often common risk factors. The first step in this process is identifying and dealing with associated risk factors.

In this section the analysis primarily focuses on understanding prevalence of risk factors among the population which can be then correlated with specific diseases. This section of the report is based on the main survey covering a population of 10538 individuals aged 17 years and above across all the states having one or more non-communicable disease to have better insights about prevalence of key risk factors among this population.

A risk factor may be defined as an aspect of lifestyle or behavior, hereditary characteristic, environmental exposure etc. that is associated with an increase in the occurrence of a particular disease, injury or other health condition.[52] The risk factors are typically classified into **three groups** by WHO,[53] Out of the three broad categories behavioural risks form the largest part (41%) followed by metabolic risk factors (37%) and the remaining are environmental/occupational risk factors (21%).

This study has covered number of risk factors that can be directly attributed to NCDs. As this survey captures individual responses, those risk factors have been covered and analysed which an individual can observe, perceive or indulge. Metabolic risk factors such as high blood pressure, High fasting blood glucose, High LDL cholesterol, Low bone mineral density and Impaired kidney function that require clinical measurement and cannot be measured by individuals themselves were not captured in the survey. Further, many environmental risk factors such air pollution (ambient particulate matter, Ozone) and Other environmental risks (Lead, Radon) were not possible to measure at individual levels. Either

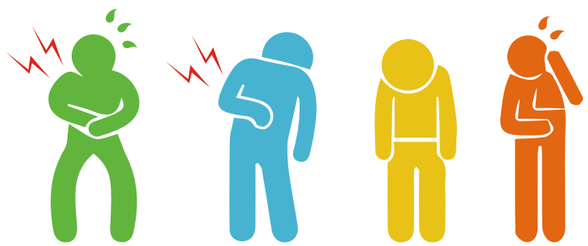
Environmental Risk Factors	Metabolic and Physical Activity related Risk Factors	Behavioural Risk Factors
■ Air pollution (ambient particulate matter, household air pollution, Ozone)	■ High blood pressure	■ Malnutrition
■ Occupational risks	■ High fasting blood glucose	■ Dietary risks
■ Other environmental risks (Lead, Radon)	■ High LDL cholesterol	■ Tobacco consumption
■ Wash (unsafe water, unsafe sanitation, handwashing)	■ Impaired kidney function	■ Alcohol and drug use
	■ High body mass index (overweight & obesity)	■ Unsafe sex
	■ Low bone mineral density	■ Sexual abuse and violence
	■ Low physical activity	

Source: *IHME*

[52]Principles of Epidemiology, CDC, 2006.
[53]Institute for Health Metrics and Evaluation(IHME), 2017, WHO collaboration Results, Seattle, United States

risk indicators were ignored, or these risk indicators are measured by perception level of exposure to these risk indicators. For example, air pollution risk captured in the survey is based on individual's perception about their exposure to air pollution.

The study has analyzed risk factors by classifying risk factors into four categories. First category is environmental risk factors. This primarily includes air pollution, which is largely non-controllable by an individual. Second category includes dietary risk factors which depends upon consumption levels of various foods like vegetables, fruits, legumes, milk, red meat and milk products etc. Metabolic and physical activity risk factor represents third category related to lifestyle. Overweight and obesity are the risk factors that are considered under metabolic risk factors, which are also correlated with low level of physical activity risk factors. Last category of risk factor analyzed include intoxication and behavioural risk factors related with an individual. Tobacco and alcohol consumption vary from individual to individual and constitute major form intoxication legally permitted for adults.



All risk factors covered under these four categories have direct correlation with various types of NCDs. The result of the prevalence of relative risk of these factors among the surveyed population are presented in following sub-sections. Prevalence is defined as the total number of individuals affected by a given risk factor in a specified population at a designated time. Example number of individuals exposed to high air pollution among surveyed population of 10538 individuals. Definition of risk factors used and referred in this section is explained in the Annexure IV of the report.

3.1 Environmental Risk Factors

Environmental risk factors related to air pollution are third most important risk factor driving disability and death in India.[54] Air pollution is non-controllable risk factor that is more pervasive as compared to other risk factors. It is all around us, no matter how affluent an area one lives in, it is hard to escape. It includes ambient particulate matter, household air pollution and ozone.

Air pollution is one of the key factors causing critical NCDs like heart diseases, respiratory diseases, lung cancer and stroke. Air pollutant particles deeply affect human circulatory and respiratory system by slipping past our body's defenses damaging our brain, heart and lungs.[55]

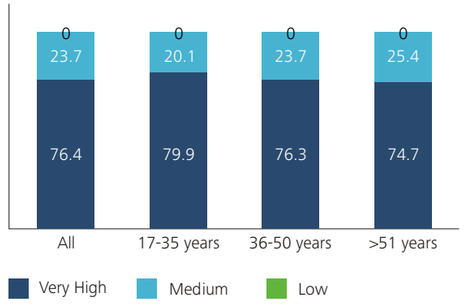
Air Pollution

Air particulate matter (PM) pollution, PM2.5 and PM10 particles can penetrate deep into lung passageways and are most harmful to health. These are closely correlated with excessive premature mortality. Air pollution is responsible for nearly 14% contribution to DALYs due to NCDs in India in 2015.

Greenpeace India[56] analysed 168 cities using data from various State Pollution Control Boards. These cities were ranked based on the annual average of PM10 particulate matter, found in the air. According to the report, 154 cities have an average particulate matter level higher than the national standard. None of the cities matched the air quality standard prescribed by WHO, although Hassan in Karnataka was close to the standard.

Survey covered questions related to air pollution. However, these were based on an individual's perception about their exposure to air pollution rather than a measurement of PM level in the air. *Survey results show that prevalence of exposure high air pollution among population is 76.4%. Every 3 out of 4 individuals perceive they are exposed to high air pollution while no one said to have low exposure to air pollution. It is pertinent that risk of air pollution is pervasive and relatively similar across all age groups but younger population who are either studying or working have a marginally higher risk.*

Air Pollution (%)



Source: *TARI Research team based on primary survey by Kantar Public*

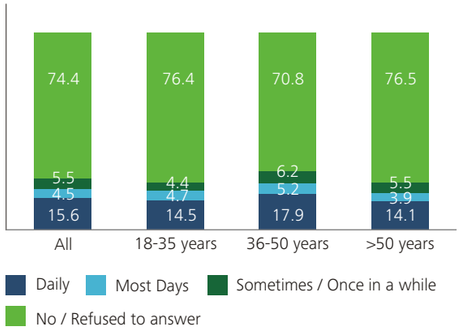
Air Pollution at Workplace

Working population are exposed to different sources of air pollution at their workplace. Growing industrialization is increasing the amounts of emissions from factories and plants. Rising automobile exhaust, harmful gases like carbon monoxide emitted from burning of fossil fuels such as coal, petroleum and natural gas, stubble or crop burning activities and mining operations are some of the other major causes of outdoor air pollution in India.

Survey results show that prevalence of air pollution at workplace among total surveyed population is 20.1 %, who witness pollution on daily basis or most of the days. These individuals are likely to be those who are exposed to outside air pollution, while working such as field workers, shop keepers, working labours and sales professionals who extensively travel for their work.

As per survey, about 3/4th of individuals refused to answer or are not exposed to air pollution at work place highlighting either these individuals are not working or work in an air-conditioned environment. Highest exposure to air pollution can be observed in age group between 36-50 years, where 30% of population between 36-50 years have higher exposure to air pollution as compared other age groups.

Air Pollution at Workplace (%)

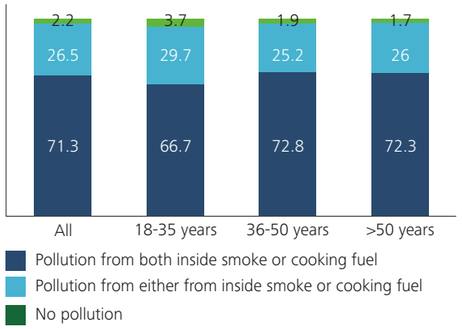


Source: *TARI Research team based on primary survey by Kantar Public*

Household Air Pollution

Household air pollution, also referred to as indoor air pollution, is the pollution generated by household combustion of fuels caused by burning fuel such as kerosene, wood and coal using basic stoves and secondhand smoke generated by tobacco smoking by family members within the household indoor premises.

Household Air Pollution (%)



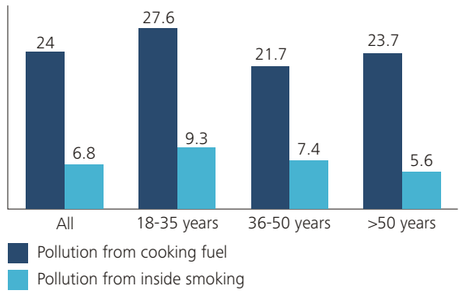
Source: *TARI Research team based on primary survey by Kantar Public*

Survey results highlight that among surveyed individuals, prevalence of exposure to household air pollution is 28.7%. While 26.5% of individuals are exposed to either smoke from cooking fuel or second-hand inside the house 2.2% of individuals are exposed to both types of smokes together.

Women and young population who are not working have higher exposure to household air population. Results also highlight that one-third of younger population (17-35 years) is exposed to household air pollution, which is higher than other age groups. Air pollution affects pregnant women and kids, which lead to pneumonia, reduce birth weight, lung growth, aggravates asthma and adversely affects brain development in children.[57]

Exposure to household air pollution from cooking fuel is 3.5 times more than other smoke /pollution inside the house. 24 % of individuals are exposed to household air pollution from cooking fuel as compared to 6.8% from other smoke / pollution inside the house. Exposure to house air pollution from both causes can be observed in younger population group.

Household Air Pollution:
Inside Smoke vs. Cooking Fuel (%)



Source: *TARI Research team based on primary survey by Kantar Public*

Water and noise pollution are also contributing risk factors. High levels of mercury in water can lead to mental illness and excessive noise can lead to hearing and sleep disorders and high blood pressure.

[54] IHME database 2017, GBD
[55] Medlineplus.gov.(2019). Health Risks of an Inactive Lifestyle: MedlinePlus. [online] Availableat: https://medlineplus.gov/healthrisksofaninactivelifestyle.html [Accessed 12Sep. 2019].
[56] Airpocalypse: Assessment of Air Pollution in Indian cities (January 2017), Greenpeace India, ublished by GPET
[57] Brockmeyer S., Amedeo D., (2016), How air pollution alters brain development:the role of neuroinflammation, Translational Neuroscience, NCBI

3.2 Metabolic and Physical Activity Risk Factors

The prevalence of metabolic syndrome has been reported worldwide. Metabolic syndrome represents a cluster of risk factors that includes high obesity, higher levels of triglycerides (TGs), increased stress levels/ blood pressure, lowers levels of HDL and elevated levels of blood glucose. High prevalence and incidence of metabolic syndrome and individual metabolic risk factors among the population is significantly associated with lower levels of physical activity and sedentary activity.[58]

According to GBD, in metabolic risks increased by 63·7% between 2007 and 20017 and accounted for 16·9% (15·618·3) of all DALYs in 2017. Increasing exposure to metabolic risks stands as one of the key drivers of increasing DALYs from NCDs, particularly among females.[59] A study highlights that people with metabolic syndrome were 1.32 to 1.79 times more likely to die of all causes than those without metabolic syndrome.[60]

High Body Mass Index (BMI)

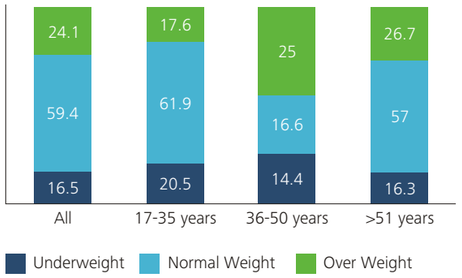
The WHO points that individuals with high BMI, i.e. overweight and obese individuals have higher risk of metabolic problems and critical NCDs including type 2 diabetes, high blood pressure, asthma and other respiratory problems, sleep disorders and liver disease. These people may also suffer from psychological effects, such as low self-esteem, depression and social isolation.[61]

With the increased intake of energy-dense foods that are high in fat and with an increase in physical inactivity due to increasing urbanization, changing modes of transportation and increasingly sedentary nature of many forms of work, overweight and obesity is increasing across the world.[62] A study[63] points that "prevalence of adult obesity has nearly tripled since 1975 and, by 2016, more than 1.9 billion adults were overweight or obese, while there has been a tenfold increase in overweight and obesity among children and adolescents over the same period."

While it is not common to find obesity and malnutrition co-existing within the same country, a vast and a middle-income country like India is facing both the challenges at the same time. While infectious diseases and under nutrition still exist as a major concern, with every passing day the country is seeing a rapid upsurge in the rates of Obesity and Overweight, especially in the urban areas. *Survey results point that 24.1% of adult population are either overweight or obese. Further, prevalence of obese people increases with age.*

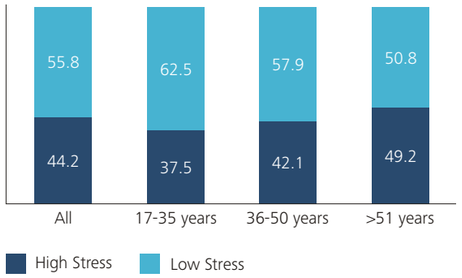
[58]Park, S. K., &Larson, J. L. (2014). The relationship between physical activity and metabolic syndrome in people with chronic obstructive pulmonary disease. *The Journal of cardiovascular nursing*, 29(6), 499–507.
[59]Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017
[60]Guize L, Thomas F, Pannier B, Bean K, Jego B, Benetos A. All-cause mortality associated with specific combinations of the metabolic syndrome according to recent definitions. DiabetesCare. 2007;30(9):2381–2387.
[61]https://www.who.int/elena/titles/ssbs_childhood_obesity/en/
[62]Who.int. (2019). Obesity and overweight. [online] Available at: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight [Accessed 16 Sep. 2019].
[63]Branca, F., Lartey, A.,Oenema, S., Aguayo, V., Stordalen, G. A., Richardson, R., … Afshin, A. (2019).Transforming the food system to fight non-communicable diseases. *BMJ (Clinical researched.)*, 364, l296. Doi:10.1136/bmj.l296

BMI (%)



Source: *TARI Research team based on primary survey by Kantar Public*

Stress Levels (%)



Source: *TARI Research team based on primary survey by Kantar Public*

High Stress Levels

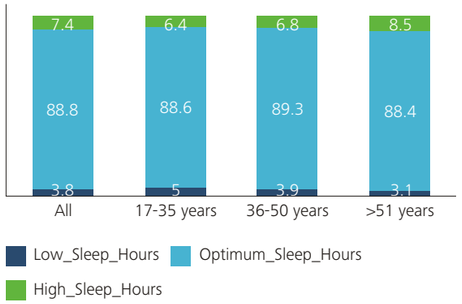
Body's reaction to harmful situations is known as stress. Human body is designed to handle small doses of stress but are not equipped to handle chronic or long-term stress. There can be different symptoms of stress which includes: cognitive symptoms of stress such as being pessimistic or seeing the negative side of things, poor judgment, inability to focus, forgetfulness and disorganization; behavioural symptoms include exhibiting more nervous behaviors such as pacing, fidgeting and nail biting etc.; physical symptoms of stress comprise of upset stomach, headaches, low energy, aches, pains, tense muscles, rapid heartbeat and chest pain, frequent colds and infections etc. Ongoing, chronic stress has been associated with the following non-communicable diseases: high blood pressure, stroke, heart attacks, abnormal heart rhythms, eating disorders, gastrointestinal problems, and cancer and skin problems such as acne, psoriasis and eczema.[64]

High stress level is an important lifestyle risk factor for NCDs, which may highly corelated with high blood pressure. Survey results highlight that 44% of population have prevalence of risk of high stress. Further, it can be observed that stress gradually increases with increase in the age.

Low Sleep

Daily adequate sleeping of about 8 hours is necessary for good mental and physical health. Lack of adequate sleeping hours on a continual basis can affect overall health condition of an individuals. It can result in metabolic disorders and NCDs such as obesity, heart disease, high blood pressure and diabetes, and may even result in early mortality.[65] *Survey results point that only 3.8% of individuals have prevalence of low sleep disorders. Adults aged between 17-35 years have highest level of sleep deprivation.*

Sleep Hours (%)



Source: *TARI Research team based on primary survey by Kantar Public*

[64]Cold, F., Health, E., Disease, H., Disease, L.,Management, P., Conditions, S. et. al. (2019). Stress Symptoms: Effects of Stress on the Body. [online] WebMD. Available at: https://www.webmd.com/balance/stress-management/stress-symptoms-effects_of-stress-on-the-body#2 [Accessed 16 Sep. 2019].
[65]http://healthysleep.med.harvard.edu/healthy/matters/consequences

Low Physical Activity

Low physical activity with inactive lifestyle increases metabolic risk factors. In absence of physical activity, bones lose mineral content and may get weaker, metabolism may get affected and the body might find it troublesome to break down sugars and fats, hormonal imbalance might be developed, the immune system may not work well, blood circulation might get poorer and the body may have more inflammation. An inactive lifestyle is one of the biggest causes behind many chronic diseases. Obesity, heart diseases including heart attack and coronary artery diseases, high blood pressure, high cholesterol, stroke, metabolic syndrome, Type 2 diabetes, certain cancers (colon, breast and uterine), Osteoporosis are to some extent attributed to following an inactive lifestyle.[66] The benefits of regular physical activity (PA), including lowered mortality rates, improved function and enhanced quality of life, are widely recognized.[67]

Low physical activity (either low or moderate physical activity) is a key risk factor for an NCD. Survey results highlight that 66.5% of population have prevalence of low physical activity. Between 17 -50 age groups, level of low physical activities is pervasive.

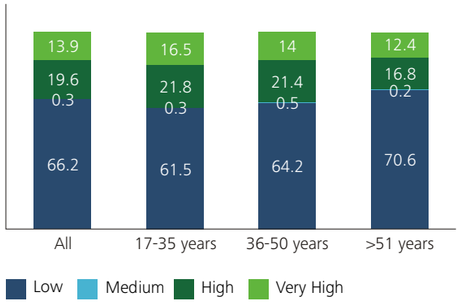
Low Physical Activity in Occupation

Low physical activity or labour in occupation is non controllable risk factor. Many of our jobs have become more sedentary which involves long hours sitting at a desk. The way we commute from one place to another has also become sedentary that involves sitting in trains, buses or cars. Due to the substantial amount of time dedicated to paid work in today's society, an individual's occupation likely has a strong influence on daily physical activity and sedentary behaviours (e.g., does their job require mostly sitting, standing, walking, engaging in repetitive tasks, or heavy labour). There is a strong association between occupational category and daily activity levels.[68]

However, research studies show a mixed relationship between physical activity in occupation and health effects. Many studies have shown high levels of occupational activity is linked with better health conditions and longer sittings during occupation with detrimental effects. On the other hand, some studies have also found high levels of occupational activity associated with adverse health effects.[69]

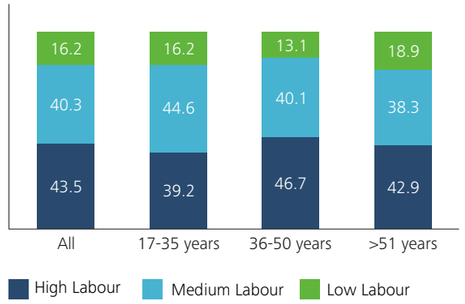
Survey findings highlight that 16% of individuals have low physical activity at their workplace. About 40% of individuals have high physical activity or labour in their occupation mitigating the risks of having an NCD.

Physical Activity (%)



Source: *TARI Research team based on primary survey by Kantar Public*

Physical Activity in Occupation (%)



Source: *TARI Research team based on primary survey by Kantar Public*

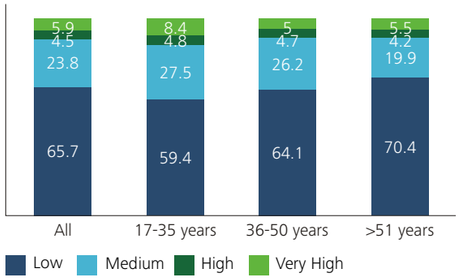
[66]Medlineplus.gov. (2019). Health Risks of an Inactive Lifestyle: MedlinePlus.[online] Available at: https://medlineplus.gov/healthrisksofaninactivelifestyle.html [Accessed 16 Sep.2019].
[67]Steeves, J. A., Tudor-Locke, C., Murphy, R. A.,King, G. A., Fitzhugh, E. C., Bassett, D. R., Van Domelen, D., Schuna, J. M.,& Harris, T. B. (2018). Daily Physical Activity by Occupational Classification in US Adults: NHANES 2005–2006, *Journal of Physical Activity and Health*,15(12),900-911.
[68]Steeves, J.A., Tudor-Locke, C., Murphy, R. A., King, G. A., Fitzhugh, E. C., Bassett, D.R., Van Domelen, D., Schuna, J. M., & Harris, T. B. (2018). Daily Physical Activity by Occupational Classification in US Adults: NHANES 2005–2006, *Journal of Physical Activity and Health*, 15(12), 900-911.[1]
[69]Steeves, J.A., Tudor-Locke, C., Murphy, R. A., King, G. A., Fitzhugh, E. C., Bassett, D.R., Van Domelen, D., Schuna, J. M., & Harris, T. B. (2018). Daily Physical Activity by Occupational Classification in US Adults: NHANES 2005–2006, *Journal of Physical Activity and Health,* 15(12), 900-911.

High Leisure Activity

'An inactive or a sedentary lifestyle'. These are some of the very common phrases used in day to day conversations and all these phrases mean the same thing: a lifestyle with a lot of sitting and lying down, with very little to no exercise. Around the world, people are spending more and more time doing sedentary activities.

Higher leisure activity (high to very high) is risk factor as it reduces body metabolism if such activity does not involve physical effort. *Survey results show that 10 % of population have prevalence of risk of high to very high leisure activity. Older population have higher leisure activity but the relative weights of leisure activities between people below the age of 35 and those between 36 to 50 years are not significantly different, making the younger population low on physical activities and hence prone to NCDs.*

Leisure Activities (%)



Source: *TARI Research team based on primary survey by Kantar Public*

3.3 Behavioral Risk Factors

Intoxication

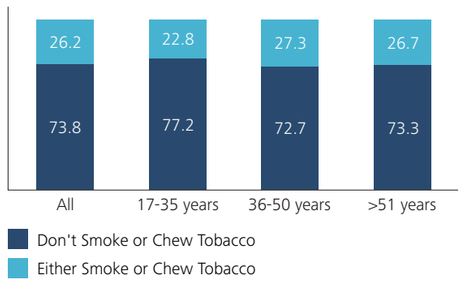
Intoxication such as tobacco, alcohol and substance abuse are behavioural risk factors that vary among individuals and depends upon their intent. These are one of the risk factors that are modifiable and targeted by advocates for change. Survey covered all three types of intoxication, however since substance abuse response were almost negligible so it is not presented in the report.

According to the GBD study, intoxication related behavioral risk factors. i.e. alcohol use and smoking have shown universal declines in the value and observed/ expected value ratio (O/E ratio) both have declined between 1990 and 2017.[70]

Tobacco Consumption

Due to its serious effects on health, around the world the growing use of tobacco is a cause of great concern. According to Global Burden of Disease (GBD) 2015, tobacco use contributed to 5.9 per cent out of total DALYs in India. The Global Adult Tobacco Survey-2 India 2016-17 reports that 28.6% of adults (aged 15 and above) consume tobacco in any form. 18% use smokeless tobacco, 7% are smokers and 4% use both forms of tobacco. The report also says that khaini is the most used tobacco product (used by 10.4 crore adults) followed by bidi (smoked by 7.2 crore adults).[71] Tobacco use in India has reduced by 6 % in last 7 years. This has come down from levels of 34.6 % in 2009-10 to 28.6 % in 2016-17. Chronic respiratory diseases, diabetes, cancer, and ischemic heart diseases are some of the NCDs, which are associated with tobacco use.[72]

Tobacco Consumption (%)



Source: *TARI Research team based on primary survey by Kantar Public*

[70]Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks for 195 countries and territories,1990–2017: a systematic analysis for the Global Burden of Disease Study 2017
[71]Global Adult Tobacco Survey-2 India 2016-17
[72]National Health PortalIndia. 2019. Effects of Tobacco on Health. [ONLINE] Available at: https://www.nhp.gov.in/effects-of-tobacco-on-health_pg. [Accessed 15September 2019].

Survey results highlight that 26.2 % of adults (aged 17 years and above) consume tobacco in any form, Results are comparable with GATS survey but suggests a declining trend of tobacco consumption in recent years. This is also in line with IHME data of GBD study that also points towards a declining trend. Tobacco consumption is highest among middle aged adults between 36 to 50 years comprising of working population.

Smoking tobacco

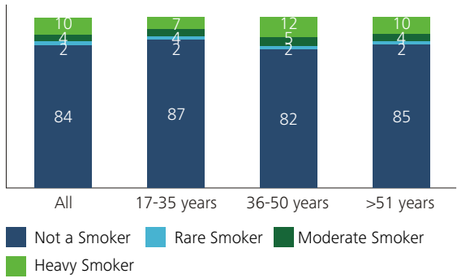
Tobacco smoke is defined "prevalence of current use of any smoked tobacco product and prevalence of former use of any smoked tobacco product."[73] According to WHO,[74] nearly 80% of the more than 1 billion smokers worldwide live in low and middle-income countries like India, where the burden of tobacco-related illness and death is the heaviest. According to the Global Burden of Disease study,[75] China, India, and Indonesia, accounted for 51.4% of the world's male smokers in 2015; 27.3% of the world's female smokers came from USA, China and India.

Survey results highlight that only 16% of adult population having an NCD have prevalence of risk of smoking tobacco. About 85% of adults are non-smokers and not exposed to relative risks of having an NCD associated with smoking. Further, results points that 10 % of individuals are heavy smokers and 4% are moderate smokers. Tobacco smoking is also highest among middle aged adults between 36-50 years comprising of working population.

Survey results further point that prevalence of smoking cigarette is 5% as compared prevalence of 11.2% of smoking of other tobacco products like bidi, cigar etc. These results are also consistent with the Global Adult Tobacco Survey 2016-17 (GATS-2), published by the Ministry of Health and Family Welfare, which also highlights that among adult consumer base of tobacco users of 28.6%, adult consumer base of cigarettes is 4%.[76] This consumption pattern is also evident from annual tobacco consumption as per NSS's 68th round July 2011-June 2012. According to NSS, the total consumption value of bidis is 37,012.36 crores or 40% of total tobacco consumption. On the other hand, total consumption value of cigarettes is 20,887.60 crores representing 23% of total consumption.[77]

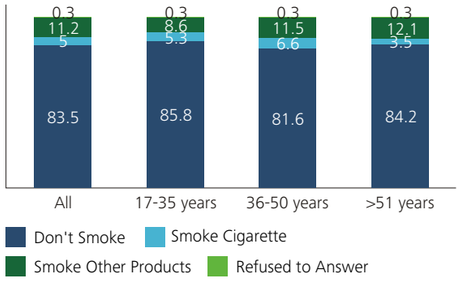
This has adverse implications on health since bidis are considered more harmful than cigarettes. According to a study conducted by the Sekhsaria Institute of Public Health, in collaboration with the Ministry of Health, the incidence of oral cancer in bidi smokers was 42% higher than in cigarette smokers.[78]

Smoking (%)



Source: *TARI Research team based on primary survey by Kantar Public*

Smoking Tobacco (%)



Source: *TARI Research team based on primary survey by Kantar Public*

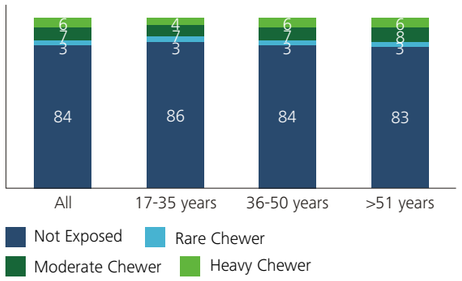
[73]Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks for 195 countries andterritories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017
[74]Tobacco, Fact Sheet, Media Centre, WHO 2017
[75]GBD 2015
[76]Tobacco Consumption, Tobacco Institute of India, http://www.tiionline.org/facts-sheets/tobacco-consumption/
[77]India- Household Consumer Expenditure, NSS 68th round July 2011 - June2012
[78]Pednekar M, Gupta PC , Yeole BB , Hebert JR. (2011), 'Association of tobacco habits ,including bidi smoking , with overall and site-specific cancer incidence: results from the Mumbai cohort study', Cancer Causes Control.

Chewing Tobacco Consumption

Chewing tobacco under GBD study is defined as current use of any chewing tobacco product.[79] Chewing tobacco in India is available in different forms such as paan, paan masala, khaini, zarda and gutka.[80] Chewing and smokeless tobacco consumption is associated with several NCDs such as oral cancers, cardiovascular diseases, low birth weight and mental illnesses.[81]

Khaini is most used tobacco product among tobacco consumers as GATS survey 2016-17. GATS survey confirms that chewing and smokeless tobacco consumption in India has also come down in the last 7 years. It has declined from 25.9% in 2009-10 to 21.4% in 2016-2017.[82] *Survey results highlight 16 % of adult population have prevalence of chewing tobacco and this increases with higher age groups. 13% to 14% individuals are moderate to heavy tobacco chewers.*

Chewing Tobacco (%)



Source: *TARI Research team based on primary survey by Kantar Public*

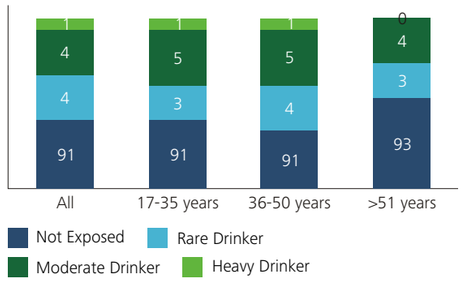
Alcohol Consumption

Men and women are advised not to drink more than 14 units per week to keep health risks to a low level1 unit is equal to 10 ml or 8 g of pure alcohol.[83] A large economic, social and disease burden has been put by the harmful use of alcohol in societies. Health problems such as behavioural and mental disorders have been associated with drinking alcohol.

In more than 200 injury and disease conditions alcohol consumption has been found as one of the causal factors. Regular drinking of alcohol more than limits over a long period of time can result in higher BMI and metabolic risk of higher blood pressure.[84] Cardiovascular diseases, some cancers and liver cirrhosis are some of the major non-communicable diseases said to be at the risk of developing due to excessive use of alcohol.[85]

Survey results show that prevalence of alcohol consumption is 9% of adult population. About 5-6% of individuals say they are moderate to heavy drinkers, while 3-4% declared themselves to be occasion drinkers. Consumption of alcohol decreases with increase in the age of population.

