

REVIEW ARTICLE

Lifestyle and Non-Communicable Diseases: A double edged sword for future IndiaJoy Kumar Chakma¹, Sanjay Gupta²¹MD Final Year, Community Health Administration, ²Associate Professor, Department of Community Health Administration, National Institute of Health and Family Welfare, Munirka, New Delhi, India. PIN – 110067

Abstract	Introduction	Methodology	Results	Conclusion	References	Citation	Tables / Figures
--------------------------	------------------------------	-----------------------------	-------------------------	----------------------------	----------------------------	--------------------------	----------------------------------

Corresponding Author

Address for Correspondence: Joy Kumar Chakma, National Institute of Health and Family Welfare, Munirka, New Delhi, India. PIN – 110067.
E Mail ID: drjkna@yahoo.com

Citation

Chakma JK, Gupta S. Lifestyle and Non-communicable Diseases: A double edged sword for future India. *Ind J Comm Health*. 2014;26(4):325-332.

Source of Funding : Nil **Conflict of Interest:** None declared

Article Cycle

Submission: 16/09/2014; **Revision:** 24/10/2014; **Acceptance:** 25/10/2014; **Publication:** 15/12/2014

Abstract

Lifestyle has long been associated with the development of many chronic diseases. WHO has recognized diabetes, cardiovascular disease and stroke, cancer and chronic lung disease/COPD as major non-communicable diseases (NCDs). These major NCDs share common lifestyle related risk factors like physical inactivity, unhealthy diet, tobacco use and harmful use of alcohol. Globally, the current scenario of NCDs is the major cause of morbidity and mortality. According to WHO Report 2004, they account for almost 60% of deaths and 47% of global burden of disease. Epidemics of NCDs are presently emerging or accelerating in most developing countries. In India, 53% of the deaths in 2008 were due to NCDs (WHO) and cardiovascular disease (CVDs) alone account for 24 percent of all deaths. As of 2005, India experienced the “highest loss in potentially productive years of life” worldwide and the leading cause of death was cardiovascular disease; mostly affecting people aged 35-64 years. The projected cumulative loss of national income for India due to NCDs mortality for 2006-2015 will be USD237 billion. By 2030, this productivity loss is expected to double to 17.9 million years lost. These major NCDs are largely preventable through effective interventions by tackling the lifestyle related modifiable risk factors. This review discusses the current scenario of NCDs with their impact on health and socioeconomic development, the threat posed by the rising trends of disease burden along with socio-demographic transition and the challenges needs to be addressed for the prevention and control of NCDs.

Key Words

Lifestyle; Risk Factors; Non-Communicable Diseases

Introduction

Since the evolution of mankind, humans adopted to various ways of living for their lives. Lifestyle is the way humans chose to live their lives. In our day to day life, many of us chose to live in many different ways which may be related to social, occupational or environmental factors, etc. With the advancement in the society along with scientific and technological progress, there has been a dramatic shift in the way today humans beings are leading their lives which is sometimes referred as modern way of living. With modern medical science and technological progress, there has been improvement in sanitation

and hygiene, prevention of diseases with vaccination and treatment of infections with antibiotics. Thus, with adequate medical attention has decreased the threat of death from most of the infectious diseases and vaccines have prevented many terrible illnesses which in the past had claimed lives of many children, and many bacterial illnesses, which were fatal in the past have now become treatable with antibiotics [1]. However, in these changes of living and with progress in modern science and technology human beings have eliminated certain forms of diseases but in this transition of improvement in living and increasing in life expectancy they brought in others,

the so-called lifestyle diseases which are also known as non-communicable diseases.

Lifestyle diseases are associated with the way a person or group of people lives on a daily basis. In other words, lifestyle diseases characterize those diseases whose occurrence is primarily based on the daily habits of people and are a result of an inappropriate relationship of people with their environment. Lifestyle diseases, also called diseases of longevity or diseases of civilization interchangeably, are diseases that appear to increase in frequency as countries become more industrialized and people live longer [2]. These diseases [1-4] include hypertension, heart diseases, stroke, diabetes, obesity, high cholesterol and diseases associated with tobacco use (smoking and chewing) like chronic bronchitis, COPD, cancer and excessive use of alcohol. There are many other conditions associated with modern living like stress, depression and substance abuse are important factors also contributing to lifestyle related morbidity and mortality like suicides [5].

These so-called lifestyle and or non-communicable diseases (NCDs), thus constitute a large group of diseases that are of long duration, and generally slow to progress; therefore, these diseases are also called 'Chronic Diseases' and they are the major cause of adult mortality and morbidity worldwide. Epidemics of NCDs are presently emerging or accelerating in most developing countries. Globally, the current scenario of NCDs is the major cause of morbidity and mortality. According to WHO Report 2004, they account for almost 60% of deaths and 47% of global burden of disease [6, 7].