Alcohol Consumption (%)



Source: *TARI Research team based on primary survey by Kantar Public*

Dietary Risk Factors

Dietary risks essentially include diets sub-optimal in calcium, low in whole grains, vegetables, seafood omega-3 fatty acids, polyunsaturated fatty acids, nuts and seeds, milk, fruits, fibre, trans-fatty acids and high in sugar-sweetened beverages, sodium, red meat, processed meat. Dietary risks are the largest contributing factor to years of life lost due to mortality and morbidity caused by NCDs in 2015 in India, at 19.1% of all identified risks. According to GBD 2017, a combination of 17 dietary risk factors lead to a large number of

[79]Global,regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks for195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017
[80]Thakur, J.S., & Paika, R. (2018). Determinants of smokeless tobacco use in India. The Indian journal of medical research, 148(1), 41–45.
[81]World Health Organization. Report on the global tobacco epidemic, 2008: The MPOWER package. Geneva: WHO: WHO; 2008.
[82]Global Adult Tobacco Survey-2 India 2016-17
[83]www.nhs.uk/live-well/alcohol-support/calculating-alcohol-units/
[84]Bhf.org.uk. (2019). *High blood pressure.* [Online] Available at: https://www.bhf.org.uk/informationsupport/risk-factors/high-blood-pressure[Accessed 16 Sep. 2019].
[85]"Alcohol". (n.d.). World Health Organization, World Health Organization, available at: https://www.who.int/news-room/fact-sheets/detail/alcohol

deaths globally through diseases like ischemic heart disease, diabetes and stroke. Overall in 2017, an estimated 11 million deaths and 255 million DALYs were attributable to poor diet. Diets high in sodium, low in whole grains, and low in fruit together accounted for more than half of all diet-related deaths globally in 2017. Although sodium, sugar, and fat have been the main focus of diet policy debate in the past two decades ,our assessment shows that the leading dietary risk factors for mortality are diets high in sodium, low in whole grains, low in fruit, low in nuts and seeds, low in vegetables, and low in omega-3 fatty acids; each accounting for more than 2% of global deaths.[86]

Metabolic risk factors along with **poor diet** have doubled the health loss in India over the past quarter of a century.[87] The largest shortfalls in optimal intake were seen for nuts and seeds, milk, whole grains, and the largest excesses were seen for sugar sweetened beverages, processed meat and sodium.[88] Poor diets are not the sole cause as large number of deaths occur each year due to consumption of adulterated foods. According to WHO,[89] unintentional poisonings kill an estimated 355,000 people globally each year. Two-thirds of these deaths occur in developing countries where "such poisonings are associated strongly with excessive exposure to, and inappropriate use of, toxic chemicals."

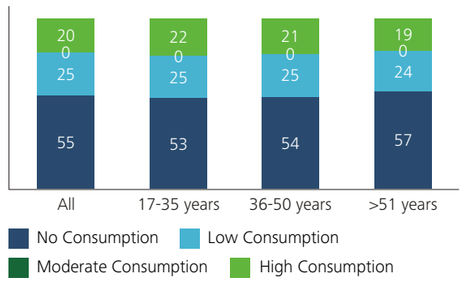
Diet Low in Legume Consumption

Legumes are a food group rich in B vitamins, contain different beneficial minerals (calcium, potassium and magnesium) and sizeable amounts of fibre and are regarded as a low-glycemic index food.[90] High legume intakes are associated with lower risk of all-cause mortality and it also does not increases the risk of CVD mortality.[91]

No legume (pulses) consumption was found to be highest prevalence of dietary risk factor among surveyed adult population. 55% of individuals are exposed dietary risk of no legume (pulses) consumption. As latest report of the Lancet 2019, mean daily consumption of legumes (fresh, frozen, cooked, canned, or dried legumes) is 60 g (50-70) per day.[92] In India, there is legume scarcity as production was about 19 million tonnes while demand was about 24 million tonnes.[93] Not all the population is able to get legumes or if get it, it does not meet dietary requirements.

Overall, 20% of individuals have enough legume consumption (moderate to high consumption). Further, consumption of legumes is highest among younger age group and shows decreasing trend for higher ages. This is in line with latest Lancet Study, points that intake on legumes is highest among adult population which decreases with age.[94]

Legume Consumption (%)



Source: *TARI Research team based on primary survey by Kantar Public*

Low Milk Consumption

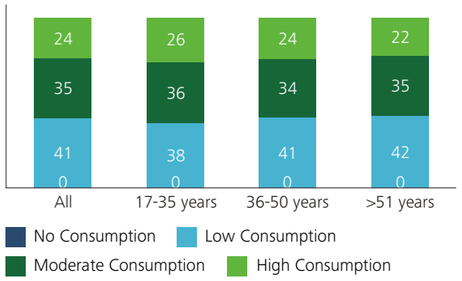
Milk consumption is important element of diet and low or milk consumption may lead certain nutritional deficiency resulting in certain NCDs. A study based on meta-analysis points out that milk and dairy products have either neutral or reduced effect on the type II

[86]Health effects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017; Lancet 2019; 393: 1958–7
[87]India makes progress against some risk factors, but disease burden due to high blood pressure, high blood sugar and high cholesterol increase, The George Institute for Global Health, Sept 2015 http://www.georgeinstitute.org.in/media-releases/india-makes-progress-against-some-risk-factors-but-disease-burden-due-to-high-blood
[88]https://www.sciencedaily.com/releases/2019/04/190403193702.htm
[89]Non-Communicable diseases and Environmental Determinants, WECF - Women in Europe for a Common Future, 2013
[90] https://www.eurekalert.org/pub_releases/2017-03/uriv-tco033017.php
[91]Li, H., Li,J., Shen, Y., Wang, J., & Zhou, D. (2017). Legume Consumption and All-Cause and Cardiovascular Disease Mortality. *BioMed research international,* 2017,8450618. Doi:10.1155/2017/8450618
[92]Healtheffects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017; Lancet 2019; 393: 1958–7
[93]Directorateof Economics & Statistics, 2015
[94]Health effects of dietary risks in 195countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017; Lancet 2019; 393: 1958–7

diabetes and results in lowered risk of CVDs, particularly stroke. Milk has also beneficial effect on the bone mineral density but directly does not have corresponding relationship with bone fracture. Further in relation to cancer, it was found to inversely related to associated with colorectal cancer, bladder cancer, gastric cancer, and breast cancer.[95]

Diet low in milk - mean daily consumption of milk including non-fat, low-fat, and full-fat milk, excluding soy-milk and other plant derivatives - 435 g (350-520) per day. The latest GBD study points that globally 16% of the recommended amount of milk is consumed, i.e. 71g average intake per day, compared with 435g recommended per day.[96] *Survey results are in line with the GBD study. Prevalence of low milk consumption among surveyed adult population is alarming: 41% of the adults report low consumption of milk. In addition, percentage of individuals having low milk consumption increases with increase in the age.*

Milk Consumption (%)

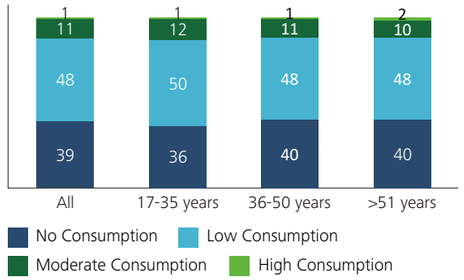


Source: *TARI Research team based on primary survey by Kantar Public*

Diet Low in Seafood Omega-3 fatty Acids

Sea food such as fish are very good source of protein and rich source of omega-3 fatty acids, which can be vital for reducing the risk of heart disease and stroke.[97] Mean daily intake of seafood omega-3 fatty acids (eicosapentaenoic acid and docosahexaenoic acid) should be 250 mg (200-300) per day.[98] However, a larger population is exposed to risk of either no consumption or low consumption of sea food in their diet. 39 % of individuals have prevalence of no consumption of sea food consumption, which increases risk of heart and stroke among them. Age has no effect on consumption of sea food and risk profile.

Sea Food Consumption (%)



Source: *TARI Research team based on primary survey by Kantar Public*

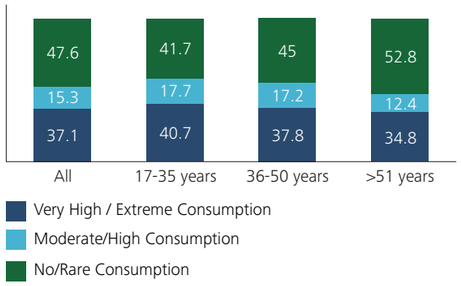
Diet High in Trans-Fats

Junk and street foods and other fried foods with high trans fats Diet high in trans **fats** raises bad (LDL) cholesterol levels along with lowering good (HDL) cholesterol levels, which heightens the risk of heart and CVDs and also associated higher incidence of developing type 2 diabetes.[99] Such diets are high in calorie and low in nutrition. Diet high in trans fatty acids -mean daily intake of trans fat from all sources, mainly partially hydrogenated vegetable oils and ruminant products -0·5% (0·01·0) of total daily energy.[100]

Prevalence of high consumption of trans fats- very high to extreme consumption of junk food/street food consumption among individuals increases risk of NCDs. *Survey results 37.1% of population have high / extreme consumption of junk food/street food/ fried food. Younger population i.e. 17 to 35 has relatively higher consumption of junk and fried foods.*

[95]Thorning, T. K., Raben, A., Tholstrup, T.,Soedamah-Muthu, S. S., Givens, I., & Astrup, A. (2016). Milk and dairy products: good or bad for human health? An assessment of the totality of scientific evidence. *Food & nutrition research*, 60, 32527.doi:10.3402/fnr.v60.32527
[96]Healtheffects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017; Lancet 2019; 393: 1958–7
[97]https://www.heart.org/en/healthy-living/healthy-eating/eat-smart/fats/fish-and-omega-3-fatty-acids
[98]Health effects of dietary risks in 195 countries,1990–2017: a systematic analysis for the Global Burden of Disease Study 2017;Lancet 2019; 393: 1958–7
[99]https://www.heart.org/en/healthy-living/healthy-eating/eat-smart/fats/trans-fat
[100]Health effects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017; Lancet 2019; 393: 1958–7

Diet High in Trans-fats (%)



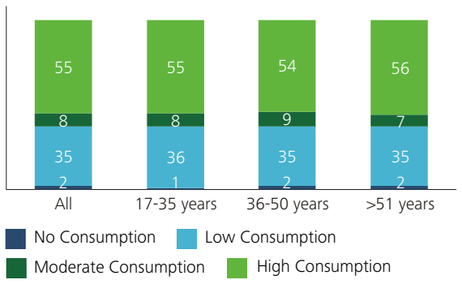
Source: *TARI Research team based on primary survey by Kantar Public*

Low Fruit Consumption

Fruits are good sources of vitamins and minerals, and low in calories and rich in dietary fiber. With extensive research it has been proven that a diet rich in fruits and vegetables can help keeping craving for unhealthy food in check and have positive effect upon the blood sugar, lower the risk of digestive and eye problems, prevent some type of cancers, reduce the risk of stroke and heart diseases and can also help keep blood pressure low.[101] Non-starchy fruits like pears, apples may even promote weight loss and low glycaemic loads present in them help prevent blood sugar spikes that can increase hunger. There are at least 9 different families of vegetables and fruits, each have potentially hundreds of different plant compounds that are beneficial to health and reduced risks associated with an NCD.[102]

Low in fruits - mean daily consumption of fruits (fresh, frozen, cooked, canned, or dried fruits, excluding fruit juices and salted or pickled fruits)- 250 g (200-300) per day. Low intake of fruits (2 million [1-4] deaths and 65 million [41-92] DALYs) were the leading dietary risk factors for deaths and DALYs globally and in many countries.[103] *Survey results show that prevalence of no or low consumption of fruits among individuals is 37%. Further, level of fruit consumption does not change with increasing age. Indian adults have sub-optimal consumption of fruits, which is one fruits is one of the leading dietary risk associated with NCDs.*

Fruits Consumption (%)



Source: *TARI Research team based on primary survey by Kantar Public*

Diet Low in Calcium Intake

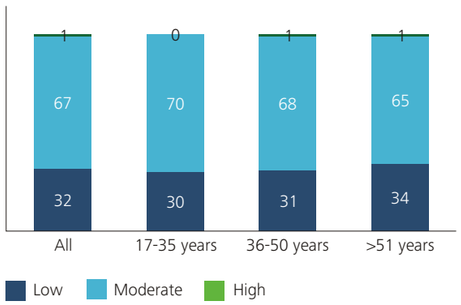
Dairy products such as milk, yoghurt and cheese, etc. along with calcium fortified foods (such as soy products) are good source of calcium. A study based on meta-analysis points that milk and dairy products has either neutral or reduced effect on the type II diabetes and results in lowered risk of CVDs, particularly stroke. Dairy products has also beneficial effect on the bone mineral density but do not directly have corresponding relationship with bone fracture. Further in relation to cancer, it was found to inversely related to associated with colorectal cancer, bladder cancer, gastric cancer, and breast cancer.[104] Not having enough calcium products in the diet may also increase risk associated with osteoporosis.[105]

Diet low in calcium - mean daily intake of calcium from all sources, including milk, yogurt, and cheese-1·25 g (1·00-1·50) per day.[106] However, estimating current measure of consumption levels of calcium intake remains a challenge. *Survey results show that 30% of*

[101]Hung HC, Joshipura KJ,Jiang R, Hu FB, Hunter D, Smith-Warner SA, Colditz GA, Rosner B, Spiegelman D,Willett WC. Fruit and vegetable intake and risk of major chronic disease. Journal of the National Cancer Institute. 2004 Nov 3;96(21):1577-84.
[102]The Nutrition Source.(2019). Vegetables and Fruits. [online] Available at:https://www.hsph.harvard.edu/nutritionsource/what-should-you-eat/vegetables-and-fruits/[Accessed 12 Sep. 2019].
[103]Healtheffects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017; Lancet 2019; 393: 1958–7
[104]Thorning, T.K., Raben, A., Tholstrup, T., Soedamah-Muthu, S. S., Givens, I., & Astrup,A. (2016). Milk and dairy products: good or bad for human health? An assessmentof the totality of scientific evidence. Food & nutrition research, 60,32527. Doi:10.3402/fnr.v60.32527
[105]https://www.betterhealth.vic.gov.au/health/healthyliving/calcium
[106]Healtheffects of dietary risks in 195 countries, 1990–2017: a systematic analysis forthe Global Burden of Disease Study 2017; Lancet 2019; 393: 1958–7

population have prevalence of low intake of calcium (milk products) intake. 2/3rd of adult population have moderate consumption of calcium intake while high consumption doesn't need any mention as it is very small. Further, higher prevalence of low intake calcium is observed in older population. Higher calcium intake in older population is necessary to maintain bone mineral density to have sufficient strength and agility.

Calcium (%)



Source: *TARI Research team based on primary survey by Kantar Public*

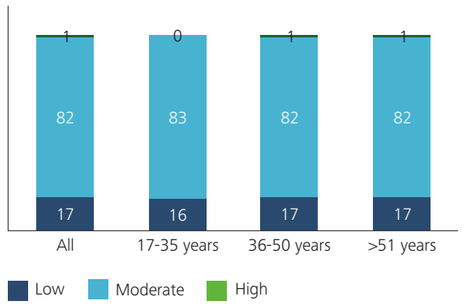
Diet Low in Whole Grains

Whole grains by retaining all parts of the seed (bran, germ and endosperm) are better sources of fiber and other important nutrients, such as B vitamins, iron, folate, selenium, potassium and magnesium.[107] Consumption of whole grains is associated with reduced risk of type 2 diabetes and chronic NCDs such as heart and CVDs, and even reduces risk of developing certain type of cancers such as colorectal cancer.[108]

According to latest GBD report in 2017,[109] across the 21 GBD regions, a diet low in whole grains was the most common leading dietary risk factor for deaths (in 16 regions) and DALYs (in 17 regions). Low intake of whole grains was the leading dietary risk factor for DALYs among men and women and the leading dietary risk factor for mortality among women, at about a quarter (23%) of the recommended amount of whole grains (29g average intake per day, compared with 125g recommended per day). Low intake of whole grains was the leading risk for deaths and DALYs among young adults (aged 2550 years). Low intake of whole grains was found to be leading dietary risk factor for deaths and DALYs in the India.

Diet low in whole grains- Mean daily consumption of whole grains (bran, germ, and endosperm in their natural proportion) from breakfast cereals, bread, rice, pasta, biscuits… and other sources- 125 g (100-150) per day.[110] Survey results show that prevalence of low intake of wh*ole grain consumption is approximately 17% of adult population. Age does not have any effect on fruits consumption behaviour.*

Whole Grain (%)



Source: *TARI Research team based on primary survey by Kantar Public*

Diet High in Sugar-Sweetened Beverages

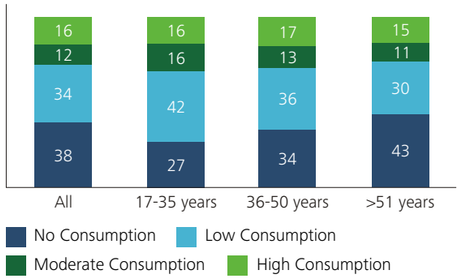
The WHO points that sugar-sweetened beverages have very high calorific value with very little nutritional value and can lead to unhealthy weight gain. This can further lead to higher risk of developing serious health problems including type 2 diabetes, high blood pressure, asthma and other respiratory problems, sleep disorders and liver disease.[111]

[107]https://www.mayoclinic.org/healthy-lifestyle/nutrition-and-healthy-eating/in-depth/whole-grains/art-20047826
[108]Cooper, D.N., Kable, M. E., Marco, M. L., De Leon, A., Rust, B., Baker, J. E., … Keim, N.L. (2017). The Effects of Moderate Whole Grain Consumption on Fasting Glucose and Lipids, Gastrointestinal Symptoms, and Microbiota. Nutrients, 9(2), 173.doi:10.3390/nu9020173
[109]Health effects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017; Lancet 2019; 393: 1958–7
[110] Health effects of dietary risks in 195countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017; Lancet 2019; 393: 1958–7
[111]https://www.who.int/elena/titles/ssbs_childhood_obesity/en/

Diet high in sugar-sweetened beverages- Mean daily consumption of beverages with ≥50 kcal per 226ml serving, including carbonated beverages, sodas, energy drinks, fruit drinks, but excluding 100% fruit and vegetable juices-3 g (0-5) per day. According latest GBD study, on an average, the world drinks around 10 times higher than recommended consumption of sugar-sweetened beverages (49g per day), far higher than the optimal intake levels of 3g. The highest intake of sugar-sweetened beverages was observed among young adults and showed a decreasing trend with age. However, sugar-sweetened beverages rank at the bottom of rankings of dietary risks for deaths and DALYs for most high-population countries.[112]

Survey results point that 16% of individuals have prevalence of risk of high consumption of sweetened carbonated beverages. In line with the GBD findings, results also point that highest intake of sugar-sweetened beverages are among young adults and shows a decreasing trend with age.

Sweetened Carbonated Beverages (%)



Source: *TARI Research team based on primary survey by Kantar Public*

Diet High in Red Meat

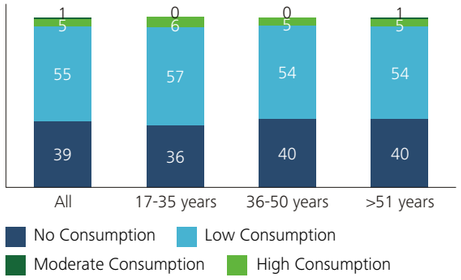
Red meat such as beef, pork, lamb, and goat, but excluding poultry, fish, eggs, and all processed meats are high sources of saturated fatty acids that naturally occurs

in these animal fats. Research shows that very high intakes of meat, particularly processed meat, is associated with increased risk of CVDs. However, modest intakes as a part of a varied diet do not point to much evidence of any deleterious effect related to NCDs.[113]

Diet high in red meat- mean daily consumption of red meat)- 23 g (18-27) per day. According to the GBD study, global intake of red meat (27 g [26-28] per day) is 18% greater than the optimal intake. However, red and processed meat consumption ranks at the bottom of rankings of dietary risks for deaths and DALYs for most high-population countries.[114]

In India, consumption of red meat is not very high. Prevalence of risk of high red meat consumption is 6% among adult population, which is based on moderate to high consumption of red meat. About 96% of the adult population have either no or low consumption of red meat. Further, age does not have any effect on consumption behaviour of red meat.

Red Meat Consumption (%)



Source: *TARI Research team based on primary survey by Kantar Public*

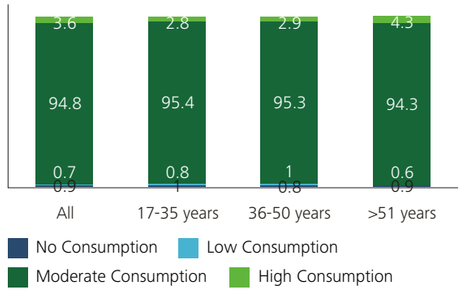
Vegetable Consumption

Vegetables are good sources of vitamins and minerals, and low in calories and rich in dietary fiber. With extensive research it has been proven that a diet rich in fruits and vegetables can help keeping craving for unhealthy food in check and have positive effect upon the blood sugar, lower the risk of digestive and eye problems. There are at least 9 different families of vegetables and fruits, each have potentially hundreds of different plant compounds that are beneficial to health and reduced risks associated with an NCD.[115]

Higher the average daily intake of vegetables, lower the chances of developing cardiovascular diseases. Most strongly associated are green leafy vegetables such as spinach, mustard greens, chard, spinach and other kind of local leafy vegetables commonly referred to as saag. Cruciferous vegetables such as cabbage, cauliflower and broccoli also make important contributions. Even regarding cancer, numerous studies have revealed that there exists a strong link between eating vegetables and fruits and protection against cancer.[116]

Sub-optimal consumption of vegetables is one of the leading dietary risk associated with NCDs. Diet low in vegetables - mean daily consumption of vegetables (fresh, frozen, cooked, canned, or dried vegetables, excluding legumes and salted or pickled vegetables, juices, nuts, seeds, and starchy vegetables such as potatoes or corn) -360 g (290-430) per day.[117] Prevalence of low vegetable consumption ranks lowest among dietary risks. *Survey results show that prevalence of little or low vegetable consumption among surveyed adult population is 1.6%. Even though adults with high consumption of vegetables is 3-4%, about 95% of adult population have moderate consumption of vegetables. Age does not have any effect on vegetable consumption behaviour of adults. Sub-optimal consumption of vegetables is one of the leading dietary risk associated with NCDs.*

Vegetables Consumption (%)



Source: *TARI Research team based on primary survey by Kantar Public*

[112] Health effects of dietary risks in 195countries, 1990–2017: a systematic analysis for the Global Burden of DiseaseStudy 2017; Lancet 2019; 393: 1958–7
[113] https://academic.oup.com/af/article/3/1/20/4638623
[114] Health effects of dietary risks in 195countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study2017; Lancet 2019; 393: 1958–7
[115] The Nutrition Source. (2019). Vegetables and Fruits. [online] Available at: https://www.hsph.harvard.edu/nutritionsource/what-should-you-eat/vegetables-and-fruits/ [Accessed 12 Sep. 2019].
[116] Hung HC, Joshipura KJ, Jiang R, Hu FB, Hunter D, Smith-Warner SA, Colditz GA, Rosner B, Spiegelman D, Willett WC. Fruit and vegetable intake and risk of major chronic disease. Journal of the National Cancer Institute. 2004 Nov 3;96(21):1577-84.
[117] Health effects of dietary risks in 195countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017; Lancet 2019; 393: 1958–7

3.4 Prevalence of Key Risk Factors – Rankings

Following table presents summarized table of prevalence of key risk factors in a descending order.

Rank	Ranking of Risk Factors	Prevalence
1	Air Pollution	76.00%
2	Low physical activity	66.50%
3	Diet low in legumes	55.00%
4	High stress levels	44.00%
5	Diet low in milk	41.00%
6	Diet low in seafood omega-3 fatty acids	39.00%
7	High consumption of trans-fats	37.00%
8	Diet low in fruits	36.00%
9	Diet low in calcium	30.00%
10	Household air pollution	29.00%
11	High BMI (overweight & obesity)	24.00%
12	Pollution at workplace	20.00%
13	Diet low in whole grains	17.00%
14	Low occupational physical activity	16.20%
15	Chewing tobacco	16.00%
16	Diet high in sugar-sweetened beverages	16.00%
17	Smoking tobacco	15.00%
18	High leisure activity	10.00%
19	Alcohol consumption	9.00%
20	Diet high in red meat	6.00%
21	Low sleep	3.80%
22	Diet low in vegetables	1.60%

Figure E-4 Source: *TARI Research team based on primary survey by Kantar Public*

Following are the key survey findings related to prevalence of key risk factors among adult population:

- Level of prevalence represented by summary exposure value (SEV) of risk factors in the IHME database,2017 is lower as compared to Kantar survey but overall outcomes are comparable
- Environmental risk factor - air pollution is perceived to be the most prevalent risk factor among surveyed population with NCD
- Factors related to lifestyle such as high stress levels and low physical activity are second most important risk factors, increasing rapidly among population due to hectic daily schedules
- For behavioral risk factors related to intoxication-prevalence of chewing tobacco, smoking tobacco, and alcohol consumption as a risk factor for NCD is less than 16%
- For behavioral risk factors related to dietary risk factors which can be observed in the large population are related to deficiency of healthy and nutritional diet: diet low in legumes, diet low in milk, fruits, and sea food etc.

4.

Specific NCDs and their associated Risk Factors

Specific NCDs and their associated Risk Factors

In this section the analysis primarily focuses on the understanding of relative risk of the factors associated with NCD. This section of the report is based on the main survey covering a population of 10500 individuals aged 17 years and above across all the states. Definition of risk factors used and referred in this section is explained in the Annexure IV of the report.

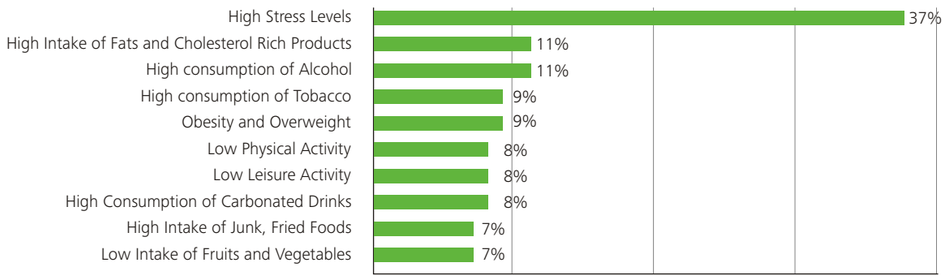
A risk ratio (RR), also called relative risk, compares the risk of a health event (disease, injury, risk factor, or death) among one group with the risk among another group. It does so by dividing the risk (incidence proportion, attack rate) in group 1 by the risk (incidence proportion, attack rate) in group 2. The two groups are typically differentiated by such demographic factors as sex (e.g., males versus females) or by exposure to a suspected risk factor (e.g., did or did not eat red meat). Often, the group of primary interest is labeled the exposed group, and the comparison group is labeled the unexposed group.[118] The strength of association i.e. the relative risk percentages of the risk factors with which they are causing the NCDs were calculated using Multinomial (polytomous) logistic regression, relative risk ratio.

The formula for risk ratio (RR) is: Risk of disease (incidence proportion, attack rate) in group of primary interest ÷ Risk of disease (incidence proportion, attack rate) in comparison group. A risk ratio of 1.0 indicates identical risk among the two groups. A risk ratio greater than 1.0 indicates an increased risk for the group in the numerator, usually the exposed group. A risk ratio less than 1.0 indicates a decreased risk for the exposed group, indicating that perhaps exposure actually protects against disease occurrence.

4.1 Heart Diseases: Key Risk Factors

Heart disease occurs when plaque develops in the arteries and blood vessels that lead to the heart. This blocks important nutrients and oxygen from reaching your heart. Plaque is a waxy substance made up of cholesterol, fatty molecules, and minerals. Plaque accumulates over time when the inner lining of an artery is damaged by high blood pressure, cigarette smoking, or elevated cholesterol or triglycerides.[119] A family history of heart disease puts an individual in the high risk group.

Relative Risk of Developing Heart Diseases



Source: *TARI Research team based on primary survey by Kantar Public*

[118]Cdc.gov.(2019). Principles of Epidemiology | Lesson 3 - Section 5. [online] Availableat: https://www.cdc.gov/csels/dsepd/ss1978/lesson3/section5.html [Accessed 16Sep. 2019].
[119]Healthline. (2019). Heart Disease Causes and Risk Factors.[online] Available at:https://www.healthline.com/health/heart-disease/causes-risks [Accessed 16 Sep.2019].

High Stress Levels

With 37% of relative risk percentage, high stress levels topped the chart in our analysis, when analyzing the relative risk percentage of the risk factors causing heart diseases. Our research found that if an individual is suffering from the high stress levels then his or her risk of getting a heart disease is 37% higher than the individual who is not suffering from high stress levels.

Today, most specialists acknowledge that emotional or psychologic stress may increase the risk of heart disease. In fact, the negative effects of acute and chronic stress on the cardiovascular system may be much more serious than often thought. Recent research and experience show that emotional stress may increase blood pressure and cholesterol. It may constrict arteries, promote arterial inflammation, blood clotting, and increase the risk of heart attack and sudden death. There is a huge body of research on psychologic stress and heart disease. In modern healthcare, stress is among the most common patient complaints.[120]

Many studies supported this claim and the most significant of them are as follows:

a. The fact that most heart attacks and sudden deaths occur in the morning hours, soon after wakening, suggests that our activities may trigger the acute event. The importance of the morning peak of heart attack and sudden deaths was documented in a meta-analysis of 66,635 patients, showing an increased risk between 6 am and noon compared to the rest of the day. Triggering may occur when 'external stressors' lead to increased activity of the sympathetic nervous system and other neuroendocrine mechanisms. This may put an increased load on the cardiovascular system that, in the presence of a vulnerable atherosclerotic plaque causes plaque disruption and thrombosis.[121] A circadian variation in blood clotting mechanisms may also play a role, with the highest risk for acute thrombosis occurring in the morning hours. These mechanisms also appear to be influenced by the sympathetic nervous system.[122]

b. The INTERHEART study was a large study of risk factors for a first heart attack among 11,000 patients worldwide who were compared with 13,000 matched controls. Stressful life events occurred more frequently within the prior year among patients than among controls. These life events included marital separation or divorce, loss of job or retirement, loss of crop or business failure, violence, major intra-family conflict, major personal injury or illness, death or a major illness of a close family member, death of a spouse, or other major stress. The authors of the study concluded that the "presence of psychosocial stressors is associated with increased risk of acute myocardial infarction, suggesting that approaches aimed at modifying these factors should be developed".[123]

c. An increased risk of heart attack was observed after the 1994 Los Angeles earthquake, compared to the week before the disaster. The 1994 earthquake occurred at 4:31 in the morning when the circadian vulnerability is high. The authors did not find a similar increase in the incidence of heart attack following the 1989 Loma Prieta earthquake that struck the San Francisco Bay Area. This earthquake occurred at 5:04 in the afternoon, during a period of relatively reduced circadian vulnerability. Thus, circadian vulnerability may affect the cardiovascular consequences of 'external stressors' such as natural disasters.[124]

d. The Whitehall II study assessed the effects of chronic stress at the workplace. There was a 2.15-fold increased risk for new coronary heart disease in men who experienced a mismatch between effort and reward at work. The high-risk subjects were those who were competitive, hostile, and overcommitted at work, in the face of poor promotion prospects and blocked careers.[125]

[120]Axel F. Sigurdsson, P. (2019). Stress and Heart Disease. [online] Docs opinion.com.Available at: https://www.docsopinion.com/2013/04/09/emotional-stress-and-heart-disease/[Accessed 12 Sep. 2019].
[121]Cohen, Mylan C et al., "Meta-Analysis of the Morning Excess of Acute Myocardial Infarction and Sudden Cardiac Death", American Journal of Cardiology, Volume 79, Issue 11,1512 – 1516.
[122] Sayer, J.,Gutteridge, C., Syndercombe-Court, D., Wilkinson, P. and Timmis, A. (1998).Circadian activity of the endogenous fibrinolytic system in stable coronary artery disease: effects of beta-adrenoreceptor blockers and angiotensin-converting enzyme inhibitors. Journal of the American College of Cardiology, 32(7), pp.1962-1968.
[123]Rosengren,A., Hawken, S., Ôunpuu, S., Sliwa, K., Zubaid, M., Almahmeed, W., Blackett, K.,Sitthi-amorn, C., Sato, H. and Yusuf, S. (2004). Association of psychosocial risk factors with risk of acute myocardial infarction in 11 119 cases and 13 648controls from 52 countries (the INTERHEART study): case-control study. The Lancet, 364(9438), pp.953-962.
[124]Brown, D.(1999). Disparate effects of the 1989 Loma Prieta and 1994 Northridgeearthquakes on hospital admissions for acute myocardial infarction: Importance of superimposition of triggers. American Heart Journal, 137(5), pp.830-836.
[125]Bosma, H.,Peter, R., Siegrist, J. and Marmot, M. (1998). Two alternative job stress models and the risk of coronary heart disease. American Journal of Public Health,88(1), pp.68-74.

High Consumption of Saturated Fats and Cholesterol Rich Foods

High consumption of fats and cholesterol rich foods increased the risk of developing a heart disease by 11% in our analysis.

From a chemical standpoint, saturated fats are simply fat molecules that have no double bonds between carbon molecules because they are saturated with hydrogen molecules. Saturated fats are typically solid at room temperature. Replacing foods that are high in saturated fat with healthier options can lower blood cholesterol levels and improve lipid profiles. Saturated fats occur naturally in many foods. The majority come mainly from animal sources, including meat and dairy products. Examples of foods with saturated fat are fatty beef, lamb, pork, poultry with skin, beef fat (tallow), lard and cream, butter, cheese and other dairy products made from whole or reduced-fat (2 percent) milk. In addition, many baked goods and fried foods can contain high levels of saturated fats. Some plant-based oils, such as palm oil, palm kernel oil and coconut oil, also contain primarily saturated fats, but do not contain cholesterol. It is recommended to limit saturated fats which are found in butter, cheese, red meat and other animal-based foods. Decades of sound science has proven it can raise your “bad” cholesterol and put you at higher risk for heart disease.[126]

Our body needs some cholesterol to work properly. But if if there is too much in your blood, it can stick to the walls of arteries and narrow or even block them. This puts us at risk for coronary artery disease and other heart diseases. Cholesterol travels through the blood on proteins called lipoproteins. One type, LDL, is sometimes called the "bad" cholesterol. A high LDL level leads to a build-up of cholesterol in arteries. Another type, HDL, is sometimes called the "good" cholesterol. It carries cholesterol from other parts of the body back to the liver. Then the liver removes the cholesterol from the body. If on is trying to lower cholesterol, one should have less than 200 mg a day of cholesterol. Cholesterol is in foods of animal origin, such as liver and other organ meats, egg yolks, shrimp, and whole milk dairy products.[127]

High Consumption of Alcohol

Alcohol if consumed in high quantities raised the risk level of developing the heart diseases by 11% in our analysis.

Drinking more than the WHO low risk drinking guidelines regularly and over a long period of time can increase the risk of developing heart disease. This is because drinking at this level can increase blood pressure. Drinking excessive amounts of alcohol causes raised blood pressure which is one of the most important risk factors for having a heart attack. Increases in your blood pressure can also be caused by weight gain from excessive drinking.[128] Heavy drinking weakens the heart muscle, which means the heart can't pump blood as efficiently. It's known as cardiomyopathy and can cause death, usually through heart failure.[129]

High Alcohol consumption also increases the prevalence of digestive disorders by 8 % and hypertension by 17 %. These association of risks to behavioral choices are largely in line with the results of studies by WHO and other organizations.

High Consumption of Tobacco

High consumption of tobacco increased the risk of developing heart disease by 9% in our analysis. The carbon monoxide in tobacco smoke reduces the amount of oxygen in the blood. This means the heart must pump harder to supply the body with the oxygen it needs. The nicotine in tobacco stimulates the body to produce adrenaline, which makes the heart beat faster and raises the blood pressure, making the heart work harder. Smoking damages the lining of the arteries, leading to a build-up of fatty material (atheroma) which narrows the artery.[130]

High tobacco consumption, whether as smoking or chewing increases risks of respiratory diseases by 17% and cancer by 18%. Illness profile of cancer shows that

[126]www.heart.org. (2019). Saturated Fat. [Online] Available at: https://www.heart.org/en/healthy-living/healthy-eating/eat-smart/fats/saturated-fats[Accessed 12 Sep. 2019].
[127]Medlineplus.gov. (2019). *How to Lower Cholesterol with Diet: MedlinePlus*.[online] Available at:https://medlineplus.gov/howtolowercholesterolwithdiet.html [Accessed 16 Sep.2019].
[128]Bhf.org.uk. (2019). *High blood pressure*. [online] Availableat: https://www.bhf.org.uk/informationsupport/risk-factors/high-blood-pressure [Accessed 16 Sep. 2019].
[129]Bhf.org.uk. (2019). *Dilated cardiomyopathy.* [Online] Available at: https://www.bhf.org.uk/informationsupport/conditions/cardiomyopathy/dilated-cardiomyopathy [Accessed 16 Sep. 2019].
[130]Bhf.org.uk.(2019). *Smoking*. [online] Available at: https://www.bhf.org.uk/informationsupport/risk-factors/smoking [Accessed 16Sep. 2019].

High tobacco consumption, whether as smoking or chewing increases risks of respiratory diseases by 17% and cancer by 18%.

three types of cancer including throat cancer, mouth cancer and kidney cancer are highly common and prevalent but throat and lung have higher co related to smoking. The risk is higher among heavy smokers over the age of 60, who run one third more risk the risk of contraction than those below 35 years.

Obesity and Overweight

If one is obese or overweight, then according to our analysis there is a 9% higher chance that one might develop a heart disease compared to the person who is not obese or overweight.

People who are overweight or obese often have health problems that may increase the risk for heart disease. These health problems include high blood pressure, high cholesterol, and high blood sugar. In addition, excess weight may cause changes to your heart that make it work harder to send blood to all the cells in your body.[131]

Low Physical Activity

Low physical activity increased the chances of developing the heart disease by 8% in our analysis.

People who enjoy regular physical activity have lower death rates than people who have no risk factors but who aren't physically active. People with heart disease who are physically fit live longer and have fewer heart attacks than heart patients who aren't physically fit. Regular physical activity benefits people who have heart disease as well as those who don't. Regular physical activity helps: lower blood pressure, decrease LDL "bad" cholesterol in blood, improve blood sugar, reduce feelings of stress, control body weight, improve quality of sleep and reduce the time it takes to fall asleep, improve memory and reduce the risk of dementia and depression, make one feel good about oneself and as a result makes one's heart healthy.[132]

High intake of Junk and Fried foods

With 7% of relative risk, according to our analysis the individuals who consumed high quantity of Junk and Fried Foods in their diet were at 7% higher risk of developing a heart disease as compared to those who did not consume high quantity of Junk and Fried Foods.
Eating Junk and fried foods may contribute to high blood pressure, low “good” HDL cholesterol and obesity, which are all risk factors for heart disease. There have been two large observational studies done on the area which has found that the more often people ate junk and fried foods, the greater their risk of developing heart disease. One study found that women eating one or more servings of fried fish per week had a 48% higher risk of heart failure, compared to those who consumed 13 servings per month. On the other hand, increased baked or broiled fish intake was associated with a lower risk. Another observational study found that a diet high in junk and fried foods was associated with a significantly higher risk of heart attack. Meanwhile, those who ate a diet high in fruits and vegetables were at a significantly lower risk.

Low Intake of Fruits & Vegetables

Low intake of Fruits & Vegetables increased the risk of developing the heart disease by 7% in our analysis.

Vegetables and fruits are good sources of vitamins and minerals. Vegetables and fruits are also low in calories and rich in dietary fiber. Vegetables and fruits, like other plants or plant-based foods, contain substances that may help prevent cardiovascular disease. Also, eating more fruits and vegetables may help you cut back on higher calorie foods which are considered as bad for heart, such as meat, cheese and snack foods.[133]

[131]Information, H.,Management, W., Overweight, H., Overweight, H., Center, T. and Health, N.(2019). *Health Risks of Being Overweight | NIDDK*. [online] National Institute of Diabetes and Digestive and Kidney Diseases. Available at: https://www.niddk.nih.gov/health-information/weight-management/health-risks-overweight[Accessed 16 Sep. 2019].
[132]www.heart.org.(2019). *What's the Link Between Physical Activity and Health?*. [Online] Available at: https://www.heart.org/en/health-topics/cardiac-rehab/getting-physically-active/whats-the-link-between-physical-activity-and-health [Accessed 16 Sep. 2019].
[133]Mayo Clinic. (2019). 8 steps to a heart-healthydiet. [online] Available at: https://www.mayoclinic.org/diseases-conditions/heart-disease/in-depth/heart-healthy-diet/art-20047702 [Accessed 12 Sep. 2019].

4.2 Diabetes: Key Risk Factors

Diabetes is a disease that occurs when blood glucose, also called blood sugar, is too high. Blood glucose is the main source of energy and comes from the food we eat. Insulin, a hormone made by the pancreas, helps glucose from food get into cells to be used for energy. Sometimes the body doesn't make enough or any insulin or doesn't use insulin well. Glucose then stays in the blood and doesn't reach cells. Over time, having too much glucose in the blood can cause health problems. Although diabetes has no cure, one can take steps to manage your diabetes and stay healthy. If you have type 1 diabetes, your body does not make insulin. Your immune system attacks and destroys the cells in your pancreas that make insulin. Type 1 diabetes is usually diagnosed in children and young adults, although it can appear at any age. People with type 1 diabetes need to take insulin every day to stay alive. If you have type 2 diabetes, your body does not make or use insulin well. You can develop type 2 diabetes at any age, even during childhood. However, this type of diabetes occurs most often in middle-aged and older people. Type 2 is the most common type of diabetes. Gestational diabetes develops in some women when they are pregnant. Most of the time, this type of diabetes goes away after the baby is born. However, if you've had gestational diabetes, you have a greater chance of developing type 2 diabetes later in life. Sometimes diabetes diagnosed during pregnancy is actually type 2 diabetes. Less common types include monogenic diabetes, which is an inherited form of diabetes, and cystic fibrosis-related diabetes.[134]

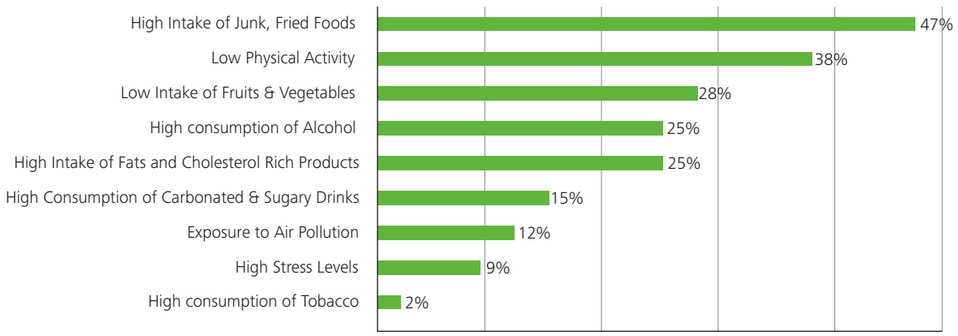
High Intake of Junk & Fried Foods

With 47% of the relative risk percentage, high intake of Junk and fried foods seem to be affecting diabetes the most in our analysis. The people who consume high quantity of junk and fried foods in their diet are at 47% greater risk of developing diabetes as compared to those who take less quantity of junk and fried food in their diet.

Junk foods may contribute to diabetes in the following ways:

- Rapid effect on blood sugar levels: Highly processed foods that are high in calories and low in vitamins, minerals, and fiber break down quickly in the body and can cause a rapid rise in blood sugar levels.
- Inappropriate portion size: Junk foods are usually not very filling and frequently come in large portion sizes. Both these factors may lead people to overeat junk foods. This can have a negative impact on diabetes, including blood sugar spikes and weight gain.
- Weight gain: Due to its poor nutritional qualities and ability to encourage overeating, people who eat junk food may gain weight. Excess weight and body fat are major risk factors for developing type 2 diabetes, which accounts for 9095 percent of all cases of diabetes.
- High blood pressure. Junk food is usually very high in sodium (salt), which contributes to high blood pressure. High blood pressure is linked to an increased risk of type 2 diabetes.
- Triglyceride levels. Junk foods are high in Trans and saturated fats, which can raise levels of triglycerides, a type of fat that is present in the blood. High levels of triglycerides increase the risk of developing type 2 diabetes.

Relative Risk of Developing Diabetes



Source: *TARI Research team based on primary survey by Kantar Public*

[134]*Whatis Diabetes? | NIDDK*. [online] National Institute of Diabetes and Digestive and Kidney Diseases. Available at: https://www.niddk.nih.gov/health-information/diabetes/overview/what-is-diabetes [Accessed 16 Sep. 2019].

According to a 2016 study published in *Experimental Physiology,* regularly eating junk foods can cause as much damage to the kidneys of people without diabetes as it does to those with the disease itself. Junk food also causes high blood sugar levels similar to those experienced by people with type 2 diabetes. As people with diabetes are already at a higher risk of kidney disease, diets containing a lot of junk food can be especially problematic.[135]

Fried foods affect your blood sugar because fat slows down digestion. When you eat simple carbohydrates, your body can quickly convert them into glucose and your blood sugar levels rise. Fried foods usually contain carbohydrates, but the fat slows digestion. Instead of your blood sugar rising immediately, you may see a higher glucose level a few hours later. Fried foods affect your blood sugar levels differently, depending on what food is fried. French fries raise blood sugar faster than fried chicken, especially if the chicken is not breaded because chicken is protein and potatoes are carbohydrates. According to the American Diabetes Association, glucose production depends on the following: the quantity of carbohydrates consumed, the type of sugar and starch in those carbs, whether the carbs are combined with fat and/or protein and the cooking process. Although the fat may slow down digestion, the nature of the fat in fried foods -- Trans fats -- are very bad for diabetics.[136]

Low Physical Activity

At number two, with 38% of relative risk percentage stood the risk factor, low physical activity. The people who have low physical activity are 38% more likely to develop diabetes as compared to those who do more physical activity.

If you stay fit and active throughout your life, you'll be able to better control your diabetes and keep your blood glucose level in the correct range. Controlling your blood glucose level is essential to prevent long-term complications, such as nerve pain and kidney disease. Exercise has many benefits, but the most critical one is that it makes it easier to control your blood glucose (blood sugar) level. People with type 2 diabetes have too much glucose in their blood, either because their body doesn't produce enough insulin to process it, or because their body doesn't use insulin properly (insulin resistant). In either case, exercise can reduce the glucose in your blood. Muscles can use glucose without insulin when you're exercising. In other words, it doesn't matter if you're insulin resistant or if you don't have enough insulin: when you exercise, your muscles get the glucose they need, and in turn, your blood glucose level goes down.

If you're insulin resistant, exercise actually makes your insulin more effective. That isyour insulin resistance goes down when you exercise, and your cells can use the glucose more effectively. Exercise can also help people with type 2 diabetes avoid long-term complications, especially heart problems. People with diabetes are likely to develop blocked arteries (heart disease), which can lead to a heart attack or stroke. Exercise helps keep your heart healthy and strong. Plus, exercise helps you maintain good cholesteroland that helps you avoid high cholesterol and the build-up of plaque that may block

[135]Leonard, J. (2019). *Junk food and diabetes: The link, the effects, and tips for eating out*. [online] Medical News Today. Available at: https://www.medicalnewstoday.com/articles/317122.php [Accessed 29 Sep.2019].
[136]LIVESTRONG.COM. (2019). *Do Fried Foods Affect Blood Sugar?* |Livestrong.com. [online] Available at: https://www.livestrong.com/article/539500-do-fried-foods-affect-blood-sugar/[Accessed 29 Sep. 2019].

the blood from passing easily through your arteries. Additionally, there are the traditional benefits of exercise: lower blood pressure, better control of weight, increased level of good cholesterol (HDL), leaner, stronger muscles, stronger bones, more energy, improved mood, better sleep, stress management; all these benefits reduce the chances of developing diabetes and to those who are already suffering from diabetes, these benefits help keeping diabetes under control.[137]

Low Intake of Fruits & Vegetables
Those with low intake of fruits and vegetables were at 28% higher risk of developing diabetes.

A diet rich in vegetables and fruits can have a positive effect upon blood sugar, which can help keep appetite in check. Eating non-starchy vegetables and fruits like apples, pears, and green leafy vegetables may even promote weight loss. Their low glycemic loads prevent blood sugar spikes that can increase hunger.

Some research looks specifically at whether individual fruits are associated with risk of type 2 diabetes. While there isn't an abundance of research into this area yet, preliminary results are compelling.

- A study of over 66,000 women in the Nurses' Health Study, 85,104 women from the Nurses' Health Study II, and 36,173 men from the Health Professionals Follow-up Study—who were free of major chronic diseases—found that greater consumption of whole fruits—especially blueberries, grapes, and apples—was associated with a lower risk of type 2 diabetes. Another important finding was that greater consumption of fruit juice was associated with a higher risk of type 2 diabetes.
- Additionally, a study of over 70,000 female nurses aged 38-63 years, who were free of cardiovascular disease, cancer, and diabetes, showed that consumption of green leafy vegetables and fruit was associated with a lower risk of diabetes. While not conclusive, research also indicated that consumption of fruit juices may be associated with an increased risk among women.
- A study of over 2,300 Finnish men showed that vegetables and fruits, especially berries, may reduce the risk of type 2 diabetes.[138]

High Consumption of Alcohol
Those consuming high quantity of alcohol were at 25% higher risk of developing diabetes.

While moderate amounts of alcohol may cause blood sugar to rise, excess alcohol can actually decrease your blood sugar level -- sometimes causing it to drop into dangerous levels, especially for people with type 1 diabetes. Beer and sweet wine contain carbohydrates and may raise blood sugar. Alcohol stimulates your appetite, which can cause you to overeat and may affect your blood sugar control. Alcoholic drinks often have a lot of calories, making it more difficult to lose excess weight. Alcohol may also affect your judgment or willpower, causing you to make poor food choices. Alcohol can interfere with the positive effects of oral diabetes medicines or insulin.[139]

High consumption of Carbonated/Sugary drinks
High consumption of Carbonated/Sugary drinks increased the chances of developing diabetes by 15%.

The following is the process through which high intake of sugary drinks could lead to diabetes:

1. Higher blood glucose concentrations from a high load of quick-digesting carbs mean more demand for insulin.
2. Higher demand for insulin in the long-term wears out the pancreas. This can result in glucose intolerance from the cells.
3. High-GI diets may, therefore, directly increase insulin resistance.

As soda has an extremely high GI, it may well contribute to this process. The review also supports the suggestion that high sugar intake adds to obesity by increasing the total energy consumed. In other words, as sugary beverages add to the overall daily intake of calories, the increase in calories likely leads to an increase in weight.[140]

[137]L. M. Lisa, Type 2 Diabetes and Exercise, Exercise Makes It Easier to Control Your Diabetes, Endocrine Web. https://www.endocrineweb.com/conditions/type-2-diabetes/type-2-diabetes-exercise
[138]The Nutrition Source. (2019). Vegetables and Fruits.[online] Available at: https://www.hsph.harvard.edu/nutritionsource/what-should-you-eat/vegetables-and-fruits/[Accessed 29 Sep. 2019].
[139]WebMD, Diabetes and Alcohol. https://www.webmd.com/diabetes/guide/drinking-alcohol

Exposure to Air Pollution
Exposure to Air pollution increased the chances of developing diabetes by 12%.

The exact mechanism behind the relationship between air pollution and diabetes has not yet been proven. However, scientists know that some pollutants once they have been breathed in can enter the bloodstream and interact with tissues and organs. These interactions ultimately disrupt the body, and, among other things, may alter insulin sensitivity and production. It is important to note that the risk of pollution-related diabetes is higher in lower-income countries that lack clean air policies, such as India, China, and Indonesia, while more wealthy countries, such as Canada, Australia, and New Zealand, have a lower risk.[141]

High stress levels
The individuals who were suffering from high stress levels they were at 9% higher risk of developing diabetes.

The blood sugar levels are controlled mainly by two groups of hormones. The first group of hormones reduces blood sugar, but insulin is the only member of this group. The second group called counter-regulatory hormones, opposes the action of insulin and increases the blood sugars. There are several of these hormones and the list includes cortisol, adrenaline, noradrenaline, glucagon and growth hormone. Stress tends to increase the levels of the counter-regulatory hormones, particularly cortisol, adrenaline and noradrenaline. If the levels of these hormones are persistently elevated, this can precipitate diabetes in a predisposed individual or worsen the diabetes control in someone who already has the disorder.[142]

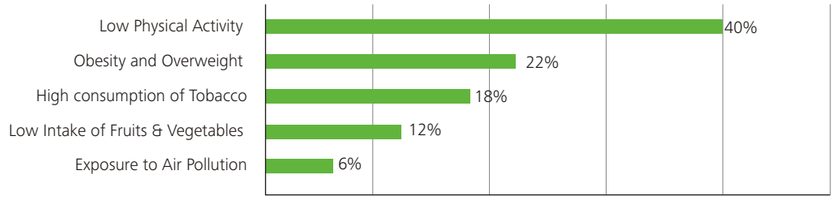
High consumption of Tobacco
High consumption of Tobacco increased the risk of developing diabetes by 2%. Tobacco use can increase blood sugar levels and lead to insulin resistance. The more one smokes, the greater the risk of diabetes.[143] Genetics also plays a role in diabetes. People with a family history of diabetes (i.e. parents having diabetes) are high risk persons.

[140]MacGill, M. (2019). Soda and diabetes risk: Links and research.[online] Medical News Today. Available at:https://www.medicalnewstoday.com/articles/259604.php [Accessed 30 Sep. 2019].
[141]Medical News Today. (2019). Strong link found between airpollution and diabetes. [online] Available at:https://www.medicalnewstoday.com/articles/322358.php [Accessed 30 Sep. 2019].
[142]Dr Mohan'sDiabetes Center in Chennai. (2019). Can Stress Cause Diabetes | Dr Mohan'sDiabetes Center. [online] Available at:https://drmohans.com/is-stress-the-cause-of-your-diabetes/ [Accessed 12 Sep.2019].
[143]World CancerResearch Fund/American Institute for Cancer Research. Food, Nutrition, Physical Activity, and the Prevention ofCancer: a Global PerspectiveExit Disclaimer. Washington DC: AICR,2007.

4.3 Cancer: Key Risk Factors

Cancer, also called malignancy, is an abnormal growth of cells. There are more than 100 types of cancer, including breast cancer, skin cancer, lung cancer, colon cancer, prostate cancer, and lymphoma. Symptoms vary depending on the type.[144] Cancers like breast, ovarian and endometrial cancer can also be hereditary.

Relative Risk of Developing Cancer



Source: *TARI Research team based on primary survey by Kantar Public*

Low physical activity

Low physical activity affects chances of developing cancer in a significant manner by 40%.

Exercise has a number of biological effects on the body, some of which have been considered to explain associations with specific cancers, including: Lowering the levels of hormones, such as insulin and estrogen, and of certain growth factors that have been associated with cancer development and progression.[145] Helping to prevent obesity and decreasing the harmful effects of obesity, particularly the development of insulin resistance (failure of the body's cells to respond to insulin),reducing inflammation, improving immune system function, altering the metabolism of bile acids, resulting in decreased exposure of the gastrointestinal tract to these suspected carcinogens[146] [147]and reducing the amount of time it takes for food to travel through the digestive system, which decreases gastrointestinal tract exposure to possible carcinogens.

There is substantial evidence that higher levels of physical activity are linked to lower risks of several cancers.[148] Colon cancer: Colon cancer is one of the most extensively studied cancers in relation to physical activity.[149] A 2009 meta-analysis of 52 epidemiologic studies that examined the association between physical activity and colon cancer risk found that the most physically active individuals had a 24% lower risk of colon cancer than those who were the least physically active[150]. A pooled analysis of data on leisure-time physical activity (activities done at an individual's discretion generally to improve or maintain fitness or health) from 12 prospective U.S. and European cohort studies reported a risk reduction of 16%, when comparing individuals who were most active to those who were least active.[151] Incidence of both distal colon and proximal colon cancers is lower in people who are more physically active than in those who are less

[144]WebMD. (2019). Cancer. [online] Available at: http://www.webmd.com/cancer/default.htm [Accessed 29 Sep. 2019].
[145]Winzer BM, Whiteman DC, Reeves MM, Paratz JD. Physical activity and cancer prevention: asystematic review of clinical trials. Cancer Causes and Control 2011;22(6):811-826.
[146]Wertheim BC, Martinez ME, Ashbeck EL, et al. Physical activity as a determinant of fecalbile acid levels. Cancer Epidemiology, Biomarkers & Prevention 2009;18(5):1591-1598.
[147]Bernstein H, Bernstein C, Payne CM, Dvorakova K, Garewal H. Bile acids as carcinogens inhuman gastrointestinal cancers. Mutation Research 2005; 589(1):47-65.
[148]World Cancer Research Fund/American Institute for Cancer Research. Food, Nutrition, Physical Activity, and the Prevention of Cancer: a Global Perspective Exit Disclaimer. Washington DC: AICR,2007.
[149]Kruk J,Czerniak U. Physical activity and its relation to cancer risk: updating the evidence. Asian Pacific Journal of Cancer Prevention 2013; 14(7):3993-4003.
[150]Wolin KY, YanY, Colditz GA, Lee IM. Physical activity and colon cancer prevention: ameta-analysis. British Journal of Cancer 2009; 100(4):611-616.
[151]Moore SC, LeeIM, Weiderpass E, et al. Association of leisure-time physical activity with risk of 26 types of cancer in 1.44 million adults. JAMA Internal Medicine 2016;176(6):816-825.

physically active[152]. [153]Physical activity is also associated with a decreased risk of colon adenomas (polyps), a type of colon polyp that may develop into colon cancer. However, it is less clear whether physical activity is associated with lower risks that polyps that have been removed will come back.

Many studies show that physically active women have a lower risk of breast cancer than inactive women; in a 2013 meta-analysis of 31 prospective studies, the average breast cancer risk reduction associated with physical activity was 12%. Physical activity has been associated with a reduced risk of breast cancer in both premenopausal and postmenopausal women; however, the evidence for an association is stronger for postmenopausal breast cancer. Women who increase their physical activity after menopause may also have a lower risk of breast cancer than women who do not.

Many studies have examined the relationship between physical activity and the risk of endometrial cancer (cancer of the lining of the uterus). In a meta-analysis of 33 studies, the average endometrial cancer risk reduction associated with high versus low physical activity was 20%. There is some evidence that the association between physical activity and endometrial cancer risk may reflect the effect of physical activity on obesity, a known risk factor for endometrial cancer. For several other cancers, there is more limited evidence of a relationship with physical activity. In a study of over 1 million individuals, leisure-time physical activity was linked to reduced risks of esophageal adenocarcinoma, liver cancer, gastric cardia cancer (a type of stomach cancer), kidney cancer, myeloid leukemia, myeloma, and cancers of the head and neck, rectum, and bladder. These results are generally corroborated by large cohort studies or meta-analyses. Nearly all the evidence linking physical activity to cancer risk comes from observational studies, in which individuals report on their physical activity and are followed for years for diagnoses of cancer.

Data from observational studies can give researchers clues about the relationship between physical activity and cancer risk, but such studies cannot definitively establish that being physically inactive causes cancer (or that being physically active protects against cancer). That is because people who are not physically active may differ from active people in ways other than their level of physical activity. These other differences, rather than the differences in physical activity, could explain their different cancer risk. For example, if someone does not feel well, they may not exercise much, and sometimes people do not feel well because they have undiagnosed cancer.[154]

Obesity and Overweight

Obese or overweight individuals were at a 22% higher risk of developing cancer.

Several possible mechanisms have been suggested to explain how obesity might increase the risks of some cancers. Obese people often have chronic local inflammation, which can, over time, cause DNA damage that leads to cancer. Overweight and obese individuals are more likely than normal-weight individuals to have conditions or disorders that are linked to or that cause chronic local inflammation and that are risk factors for certain cancers. For example, chronic local inflammation induced by gastroesophageal reflux disease or Barrett esophagus is a likely cause of esophageal adenocarcinoma.