In a developing country like India, the present scenario of these diseases is in quite alarming situation as the profile of these diseases is changing very rapidly. The World Health Organization (WHO) has identified India as one of the nations that is going to have most of the lifestyle related disorders in the near future. But, the important fact is that not only are the lifestyle disorders becoming more common, but they are showing a drastic shift towards the younger population. Thus, the populations at risk of their forties are shifting to their thirties and maybe even younger. As of 2005, India experienced the "highest loss in potentially productive years of life" worldwide and the leading cause of death was cardiovascular disease; mostly affecting people aged 35-64 years [8]. It has been calculated that, in 2000, 9.2 million years of productive life were lost in India.

This translates into USD9 billion of lost national income [9]. The projected cumulative loss of national income for India due to non-communicable disease mortality for 2006-2015 will be USD237 billion. By 2030, this productivity loss was expected to double to 17.9 million years lost – almost 1,000% greater than the corresponding loss in the United States, which has a population a third the size of India's. As a low-middle income country it is not surprising that India's expenditure on healthcare is also quite low [10]. Thus, India must either shift government health expenditures towards, or increase absolute spending on, prevention, screening, early intervention, and new medical treatments for reducing the burden of NCDs.

The magnitude of the problem:

I. Burden of Non-communicable Diseases in India.

The rapidly increasing burden of non-communicable diseases is now posing a major threat not only to the health of the populations but also to the country's economic growth and development. According to WHO, 53 percent of the deaths in 2008 were due to NCDs in India [11]. Cardiovascular disease (CVDs) alone account for 24 percent of all deaths. Chronic respiratory diseases (CRDs), cancers and diabetes accounted for 11, 6 and 2 percent of all deaths respectively [12] is shown in [Figure 1](#). Moreover, the burden of infectious disease still remains high in India, with communicable, maternal, perinatal, and nutritional conditions accounting for 37% of all mortality, compared with just 7% in a most populous country like China [13] and India is very soon to be the world's most populous country keeping behind China in the population growth. While China has made good progress with regard to successful infectious disease control but India still continues to face a double burden of diseases. On the other hand, the 'Emerging Infectious Diseases' in India is another challenge to the present infectious disease control programmes and strategies in the public health system and threaten to devastate health and economic development unless a strategic vision and an effective plan of action are developed to combat these [14].

The major NCDs in India are Cardiovascular diseases (CVDs), Cancer, Diabetes and Chronic obstructive pulmonary disease (COPD) and the great concern is that NCDs have over taken the communicable diseases and become the leading cause of death and disability. Currently NCDs account for 53% of the total deaths and 44% of disability adjusted life years

(DALYs) lost and projections indicate a further increase to 67% of total deaths by 2030. CVD is the major contributor to this burden, attributable to 52% of NCD associated deaths and 29% of total deaths [15]. Moreover, a substantial proportion of these deaths are in the productive age-group and all of them are preventable in nature. But, the rising challenge due to NCDs is that it increasingly affecting the younger populations [16].

NCDs are no more limited to the urban cities and towns in India. A study in south Indian state of Andhra Pradesh by R. Joshi *et al.* have reported that even in rural India the leading cause of death (32%) is due to NCDs followed by injuries and external cause of deaths (12%) [17]. In another study conducted by SD Bhardwaj *et al.* reported high burden NCD risk factors among the population in rural area of Nagpur, Maharashtra. It showed tobacco and alcohol use was high among men while physical inactivity and overweight were higher in women. Low fruit and vegetable consumption was found among both the gender [18].

II. Trends and Projections of NCDs in India.

The trends and projections of major NCDs in India indicate that the situation is very alarming for the country's present health care system and health care infrastructures. There were 32 million diabetes patients in India in 2000 as per WHO and within a decade, it rose to 51 million in 2010 as per International Diabetes Federation and is being projected to be 80 million by 2030 (WHO). Cardiovascular diseases (CVDs) have doubled in less than a decade from 19 million in 1998 (ICMR) to 38 million in 2005 (National Commission of Macroeconomics and Health) and in a very near future it is projected to be 64 million by 2015 (National Commission of Macroeconomics and Health). The annual incidence of cancer is 1.1 million (ICMR) and prevalence of COPD is 3.49% (ICMR).

Projection estimates from the WHO have shown that by the year 2030, CVDs will emerge as the main cause of death (36%) in India as shown in [Figure 2](#). Since the majority of deaths are premature, there is a substantial loss of lives during the productive years as compared to other countries [19]

Lifestyle risk factors and their relationship with NCDs

Humankind has faced a major shift in dietary and physical activity patterns and subsequent body composition since Paleolithic era. These changes are reflected in nutritional outcomes, such as changes in

average stature and body composition. Furthermore, these dietary and activity pattern changes are paralleled by major demographic changes and changes in health status, which are reflected in the rising prevalence of non-communicable diseases [20]. WHO have identified that most NCDs are the result of four particular lifestyle related behavioral risk factors like tobacco use, physical inactivity, unhealthy diet, and the harmful use of alcohol that lead to four key metabolic/physiological changes e.g., raised blood pressure (BP), overweight/obesity, raised blood glucose and raised cholesterol levels [21].