Obesity is a risk factor for gallstones, a condition characterized by chronic gallbladder inflammation, and a history of gallstones is a strong risk factor for gallbladder cancer. Chronic ulcerative colitis (a chronic inflammatory condition) and hepatitis (a disease of the liver causing inflammation) are risk factors for different types of liver cancer. Fat tissue (also called adipose tissue) produces excess amounts of estrogen, high levels of which have been associated with increased risks of breast, endometrial, ovarian, and some other cancers. Obese

[152]Boyle T, Keegel T, Bull F, Heyworth J, Fritschi L. Physical activity and risks of proximal and distal colon cancers: a systematic review and meta-analysis.Journal of the National Cancer Institute 2012; 104(20):1548-1561.
[153]Robsahm TE, Aagnes B, Hjartåker A, et al. Body mass index, physical activity, and colorectal cancer by anatomical subsites: a systematic review and meta-analysisof cohort studies. European Journal of Cancer Prevention 2013; 22(6):492-505.
[154]National Cancer Institute. (2019). *Physical Activity and Cancer Fact Sheet.* [online] Available at: https://www.cancer.gov/about-cancer/causes-prevention/risk/obesity/physical-activity-fact-sheet [Accessed 27 Sep. 2019].

people often have increased blood levels of insulin and insulin-like growth factor-1 (IGF-1). (This condition, known as hyperinsulinemia or insulin resistance, precedes the development of type 2 diabetes.) High levels of insulin and IGF-1 may promote the development of colon, kidney, prostate, and endometrial cancers.

Fat cells produce adipokines, hormones that may stimulate or inhibit cell growth. For example, the level of an adipokine called leptin, which seems to promote cell proliferation, in the blood increases with increasing body fat. And another adipokine, adiponectinwhich is less abundant in obese people than in those of normal weightmay have antiproliferative effects. Fat cells may also have direct and indirect effects on other cell growth regulators, including mammalian target of rapamycin (mTOR) and AMP-activated protein kinase. Other possible mechanisms by which obesity could affect cancer risk include changes in the mechanical properties of the scaffolding that surrounds breast cells and altered immune responses, effects on the nuclear factor kappa beta system, and oxidative stress. There is consistent evidence that higher amounts of body fat are associated with increased risks of a number of cancers, including: Endometrial cancer, Gastric cardia cancer, Liver cancer, Kidney cancer, Multiple myeloma, Meningioma, Pancreatic cancer, colorectal cancer, Gallbladder cancer, Breast cancer, ovarian cancer and Thyroid cancer.[155]

High consumption of tobacco

High consumption of Tobacco increased the chances of developing cancer by 18%.

Tobacco smoke has at least 70 chemicals that cause cancer, also known as carcinogens. Every time one breathes in that smoke, those chemicals get into the bloodstream, which carries the chemicals to all parts of the body. Many of these chemicals can damage certain DNA, which controls how the body makes new cells and directs each kind of cell to do what it is made for. Damaged DNA can make cells grow differently from how they are supposed to. These unusual cells can turn into cancer. Smokeless tobacco products, such as dipping and chewing tobacco, can cause cancer, too, including cancers of the esophagus, mouth and throat, and pancreas. Smoking tobacco in a pipe causes lung cancer and increases the risk of cancers of the mouth, throat, larynx, and esophagus, even though pipe smokers don't inhale the smoke into their lungs.[156]

Low intake of Fruits & Vegetables

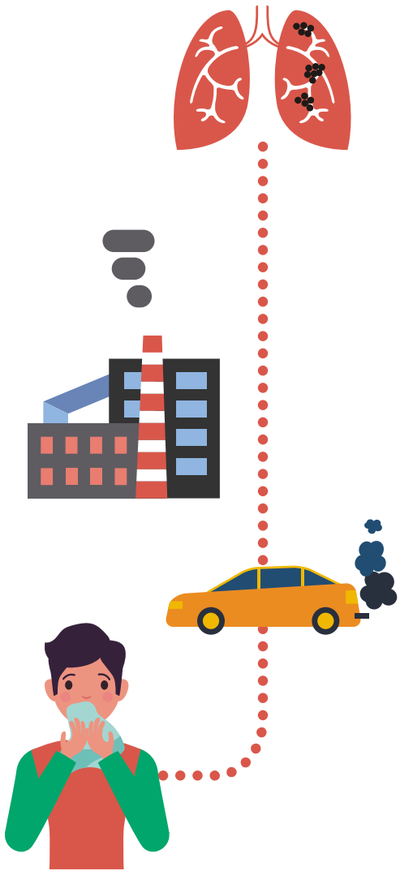
Low intake of fruits and vegetables in the diet (including a low fibre diet) increased the chances of developing cancer by 12%.

People whose diets are rich in plant foods such as fruits and vegetables have a lower risk of getting cancers of the mouth, pharynx, larynx, esophagus, stomach, and lung, and some evidence suggests that maintaining a diet rich in plant foods also lowers the risk of cancers of the colon, pancreas, and prostate. To help prevent the aforementioned cancers, experts recommend the daily consumption of 2 to 6.5 cups of fruits and vegetables, depending on one's energy needs. This includes 1 to 2.5 cups of fruits and 1 to 4 cups of vegetables, with special emphasis on dark green and orange vegetables and legumes.[157]

Numerous early studies revealed what appeared to be a strong link between eating fruits and vegetables and protection against cancer. The most prominent studies are as follows:

A study by Farvid and colleagues followed a Nurses' Health Study II cohort of 90,476 premenopausal women for 22 years and found that those who ate the most fruit during adolescence (about 3 servings a day) compared with those who ate the lowest intakes (0.5 servings a day) had a 25% lower risk of developing breast cancer. There was a significant reduction in breast cancer in women who had eaten higher intakes of apples, bananas, grapes, and corn during adolescence, and oranges and kale during early adulthood. No protection was found from drinking fruit juices at younger ages.

[155]National Cancer Institute. (2019). *Obesity and Cancer Fact Sheet.* [online] Available at:https://www.cancer.gov/about-cancer/causes-prevention/risk/obesity/obesity-fact-sheet[Accessed 30 Sep. 2019].
[156]Centre for Disease Control and Prevention (CDC), Tobacco and Cancer.https://www.cdc.gov/cancer/tobacco/index.htm
[157]National Cancer Institute (Unites States),Fruit and Vegetable Consumption. https://progressreport.cancer.gov/prevention/fruit_vegetable



Farvid and colleagues followed 90, 534 premenopausal women from the Nurses' Health Study II over 20 years and found that higher fiber intakes during adolescence and early adulthood were associated with a reduced risk of breast cancer later in life. When comparing the highest and lowest fiber intakes from fruits and vegetables, women with the highest fruit fiber intake had a 12% reduced risk of breast cancer; those with the highest vegetable fiber intake had an 11% reduced risk.

After following 182,145 women in the Nurses' Health Study I and II for 30 years, Farvid's team also found that women who ate more than 5.5 servings of fruits and vegetables each day (especially cruciferous and yellow/orange vegetables) had an 11% lower risk of breast cancer than those who ate 2.5 or fewer servings. Vegetable intake was strongly associated with a 15% lower risk of estrogen-receptor-negative tumors for every two additional servings of vegetables eaten daily. A higher intake of fruits and vegetables was associated with a lower risk of other aggressive tumors including HER2-enriched and basal-like tumors.

A report by the World Cancer Research Fund and the American Institute for Cancer Research suggests that non-starchy vegetables—such as lettuce and other leafy greens, broccoli, cabbage, as well as garlic, onions, and the like—and fruits "probably" protect against several types of cancers, including those of the mouth, throat, voice box, esophagus, and stomach. Fruit probably also protects against lung cancer.

Specific components of fruits and vegetables may also be protective against cancer. For example: A line of research stemming from a finding from the Health Professionals Follow-up Study suggests that tomatoes may help protect men against prostate cancer, especially aggressive forms of it. One of the pigments that give tomatoes their red hue—lycopene—could be involved in this protective effect. Although several studies other than the Health Professionals Study have also demonstrated a link between tomatoes or lycopene and prostate cancer, others have not or have found a weak connection.[158]

Exposure to the Air Pollution

Exposure to Air pollution increased the chances of developing cancer by 6%.

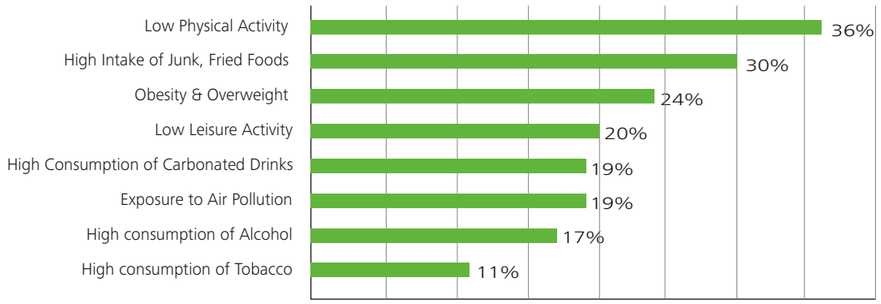
Pollution might spark defects in DNA repair function, alterations in the body's immune response, or inflammation that triggers angiogenesis, the growth of new blood vessels that allows tumors to spread. In the case of the digestive organs, pollution could affect gut microbiota and influence the development of cancer.[159] There has long been concern that airborne carcinogens contribute to the global burden of cancer, especially of the lung, which receives the most substantial inhaled doses.[160] Exposure to water pollution and contaminated food also increase the chances of getting cancer.

[158]The Nutrition Source. (2019). Vegetables and Fruits. [online]Available at:https://www.hsph.harvard.edu/nutritionsource/what-should-you-eat/vegetables-and-fruits/[Accessed 30 Sep. 2019].
[159]Aacrfoundation.org. (2019). *Air Pollution May be Associated With Many Kinds of Cancer.* [online] Available at: https://www.aacrfoundation.org/Science/Pages/air-pollution-associated-cancer.aspx[Accessed 29 Sep. 2019].
[160]Indiaenvironmentportal.org.in. (2019). [online] Available at: http://www.indiaenvironmentportal.org.in/files/file/air%20pollution%20and%20cancer.pdf[Accessed 29 Sep. 2019].blood-pressure-hypertension/[Accessed 27 Sep. 2019].

4.4 Hypertension: Key Risk Factors

When your heart beats, it pumps blood round your body to give the body the energy and oxygen it needs. Pressure is needed to make the blood circulate. The pressure pushes against the walls of the arteries (blood vessels) and this blood pressure is a measure of the strength of this pushing, combined with the resistance from the artery walls. A normal heart pumps blood around the body easily, at a low pressure. High blood pressure or hypertension means that your heart must pump harder and the arteries must carry blood that's flowing under greater pressure. This puts a strain on your arteries and your heart, which in turn increases your risk of a heart attack, a stroke or of suffering from kidney disease.[161] Apart from the external factors mentioned herein, hypertension is also a genetic disorder.

Relative Risk of Developing Hypertension



Source: *TARI Research team based on primary survey by Kantar Public*

Low Physical Activity

Amongst the risk factors analyzed for developing chances of hypertension, low physical activity came to be affecting hypertension the most, by as much as 36%.

Exercise is a key component of lifestyle therapy for the primary prevention and treatment of hypertension. Several studies consistently demonstrate beneficial effects of exercise on hypertension with reductions in both systolic and diastolic blood pressure with as much as 57 mmHg reductions in those with hypertension. Exercise has been associated with immediate significant reductions in systolic blood pressure. This immediate reduction in blood pressure after exercise can persist for almost 24 hours and is referred to as post-exercise hypotension with the most pronounced effects seen in those with higher baseline blood pressure. More frequent or chronic exercise results in more sustained reductions in blood pressure referred to as the exercise training response. Although age, sex, or ethnicity does not appear to change the blood pressure response to exercise, it should be noted that most studies have been limited by primarily studying population of middle-aged men of European descent.

The reduction in blood pressure with physical activity is thought to be due to attenuation in peripheral vascular resistance, which may be due to neurohormonal and structural responses with reductions in sympathetic nerve activity and an increase in arterial lumen diameters, respectively. Other proposed mechanisms for blood pressure reduction include favorable changes in oxidative stress, inflammation, endothelial function, arterial compliance, body mass, renin-angiotensin system activity, parasympathetic activity, renal function, and insulin sensitivity. The mechanisms underlying blood pressure reduction with exercise and its associated outcomes are still under investigation with many studies limited by size and marked heterogeneity. Furthermore, the anti-hypertensive response to exercise is highly variable; differences in exercise regimens, environmental factors, and genetic factors may be responsible for considerable inter- and intra-study variability in the blood pressure response to exercise. In one study, 2025% of those with hypertension were non-responders with no reduction in blood pressure with exercise. Studies investigating the genetic and clinical factors associated with responders and non-responders are ongoing.[162]

High Intake of Junk and Fried Foods

High intake of Junk and Fried foods was not very far from low Physical activity and it accounts for increasing the chances of developing hypertension by 30%.

Any food that has no or negligible nutritional value can be considered as junk foods. Most of the fast foods, including candy, bakery products, burgers and sausages, salty and oily snacks or soft drinks can be categorized as junk food. They have a high calorie content, salts and fats. The more we consume these, the less is the intake of essential nutrients and vitamins in the body. Junk foods are known for causing obesity, increased stress, digestive problems, worsening of appetite etc. All these causes of Junk foods are major risk factors of hypertension.[163] High in calories, Trans fats and Harmful Acrylamide, regular intake of fried foods affect cardiovascular system of the body and increase the risk of high blood pressure.[164]

Obesity & Overweight

Obesity & Overweight account for increasing the chances of developing hypertension by 24%.

Additional fat tissue in the body needs oxygen and nutrients in order to live, which requires the blood vessels to circulate more blood to the fat tissue. This increases the workload of the heart because it must pump more blood through additional blood vessels. More circulating blood also means more pressure on the artery walls. Higher pressure on the artery walls increases the blood pressure. In addition, extra weight can raise the heart rate and reduce the body's ability to transport blood through the vessels.[165]

Exposure to Air Pollution

Exposure to Air Pollution increases the chances of developing hypertension by 19%.

The mechanisms by which air pollution exposure could contribute to the development of hypertension might include systemic inflammation and oxidative stress,[166] which may cause increased sympathetic tone and potentially lead to arterial remodeling.[167] Schins et al observed that when rats were exposed to PM2.5, their blood endotoxin content, interleukin-8 and tumour necrosis factor- levels increased significantly.[168] Oxidative stress may also increase the circulation of activated inflammatory cytokines, which may subsequently induce endothelial dysfunction, lead to an imbalance in vascular homeostatic response, and result in total peripheral resistance and a fixation of evaluated blood pressure.[169] [170]PM exposure may also elevate blood pressure by inducing autonomic nervous system imbalance and vasoconstriction.[171] In addition, PM exposure can also

[161]nhs.uk.(2019). *High blood pressure (hypertension).* [online] Available at:https://www.nhs.uk/conditions/high-blood-pressure-hypertension/ [Accessed 27Sep. 2019].

[162]Hegde, S. and Solomon, S. (2015). *Influence of Physical Activity on Hypertension and Cardiac Structure and Function.* Current HypertensionReports, 17(10).
[163]icicilombard.com. (2019). *What are the Harmful Effects of Eating Junk Food?.* [online] Available at:https://www.icicilombard.com/insurance-information/health-insurance-info/article/5-harmful-effects-of-junk-food [Accessed 29 Sep. 2019].
[164]Healthline. (2019). *Why Are Fried Foods Bad For You?*.[online] Available at: https://www.healthline.com/nutrition/why-fried-foods-are-bad#section4[Accessed 29 Sep. 2019].
[165] Stanford Health Care, Effects of Obesity. https://stanfordhealthcare.org/medical-conditions/healthy-living/obesity.html
[166]Brook RD,Franklin B, Cascio W, Hong Y, Howard G, Lipsett M, Luepker R, Mittleman M, Samet J, Smith SC, Tager I; Expert Panel on Population and Prevention Scienceof the American Heart Association. Air pollution and cardiovascular disease: a statement for healthcare professionals from the Expert Panel on Population andPrevention Science of the American Heart Association.Circulation. 2004;109:2655–2671. doi: 10.1161/01.CIR.0000128587.30041.C8.
[167]Brook RD,Rajagopalan S. Particulate matter, air pollution, and blood pressure.J Am SocHypertens. 2009; 3:332–350. doi: 10.1016/j.jash.2009.08.005.
[168]Schins RP,Lightbody JH, Borm PJ, Shi T, Donaldson K, Stone V. Inflammatory effects of coarse and fine particulate matter in relation to chemical and biological constituents. Toxicol Appl Pharmacol. 2004; 195:1–11. doi: 10.1016/j.taap.2003.10.002.
[169]Brook RD,Rajagopalan S. Particulate matter, air pollution, and blood pressure. J Am SocHypertens. 2009; 3:332–350. doi: 10.1016/j.jash.2009.08.005.
[170] Fuks K,Moebus S, Hertel S, Viehmann A, Nonnemacher M, Dragano N, Möhlenkamp S, JakobsH, Kessler C, Erbel R, Hoffmann B; Heinz Nixdorf Recall Study Investigative Group. Long-term urban particulate air pollution, traffic noise, and arterial blood pressure. Environ Health Perspect. 2011; 119:1706–1711. Doi:10.1289/ehp.1103564.
[171]Coogan PF,White LF, Jerrett M, Brook RD, Su JG, Seto E, Burnett R, Palmer JR, RosenbergL. Air pollution and incidence of hypertension and diabetes mellitus in black women living in Los Angeles. Circulation. 2012; 125:767–772. Doi:10.1161/CIRCULATIONAHA.111.052753.

reduce daytime sodium excretion and blunt the normal nocturnal reduction in blood pressure. If this happens repeatedly, the impaired renal handling of excess sodium may partly contribute to elevated blood pressure.[172]

High Consumption of Alcohol

High consumption of Alcohol increases the chances of developing hypertension by 17%.

Alcohol can raise your blood pressure directly and indirectly. The direct effects of alcohol on blood pressure are related to the way alcohol is processed through your body. Having more than 3 drinks at once can temporarily raise your blood pressure, but once the alcohol is processed out of your body, blood pressure usually returns to normal. Similarly, binge drinking—having 5 or more drinks in 2 hours for men and 4 or more drinks in 2 hours for women—can cause a temporary spike in blood pressure. But if binge drinking turns into long-term excess, it may lead to chronic hypertension (high blood pressure). Talking about the indirect effects of alcohol on blood pressure, alcohol contains lots of calories and sugars which contribute to increased body fat, weight gain, and poor diet. All these factors can lead to high blood pressure. Heavy drinkers—binge drinking at least 5 days in one month—are more likely to experience the direct and indirect effects of alcohol on blood pressure compared to moderate drinkers. To improve blood pressure, it's worthwhile for heavy drinkers to gradually reduce their intake by 1 to 2 servings of alcohol per day until they are drinking no more than 1 to 2 servings total per day. This would be considered moderate drinking.[173]

High consumption of Tobacco

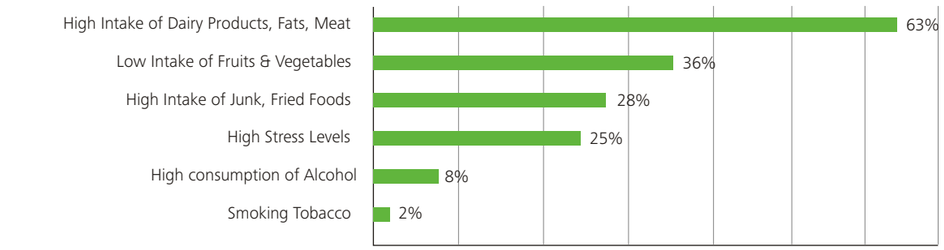
High consumption of Tobacco increased the chances of developing hypertension by 11%.

Smoking cigarettes and chewing tobacco cause an immediate and temporary rise in blood pressure. Worse, the chemicals in tobacco can damage the lining of artery walls, causing arteries to narrow and increasing blood pressure. Even second-hand smoke can increase blood pressure.[174]

4.5 Digestive Disorders: Key Risk Factors

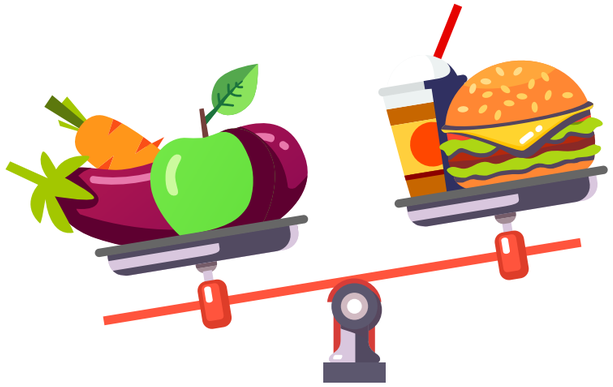
Digestive diseases are disorders of the digestive tract, which is sometimes called the gastrointestinal (GI) tract. In digestion, food and drink are broken down into small parts (called nutrients) that the body can absorb and use as energy and building blocks for cells. The digestive tract is made up of the esophagus (food tube), stomach, large and small intestines, liver, pancreas, and the gallbladder. A digestive disease is any health problem that occurs in the digestive tract. Conditions may range from mild to serious. Some common problems include cancer, irritable bowel syndrome, and lactose intolerance.[175]

Relative Risk of Developing Digestive Disorders



Source: *TARI Research team based on primary survey by Kantar Public*

[172]Tsai DH, Riediker M, Wuerzner G, Maillard M,Marques-Vidal P, Paccaud F, Vollenweider P, Burnier M, Bochud M. Short-term increase in particulate matter blunts nocturnal blood pressure dipping and daytime urinary sodium excretion. Hypertension. 2012; 60:1061–1069. Doi:10.1161/HYPERTENSIONAHA.112.195370.
[173]AmericanHeart Association, Limiting Alcohol to Manage High Blood Pressure.
[174]Measure up Pressure Down (American Medical Group Foundation), How Can I Prevent High Blood Pressure? Http://www.measureuppressuredown.com/Learn/ preventHighBP_learn.asp
[175]Medlineplus.gov. (2019). *Digestive diseases: MedlinePlusMedical Encyclopedia.* [online] Available at:https://medlineplus.gov/ency/article/007447.htm [Accessed 29 Sep. 2019].



Unhealthy Diet

High intake of dairy products, fats and meat affect digestive disorders the most, increasing their chances by 63%. Low intake of fruits and Vegetables increased the chances by 36% and high intake of Junk and Fried foods increased the chances of developing digestive disorders by 28%.

The digestive system includes the following: mouth, throat, esophagus, stomach, small and large intestines, liver, pancreas, gallbladder, and anus. All these organs need proper nutrients to function properly. Too little healthy foods and too much unhealthy foods can interfere with normal processes of your digestive system. Cells organize and form tissues, which organize and form organs. All cells need adequate nutrients to do work. Without proper nutrients, the cells can die or fail to function properly. The body also needs antioxidants substances commonly found in fruits and vegetables to neutralize free radicals, or highly reactive molecules, that can harm cells. When free radicals attack the cells and impair them, they lose their ability to produce functioning enzymes -- specialized proteins needed in every facet of biological activity, including digestion and metabolic processes.

Fiber saves time and discomfort in clearing bowels. Without adequate dietary fiber, there is increased risk of constipation. One may experience straining, lack of bowel movement and difficulty eliminating hard, dry stools. One may also feel bloated. Fiber helps move the stool along the digestive tract. Without it, stool may move slowly, allowing the large intestine to over-absorb the water content, leaving the stool dry and hard. Although constipation is temporary, getting enough fiber in diet, drinking plenty of fluids and exercise can help reduce experience of constipation. Constipation increases the risk of diverticular disease. Diverticula are protruding pockets formed from the colon. These pouches form because the muscles of the colon have difficulty passing stool along the tract and must use more force. People who eat a high-fiber diet have a decreased risk of developing diverticula compared to people who eat less fiber in their diets. Eating too much high-fat and cholesterol foods, and not enough of a high-fiber diet, can increase your risk of gallstones. Gallstones are small solid substances that form in the gallbladder, the organ that sits below the liver in the right abdomen. The solid substances are made from bile, a type of liquid that liver makes. Bile contains bile salts, fats, cholesterol, proteins, bilirubin and water. Gallbladder stores the bile. When the body needs bile salts to break up fat, the stored bile gets released.[176]

High stress levels

High stress levels increase the chances of developing digestive disorders by 25%.

Our brain and gut are more in sync than we may realize. For instance, the very thought of food can cause the stomach to produce digestive juices or the thought of giving a big presentation may cause constipation or uncontrollable bowels. The brain and gut are in constant communication. This direct relationship causes our gastrointestinal system to be sensitive to emotions and reactions such as stress. When one is stressed, the brain sends signals for chemicals such as adrenaline, serotonin (a hormone that affects mood and is found in the digestive system) as well as the stress hormone cortisol to be released. These hormones can cause adverse reactions. Stress negatively affects the digestive system

[176]LIVESTRONG.COM.(2019). *How Does a Poor Diet Affect Your Digestive System? | Livestrong.com.* [Online] Available at:https://www.livestrong.com/article/435030-how-does-a-poor-diet-affect-your-digestive-system/ [Accessed 30 Sep. 2019].

in many ways. It can cause a decrease in blood and oxygen flow to the stomach, cramping, an imbalance in gut bacteria and inflammation. These symptoms can further develop into gastrointestinal (GI) disorders such as irritable bowel syndrome (IBS), irritable bowel disease (IBD), peptic ulcers or gastroesophageal reflux disease (GERD).[177]

High Consumption of Alcohol

The individuals who took high doses of alcohol regularly were at 8% higher risk of developing digestive disorders as compared to those whose alcohol consumption was less and not regular.

Alcohol is not digested like other foods. Once alcohol is swallowed, it travels down the esophagus into the stomach and the small intestine. It avoids the normal digestive process and goes right into the bloodstream. About 20 percent of the alcohol consumed is absorbed in the stomach, and about 80 percent is absorbed in the small intestine. One organ that is particularly affected by alcohol is the liver because it is the main organ that processes alcohol. Heavy drinking over a period of years can damage the liver. Some of this damage comes from free radicals, a group of molecules that are highly reactive. These molecules can attack the nearest stable molecule, leading to a dangerous chain reaction that can result in a disease called cirrhosis of the liver. Cirrhosis occurs when scar tissue replaces normal, healthy tissue and the liver, which needs unrestricted blood flow, doesn't work as it should.

Alcohol increases acid in the stomach, which in alcohol abusers can lead to severe stomach pain or sores in the intestines. One way to help prevent the increase of acid is by eating while drinking. Food slows down the rate at which alcohol is absorbed by the body.[178]

Smoking Tobacco

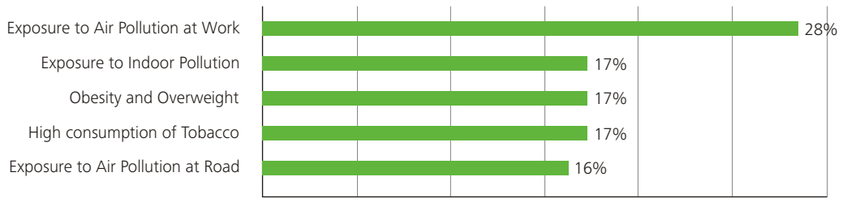
Smoking tobacco increased the chances of developing digestive disorders by 2%.

Smoking has harmful effects on all parts of the digestive system, contributing to common disorders such as heartburn and peptic ulcers. It also increases the risk of Crohn's disease and possibly gallstones. Smoking seems to affect the liver too, by changing the way it handles drugs and alcohol. In fact, there seems to be enough evidence to stop smoking solely because of digestive distress.[179]

4.6 Respiratory Diseases: Key Risk factors

Respiratory disease is a type of disease that affects the lungs and other parts of the respiratory system. Respiratory diseases may be caused by infection, by smoking tobacco, or by breathing in secondhand tobacco smoke, radon, asbestos, or other forms of air pollution. Respiratory diseases include asthma, chronic obstructive pulmonary disease (COPD), pulmonary

Relative Risk of Developing Respiratory Diseases



Source: *TARI Research team based on primary survey by Kantar Public*

[177]Malcolm, X. (2019). How Stress Affects Your Digestive System -Health Beat. [online] Health Beat. Available at: https://jamaicahospital.org/newsletter/how-stress-affects-your-digestive-system/[Accessed 30 Sep. 2019].
[178]Sciencenetlinks.com. (2019). Understanding the Effects of Alcohol: Digestive System. [online] Available at: http://sciencenetlinks.com/interactives/alcohol/ebook/pages/digestive-system.htm[Accessed 30 Sep. 2019].
[179]National Institute of Diabetes and Digestive and Kidney Diseases.(2019). Smoking and the Digestive System | NIDDK. [online] Available at: https://www.niddk.nih.gov/health-information/digestive-diseases/smoking-digestive-system[Accessed 30 Sep. 2019].

fibrosis, pneumonia, and lung cancer. Also called lung disorder and pulmonary disease.[180]

Exposure to the Air Pollution

Similar to the findings of the conventional studies, exposure to Air Pollution at work was found to be affecting the respiratory diseases the most, increasing the chances of developing respiratory diseases by 28%. Exposure to indoor air pollution increased the chances by 17%. Exposure to Air Pollution at Road was not also far behind in causing respiratory diseases and with 16% of relative risk percentage the analysis showed that exposure to Air Pollution at road increased the chances of developing respiratory diseases by 16%.

The quality of the air we breathe affects the quality of our health. Air quality has an impact on the health of our lungs and the entire respiratory system. In addition to oxygen, the air contains other substances such as pollutants, which can be harmful to health. The inhalation of those pollutants may have harmful effects on the lungs and other organs of the body. The respiratory system is particularly sensitive to air pollutants because it is made up of a mucous membrane covering its internal surface. The lungs are designed to absorb large amounts of air (400 million liters on average over a lifetime) in close contact with the bloodstream and facilitate the transport of oxygen. The cells of the lung tissue can be damaged by air pollutants such as ozone, metals and free radicals. Ozone can cause damage to the alveoli - air sac in the lungs where exchange of oxygen and carbon dioxide is produced. More specifically, the airway tissues, which contain many bio-activation enzymes, can transform organic pollutants into reactive metabolites, which can cause lung injuries.[181]

Obesity and Overweight

The people who were obese or overweight were at 17% higher risk of developing a respiratory disease.

Abdominal obesity is associated with worsening lung function and respiratory symptoms. Studies that focused on waist circumference (WC) found that elevated waist-to-hip ratio and abdominal height had good correlation with impaired lung function. Various medical conditions are also associated with an elevated WC. These include cardiovascular diseases (atherosclerosis, ischemic heart disease, stroke, hyperlipidaemia, and hypertension), type 2 diabetes mellitus, and the metabolic syndrome. Peripheral obesity is associated with fewer medical complications and better lung function. Excess weight on the anterior chest wall lowers chest wall compliance and respiratory muscle endurance with increase in work of breathing and airway resistance. Furthermore, the build-up of adipose tissue in the anterior abdominal wall and in the intra-abdominal visceral tissue hinders diaphragmatic movement, diminishes basal lung expansion during inspiration, and with the closure of peripheral lung units, causes ventilationperfusion abnormalities and arterial hypoxemia. These changes contribute to an increase in prevalence of respiratory problems in obese individuals, particularly on exertion and in the supine position such as during sleep and preoperatively during anaesthesia. Two recent studies have demonstrated that changes in lung volume can occur at early stages of obesity and are not limited to the morbidly obese individuals (BMI > 40 kg/m2). Reduction in FRC and ERV due to loss of basal lung volume can occur even in overweight patients (BMI > 2530 kg/m2) or relatively lean individuals with a WC above the normal range (>35 in women; >40 in men). The site of fat accumulation is crucial in determining the effect of obesity on respiratory system mechanics. BMI alone does not provide enough information about the bodily distribution of fat mass (FM).[182]

High consumption of Tobacco

High consumption of Tobacco raised the chances of developing Respiratory diseases by 17%.

The effects of tobacco smoke and smokeless tobacco on the respiratory system include: irritation of the trachea (windpipe) and larynx (voice box), reduced lung function and breathlessness due to swelling and narrowing of the lung airways and excess mucus in the lung passages,

[180]National Cancer Institute. (2019). NCI Dictionary of Cancer Terms. [online] Available at:https://www.cancer.gov/publications/dictionaries/cancer-terms/def/respiratory-disease [Accessed 29 Sep. 2019].
[181]Steff. R. ''Air Pollutants Affect the Respiratory and Cardiovascular System, 2009. Disabled World. Https://www.disabled-world.com/health/respiratory/air-pollutants.php
[182]Makker, H. (2010). Obesity and respiratory diseases. International Journal of General Medicine, p.335.

impairment of the lungs' clearance system, leading to the build-up of poisonous substances, which results in lung irritation and damage, increased risk of lung infection and symptoms such as coughing and wheezing, permanent damage to the air sacs of the lungs.[183]

4.7 Skin Diseases: Key Risk factors

Skin disease refers to any of the diseases or disorders that affect the human skin. They have a wide range of causes. Although most diseases affecting the skin originate in the layers of the skin, such abnormalities are also important factors in the diagnosis of a variety of internal diseases. There is some truth in the belief that the skin mirrors a person's internal health. Often, the visibility and accessibility of skin make it the first organ of the body to show detectable signs of underlying disease. Abnormalities of the skin frequently suggest metabolic, malignant, and glandular diseases.

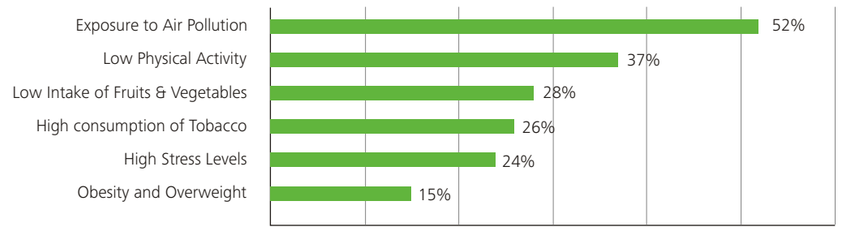
Like other tissues, skin is afflicted by all types of pathological changes, including hereditary, inflammatory, benign and malignant (neoplastic), endocrine, hormonal, traumatic, and degenerative processes. Emotions affect the health of the skin as well. The reaction of the skin to these diseases and disorders differs from that of other tissues in many ways. For example, extensive inflammation of the skin may affect metabolism within other organs and systems of the body, causing anemia, circulatory collapse, disorders of body temperature, and disturbance of water and electrolyte balance in the blood. The skin has such vigorous healing properties, however, that widespread injury, as in thermal burns, may be followed by a marked degree of regrowth of the injured or diseased areas, with a disproportionally small degree of scarring.[184]

Exposure to the Air Pollution

Proving the conventional literature right, exposure to Air Pollution came to be affecting the skin diseases the most, increasing the chances by as high as 52%.

The human skin, and mainly the upper layer of the epidermis, play the role of a barrier, but are also one of the first and major targets of air pollutants. Air pollutants include those of environmental origin, as well as those of anthropic origin. Major air pollutants with effects on the skin include the solar ultraviolet radiation (UVR), polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), nitrogenoxides (NOx), particulate matter (PM), and cigarette smoke. The actions of various air pollutants may be amplified in the presence of other air pollutants and with the interaction of UVR and form major active components of the pro-oxidant smog. Depending on the nature of these pollutants and the

Relative Risk of Developing the Skin Diseases



Source: *TARI Research team based on primary survey by Kantar Public*

[183]Better Health Channel, Smoking - effects on your body. Https://www.betterhealth.vic.gov.au/health/healthyliving/smoking-effects-on-your-body
[184]EncyclopediaBritannica. (2019). Skin disease | pathology. [online] Available at: https://www.britannica.com/science/human-skin-disease [Accessed 29 Sep. 2019].

integrity of the skin, the modes of the penetration of pollutants differ. Alterations that disturb the skin barrier function, in either stratum corneum lipid metabolism or protein components of the corneocytes, are involved in the development of various skin diseases. The protective ability of the skin is not unlimited, and problems arise when an abnormal exposure to environmental stressors exceeds the skin's normal defensive potential. Air pollutants may induce severe interference of normal functions of lipids, DNA and/or proteins of the human skin via oxidative damage, leading to skin aging, inflammatory or allergic conditions such as atopic dermatitis, psoriasis and acne, and skin cancer.[185]

Low Physical Activity

Low Physical activity increased the chances of developing skin diseases by 37%.

By increasing blood flow, exercise helps nourish skin cells and keep them vital. Blood carries oxygen and nutrients to working cells throughout the body, including the skin. In addition to providing oxygen, blood flow also helps carry away waste products, including free radicals, from working cells. Contrary to some claims, exercise doesn't detoxify the skin. The job of neutralizing toxins belongs mostly to the liver. But by increasing blood flow, a bout of exercise helps flush cellular debris out of the system. Exercise has also been shown to ease stress. And by decreasing stress, some conditions that can be exacerbated by stress can show some improvement. Conditions that can improve when stress is reduced include acne and eczema. Although researchers are still investigating the link between stress and skin, studies show that the sebaceous glands, which produce oil in the skin, are influenced by stress hormones. Regular exercise helps tone muscles, of course. That doesn't have a direct effect on skin, dermatologists say. But firmer muscles help you look better overall.[186]

Low Intake of Fruits and Vegetables

Low Intake of fruits and vegetables increased the chances of developing skin diseases by 28%.

Diets rich in fruits and vegetables are good for overall health, skin included. Healthful foods appear to reduce inflammation and decrease the likelihood of breakouts. Here are some of the big players when it comes to healthy skin. Vitamin A helps regulate the skin cycle, so no acne-causing protein and oil get trapped; it's the main ingredient in Accutane, an effective prescription medicine for acne. Good food sources of vitamin A include fish oil, salmon, carrots, spinach, and broccoli. Zinc. There is some evidence that people with acne have lower than normal levels of the mineral zinc. Zinc appears to help prevent acne by creating an environment inhospitable to the growth of acnes. It also helps calm skin irritated by breakouts. Zinc is found in turkey, almonds, Brazil nuts, and wheat germ. Vitamins E and C. The antioxidants vitamin E and vitamin C have a calming effect on the skin. Sources of vitamin C include oranges, lemons, grapefruit, papaya, and tomatoes. One can get vitamin E from sweet potatoes, nuts, olive oil, sunflower seeds, avocados, broccoli, and leafy green vegetables. Selenium. The mineral selenium has antioxidant properties that help protect skin from free radical damage. And one study showed that, together with vitamin E, it may improve acne as well. A small Swedish study on 42 men and 47 women found that

[185]Drakaki, E., Dessinioti, C. and Antoniou, C. (2014). Air pollution and the skin. Frontiers in Environmental Science, 2.
[186]webmd. (2019). Exercise for Healthy Skin. [Online] Available at: http://Exercise for Healthy Skin [Accessed 27 Sep. 2019].

those who consumed selenium together with vitamin E for 12 weeks saw improvements in their acne. Food sources of selenium include wheat germ, tuna, salmon, garlic, Brazil nuts, eggs, and brown rice. Omega-3 fatty acids. Omega-3 fatty acids inhibit certain molecules that lead to inflammation and resulting skin problems. They also support the normal healthy skin cell turnover that helps keep acne at bay. One can get omega-3 fatty acids from cold water fish, such as salmon and sardines; flaxseed oil; walnuts; sunflower seeds; and almonds.[187]

High Consumption of Tobacco

High Consumption of Tobacco increased the chances of developing skin diseases by 26%.

Studies suggest that tobacco smoke exposure decreases capillary and arteriolar blood flow, possibly damaging connective tissues that help maintain healthy skin. Skin fibroblasts (the cells in connective tissue that form collagen and elastin) are damaged by tobacco smoke. There is also evidence that tobacco smoke is phototoxic. Smoke becomes more toxic in the presence of ultraviolet light (UV), such as is found in sunlight, and causes more damage to skin cells than either smoke or UV would cause on their own.[188]

High Stress Levels

High stress levels increased the chances of developing skin diseases by 24%.

Stress can affect the whole body, including hair, nails, and skin. Stress causes a chemical response in the body that makes skin more sensitive and reactive. It can also make it harder for skin problems to heal. Stress causes the body to make hormones like cortisol, which tells glands in the skin to make more oil. Oily skin is more prone to acne and other skin problems.[189]

Obesity and Overweight

Standing at the bottom of the chart amongst the risk factors analyzed for the skin diseases, the people who had obesity or who were overweight had 15% higher chances of developing a skin disease as compared to the people who were not obese or overweight.

Being overweight (obesity) may cause skin problems due to several factors. Changes in hormones may cause acanthosis nigricans, which are darkened, velvety areas of the neck and body folds, while stretching of the skin may result in stretch marks (striae). Increased strain on the leg veins may cause fluid retention, leg swelling, and rupture of superficial capillaries (capillaritis), varicose veins, dermatitis, and even ulcers. Retained moisture in body folds encourages the growth of bacteria and fungi, leading to skin rashes and potential breakdown and a variety of infections, such as intertrigo. Finally, the foot may develop corns and calluses due to the increased weight. Many of these skin problems will resolve with a healthy diet and subsequent weight loss.[190]

Analysis of the risk factors of the heart diseases shows that high stress levels is the foremost risk factor. High intake of junk, fried food and low physical activity, are two factors that were found to be major causes of diabetes. When analyzing the risk factors of cancer, low physical activity and obesity or overweight came to be the most significant causes. Like diabetes, low physical activity and high intake of junk, fried foods were the risk factors found to be causing the hypertension the most. For skin diseases, exposure to air pollution and low physical activity were found to be the major risk factors.

From the analysis it is clear that low physical activity, high consumption of fast foods and high stress, are the risk factors which have been found to have the most significant role in causing major non-communicable diseases. As these factors have become integral aspects of modern-day lifestyle of people in the contemporary age, it is recommended that people should reduce such harmful lifestyle or should find a balance to neutralize the effects of this lifestyle to keep their body healthy and away from diseases.

[187] WebMD,Healthy Diet, Healthy Skin.https://www.webmd.com/skin-problems-and-treatments/acne/features/diet-and-skin#2
[188] Scollo MM,Winstanley MH [eds]. Tobacco in Australia [3rd edition]. Chapter 3: The health effects of active smoking [online]. Melbourne: Cancer Council Victoria. 21November 2008 [cited 18 May 2009].
[189] WebMD,Effects of Stress on Your Skin. Https://www.webmd.com/beauty/the-effects-of-stress-on-your-skin
[190] skin sight, Skin Problems Related to Obesity. Https://www.skinsight.com/disease-groups/skin-problems-related-to-obesity

5.

Prevalence of NCDs in India

Prevalence of NCDs in India

This section of the report primarily focuses on the prevalence of NCDs in India. The findings presented here are based on the national level survey done by Kantar Public covering 40193 households and 233672 individuals. The required sample size for estimating prevalence and to identify respondents for detailed interviews was arrived at after ascertaining the required sample of NCD affected individuals and dividing it with prevalence (separately for Rural and Urban areas) of major NCDs, like heart ailments, diabetes, hypertension, respiratory ailments and cancer according to NFHS 4. Kantar Public assures that the final sample is robust enough at 5% of margin of error for various levels of analysis - Overall, State, Rural/ Urban, demographics like: Gender, age groups and major NCDs.

We present findings of the survey in the following four sections. For further strengthening and validating the findings of the survey, we have compared it with the IHMA data wherever possible.

Prevalence of NCDs in India | **Prevalence of Key NCDs** | **Prevalence of NCDs in Indian States** | **Demographic Profile and Prevalence**

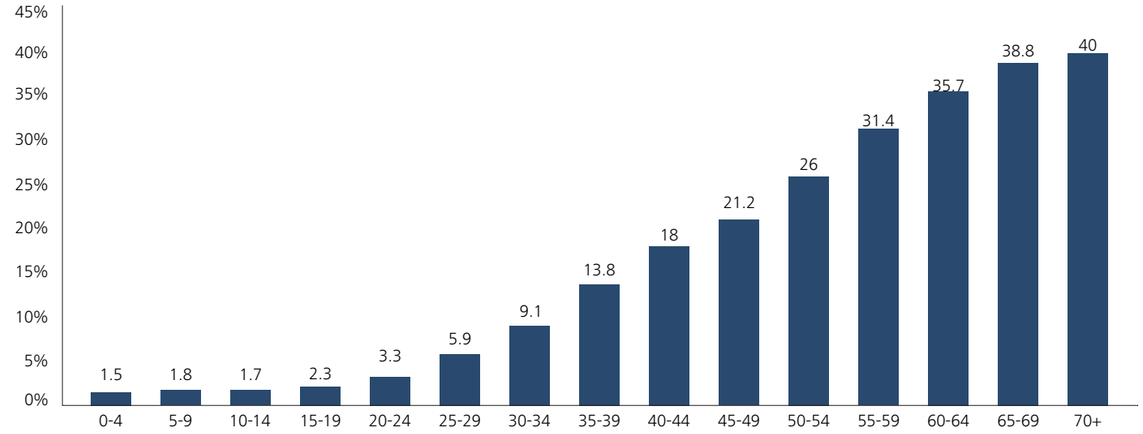
5.1 Prevalence of NCD in India

The findings of the survey suggests that prevelance of having any NCDs among the population is 116 per 1000 population. A study using the National Sample Survey Organisation (NSSO 71th Round, 2014) data and doing biverate analysis estimates the overall prevalance of the NCDs at 55 per 1000 people.[191] Recent estimation of overall prevalence of NCDs from this survey highlights that prevalence of NCD among the population has doubled in the last five years. However, the prevalence of NCDs varies significantly across geographies and among different age groups.

The age profiling of the population reveals that risk of NCDs increases with age and is significantly high for the older population. About 3.3 percent of the population aged below 25 years have a possibility of having a NCDs and the prevalence of NCDs thereafter increases gradually. The risk of having NCDs among population is almost 4 times as they move from age of 25 years toward fifties. Every 4th Person in population aged 50 years or above has a higher risk of having a NCD. Population with age 70 years and above have the highest risk of having a NCDs, where every two out of five persons have some kind of NCD.

[191] Bhise, Mahadev & Patra, Shraboni & Chaudhary, Mamta. (2018). Geographical variation in prevalence of non-communicablediseases (NCDs) and its correlates in India: evidence from recent NSSO survey. Journal of Public Health. 26. 10.1007/s10389-017-0889-x.

Prevalence of NCDs: Age Groups (%)



Source: *TARI Research team based on primary survey by Kantar Public*

5.2 Key NCDs and Their Prevalence

The analysis of prevalence of key NCDs is important to understand for designing and developing heath policies and undertaking suitable preventive measures to avert increasing incidence of these NCDs in the future. The data from Global Burden of the Disease 2017 estimates the prevalence of NCDs among Indian population and attributable DALYS, YLDs and deaths due to specific NCDs. Digestive, Mental /Neurological Disorders and Skin and subcutaneous diseases have higher prevalence among in the Indian population. Cardiovascular diseases, chronic respiratory diseases and neoplasm are more critical NCDs with higher burden.

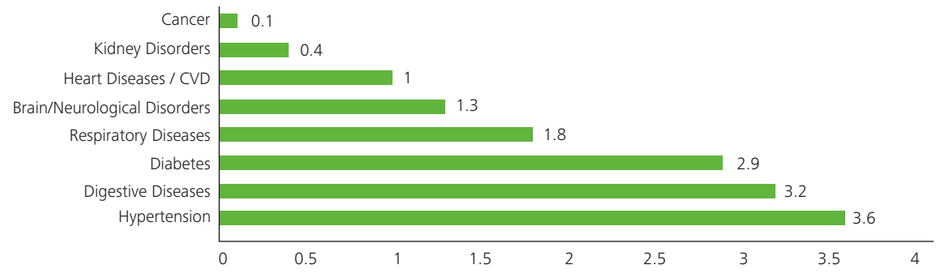
Key NCDs and their Burden (in Millions) in India (2017)

NCDs	DALYs	Deaths	Prevalence	YLDs
Cardiovascular Diseases	65.1	2.6	59.2	3.7
Chronic Kidney Diseases	7.3	0.2	115.1 7	1.2
Chronic Respiratory Diseases	33.8	1.3	7.9	9.5
Diabetes Mellitus	11.2	0.3	67.8	5.6
Digestive diseases	15.5	0.4	262.3	2.3
Neoplasm / Cancer	26.5	0.9	3.6	0.5
Mental/ Neurological Disorders	40.1	0.3	821.2	35.5
Skin and Subcutaneous Diseases	6.9	0.0	320.0	6.3

Source: *Global Burden of Disease Study 2017 (GBD 2017) Results*

This survey points that Hypertesion has the largest prevalalence among the population. It shows that 36 out of 1000 (3.6 %) respondents are suffering from this metabolic disorder that leads to other critical NCDs. Digestive diseases were the second most prevalent NCD among the respondents at 3.2%. According to the survey, Cancer was the least prevalent NCD at a mere 0.1%.These findings are in line with government estimates, published in National Health Profile 2018, which shows that hypertension is the most prevalent disease, followed by diabetes, CVDs, stroke and lastly cancers.

Prevalence (%) of NCDs by Disease Type



Source: *TARI Research team based on primary survey by Kantar Public*

Diabetes mellitus, one of the most common NCD and critical metabolic disorder has prevalence of 32 per 1000 population. Global Burden of Disease highlights the number of persons with diabetes has increased from 51.4 million in 2007 to 67.8 million in 2017. The prevalence of hypertension, digestive diseases and diabetes is more prevalent than other NCDs as they are largely caused by preventable risk factors such as poor dietary habits and high stress levels.

Diseases of the respiratory system are the fourth largest prevalent disease that is mainly caused by environmental risk factors such as air pollution. Heart diseases/ CVDs and Neoplasm/cancer which are most critical NCDs have lower prevalence as they are high risk NCDs and difficult to detect. These three diseases together have a prevalence of 140.8 million among Indian population and have highest burden with 4.8 million deaths and 125.4 million DALYS.[192]

High prevalence of NCDs is generally associated with co-morbidity, that is, many a time two or more diseases may affect a person together. Presented below is the correlation matrix for the 8 diseases under consideration of the survey. The survey responses showed that while some NCDs had high co-morbidity with each other, some others were less correlated.

[192]Global Burden of Disease Collaborative Network.Global Burden of Disease Study 2017 (GBD 2017) Results. Seattle, United States:Institute for Health Metrics and Evaluation (IHME), 2018.

Diabetes mellitus, one of the most common NCD and critical metabolic disorder has prevalence of 32 per 1000 population. Global Burden of Disease highlights the number of persons with diabetes has increased from 51.4 million in 2007 to 67.8 million in 2017.

Correlation Matrix of Non-Communicable Diseases

Diseases	Heart Diseases	Cancer	Diabetes	Respiratory Diseases	Hypertension	Brain / Neurological Disorders	Kidney Disorders	Digestive Diseases
Heart disease	100	5.3	4.4	5.6	6.2	4.1	6.5	2.5
Cancer	0.7	100	0.4	0.3	0.2	0.3	1.2	0.3
Diabetes	12.6	9.9	100	7.4	19.3	5.5	10.2	6
Respiratory Diseases	10	3.6	4.6	100	7.8	5.8	7.7	7.9
Hypertension	22.3	6.4	24.3	15.6	100	12.2	12.6	14.6
Brain / Neurological Disorders	5.3	2.8	2.6	4.3	4.4	100	7.9	3.2
Kidney Disorders	2.6	3.9	1.4	1.7	1.4	2.4	100	1.7
Digestive Diseases	8	6.8	6.7	14.1	12.9	7.7	13.6	100

Source: *TARI Research team based on primary survey by Kantar Public*

As can be seen from the chart above, hypertension has high co-morbidity with all other diseases as people with this metabolic disorder also develop other critical NCDs such as heart disease/ CVDs and respiratory diseases. Similarly, for diabetes, respondents also report from one or more of other NCDs such as heart disease/ CVDs and kidney disorders. Digestive diseases share high co-morbidity with respiratory diseases as well as kidney disorders. Overall, the least correlation was seen between diabetes and neurological disorders.

5.3 Prevalence of NCDs in Indian states

India has a varied geographical area with different topography, environmental conditions and dietary habits. Analysis of prevalence of NCDs among geographies and states shows significant variation. This survey was carried out on the national level covering all regions and 21 state clusters.[193] All states were covered except for states in north-eastern region which were represented by the Assam and Tripura. If one compares national average of 116 per 1000 population among the state's prevalence, Odisha has the highest prevalence of NCDs (272 per 1000 population), while Gujarat has lowest prevalence (60 per 1000 population). Population of the northern, central, and western regions of the country has prevalence lower than the nation average. Prevalence is quite high in the lesser developed regions of India including eastern and north-east regions. The other states with NCD prevalence higher than the national average were Andhra Pradesh, Telangana and West Bengal. All other states reported relatively low cases of NCDs among the survey respondents.

State wise analysis showed that prevalence of certain NCDs was even more than national average in some states. For Heart diseases, while the national average prevalence rate was 1.01%, states such as J&K, Chandigarh, Punjab, Haryana, Assam, Tripura, West Bengal, Jharkhand, and Kerala had higher rates, with the highest being Tripura at 4.17%.

[193] Andhra Pradesh (AP) includes both AP and Telangana, Maharashtra includesGoa, Assam and Tripura represent NE clust

Prevalence of NCDs: State wise

States	Any NCDs	Heart Diseases	Cancer	Diabetes	Respiratory Diseases	Hypertension	Brain / Neurological Disorders	Kidney Disorders	Digestive Diseases
Jammu and Kashmir	9.69%	**1.58%**	0.06%	**3.00%**	**1.84%**	2.29%	0.52%	0.24%	0.90%
Himachal Pradesh	6.40%	0.42%	0.02%	1.83%	1.08%	2.31%	0.32%	0.09%	1.14%
Chandigarh	13.34%	**2.74%**	0.00%	**3.28%**	0.48%	**7.09%**	0.36%	**2.51%**	1.08%
Punjab	11.91%	**1.73%**	0.04%	**2.98%**	1.36%	**5.59%**	1.29%	**0.89%**	1.06%
Uttarakhand	7.13%	0.85%	0.06%	1.71%	1.61%	1.80%	0.21%	0.19%	1.78%
Haryana	12.07%	**2.01%**	**0.14%**	2.05%	**3.00%**	2.67%	**1.43%**	**0.91%**	1.91%
NCT of Delhi	10.73%	0.68%	0.05%	**3.35%**	**2.52%**	**3.80%**	0.30%	0.16%	**3.45%**
Rajasthan	6.50%	0.57%	0.12%	0.76%	**1.91%**	1.20%	**1.60%**	0.23%	1.11%
Uttar Pradesh	6.26%	0.48%	**0.14%**	0.94%	1.34%	1.20%	0.45%	0.23%	2.20%
Bihar	11.89%	0.92%	0.02%	2.28%	2.04%	**3.83%**	0.57%	0.33%	**5.11%**
Assam	**22.33%**	**4.05%**	0.08%	2.78%	**1.84%**	**8.35%**	**6.18%**	**0.66%**	**4.23%**
Tripura	**26.27%**	**4.17%**	**0.26%**	**4.41%**	**3.92%**	**8.01%**	**6.00%**	**1.14%**	**7.58%**
West Bengal	**17.83%**	**2.34%**	**0.17%**	**3.53%**	**3.44%**	**5.13%**	**3.50%**	**0.96%**	**4.80%**
Jharkhand	10.77%	**1.35%**	0.08%	**2.89%**	1.36%	2.89%	**1.45%**	0.24%	**3.71%**
Odisha	**27.19%**	0.76%	0.12%	**3.76%**	**3.74%**	**9.42%**	**1.75%**	0.19%	**15.91%**
Chhattisgarh	6.13%	0.32%	0.05%	1.97%	1.07%	2.51%	0.22%	0.07%	1.46%
Madhya Pradesh	11.18%	0.68%	0.06%	**3.52%**	**2.61%**	1.50%	0.93%	0.11%	2.54%
Gujarat	5.99%	0.41%	0.11%	2.35%	0.78%	0.79%	0.33%	0.09%	1.61%
Maharashtra	9.33%	0.56%	0.13%	2.46%	1.68%	3.36%	0.45%	**0.51%**	2.01%
Andhra Pradesh	**16.66%**	0.59%	0.10%	**4.69%**	1.38%	**8.54%**	**2.52%**	**0.66%**	2.32%
Karnataka	9.98%	0.97%	0.30%	2.26%	1.40%	2.46%	0.43%	0.33%	**4.13%**
Kerala	11.79%	**1.83%**	**0.71%**	**5.85%**	1.51%	1.55%	0.57%	0.93%	0.47%
Puducherry	**17.95%**	0.64%	**0.32%**	**9.29%**	0.00%	**11.54%**	1.28%	0.32%	0.32%
Tamil Nadu	12.11%	0.29%	0.03%	**6.56%**	0.33%	**4.55%**	**1.50%**	0.17%	1.24%

Source: *TARI Research team based on primary survey by Kantar Public*

Cancers were overall relatively lower than national average (0.13%) with only exceptions being Tripura, WB, Kerala and Puducherry, highest again being Tripura (0.26%). Diabetes, respiratory diseases, hypertension, neurological disorders and digestive diseases were all highly prevalent in the most states, with diabetes (2.85%), hypertension (3.60%) and digestive diseases (3.19%) having high national averages too as compared to other diseases. Kidney diseases were prevalent at a low national average of 0.4%; however, Chandigarh, Punjab, Bihar, Assam, Tripura, WB, Maharashtra, AP, and Kerala have prevalence rates higher than the national average.

5.4 Demographic Profile and Prevalence of NCDs

The prevalence survey covered four demographic aspects of the population, namely: Age, Gender, Area of living (rural/ urban) and household size. Prevalence of key NCDs with respect to these demographic profiles of the population is discussed and analyzed in the following subsections.

Age: Risk of NCDs Increases After 35 years

Prevalence of NCDs in the population has direct correlation with ageing. The chi-square test results confirm this fact and there is signficant difference in prevalence of NCDs between the different age groups signifcant at level of 0.1 percent. Results of the same are given in the Annexure II of the report. Population below the age of 18 has relatively low risk of having any NCDs. However, with increase in age exposure to the risk factor attributing for cause of a specific NCD rises. *The survey findings highlight that prevalence of NCDs increases after 18 years and shows quantum leap when an individual crosses the age of 35 years.*

The risk of having a metabolic disorder and disease including diabetes and hypertension almost increases by 4 times as they move from age group 18- 25 years to 26-35 years and further by 3 times as they move from age group of 26-35 years to age group of 36-45 years.

Prevalence of NCDs by Age Groups

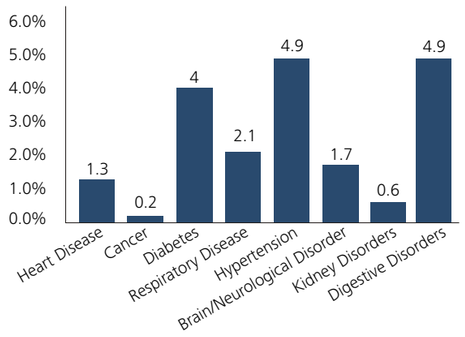
Age Groups (in Years)	Heart Diseases	Cancer	Diabetes	Respiratory Diseases	Hypertension	Brain / Neurological Disorders	Kidney Disorders	Digestive Diseases
Below 18	0.18%	0.03%	0.18%	0.41%	0.08%	0.45%	0.08%	0.46%
18-25	0.36%	0.02%	0.39%	0.43%	0.48%	0.62%	0.17%	1.19%
26-35	0.66%	0.08%	1.34%	1.20%	2.15%	1.07%	0.41%	3.49%
36-45	1.23%	0.18%	4.10%	2.10%	5.11%	1.86%	0.48%	5.67%
46-59	2.40%	0.34%	8.52%	3.46%	9.28%	2.43%	0.99%	6.42%
60 and Above	3.75%	0.44%	10.99%	8.04%	15.47%	3.89%	1.10%	7.41%

Source: *TARI Research team based on primary survey by Kantar Public*

[1] This is dummy text
[2] This is dummy text

The risk of having a metabolic disorder and disease including diabetes and hypertension almost increases by 4 times as they move from age group 18-25 years to 26-35 years and further by 3 times as move from age group of 26-35 years to age group of 36-45 years. This risk increases by two times for higher age group. For the critical NCDs such heart disease, cancer and respiratory disease, the prevalence and risk of having such disease in an individual is twice in the age group of 36-45 years as compared to the age group of 26-35 years. The graph below shows that prevalence of key NCDs in the most productive life years of the population, that is, between 26 to 59 years.

Prevalence of NCDs in the Age Group: 26-59 Years (%)



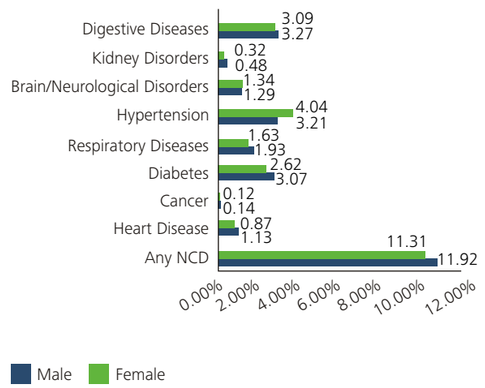
Source: *TARI Research team based on primary survey by Kantar Public*

Gender: Males are More Prone to NCDs

Worldwide, there are disparities in the prevalence of NCDs among men and women. Yet there is still a shortage of rigorously analyzed sex-disaggregated data related to NCDs in low and middle-income countries like India, which makes it difficult to accurately determine the influence of gender-related factors on NCD morbidity and mortality and to establish the extent to which gaps exist in treatment for males and females. Men and women face different levels of susceptibility to NCDs based on their genetic makeup as well as on prevailing gender norms that influence the various risk factors for NCDs. The different roles of males and females in the household lead to different levels of exposure to environmental risk factors and pollutants, an important contributing risk factor to NCDs.

The survey findings highlight prevalence of NCD among males is 119 per 1000 male population while for females it is 113 per 1000 female population. Chi-square test reveals that there is significant difference in prevalence of NCDs between male and female population. *According to survey results males are more prone to contracting NCDs than females except for Hypertension and neurological disorders which are more prevalent in women. Kidney disorders were prevalent in men at 0.48% and with a very marginal difference in females at 0.32%.*

Prevalence of NCDs in India by Gender (%)



Source: *TARI Research team based on primary survey by Kantar Public*

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The Chi-square test shows that for most of the NCDs, there exists a significant difference in prevalence between male and female population except for cancer and brain/neurological disorder. For digestive diseases, the prevalence rate among the male population is 3.27%, marginally higher than 3.09 percent among female population and significant at 5 percent level.

Rural and Urban: Metabolic Diseases are More Prevalent in Urban Areas

Intuitively, one would expect a lower prevalence of NCD in a rural population who traditionally lead a more active lifestyle compared to their urban counterparts. However, if one looks at the overall prevalence of NCDs among the rural and urban population, it remains the same at 116 per 1000 population with no significant difference.

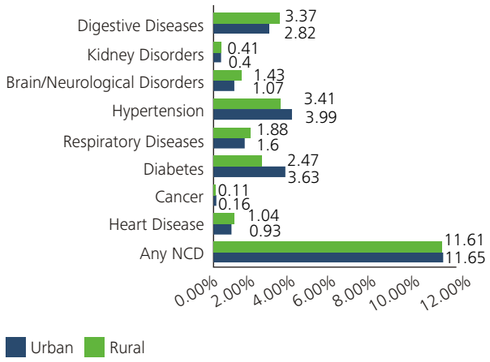
However, physical activity may be only one cog in the wheel underpinning the explosion of metabolic and cardiovascular diseases in India. The two diseases which were more prevalent in urban areas were hypertension and diabetes, as shown in the graph below. Results from the Chi-square test confirm that prevalence of hypertension and diabetes among urban population is significantly higher in comparison to the rural population at 0.001 significance levels.

This is in line with a recent study[194] that shows six in ten adults in large South Asian cities such as Chennai, Delhi, and Karachi have either diabetes or pre-diabetes. A higher prevalence of diabetes, dyslipidemia, and hypertension was observed in educated and more affluent groups in urban areas.[195] Such studies reinforce the notion that urbanization, westernization, and affluence have a significant role in the huge explosion of NCDs in countries like India.

The results from survey point out that digestive diseases, kidney disorders, neurological disorders, respiratory diseases, cancer, and heart diseases, all had higher relative prevalence in rural areas. Results of chi-square test further confirms this fact rural population have higher prevalence of these specific NCDs, except for kidney disorders, in comparison to the urban population at 0.001 significance levels.

The findings are important from the perspective of the health planning policy as most of the people in the rural area lack awareness about risk factors specific to an NCD and also have inadequate access to health facilities.

Prevalence of NCDs in India by Location (%)



Source: *TARI Research team based on primary survey by Kantar Public*

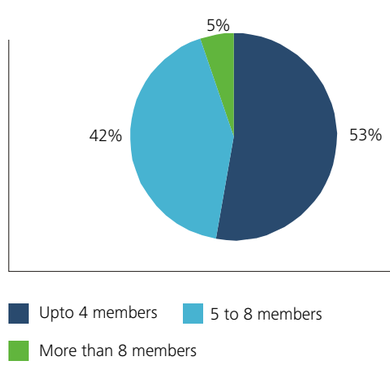
[194]Deepa M, Grace M, Binukumar B, Pradeepa R, Roopa S, Khan HM,et al. High burden of pre diabetes and diabetes in three large cities in South Asia: The Center for cArdio-metabolic risk reduction in South Asia (CARRS)study. Diabetes Res Clin Pract. 2015;110:172–82

[195]Ali MK, Bhaskarapillai B, Shivashankar R, Mohan D, Fatmi ZA, Pradeepa R,et al. Socioeconomic status and cardiovascular risk in urban South Asia: The CARRS study. Eur J Prev Cardiol. 2016;23:408–19.

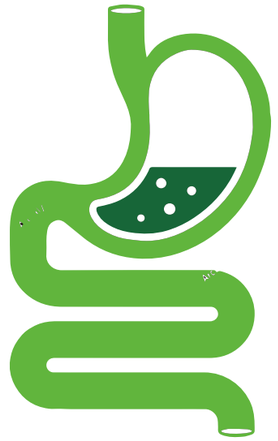
Household Size: Smaller families have higher Prevalence

With growing population, modernization and urbanization typical families are becoming smaller and nuclear. The prevalence survey captured household size of families to assess the prevalence at family levels. Our prevalence survey data also shows that smaller households with family size up to 4 family members with 52.73 percent dominate in Indian society. Joint families with more than 8 family members account for 5.2 percent.

Household Size Distribution



Source: *TARI Research team based on primary survey by Kantar Public*



Results of prevalence survey show that prevalence of NCDs is highest in smaller families with household size up to 4 family members. Chi-square test results statistically confirm this fact for all disease, except digestive and cancer, at significance level of 0.1 percent. Results of this test are given in Annexure II of the report.

Prevalence levels in cancer for household's size are statistically significant at the 1 percent levels. In case of digestive diseases, its prevalence is almost same in different household sizes and no statistical difference is observed.

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Prevalence of NCDs: Household Size

Key NCDs	Upto 4 members	5 to 8 members	More than 8 members
Any NCD	12.55%	10.75%	9.33%
Heart disease	1.08%	0.93%	0.83%
Cancer	0.15%	0.11%	0.07%
Diabetes	3.30%	2.43%	1.74%
Respiratory Diseases	1.95%	1.64%	1.35%
Hypertension	3.96%	3.23%	2.97%
Brain / Neurological Disorders	1.39%	1.26%	1.01%
Kidney Disorders	0.45%	0.38%	0.18%
Digestive Diseases	3.21%	3.15%	3.19%

Source: *TARI Research team based on primary survey by Kantar Public*

It can be observed that metabolic diseases such as diabetes and chronic diseases such as cancer, kidney disorders, heart diseases and respiratory diseases are significantly higher in the smaller families as individuals are prone to lifestyle and dietary risk factors.

The results of Global burden of the disease shows that prevalence of the major NCDs has increased from 1990 to 2017. However, further analysis reveals that the age-standardized prevalence has remained more or less same for many of the NCDs and has increased certain NCDs like diabetes, CVDs, ischemic heart disease and skin disease. The report "India: Health of the Nation's States"[196] *suggest that "overall increase in NCD prevalence is a mixed phenomenon, with ageing of the population causing an increase in many NCDs, along with an additional increase due to exposure of risk factors for causes that have an age-standardized increase in the prevalence." In the subsequent sections, based on the main survey, we will analyze prevalence of the risk factors to the population and attribution to these risk factors for causation of specific NCD.*

[196] Report"India: Health of the Nation's States", page 63

6.

Preventive Control and Treatment Seeking Behaviour

Preventive Control and Treatment Seeking Behaviour

Over the last few decades, the advancement in medical technology has made it possible to cure diseases that were once considered incurable. However, the cost of their treatment is very high and makes it unaffordable for a large section of the population in India. Research evidence has shown that intervention such as primary health care which are aimed at early detection and timely treatment are quite important and excellent economic investments as they provide early sign to patients that can reduce the need for more expensive treatment.[197]

In this perspective, it is important to understand the preventive steps taken by individuals for controlling NCDs as they have to live with such disability for their entire life and cost of treatment of such NCD may put them in financial distress. This section of the report focuses on preventive control of NCDs looking into aspects of preventive checkups and the time when people approach for medical advice. It also focuses on the treatment seeking behavior of individuals suffering from a particular NCD while also analysing the kind of treatment they are seeking and duration of such treatment.

This section of the report is based on the main survey covering a population of 10500 individuals aged 17 years and above across all the states having one or more non-communicable disease to have better insights about their disease and treatment of these diseases. The sample weights were accounted in the survey module to adjust for adequate data representation. The analysis here, therefore, is based on weighted 10538 individual observations. Results here are presented for nine broad disease categories and results for specific diseases under these categories are provided in the Annexure V of the report.

6.1 How people go for preventive health check ups

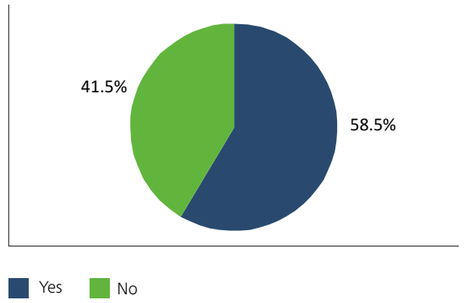
The results of survey in previous sections highlighted that it is very difficult for individuals to notice symptoms of the NCDs. For most of the NCDs symptoms are not evident until complications set in. In this perspective, it is important that individuals take preventive check-ups for taking necessary preventive actions and early detection and treatment if conditions of specific NCDs are setting in. Evidence shows that in case of critical NCDs like cancer, patients have good chances of survival if detected and treated in early stage of cancer.[198]

Preventive check-ups can allow individuals to know their body conditions and early warning signals of the conditions of an NCD. Battle against NCDs is half won if symptoms are detected because it is very difficult to successfully and completely manage the conditions and fully cure it after being diagnosed with a disease.[199]

Preventive measures such as getting annual health check-ups keep one informed of their state of health. *Survey results show that 58.5 percent of individuals covered in the survey go for medical check-ups. The balance 41.5 percent of individuals in the absence of the health check-ups don't know about their medical condition. Based on this information, a person can make a few simple lifestyle and nutrition changes and, in many cases, reduce the necessity of having to go to a specialist doctorlike a diabetologist, a neurologist or a cardiac surgeon or even a physiotherapistfor getting treatment done for a protracted ailment.*[200]

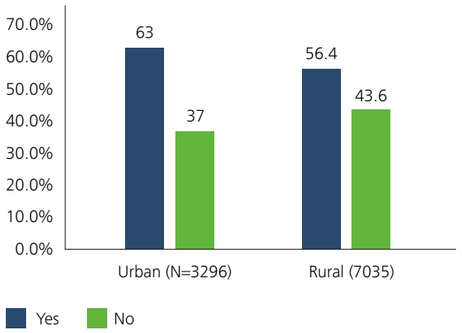
[197] WHO,Noncommunicable diseases; https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases
[198] HealthMinistry to launch population-based prevention, screening and control programmefor five non-communicable diseases,https://pib.gov.in/newsite/PrintRelease.aspx?relid=157571
[199] Preventive healthcare: Going beyond an apple aday, Available at https://www.financialexpress.com/opinion/preventive-healthcare-going-beyond-an-apple-a-day/1273032/
[200] Preventive healthcare: Going beyond an apple aday, Available at https://www.financialexpress.com/opinion/preventive-healthcare-going-beyond-an-apple-a-day/1273032/

How Many People go for Health check ups



Source: *TARI Research team based on primary survey by Kantar Public*

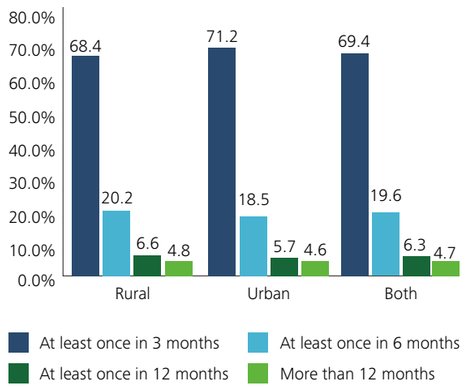
People go for timely Health Check ups: Urban vs. Rual (%)



Source: *TARI Research team based on primary survey by Kantar Public*

Further, percentage of individuals going for the health checks is relatively higher among the urban population in comparison to rural population. Awareness about regularly monitoring of conditions of NCDs, availability of primary healthcare facilities and other constraints including financial conditions could be limiting people living in the rural areas for going for medical checkups.

Frequency of going for Health Check ups (%)



Source: *TARI Research team based on primary survey by Kantar Public*

Analysis of people undertaking health checkups reveal that 95 percent of people have checks ups at least once in year. Further, more than 2/3rd of people undertaking health checkups do it regularly after every 3 months while about 20 % of such people do it after every 6 months. This suggests that most people start taking health check-ups once they know their medical conditions and do it more frequently for controlling and treating an aggravating condition of NCD.

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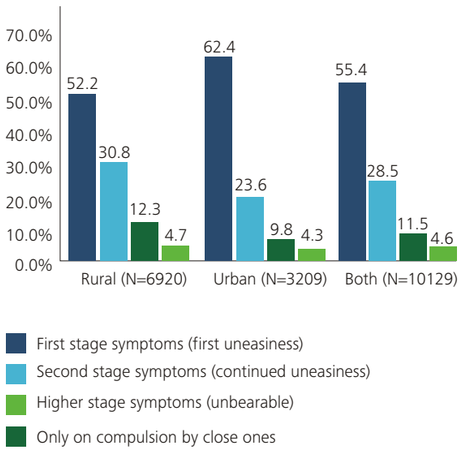
6.2 When people seek medical advice

As mentioned before, most of the NCDs symptoms are not evident until complications set in. However, even if when the conditions start giving their indications of a disease and individuals still ignore them the conditions of an NCD may further deteriorate very rapidly. This may result in difficultly in treating such disease with significant financial burden. Further, conditions if ignored continuously may also lead to mortality. Results of the survey shows that 55 percent of the population approach for a medical advice at the early stage of a disease, that is, when they have any kind uneasiness or any kind of symptoms. Percent of such individuals in urban and rural areas is significantly different as about 52 % percent of people in rural areas go for medical advice in first stage as compared to the 62 percent in the urban areas. Absence of nearby health facilities in rural areas could be one reason for such significant difference.

When People Approach for Medical Advice (%)

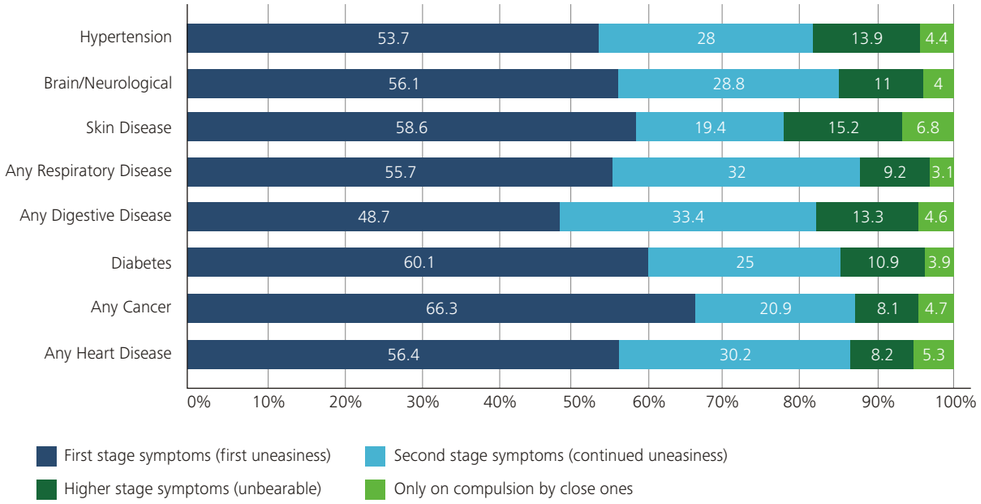


Source: *TARI Research team based on primary survey by Kantar Public*

Nearly 30 percent of individuals go for medical advice when symptoms persist over a period of time, where again percentage of such people is higher among rural population. More than 16 % percent of individuals seek medical advice only when condition of a disease becomes critical and unbearable and forced by their families. These individuals are at risk of prolonged treatment and conditions where such disease may not be completely cured.

Results of survey on key NCDs show that more than 80 percent of individuals approach for medical advice either at the first stage or second stage of symptoms in case of chronic NCDs like hypertension, diabetes, heart diseases, cancer, respiratory diseases and brain/ neurological disorders where they understand that any further delay could have compounding impact on their health conditions. In case of common digestive and skin disease individuals' approach for medical advice only when it gets very critical and unbearable.

When People Approach for Medical Advice (%)



Source: *TARI Research team based on primary survey by Kantar Public*

6.3 How people seek treatment for their NCD

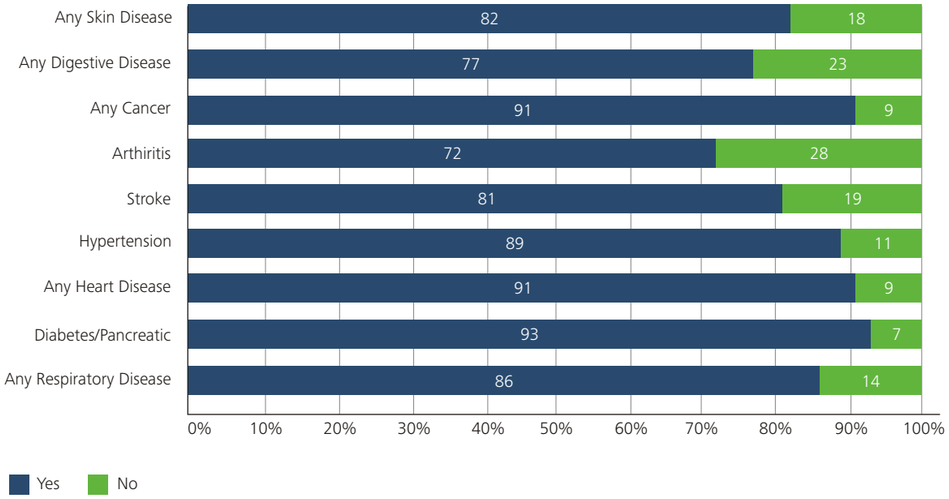
After looking into preventative actions of the individuals in pervious sub-sections, this part of the report focuses on the treatment seeking behavior of the individuals. Here the analysis focuses on how many individuals suffering an NCD go for treatment of their disease, for how long they are seeking treatment of their disease and what kind of treatment they are seeking of their disease. Results here are presented for nine broad disease categories and results for specific diseases under these categories are provided in the Annexure V of the report.

Are people seeking treatment for their NCD?

Often, one tends to lean towards self-medication of treatment of a pre-supposed disease based on self-diagnosis or prescription from a local pharmacist. These habits increase the risk of morbidity and mortality from NCDs as they are not diagnosed accurately or on time.

The survey results highlight that about 90 % of individuals suffering from chronic NCDs such as Cancer, heart disease, diabetes, hypertension and respiratory disease (86 % percent in this case) are seeking treatment for their disease. For disease like arthritis, brain/neurological disorders (stroke), skin and digestive disorders nearly 20 percent individuals don't seek medical treatment and rely upon home remedies. Results for specific disease under these nine broad disease categories can be checked from Annexure V of the report.

Whether Seeking Treatment (%)



Source: *TARI Research team based on primary survey by Kantar Public*

What kind of treatment are people undergoing for their NCD?

As per National Sample Survey Organisation,[201] the average total medical and other related non-medical expenditure per hospitalization in rural and urban areas are Rs.16,956/- and Rs.26,455/- respectively and average total medical expenditure for non-hospitalized treatment per ailing person in rural and urban areas are Rs.509/- and Rs.639/- respectively.

The kind of treatment that individuals are taking for their disease shows gravity of the condition of their disease. Results here are presented for kind of treatment individuals are undergoing for key nine disease categories and findings for specific diseases under these categories can be checked from Annexure V of the report.

Results show that more than 10% of individuals having skin or digestive diseases rely upon Ayush treatment or treatment by non-licensed doctors ('quack') or other kind of treatment including home remedies, advice from elders and internet search. This is line with our previous findings where many people do not seek treatment for such diseases and believe symptoms can be resolved easily without medical supervision. In these diseases, less than 15% of individuals get hospitalized whenever the situation gets aggravated.

[201]Health in India – NSS 71st Round"(January-June 2014)

Type of Treatment Sought

Broad Disease Category	Under the supervision of doctor - Hospitalized	Under the supervision of doctor - Regular visit but not hospitalized	Under the supervision of doctor - Visit only when required	AYUSH	Non-licensed doctor ('quack')	Others
Any Respiratory Disease	15.1%	24.4%	54.6%	1.6%	3.1%	1.1%
Diabetes	14.5%	26.3%	55.3%	1.6%	1.1%	1.2%
Any Heart Disease	17.0%	28.0%	51.7%	0.8%	1.4%	1.0%
Hypertension	12.2%	25.9%	58.1%	1.5%	1.0%	1.3%
Brain/ Neurological	19.0%	29.9%	49.2%	0.6%	0.9%	0.9%
Any Cancer	24.1%	32.4%	42.0%	0.6%	0.6%	0.0%
Any Digestive Disease	9.6%	19.6%	57.4%	6.1%	4.7%	2.6%
Any Skin Disease	13.3%	30.8%	45.3%	3.9%	3.8%	2.8%

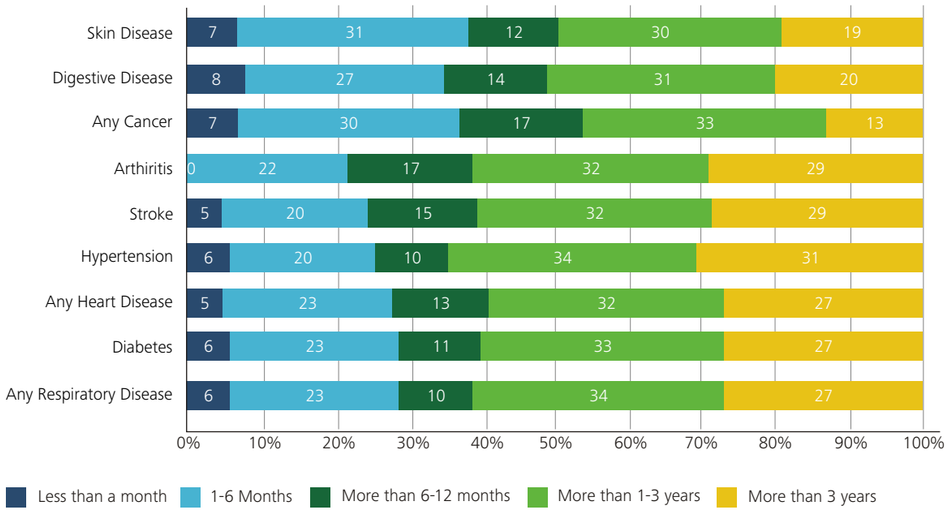
Source: *TARI Research team based on primary survey by Kantar Public*

In case of other diseases less than 5 % of individuals rely upon treatment by Ayush, non-licensed doctors ('quack') and other means. Nearly 80 % individuals suffering from metabolic disorders like diabetes and hypertension, other chronic diseases of heart and respiratory disorder make need based or regular visit to doctors for treatment of their disease. In most of the chronic NCDs, more than 15 % of individuals seek treatment through hospitalization under supervision of a doctor, where 24.1 % is the highest in case of cancer. Regular visit to doctors and inpatient hospitalization for l9onger duration puts significant financial burden on individuals suffering chronic NCDs and affects their families.

How long are people undergoing treatment for their NCD?

When the conditions of a disease are not managed in its early stages, individuals have to live with such disability during their entire life. The cost of treatment also increases as duration of treatment of diseases prolongs and even may not fully cure off. Results here are presented for duration of treatment of nine broad disease categories. The findings for specific diseases under these categories can be checked from Annexure V of the report.

Duration of Treatment for NCD (%)



Source: *TARI Research team based on primary survey by Kantar Public*

Results from survey show that for most of the NCDs including brain/ neurological orders, hypertension, diabetes, heart and respiratory more than 60 % of individuals are having treatment for more than 1 year and about 27% percent having treatment for more than 3 years. Resulting financial burden of cost of treatment of these chronic NCDs of such a long duration certainly is very high, and particularly debilitating on low income groups.

Only 13 percent of the individuals suffering from cancer report treatment for more than 3 years. This may be because symptoms of cancer are evident quite late and also because chances of survival and complete treatment are low unless very high-end medical treatment is availed. Only 20% of the individuals are suffering digestive and skin diseases undergo treatment for more than 3 years as symptoms of these diseases are evident in early stages and therefore are relatively treatable.

Detection, screening and treatment of NCDs, as well as palliative care, are key to controlling them and tackling their rapid growth in India. Focused approach is required towards preventive care as a large section of population still do not go for preventive checks and approach for medical advice only at later stages of a disease. The data from the National Health Accounts, 2013-14 suggests that only 9.6 percent of the overall healthcare expenditure is spent on preventive healthcare.[202] WHO has suggested that primary healthcare is one the key interventions with high impact in dealing with chronic diseases which can lead to their early detection and timely treatment.[203] Ministry of Health has a long way to go to cover a large section of untouched people who still do not go for preventive checkups and medical advice. These people may be targeted under the country's expanding scheme of the primary healthcare to provide access to prevention and primary care services.[204]

[202] Preventivehealthcare: Going beyond an apple a day, Available at https://www.financialexpress.com/opinion/preventive-healthcare-going-beyond-an-apple-a-day/1273032/
[203] WHO,Noncommunicable diseases; https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases
[204] Health Ministry to launch population basedprevention, screening and control programme for five non-communicable diseases,https://pib.gov.in/newsite/PrintRelease.aspx?relid=157571

7.

The Way Forward

The Way Forward

Increase in non-communicable diseases is driven by several external forces such as globalization and urbanization. These developments, coupled with rapid economic growth, have led to dramatic lifestyle changes. Convenience diet, increased stress levels, irregular sleep cycle, lack of time and inclination to do physical exercise are some of the leading causes of disorders such as raised blood pressure, increased blood glucose, elevated blood lipids, overweight and obesity. All these changes are major cause for upsurge of NCDs around the world and in India.

Demographic changes are also driving the rise in NCDs. According to United Nations Population Division (UNPD), life expectancy in India is currently 66 years, but is expected to climb to 73 by 2050. It is also expected that the size of the population aged 50 and above will increase by around 15% over the next 35 years. Those aged 60 and above will also increase by nearly 10% by 2050, and as well as those aged 80 and above. Research[205] suggests that the increasing aging population in India will also lead to an increase in the burden of NCDs since certain NCDs are what is termed as 'old age diseases'

The world is paying a heavy price with an increasing load of NCDs. In India too, NCDs continue to be an important public health problem being responsible for a major proportion of mortality and morbidity. The burden of the NCDs in India with a population of the over 1.3 billion is quite huge. NCDs in India contribute to 6.3 million deaths in 2017, which is about 15.3 percent of overall global deaths due to NCDs.[206] In 1990s, top five individual causes of disease burden were all communicable diseases whereas in 2017, three of top five causes are NCDs.

WHO has declared that NCDs are threatening progress towards the 2030 agenda for Sustainable Development, which includes a target of reducing premature deaths from NCDs by one-third and requests for serious action to control them. In this context, it is important that the growing menace of NCDs is dealt with in a holistic way. Based on the findings of the study and overall analysis, we have put forth some recommendations to effectively combat with huge burden of NCDs faced by India.

Awareness and Penetration of Health Insurance Coverage

Over the last few decades, the advancement in medical technology has made it possible to cure diseases that were once considered incurable. All these developments are occurring in a setting where health expenditures are growing rapidly led by an unregulated private sector and where health insurance and pension coverage are still limited.

Given the fact that NCDs are spreading fast and knowledge of NCDs in India among people is very low while medical treatment costs are extremely high, it is important to spread awareness of the benefits of health insurance in times of medical emergencies. Buying a health insurance policy for oneself and family is important because medical care in India and worldwide is expensive, especially in the private sector. To lessen the burden of medical expenses, it is a good practice to buy health insurance for medical emergencies. For patients with NCDs, being uninsured is associated with 2-7-fold higher odds of catastrophic levels of out-of-pocket costs.[207] It is imperative to cover low income and vulnerable households under Universal Health Insurance scheme of Government of India. It is also important that

[205]Dey et al., 2012.Health of the elderly in India: challenges of access and affordability. In Agingin Asia: findings from new and emerging data initiatives. Panel on policy research and data needs to meet the challenge of aging in Asia, J. P. Smith & M. Majumdar, Eds. Washington, DC: The National Academies Press, 371–386,

[206]Global Burden of Disease Collaborative Network. Global Burden of Disease Study 2017 (GBD2017) Results. Seattle, United States: Institute for Health Metrics and Evaluation (IHME), 2018.

[207]Jan S, Laba TL, Essue BM, Gheorghe A, Muhunthan J, Engelgau M, Mahal A, Griffiths U, McIntyre D, Meng Q, Nugent R, Atun R. Action to address the household economic burden of non-communicable diseases. Lancet. 2018 May19; 391(10134):2047-2058. doi: 10.1016/S0140-6736(18)30323-4. Epub 2018 Apr 5. Review. PubMed PMID: 29627161.

such schemes are widely advertised to bring more people under the umbrella of health insurance.

Significant Public Expenditure on Healthcare

The cost of medical treatment is very high and unaffordable for a large section of the population in India although, paradoxically, India also has a growing medical tourism sector to cater to foreign patients. As per National Sample Survey Organisation, the average total medical and other related non-medical expenditure per hospitalisation in rural and urban areas are Rs.16,956/- and Rs.26,455/- respectively and average total medical expenditure for non-hospitalized treatment per ailing person in rural and urban areas are Rs.509/- and Rs.639/- respectively. The economic burden on households of non-communicable diseases (NCDs), including cardiovascular diseases, cancer, respiratory diseases, and diabetes, poses major challenges to global poverty alleviation efforts. WHO Assistant Secretary General in the Foreword of Non-Communicable Diseases Country Profiles 2018 highlighting the growing menace and interventions required for controlling NCDs, points that "without significant investment, 15 million will continue to die each year from NCDs in the prime of their lives, between the ages of 30 and 70."

The country needs to substantially increase investment as a percentage of GDP in healthcare infrastructure including health centres, hospitals, medical colleges, research institutes and laboratories. To enable coverage of predictable and long-term costs of treatment, national programmes to extend financial protection should be based on schemes that entail compulsory enrolment and be financed through taxation. Priority should be given to eliminating financial barriers to the uptake of and adherence to interventions that are cost-effective and are designed to help the poor. In concert with programmes to strengthen national health systems and governance arrangements, comprehensive financial protection against the growing burden of NCDs is crucial in meeting the UN's Sustainable Development Goals.[208]

The Government of India is working in the right direction through increasing the public healthcare expenditure. The National Health Policy, 2017 provides for increasing public expenditure on health to 2.5% of GDP in a time bound manner by 2025. In order to provide affordable health care services to the people of the country, especially the poor, the Government of India has announced several steps which inter-alia includes:[209]

- Implementation of National Health Mission Free Drugs and Free Diagnostic initiative to provide essential drugs and diagnostics free of cost in public health facilities.
- Decision to transform Sub-Health Centers/PHCs to Health and Wellness Centers to provide comprehensive primary care, to undertake promotive and health promotion activities.
- Screening and Management of 5 common NCDs of hypertension, diabetes, and cancers of oral, cervix and breast.
- Pradhan Mantri National Dialysis Programme for free dialysis services to the poor in district hospitals.
- Making available tertiary health care services in the public sector through strengthening of hospitals, establishment of AIIMS institutions in the States and up-gradation of existing Government medical colleges across the country.
- Making available quality generic medicines at affordable prices to all, under 'Jan Aushadhi Scheme', in collaboration with the State Governments.
- Rashtriya Swasthya Bima Yojana (RSBY) which provides for smart card based cashless health insurance on family floater basis.

It is important that such measures must be implemented on the ground and cover many more citizens.

Greater Awareness about NCDs

The awareness about the role of risk factors in the causation of NCDs is relatively poor. Hence, lifestyle

[208]Jan S, Laba TL, Essue BM, Gheorghe A, Muhunthan J, Engelgau M, Mahal A, Griffiths U, McIntyre D, Meng Q, Nugent R, Atun R. Action to address the household economic burden of non-communicable diseases. Lancet. 2018 May19; 391(10134):2047-2058. doi: 10.1016/S0140-6736(18)30323-4. Epub 2018 Apr 5. Review. PubMed PMID: 29627161.

[209] Increase in Costs of Healthcare Services, July2017 Press Information Bureau, Government of India, Ministry of Health andFamily Welfare

changes and dietary modifications should be promoted among the high-risk groups in this category. More efforts need to be put in to increase knowledge in the community regarding NCDs and its mitigation. Efforts should be made to establish surveillance mechanism at the community level to monitor, evaluate, and guide policies and programmes.

Lack of trained health care workers, primary care providers armed with inadequate knowledge and skills along with ill-defined roles of various health sectors i.e. public, private, and voluntary sectors in providing care have played key hurdles in combating the growing burden of non-communicable diseases. Empowerment of the community through effective health education, use of trained public health personnel along with provision of free health care and social insurance would prove beneficial in effectively controlling the growing prevalence of NCDs. Awareness about good lifestyle habit must be taught from school level onward to ingrain the values of health, fitness and disease-free living.

Preventive Checks are Key for Fight Against NCDs

Findings of this study highlight that across almost all NCDs, except skin diseases, digestive disorders and cancer, more than 40 % of the respondents suffering from these diseases stated that they were not aware of having their respective diseases for more than 3 years. For most of the NCDs symptoms are not evident until complications set in.

In this perspective, it is important that individuals take preventive check-ups for taking necessary preventive actions and early detection and treatment if conditions of specific NCDs are setting in. Evidence shows that in case of critical NCDs like cancer, patients have good chances of survival if detected and treated in early stage of cancer.[210] Battle against NCDs is half won if symptoms are detected because it is very difficult to successfully and completely manage the conditions and fully cure it after being diagnosed with a disease.[211]

Preventive measures such as getting annual health check-ups keep one informed of their state of health. Several employers in the formal sector make it mandatory for employees to undergo annual health check-ups. Such check-ups must be extended to the vast informal sector through special camps or as part of government's healthcare system.

It is important that people should undergo regular preventive medical tests and visit a certified medical practitioner so that diseases can be caught in early stages to have quicker treatment and better control. Late detection may cause disability for life besides causing financial distress due to cost of treatment of such NCD.

Detection, screening and treatment of NCDs, as well as palliative care, are key to controlling them and tackling their rapid growth in India. WHO has suggested that primary healthcare is one the key interventions with high impact in dealing with chronic diseases which can lead to their early detection and timely treatment.[212] Ministry of Health has a long way to go to cover a large section of untouched people who still do not go preventive checkups medical advice. These people may be targeted under expanding scheme of the primary healthcare to provide access to prevention and primary care services.

State Specific Policy Intervention for NCDs

With almost one-fifth of the world's population living in India, the health status and the drivers of health loss are expected to vary among different parts of the country and among states. The results on prevalence of NCDs in this study also shows that different NCDs have significant heterogeneity and variation across different states.

National-level data can obscure disparities across India's varied landscape, so a detailed understanding of health challenges at the state level is necessary to ensure that policies are responsive to the specific context of each state. While the central government policies have significant influence on health initiatives across the

[210]HealthMinistry to launch population-based prevention, screening and control programmefor five non-communicable diseases,https://pib.gov.in/newsite/PrintRelease.aspx?relid=157571
[211]Preventivehealthcare: Going beyond an apple a day, Available athttps://www.financialexpress.com/opinion/preventive-healthcare-going-beyond-an-apple-a-day/1273032/
[212]WHO,Noncommunicable diseases; https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases?

country, health is a state subject in the Indian federal structure, with the majority of public spending on health from the state budgets.

Due geographical diversity, climatic conditions, and dietary habits in various states of India, the pattern, distribution of diseases and their determinants vary a lot, thereby effecting the choice and delivery of evidence-based prevention and control interventions. Accordingly, effective efforts to improve population health in each state require systematic knowledge of the local health status and trends.

Being a country of diversities, one size fits all principle never fits for implementation of interventions in Indian states. The Report, "India: Health of the Nation's States" also suggests that "India's states will require very different policy approaches according to nature of the diseases burden they are facing". The focus should be on specific measures that work in these states to reduce the increasing incidence of the major NCDs of states to reduce the health burden.

Regular Monitoring of Risk Factors and NCDs

Chronic diseases can be drastically prevented if their underlying risk factors are controlled. These risk factors are measurable and largely modifiable, and thus continuing surveillance of the levels of risk factors is of fundamental importance in NCD control.

In India, there is no regular system for collecting data on non-communicable diseases (NCDs)-which can be said to be of adequate coverage or quality. A report by the NITI Aayog highlighting such issue points that there is lack of availability of acceptable quality data to address critical areas such as NCDs and financial risk protection in a health index for its states.[213] Many studies have been conducted on NCDs using survey data at district level or the state level. However, it is difficult to generalise the findings at national level considering the vast geographical and socio-economic diversity of more than 1.3 billion population of India. The report on India: Health of the Nation's States by Institute of Health metrics and Evaluation (IHME, 20017) emphasises for requirement greater local data for robust sub national estimates.[214]

Regular monitoring of NCD risk factors is crucial for developing strategies and policies to inhibit growing burden of NCDs in the country. In India, most national or regional surveys do not capture data about all risk factors related to NCDs. National Family Health Survey NFHS (IIPS, 1998-99; 2007; 2015-16) and GATS (2015-16) even though cover most of the states and UTs, fail to cover all the risk factors.[215] Moreover, these surveys lack regular periodicity.

Regular monitoring of all risk factors associated with NCDs is a perquisite for deriving national /state level strategy about a particular risk factor and NCDs.[216]

Measures to reduce NCDs should therefore be focused on preventing and controlling the risks attributed to these diseases in an integrated manner. A first step in this direction is identifying the related risks and intervention at all levels, from communities, governments, private organisations and non-government organisations. A comprehensive composite assessment of all major diseases and risk factors across all states of India, providing estimates over an estimated period of time, is needed for an informed health system and policy development.

Effective Dealing with Lifestyle and Modifiable Risk Factors

From the analysis of risk factors and its association with NCDs, it is clear that low physical activity, high consumption of fast foods and high stress, are the risk factors which have been found to have the most significant role in causing major non-communicable diseases. These factors have become integral aspects of modern-day lifestyle of people in the contemporary age and hence requires a conscious effort to break the habit.

Another interesting factor is the urban-rural discrepancies that exist in physical activity in India. Rural

[213]Ministry ofHealth and Family Welfare, World Bank, NITI Aayog. Healthy states, progressiveIndia- Report on the ranks of the states and union territories. New Delhi,India: 2018.
[214] IndianCouncil of Medical Research, Public Health Foundation of India and Institute ofHealth metrics and Evaluation. India: Health of the Nation's States - The IndiaState- Level Disease Burden Initiative. New Delhi: ICMR, PHFI, and IHME, 2017.
[215] Nethan, S., Sinha, D., & Mehrotra, R. (2017). Non-CommunicableDisease Risk Factors and their Trends in India. Asian Pacific journal ofcancer prevention: APJCP, 18(7), 2005–2010.
[216] Indian Council ofMedical Research, Public Health Foundation of India and Institute of Healthmetrics and Evaluation. India: Health of the Nation's States - The India State-Level Disease Burden Initiative. New Delhi: ICMR, PHFI, and IHME, 2017

India has a strong agricultural economy while many urban jobs require less physical labour that involve mainly desk-based activities. According to a study by the World Bank,[217] the difference in physical activity is further exacerbated by the urban population's reliance on public or private means of transportation rather than walking. The rising scarcity of open spaces like parks or (playgrounds),[218] also a consequence of rapid urban growth and limited urban planning, add to the problem. Other sedentary behaviours, such as watching television or playing video games, are more common in cities, where electricity and the internet are more accessible.

It is recommended that people should reduce such sedentary lifestyle or should find a balance to neutralize the effects of this lifestyle to keep their body healthy and away from diseases.

Managing Dietary Risk Factors through Effective Food Policy

Undernutrition and overnutrition pose a significant challenge in India, both swelling the burden of NCDs[219] with malnutrition and obesity paradoxically co-existing in India.

Dietary risks are the largest contributing factor to years of life lost due to mortality and morbidity caused by NCDs in 2015 in India, at 19.1% of all identified risks. According to GBD 2017, a combination of 17 dietary risk factors lead to a large number of deaths globally through diseases like ischemic heart disease, diabetes and stroke. Diets high in sodium, low in whole grains, and low in fruit together accounted for more than half of all diet-related deaths globally in 2017. Although sodium, sugar, and fat have been the main focus of diet policy debate in the past two decades , assessment shows that the leading dietary risk factors for mortality are diets low in whole grains, low in fruit, low in nuts and seeds, low in vegetables, and low in omega-3 fatty acids; each accounting for more than 2% of global deaths.[220]

Unhealthy diets, malnutrition, and NCDs are closely linked, which are logical consequences of the modern-day food system. While focus to eliminate hunger has resulted in easy access to cereal foods, a diet rich in protein, vitamins, and minerals such as fresh fruits and vegetables and legumes and pulses has not reached everyone.[221] Agricultural economics, international trade, rural development & urban planning, food and public distribution system drives the food supply system and guides what reaches the population at which price and what quantity. This is evident from findings of this study too, which shows highest risk of low legume/pulses consumption. The driving factors for such high risk of pulses consumption are **agriculture production economics and public distribution system.** India is deficient in production of pulses and relies significantly on imports which may be a reason why pulses are not included in the food public distribution system and therefore fail to reach low income and vulnerable sections of society. All components of a national food policy must be re-visited and re-vamped with a holistic approach toward nutrition and preventive healthcare.

More deliberations and thought are require involving views from all the stakeholders while developing suitable food policy taking a holistic approach taking into account all interlocked factors, such as food production, processing, and distribution, that create entire food value system. Further, food contamination and adulteration is quite prevalent in the country that can be cause major NCDs. Therefore, in view of the magnitude of the disease burden attributable to diet and the limitations of the existing interventions, development of novel food system interventions and effective policy measures are urgently needed.[222]

WHO's 13th General Programme of Work (GPW13) has prioritized reduction of salt/sodium intake and elimination of industrially produced trans-fats from the food supply with objective of ensuring healthy lives and promote well-being for all at all ages. This will guide work of WHO during 2019-2023.[223] *In line with WHO priority action plan, the Government of India should also take necessary action and policy measure to control the risk of these factors, which were found to be have higher prevalence among adult population.*

[217] India's transport sector: the challenges ahead. In The World Bank. Washington, DC: World Bank. 2002
[218] Sudhakar, P. (2013).Urban expansion vs. green cover /parks. Eco News, 19(1), 5-7.
[219] NNMB Technical report No.27, 2017, National Institute of Nutrition
[220] Health effects of dietary risks in 195countries, 1990–2017: a systematic analysis for the Global Burden of DiseaseStudy 2017; Lancet 2019; 393: 1958–7
[221] Health effects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017; Lancet 2019; 393: 1958–7
[222] Health effects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017; Lancet 2019; 393: 1958–7
[223] https://www.who.int/news-room/fact-sheets/detail/healthy-diet

Annexure I

Research Approach, Survey Design and Data Collection

Annexure 1: Research Approach, Survey Design and Data Collection

Considering the national level coverage of the study, it becomes essential that there is a robust and concrete implementation plan in place to ensure a successful execution of the survey. Here we present the project plan and section presents our project management plan for each key activity to be undertaken as a part of study. The survey was conducted in 21 state clusters spanning across India, as detailed in ensuing sections.

Survey Design

Target Groups

The study is expected to reflect, based on a household survey, statistically valid sample size and representative of the geographic spread of the country with rural/ urban distribution, population size and density of each constituent state/ region, stratification and socio-economic distribution of population. Further, the study is aimed to reflect regional and socio-economic variation of usage by product type, gender classification and adult population group.

A.For Prevalence estimation

Key Informed Member (preferably head of the household/ chief wage earner who are key decision makers) of the household above the age of 18 years would be included

B.For understanding correlation between NCDs and Life-Style factors

Aligned with the stated objectives of survey, two categories of respondents above the age of 18 years would be covered:

1. Y or ones who are suffering from NCDs and consume Tobacco/alcohol

2. Z or ones who are suffering from NCDs and do not consume Tobacco/alcohol

Respondents falling under categories Y and Z are only considered for main study because the inclusion of these categories is sufficient for meeting one of the two main objectives i.e. understand correlation between NCDs and Life-Style factors. Furthermore, another objective of estimating prevalence of NCDs would get achieved from separate involving administration of prevalence tool.

Sample Size: Key Consideration and calculation technique

Following were the key considerations for sampling:

- Sample for estimating prevalence should be robust enough for various level of analysis - Overall, State, Rural/ Urban, demographics like: Gender, age groups and major NCDs

- Sample should be pre-determined and adequate for understanding correlation between NCDs and Life-Style factors with varying degree of margin of error at Overall, Zonal and State level

Sample Size formula considered for state level

$$N = \frac{Z^2 \times P \times (1-P) \times D}{C^2}$$

N = the sample size
P = assumed to be 0.5 for yielding maximum sample size
Z= Constant set according to the confidence level, for 95%, this value is 1.96
C = Margin of error
D= Design effect, this value has been taken from a minimum of 1.25 to maximum of 2, based on the number of sampling stages involved

Household Sample Size for estimating prevalence

- Sample size required to be covered for estimating prevalence and identify respondents for detailed interviews was arrived after ascertaining the required sample of NCD affected individuals and dividing it with prevalence (separately for Rural and Urban areas) of major NCDs, like heart ailments, diabetes, hypertension, respiratory ailments and cancer according to NFHS 4.
- This resulted in number of individuals to be included in sampling frame so as to achieve required number of NCD affected individuals
- Lastly, number of individuals to be included in sampling frame was divided with mean household size of citizens aged 18 years and above according to Census 2011

Final sample would be robust enough at 5% of margin of error for various levels of analysis - Overall, State, Rural/ Urban, demographics like: Gender, age groups and major NCDs.

A. Individual sample Size considered for state level for understanding correlation between occurrence of NCDs and Life-Style factors

With margin error assumed to be at standard rate of 5% and design effect of 1.75 (for multi-stage sampling), sample for each state cluster came out to be around 672, rounded off to 680.

B. Standalone sample Size considered for state level for NCD affected individuals

With margin error assumed to be at standard rate of 5% and design effect of 1.25 (for multi-stage but decreased levels of sampling), sample for each state came out to be 480.

Sample Size: Distribution and Stages of Sampling

The sample size covered is distributed across 21 state clusters. The clusters considered are:

- NCT of Delhi which is a cluster of Faridabad, Gurugram, Ghaziabad and Noida
- Tamil Nadu and Puducherry
- Andhra Pradesh and Telangana
- North Eastern states which includes Assam and Tripura
- Maharashtra and Goa
- Punjab and Chandigarh
- Rest of the states are considered individually

In order to reduce the number of stages so as to keep the design effect to minimum, we propose sampling of PSUs (villages for rural areas and wards for urban areas) in each state cluster directly using Census 2011 data as sampling frame. Stages of sampling have been mentioned below:

Step 1: Sampling of Primary Sampling Units (Villages and Wards)

The required number of Primary Sampling Units (PSUs) across Rural and Urban areas has been provided above. We shall list the PSUs in the descending order population as sizing variable and then run PPS (Probability Proportionate to Size) method to sample the required number of PSUs across each state.
By doing this, it shall be ensured that selection of PSUs results in adequate representation of the state.

Step 2: Sampling of Households for estimating prevalence of NCDs

Scenario 1: No Segmentation Required

If total number of households in the selected PSU is equal to or less than required sample of households, then all households would be approached using right hand rule principal.

Scenario 2: Segmentation Required

If total number of households in the selected PSU is more than required sample of households, then PSU would be divided into two or more segments, with each segment comprising of 40 households

Then any required number of segments from total segments would be randomly selected, and all households in selected segment would be approached using right hand rule principal

Step 3: Sampling of Households with NCD affected individuals

Number of individuals suffering from various NCDs in selected PSU would be identified from Step 2

In selected PSU, 15 corresponding households would be selected (with one individual selected from one household) from total number of households with at least one-member suffering from NCD using systematic random sampling

- Individuals suffering from each of the identified NCDs would be arranged in serial number of their house
- All such individuals suffering from a particular NCD would be given a running serial number
- Number of individuals to be sampled for a particular NCD would be in proportion to overall NCD affected population
- Individuals would then be sampled through systematic random sampling
- Care would be taken to increase chance selection of individuals suffering from rare NCDs like Cancer by rounding up their population proportion to the nearest corresponding integer value

Step 4: Sampling of NCD affected individuals

In case if in sampled household, one person was reported to be suffering from NCD, then he/she would be selected

- In case if in sampled household, more than one person was reported to be suffering from NCD, then any one of them would be randomly selected

Survey Data Collection Tools

There are 2 tools to be used in the study. Main tool was programmed in CAPI application, while prevalence tool followed Pen and Paper Personal Interview Approach (PAPI).

To help the interviewers and supervisor with the understanding about the survey protocols and tools, a training manual was prepared by the Kantar Public research team members to be used by field investors.

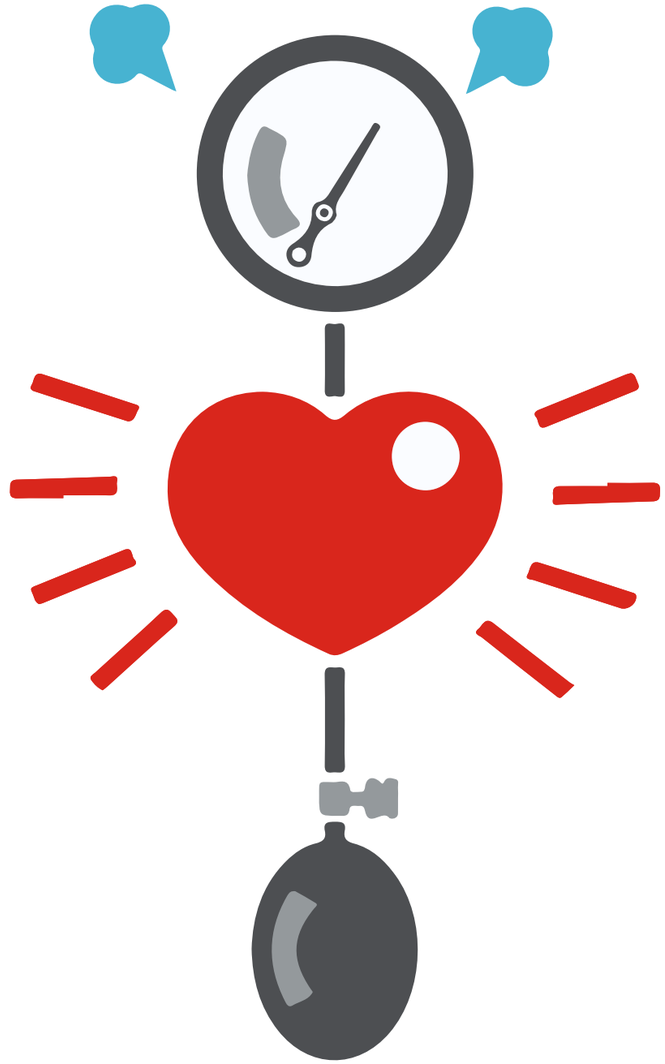
The study is proposed to cover 21 state clusters in India. As the geographic spread suggests use of multiple language versions of tools and manual, the correct translation in local languages becomes a critical responsibility for the researchers. For the purpose of translating the research tools and manuals, Kantar used the services of professional translators. These translators are empaneled with us and can undertake the translations across all Indian languages. Post completion of the regional translation of the tools, they would be transferred in the CAPI application by the following process.

CAPI application conversion in locallanguages and syncing on the tabs

A. Unicode translation of the questionnaireshared with CAPI team
B. CAPI team adopts the English tool intolocal language tools by programming
C. Research tools uploaded on the NIPO server
D. Through dedicated login IDs, interviewersyncs the tools on their local machines (tabs)

→ **Output:** CAPI application available in regional languages

The pre-test of the survey tools in PAPI in selected location in Delhi was done with objective of understanding the possible operational challenges and in facilitating further improvement of questionnaire. All the reviews and feedbacks received (including the comments on the survey tools and vernacular version) would be incorporated in CAPI and all the changes shall be documented in the **Pre-test report.** The CAPI application in regional language would be finalized, in close consultation with the TARI team.



Data Collection

The data collection process will be for one month starting from end of November to end to December 2018. Process of data collection would be as follows.

Data collection for Prevalence tool:

1. Each PSU will be divided into clusters or segments. Each cluster will be of size 40

2. All 40 households in each chosen cluster will be interviewed for prevalence

3. The investigator would choose the clusters randomly for interviewing, and the number of clusters chosen will depend on the requirement of the responding households in that particular PSU i.e. if the requirement is 80, 2 clusters would be selected

Following this approach would expectedly ensure adequate geographical coverage of selected PSU.

Data collection for Main tool:

1. At the end of survey for prevalence tool each day, the supervisor of each team would prepare a list of eligible households for administering main tool
2. The list would be PSU wise
3. Required interviews for main tool will be conducted the next day following systematic random sampling, not contradicting with the requirement to purposively select respondents suffering from rare NCDs
4. It should be noted that the list prepared by the supervisor is designed to cover all target groups for our study
5. A total of 22 interviews would be conducted in each of the selected PSU in both urban and rural areas. Out of the 21 interviews 6 interviews would be conducted with respondents not suffering from any NCD but consuming alcohol and tobacco. The remaining 15 interviews would cover respondents suffering from NCDs
6. This tool shall be captured in CAPI

A note on need for booster sampling: in PSUs wherein required number of eligible respondents could not be identified from the prevalence tool, deficit would be covered through purposively selecting eligible respondents. This would help in achieving required sample.

- There were 21 clusters with 32 PSUs in each cluster
- Rural sample per cluster: 16 PSUs
- Urban sample per cluster: 16 PSUs
- A total of 672 PSUs was sampled
- Prevalence Estimation: Total sample covered was 40192
- Main Survey: Total Sample covered was 14173

Limitations of the study

Estimation of prevalence of NCDs should at best be done through capturing of clinical/ biometric information of individuals. However, present study has been designed to estimate prevalence of self-reported NCDs, which might be significantly influenced by awareness of NCDs among respondents and willingness to reveal the same.

Another possible limitation of this study is that the prevalence of diseases would be based on the questionnaire that concerns only major NCDs. However, rigorous study design and very good quality control is expected to act as an assurance of reliable data.

Annexure II

Statistical Test Results of the Prevalence of Diseases

Annexure 11: Statistical Test Results of the Prevalence of Diseases

The annexure II presents statistical tests results of key NCDs for demographic profiles including age group, rural-urban, male- female and household size. The statistical results are based on weighted analysis of 233672 individuals covered in the prevalence survey.

Age Groups Analysis

Pearson chi-square test statistics for analyzing the prevalence of NCDs among the age groups: below 18 years, 18 - 25 years, 26 -35 years, 36 -45 years, 46 - 59 years, above 60 years are given below:

Prevalence of NCDs among Age Groups: Chi Square Test Results

Key NCDs	Pearson Chi- Square Value	p value	Significance level @ 0.1 percent
Any NCD	29705.15	0.000	Significant
Heart disease	2695.425	0.000	Significant
Cancer	349.142	0.000	Significant
Diabetes	10869.44	0.000	Significant
Respiratory disease	6023.04	0.000	Significant
Hypertension	14398.88	0.000	Significant
Brain/neurological disorder	1901.231	0.000	Significant
Kidney disorders	693.517	0.000	Significant
Digestive diseases	4889.761	0.000	Significant

Source: *TARI Research team based on primary survey by Kantar Public*

Gender

Pearson chi-square test statistics for analyzing the prevalence of NCDs between male and female population are given below:

Prevalence of NCDs in Male and Female Population: Chi Square Test Results

Key NCDs	Pearson Chi- Square Value	p value	Significance level @ 0.1 percent
Any NCD	21.024	.000	Significant
Heart disease	36.854	.000	Significant
Cancer	1.865	.172	Not Significant
Diabetes	42.206	.000	Significant
Respiratory disease	29.848	.000	Significant
Hypertension	115.903	.000	Significant
Brain/neurological disorder	1.523	.217	Not Significant
Kidney disorders	36.274	.000	Significant
Digestive diseases	6.162	.013	Significant @ 5 percent

Source: *TARI Research team based on primary survey by Kantar Public*

Urban-Rural

Pearson chi-square test statistics for analyzing the prevalence of NCDs between urban and rural population are given below:

Prevalence of NCDs in Rural and Urban Population: Chi Square Test Results

Key NCDs	Pearson Chi- Square Value	p value	Significance level @ 0.1 percent
Any NCD	0.067	.796	Not Significant
Heart disease	6.735	.009	Significant @ 1 percent
Cancer	11.135	.001	Significant
Diabetes	249.029	.000	Significant
Respiratory disease	23.159	.000	Significant
Hypertension	49.407	.000	Significant
Brain/neurological disorder	52.564	.000	Significant
Kidney disorders	0.064	.801	Not Significant
Digestive diseases	49.835	.000	Significant

Source: *TARI Research team based on primary survey by Kantar Public*

Household Size

Pearson chi-square test statistics for analyzing the prevalence of NCDs between household sizes: Upto 4 family members, 5-8 family members, more than 8 family members are given below:

Prevalence of NCDs Among Household Size: Chi Square Test Results

Key NCDs	Pearson Chi- Square Value	p value	Significance level @ 0.1 percent
Any NCD	237.562	.000	Significant
Heart disease	17.137	.000	Significant
Cancer	12.186	.002	Significant @ 1 percent
Diabetes	206.675	.000	Significant
Respiratory disease	43.66	.000	Significant
Hypertension	99.659	.000	Significant
Brain/neurological disorder	15.92	.000	Significant
Kidney disorders	22.898	.000	Significant
Digestive diseases	0.664	.717	Not Significant

Source: *TARI Research team based on primary survey by Kantar Public*

Annexure III

Awareness and Knowledge of NCDs

Annexure 111: Awareness and Knowledge of NCDs

The annexure III focuses findings of the survey covering the aspects discussed in the section 6 of the report. Specifically, it focuses on how long it takes people to know about their NCD and how they came to know about their disease.

While the results of nine broad diseases are already shown in the section 3, here results are given for specific diseases under these nine broad disease categories for further reference and analysis. This is based on the main survey covering a population of 10500 individuals aged 17 years and above across all the states having one or more non-communicable disease to have better insights about their disease and treatment of these diseases. The sample weights were accounted in the survey module to adjust for adequate data representation. The analysis here, therefore, is based on weighted 10538 individual observations.

How long does it take people to become aware of their NCD?

When People Know About their NCD

Diseases Broad Categories	Specific Diseases	Less than a month	1 to 6 months	More than 6 months to 12 months	More than 1 years to 3 years	More than 3 years
Respiratory Disease	Pneumonia	11%	34%	15%	21%	19%
	Asthma	2%	13%	8%	30%	47%
	Cystic Fibrosis	4%	21%	6%	37%	31%
	Acute Respiratory Infection	1%	15%	8%	37%	39%
Diabetes/ Pancreatic	Diabetes	2%	15%	10%	32%	41%
	Increased Sugar	4%	16%	11%	37%	32%
	Blood Glucose	2%	15%	19%	39%	24%
Heart Diseases	COPD	2%	24%	12%	26%	36%
	Gen. Heart Disease	4%	14%	14%	35%	36%
	Heart infections	2%	20%	12%	24%	43%
	Coronary heart disease	2%	7%	12%	26%	53%
Cancer	Throat cancer	5%	20%	22%	36%	16%
	Bladder Cancer	3%	16%	30%	30%	19%
	Breast cancer	8%	11%	19%	32%	30%
	Cervical Cancer	0%	23%	14%	36%	26%
	Esophageal cancer	0%	19%	4%	46%	31%
	Kidney Cancer	3%	24%	12%	43%	19%

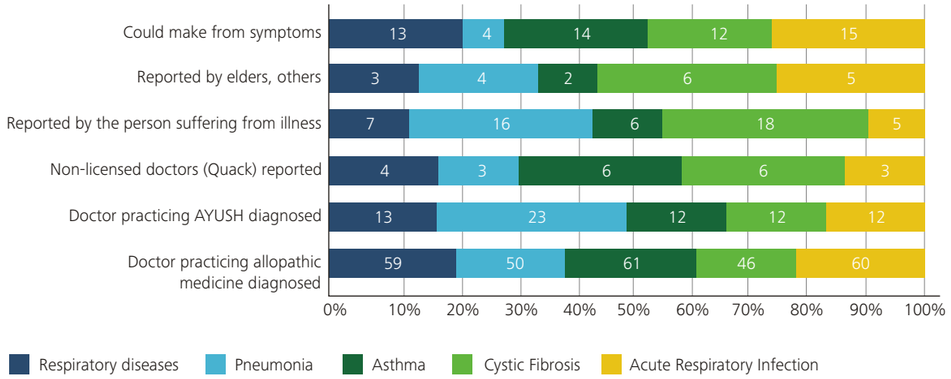
Contd.

	Liver cancer	2%	18%	16%	49%	18%
	Lung Cancer	2%	20%	5%	51%	20%
	Mesothelioma	0%	19%	5%	10%	62%
	Mouth cancer	2%	25%	16%	32%	24%
	Other Cancer	0%	0%	0%	0%	67%
Digestive Diseases	Constipation	2%	21%	9%	39%	29%
	Irritable bowel syndrome (IBS)	2%	13%	11%	50%	24%
	Anal disorders	0%	15%	11%	24%	47%
	Diverticular disease	0%	27%	20%	53%	0%
	Colitis	8%	15%	15%	62%	8%
	Viral gastroenteritis	6%	14%	2%	32%	47%
	Cyclic vomiting syndrome	7%	29%	14%	21%	36%
	Dyspepsia (indigestion)	5%	18%	18%	35%	24%
	Gallstone	1%	17%	23%	35%	23%
	Gastritis	5%	15%	11%	32%	37%
	GI bleeding	0%	33%	17%	33%	33%
	Other Digestive disease	2%	12%	5%	40%	42%
Skin Diseases	Acne vulgaris	7%	36%	21%	21%	15%
	Skin cancer	8%	30%	19%	24%	19%
	Atopic Dermatitis	0%	25%	9%	34%	34%
	Contact Dermatitis	3%	14%	18%	38%	29%
	Hives	2%	22%	5%	44%	27%
	Psoriasis	0%	16%	26%	26%	35%
	Actinic Keratosis	8%	15%	69%	8%	8%
	Vitiligo	11%	28%	6%	17%	33%
	Other skin disease	1%	14%	13%	34%	38%

Source: *TARI Research team based on primary survey by Kantar Public*

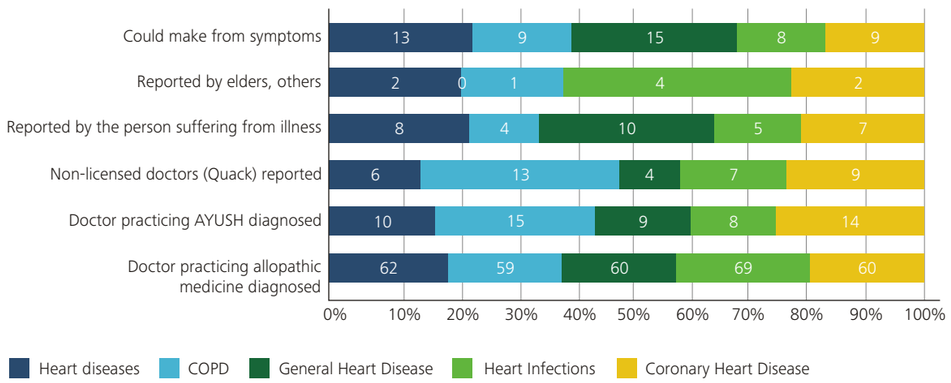
How do people know about their NCD?

Knowledge about Respiratory Diseases



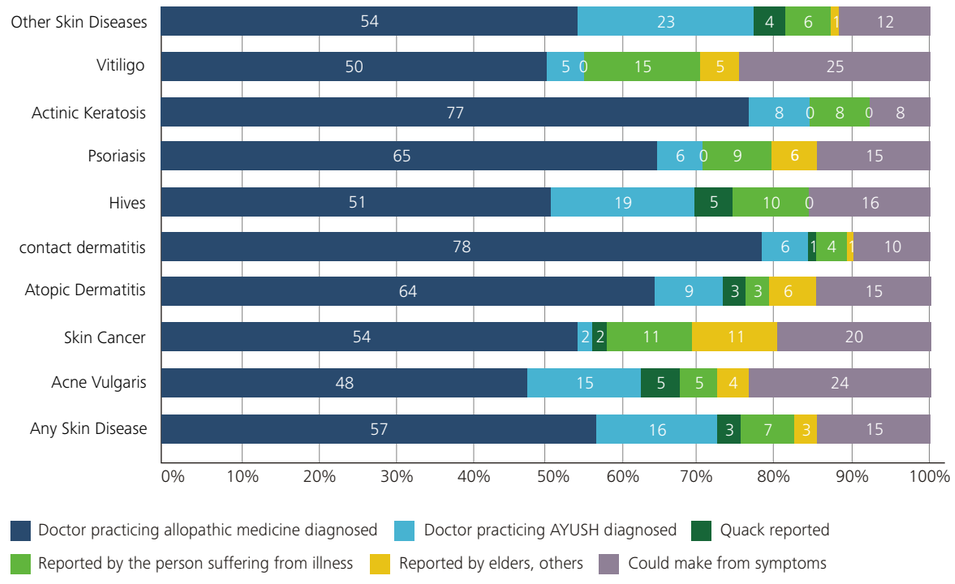
Source: *TARI Research team based on primary survey by Kantar Public*

Knowledge about Heart Diseases



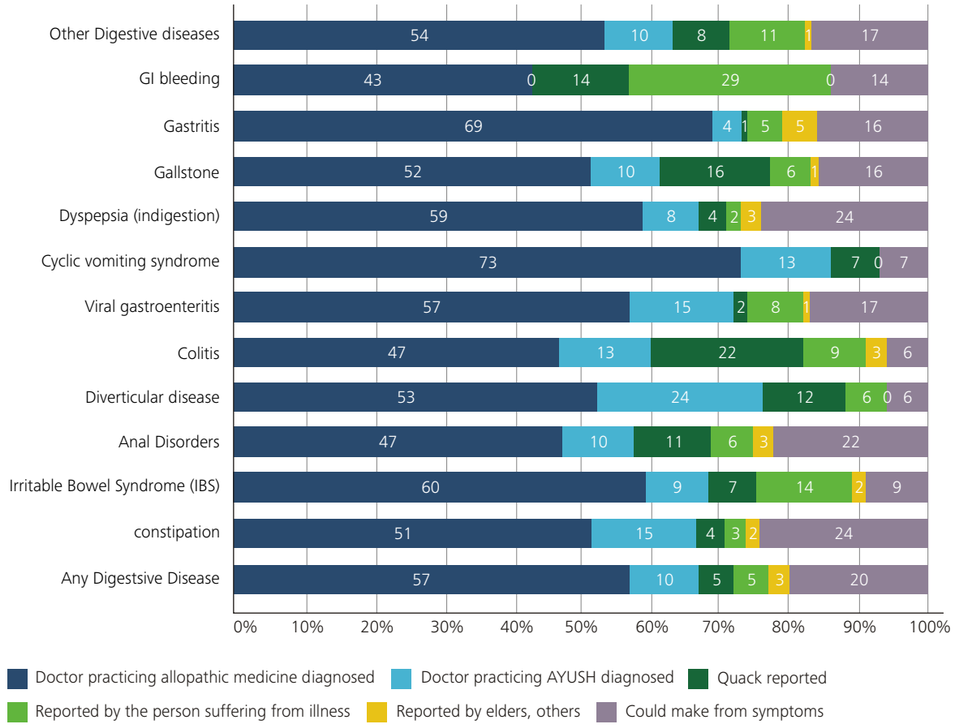
Source: *TARI Research team based on primary survey by Kantar Public*

Knowledge about Skin Diseases



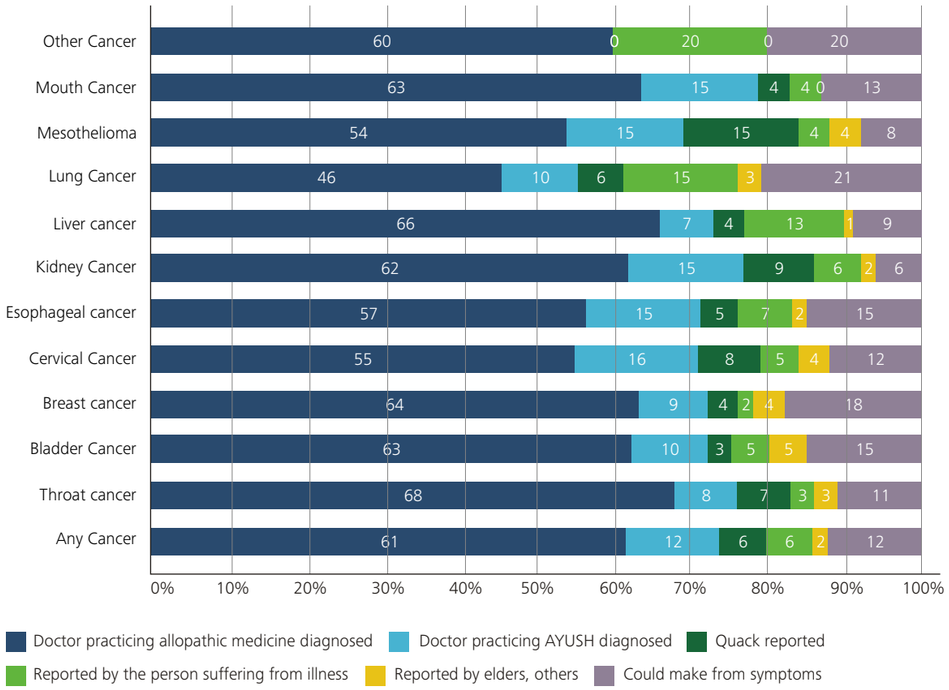
Source: *TARI Research team based on primary survey by Kantar Public*

Knowledge about Digestive Diseases



Source: *TARI Research team based on primary survey by Kantar Public*

Knowledge about Cancer



Source: *TARI Research team based on primary survey by Kantar Public*

Annexure IV

Operational Definition of the Risk Factors

Annexure 1V: Operational Definition of the Risk Factors

The annexure IV provides definition of the key risk factors used in the results and analysis used in the section 4 and 5 of the report.

1. Air Pollution

Air pollution has been provided in terms of respondent's perception on exposure to pollutants such as smoke, dust, vehicular pollution, industrial pollution, etc. near their home and work place. This does not have the actual air pollution level in the area in terms of PPM etc.

2. Physical activity

"Strenuous activities" was calculated as a proxy indicator for physical activity during work or otherwise Definition: Strenuous activities include Brisk walk (includes all form), Jogging, Physical Activities/ Exercise/ Gym, Cycling etc.

a. Low strenuous activity: Doing strenuous activities for one hour per day per week
b. Moderate strenuous activity: Doing strenuous activities for 1 to 2 hours per day per week
c. High strenuous activity: Doing strenuous activities for 2 to 4 hours per day per week
d. Very High strenuous activity: Doing strenuous activities for more than hours per day per week

3. Legume consumption:Consumption of pulses

Legumes include all types of pulses including Rajma, Dal etc.

a. No consumption: Never consume
b. Low Consumption: Consumption once a week or less
c. Moderate consumption: Consumption 2 to 6 times per week
d. High consumption: Consumption once or more every day

4. Stress levels

Refers to mental stress which has been defined by sleeping disorders, inability to concentrate or requirement of treatment and classified as follows

a. High Stress: If a person report to
I. have a sleep disorder, or
II. resorting to sleeping pills, or
III. not being able to concentrate in their regular work, or
IV. be needing treatment for a mental health condition (e.g. depression, anxiety, bipolar disorder, psychosis)
b. Low Stress: If a person reports the following
I. Does not have a sleep disorder, and
II. Does not need sleeping pills, and
III. Can concentrate in their regular work, and
IV. Does not have a mental health condition

5. Milk Consumption

Considered as consumption of cow/goat/buffalo milk or packaged milk

a. No consumption: Never consume
b. Low Consumption: Consumption less that once a week
c. Moderate consumption: Consumption 2 to 6 times per week
d. High consumption: Consumption once or more every day

6. Sea food Omega-3 fatty Acid Consumption

Considered as consumption of sea-food including prawns, crabs, fish etc.

a. No consumption: Never consume
b. Low Consumption: Consumption less that once a week

c. Moderate consumption: Consumption 2 to 6 times per week
d. High consumption: Consumption once or more every day

7. Trans-fat food consumption

Defined as consumption of Pasta, noodles, chow mien, momos, macaroni, pizza, burger, street food like samosa, Patties, tikki etc.

a. No consumption: Never consume
b. Low Consumption: Consumption less that once a week
c. Moderate consumption: Consumption 2 to 6 times per week
d. High consumption: Consumption once or more every day

8. Fruits consumption

Defined as all fruits including citrus fruits like lemons, limes, oranges and Indian berries etc., tropical fruits like bananas, pineapple, papaya, kiwi, mango, passion fruit, pomegranates etc. and tree fruit: like apples, pears, cherries, peaches, nectarines, plums etc.

a. No consumption: Never consume
b. Low Consumption: Consumption less that once a week
c. Moderate consumption: Consumption 2 to 6 times per week
d. High consumption: Consumption once or more every day

9. Milk products (calcium) consumption

Consumption of milk products like paneer, cheese, curd etc

a. Low Consumption: Consumption less that once a week
b. Moderate consumption: Consumption 2 to 6 times per week
c. High consumption: Consumption once or more every day

10. Household air pollution

Corresponds to how often does the respondent perceive experiencing air pollution that includes smoke, dust, vehicular pollution, industrial pollution - near their home

a. Daily: frequency of exposure to one of the above pollutants near home is 6-7 days a week
b. Most days: frequency of exposure to one of the above pollutants near home is 4-5 days a week
c. Sometimes/ Once in a while: frequency of exposure to one of the above pollutants near home is 1-3 days a week
d. No exposure: No exposure to one of the above pollutants near home

11. Body mass index (BMI)

BMI is a person's weight in kilograms (kgs) divided by the square of their height in meters (kg/m2).

12. Pollution at work place

Corresponds to how often does the respondent perceive experiencing air pollution that includes smoke, dust, vehicular pollution, industrial pollution at/near their work place

a. Daily: frequency of exposure to one of the above pollutants at/near their work place is 6-7 days a week
b. Most days: frequency of exposure to one of the above pollutants at/near their work place is 4-5 days a week
c. Sometimes/ Once in a while: frequency of exposure to one of the above pollutants at/near their work place is 1-3 days a week
d. No exposure: No exposure to one of the above pollutants near home

13. Whole grain consumption

Consumption of wheat, white rice, brown rice, barley, porridge etc.

a. Low Consumption: Consumption less than once a week
b. Moderate consumption: Consumption 2 to 6 times per week
c. High consumption: Consumption once or more every day

14. Occupational physical activity

a. Low Labour: People working as businessman/ industrialists, government servants in office, self-employed people, office executives in private sector, unemployed people etc.
b. Moderate Labour: People working as drivers, shop owners/petty traders, salesperson, clerks, student, housewife etc.
c. High Labour: People working as agricultural labourers, farmers, unskilled, skilled and semi-skilled workers, scrap or garbage collectors, domestic servants etc.

15. Chewing tobacco consumption

Definition of chewing tobacco: Chewing tobacco includes of Khaini, supari, gutka, pan masala, etc.

a. No consumption: Never consumed
b. Rare consumer: Chewing of tobacco less than once per day or have been chewing tobacco for less than one year
c. Moderate consumer: Chewing of tobacco on an average of 12 times per week for more than two years/ chewing of tobacco more than three times for 2 years
d. Heavy consumer: Chewing of tobacco more than 3 times per day for more than 3 years

16. Sugar-sweetened beverages consumption

Consumption of tea, coffee, carbonated drinks and Juice (Fresh/ Packed) / Coconut water etc.

a. No consumption: Never consumed
b. Low Consumption: Consumption less that once a week
c. Moderate consumption: Consumption 2 to 6 times per week
d. High consumption: Consumption once or more every day

17. Smoking tobacco

Definition: Smoking tobacco includes bidi, cigarette, cigar or pipe, hookah or any other local tobacco product

a. No consumption: Never consumed
b. Rare consumer: Smoking tobacco less than once per day or have been smoking for less than one year
c. Moderate consumer: Smoking tobacco on an average of 12 times per week for more than two years/ Smoking more than three times for 2 years
d. Heavy consumer: Smoking tobacco more than 3 times per day for more than 3 years

18. Alcohol consumption

Definition of alcohol: Alcohol includes beer, wine, whisky, brandy, vodka, country liquor etc.

a. No consumption: Never consumed
b. Rare consumer: Consuming alcohol less than once per day or have been smoking for less than one year
c. Moderate consumer: Consuming alcohol on an average of 12 times per week for more than two years/ Consuming alcohol more than three times for 2 years
d. Heavy consumer: Consuming alcohol more than 3 times per day for more than 3 years

19. Red meat consumption

Defined as consumers of chicken, mutton, beef, pork etc.

a. No consumption: Never consume
b. Low Consumption: Consumption less that once a week
c. Moderate consumption: Consumption 2 to 6 times per week
d. High consumption: Consumption once or more every day

20. Vegetables consumption

Defined as consumers of vegetables include root vegetables, tuber vegetables, leafy vegetables, flowery vegetables, fruity vegetables, stems and seeded vegetables

a. No consumption: Never consume
b. Low Consumption: Consumption less that once a week
c. Moderate consumption: Consumption 2 to 6

times per week

d. High consumption: Consumption once or more every day

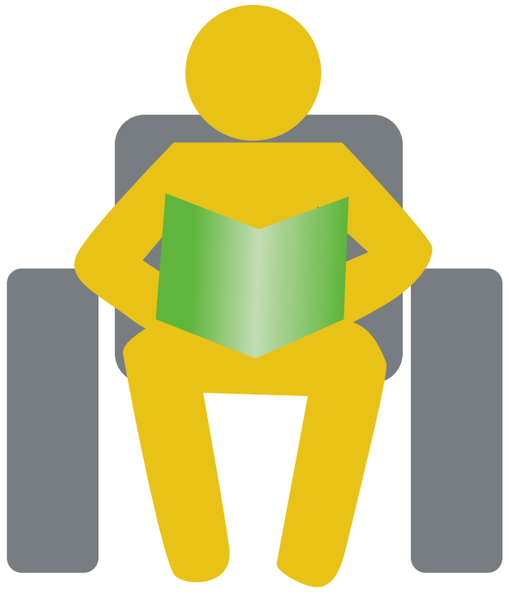
21. Sleeping habits

a. Low sleep hours: Person sleeps for 5 hours or below
b. Optimum sleep hours: Person sleeps between 5 to 10 hours
c. High sleep hours: Person sleeps for 10 hours and above

22. Leisure activities

Activities that are done in free time and that do not require a person to be physically active to an extent that he/she is stressing their body e.g. watching television, playing video games, surfing internet, talking over phone etc.

a. Low: Less than 6 hours per day per week
b. Moderate: 6-10 hours per day per week
c. High: 10-15 hours per day per week
d. Very high: More than 15 hours per day per week



Annexure V

Treatment Seeking Behaviour

Annexure V: Treatment Seeking Behaviour

The annexure V focuses findings of the survey covering the aspects discussed in the section 6 of the report. Specifically, it investigates aspects of preventive control of NCDs and the treatment seeking behavior of individuals suffering from a particular NCD while looking at the kind and duration of such treatment.

While the results of nine broad diseases are already shown in section 6, here results are given for specific diseases under these nine broad disease categories for further reference and analysis. This is based on the main survey covering a population of 10500 individuals aged 17 years and above across all the states having one or more non-communicable disease to have better insights about their disease and treatment of these diseases. The sample weights were accounted in the survey module to adjust for adequate data representation. The analysis here, therefore, is based on weighted 10538 individual observations.

Are people seeking treatment for their NCD?

Whether Seeking Treatment for NCD

Diseases Broad Categories	Specific Diseases	Yes	No
Respiratory Disease	Pneumonia	76%	24%
	Asthma	88%	12%
	Cystic Fibrosis	84%	16%
	Acute Respiratory Infection	86%	14%
Diabetes/ Pancreatic	Diabetes	93%	7%
	Increased Sugar	92%	8%
	Blood Glucose	96%	4%
Heart Diseases	COPD	90%	10%
	Gen. Heart Disease	90%	10%
	Heart infections	94%	6%
	Coronary heart disease	94%	6%
Cancer	Throat cancer	90%	10%
	Bladder Cancer	92%	8%
	Breast cancer	85%	15%
	Cervical Cancer	93%	7%
	Esophageal cancer	98%	2%
	Kidney Cancer	97%	3%
	Liver cancer	93%	7%

Contd.

	Lung Cancer	84%	16%
	Mesothelioma	57%	43%
	Mouth cancer	92%	8%
	Other Cancer	67%	33%
Digestive Diseases	Constipation	75%	25%
	Irritable bowel syndrome (IBS)	85%	15%
	Anal disorders	85%	15%
	Diverticular disease	80%	20%
	Colitis	96%	4%
	Viral gastroenteritis	83%	17%
	Cyclic vomiting syndrome	100%	0%
	Dyspepsia (indigestion)	68%	32%
	Gallstone	77%	23%
	Gastritis	85%	15%
	GI bleeding	67%	33%
	Other Digestive disease	76%	24%
Skin Diseases	Acne vulgaris	78%	22%
	Skin cancer	76%	24%
	Atopic Dermatitis	84%	16%
	Contact Dermatitis	90%	10%
	Hives	84%	16%
	Psoriasis	87%	13%
	Actinic Keratosis	100%	0%
	Vitiligo	67%	33%
	Other skin disease	81%	19%

Source: *TARI Research team based on primary survey by Kantar Public*

Type of treatment sought for NCD

Type of Treatment Sought for NCD

Diseases Broad Categories	Specific Diseases	Under the supervision of doctor - Hospitalized	Under the supervision of doctor - Regular visit but not hospitalized	Under the supervision of doctor - Visit only when required	AYUSH	Non-licensed doctors (Quack)	Others
Respiratory Disease	Pneumonia	10.2%	31.5%	54.3%	1.6%	2.4%	0.8%
	Asthma	19.3%	20.8%	54.9%	0.7%	2.9%	1.4%
	Cystic Fibrosis	8.7%	32.6%	52.2%	2.2%	0.0%	4.3%
	Acute Respiratory Infection	10.9%	26.9%	54.5%	3.0%	4.1%	0.4%
Diabetes/ Pancreatic	Diabetes	13.2%	32.8%	50.3%	1.9%	1.3%	0.4%
	Increased Sugar	16.3%	16.6%	63.1%	1.2%	0.9%	1.9%
	Blood Glucose	15.5%	28.7%	52.5%	0.6%	0.0%	3.3%
Heart Diseases	COPD	15.8%	15.8%	60.5%	0.0%	2.6%	7.9%
	Gen. Heart Disease	14.7%	30.3%	50.8%	1.2%	1.6%	1.2%
	Heart infections	23.0%	26.5%	48.5%	0.0%	1.5%	0.0%
	Coronary heart disease	16.5%	24.8%	57.9%	0.8%	0.0%	0.0%
Cancer	Throat cancer	22.4%	37.9%	37.3%	1.2%	0.6%	0.0%
	Bladder Cancer	20.6%	17.6%	61.8%	0.0%	0.0%	0.0%
	Breast cancer	15.6%	28.9%	55.6%	0.0%	0.0%	0.0%
	Cervical Cancer	28.6%	28.6%	41.3%	0.0%	0.0%	0.0%
	Esophageal cancer	18.0%	36.0%	46.0%	0.0%	0.0%	0.0%
	Kidney Cancer	35.1%	21.3%	41.5%	2.1%	0.0%	0.0%
	Liver cancer	22.2%	38.9%	38.9%	0.0%	0.0%	0.0%
	Lung Cancer	29.8%	29.8%	40.4%	0.0%	0.0%	0.0%
	Mesothelioma	0.0%	41.7%	58.3%	0.0%	0.0%	0.0%
	Mouth cancer	23.5%	37.8%	36.7%	0.0%	2.0%	0.0%
	Other Cancer	0.0%	50.0%	0.0%	0.0%	50.0%	0.0%
Digestive Diseases	Constipation	6.9%	16.2%	61.5%	6.9%	5.6%	2.7%
	Irritable bowel syndrome (IBS)	15.4%	43.6%	33.3%	2.6%	0.0%	5.1%
	Anal disorders	15.7%	28.9%	39.8%	1.2%	12.0%	2.4%
	Diverticular disease	33.3%	8.3%	50.0%	0.0%	0.0%	8.3%
	Colitis	20.0%	32.0%	20.0%	4.0%	24.0%	0.0%
	Viral gastroenteritis	6.0%	35.8%	46.3%	1.5%	9.0%	1.5%
	Cyclic vomiting syndrome	50.0%	7.1%	42.9%	7.1%	0.0%	0.0%
	Dyspepsia (indigestion)	11.3%	14.2%	55.9%	11.9%	2.6%	4.1%
	Gallstone	7.1%	22.2%	58.7%	6.3%	3.2%	2.4%

Contd.

	Gastritis	9.4%	19.1%	62.7%	3.2%	3.8%	1.8%
	GI bleeding	0.0%	50.0%	50.0%	0.0%	0.0%	0.0%
	Other Digestive disease	7.7%	38.5%	52.3%	0.0%	1.5%	0.0%
Skin Diseases	Acne vulgaris	0.0%	24.6%	49.2%	9.2%	10.8%	4.6%
	Skin cancer	46.4%	3.6%	42.9%	0.0%	7.1%	0.0%
	Atopic Dermatitis	11.1%	11.1%	74.1%	0.0%	7.4%	0.0%
	Contact Dermatitis	32.4%	14.1%	46.5%	0.0%	4.2%	2.8%
	Hives	12.8%	12.8%	55.3%	8.5%	8.5%	2.1%
	Psoriasis	0.0%	44.4%	40.7%	3.7%	0.0%	11.1%
	Actinic Keratosis	0.0%	38.5%	46.2%	0.0%	7.7%	7.7%
	Vitiligo	0.0%	41.7%	25.0%	33.3%	0.0%	0.0%
	Other skin disease	10.7%	43.8%	40.5%	2.5%	0.4%	2.1%

Source: *TARI Research team based on primary survey by Kantar Public*

How long are people seeking treatment for their NCD?

Type of Treatment Sought for NCD

Diseases Broad Categories	Specific Diseases	Less than a month	1 to 6 months	More than 6 months to 12 months	More than 1 years to 3 years	More than 3 years
Respiratory Disease	Pneumonia	17%	36%	16%	17%	13%
	Asthma	5%	21%	10%	34%	30%
	Cystic Fibrosis	7%	33%	15%	28%	17%
	Acute Respiratory Infection	5%	21%	9%	39%	27%
Diabetes/ Pancreatic	Diabetes	5%	22%	11%	32%	31%
	Increased Sugar	6%	24%	11%	36%	24%
	Blood Glucose	17%	24%	12%	33%	15%
Heart Diseases	COPD	5%	36%	13%	18%	28%
	Gen. Heart Disease	3%	24%	16%	35%	22%
	Heart infections	9%	22%	12%	24%	33%
	Coronary heart disease	3%	12%	8%	38%	39%
Cancer	Throat cancer	5%	29%	24%	28%	14%
	Bladder Cancer	9%	26%	18%	38%	9%
	Breast cancer	15%	15%	15%	35%	20%
	Cervical Cancer	6%	37%	11%	35%	10%

Contd.

Cancer	Esophageal cancer	4%	22%	18%	40%	16%
	Kidney Cancer	7%	32%	14%	38%	9%
	Liver cancer	8%	33%	12%	35%	13%
	Lung Cancer	9%	23%	19%	38%	11%
	Mesothelioma	0%	23%	8%	38%	31%
	Mouth cancer	6%	38%	17%	24%	14%
	Other Cancer	0%	0%	0%	0%	100%
Digestive Diseases	Constipation	9%	27%	14%	35%	15%
	Irritable bowel syndrome (IBS)	13%	18%	13%	39%	16%
	Anal disorders	4%	30%	12%	27%	28%
	Diverticular disease	0%	42%	50%	8%	0%
	Colitis	19%	19%	31%	23%	8%
	Viral gastroenteritis	7%	18%	18%	31%	25%
	Cyclic vomiting syndrome	20%	33%	13%	20%	13%
	Dyspepsia (indigestion)	9%	30%	13%	27%	21%
	Gallstone	5%	26%	24%	38%	8%
	Gastritis	9%	29%	9%	27%	27%
	GI bleeding	0%	40%	20%	40%	0%
	Other Digestive disease	9%	12%	9%	32%	38%
Skin Diseases	Acne vulgaris	9%	58%	22%	6%	4%
	Skin cancer	18%	32%	14%	29%	7%
	Atopic Dermatitis	4%	35%	4%	31%	27%
	Contact Dermatitis	8%	34%	8%	23%	27%
	Hives	6%	19%	9%	49%	17%
	Psoriasis	0%	43%	7%	29%	21%
	Actinic Keratosis	8%	69%	8%	8%	8%
	Vitiligo	23%	46%	0%	8%	23%
	Other skin disease	6%	21%	12%	39%	23%

Source: *TARI Research team based on primary survey by Kantar Public*

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The Associated Chambers of Commerce & Industry of India (ASSOCHAM) is the country's oldest and most agile apex chamber, always evolving with the times ever since it was set up in 1920. The ASSOCHAM reaches out to and serves over 4.5 lakh members from trade, industry and professional services through over 400 associations, federations and regional chambers spread across the length and breadth of the country. It has built a strong presence in states, as also spread its wings in the key cities of the world.

With a rich heritage of being led by stalwarts of independent India, like JRD Tata, Nani Palkhivala, H P Nanda, L M Thapar, A N Haksar and Raunaq Singh, among others, the ASSOCHAM has shown the ability to transform itself to the contemporary Corporate India and of late has emerged as the 'Knowledge Chamber', leveraging the country's strength in the knowledge - led global economy.

Be it education, health, manufacturing, banking-finance, international trade, energy, human resource, science and technology, entertainment or the rural landscape comprising agriculture and rural infrastructure, the ASSOCHAM has well-established National Councils in each of the segments, chaired by well-known industry leaders, academicians, economists and independent professionals. These councils deliberate extensively and share their inputs with the government.

ASSOCHAM is working hand in hand with the government, institutions of importance and national and international think tanks to contribute to the policy making process even as it shares vital feedback on implementation of decisions of far-reaching consequences.

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