The obesity epidemic is spreading to low-income and middle-income countries as a result of new dietary habits and sedentary ways of life, fuelling chronic diseases and premature mortality. The Organization for Economic Co-operation and Development (OECD) and WHO, jointly developed a micro simulation model (chronic disease prevention [CDP] model) that implements a so-called causal web of lifestyle risk factors for selected chronic diseases [22] as shown in [Figure 3](#).

In the causal web concept there are mutual interactions between risk factors, which therefore have both direct and indirect effects on chronic diseases. The model explicitly accounts for three groups of chronic diseases: stroke, ischemic heart disease, and cancer (including lung, colorectal, and female breast cancer). Proximal risk factors, such as high blood pressure, cholesterol, and blood glucose, have a direct effect on the probability of developing these three chronic diseases, on the basis of established pathophysiological mechanisms. Conversely, distal risk factors such as low intake of fruit and vegetables, high fat intake, and insufficient physical activity have an indirect effect on chronic diseases, which was modeled on the basis of the existing empirical evidence. The indirect effect is mediated partly by BMI, which acts on proximal risk factors and directly on disease events.

Lifestyle related risk factors of NCDs in adolescent in India.

The increasing prevalence of lifestyle related behavioral risk factors like tobacco use, physical inactivity, unhealthy diet, and use of alcohol in the early phase of life which lead to the key metabolic and or physiological changes e.g., raised blood pressure (BP), overweight/obesity, raised blood glucose and raised cholesterol levels is a cause of great concern for the increasing burden of NCDs in

India. Many studies have shown that the prevalence of risk factors for NCDs in early phase of life i.e. childhood and adolescence bears significant tendency towards development of disease in adulthood [23-25]. There is inappropriate dietary practices (fast food consumption, low fruit consumption), low physical activity, higher level of experimentation with alcohol and to a lesser extent smoking, high prevalence of obesity and hypertension in the school children [26-28]. Moreover, many studies have shown that awareness regarding lifestyle risk factors of NCDs among the school children is poor [27-29] which is the most critical area for any interventional program for prevention and control of NCDs in this age group.

Global strategy for the prevention and control of NCDs:

WHO in its World Health Assembly in May 2008 endorsed Action Plan of Global Strategy for the Prevention and Control of Non-communicable Diseases with the following six objectives:

1. To raise the priority accorded to NCDs in development work at global and national levels, and integrate prevention and control of NCDs into policies across all government departments.
2. To establish strengthen national policies and programmes.
3. To reduce and prevent risk factors.
4. To prioritize research on prevention and health care.
5. To strengthen partnership and
6. To monitor NCD trends and assess the progress made at country level.

India's response towards prevention and control of NCDs:

India as a WHO member state is committed to implement the appropriate action plan and take necessary steps and initiatives as per the Action Plan of Global Strategy for the Prevention and Control of NCDs to meet the objectives as per suggested timelines. This calls for enhancing the existing capacity, mechanisms and mandates of all relevant stakeholders in facilitating and ensuring action across various sectors for prevention and control of NCDs.

Policy, planning and strategies for tackling the emerging public health problems of NCDs [30].

I. Leadership and Co-ordination:

The Directorate of Health Services, Ministry of Health and Family Welfare, government of India has a dedicated Non-communicable Diseases (NCDs)

division that acts as the focal point for coordinating the NCDs control programs in the country. The division's structure is currently under reorganization to accommodate the expansion of the National Program on Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS). The National Health Mission (previously National Rural Health Mission [NRHM]) provides an overarching umbrella, subsuming the existing programs of the Ministry of Health including all NCDs control programs.

II. NCDs related Institutions:

India's has several major institutions dealing with NCDs at the national level. The key institutions include: The Indian Council for Medical Research (ICMR), the National Institute of Communicable Diseases (NICDC), the All India Institute of Medical Sciences (AIIMS).

III. Programs and Initiatives:

India is gradually developing a broad array of public health programs targeting NCDs. The major program initiatives undertaken for prevention and control of the major NCDs are:

- a. National Program for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS): It has launched the National Program for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS) in 2010 by merging the National Cancer Control Program and the National Program for Prevention and Control of Diabetes, Cardiovascular Diseases and Stroke [31]. The program is initially being implemented in 100 districts of 21 states and is under expansion to cover all districts of the country in a phased manner during the 12th Five Year Plan. The integration of services at district level and beyond, equitable with universal coverage under the umbrella of National Health Mission is envisaged under the program. NPCDCS has three major components: health promotion for general population; disease prevention for those with high risk and assessment of the risk factor burden. The focus of the program is on health promotion and prevention, strengthening of infrastructure including human resources, early diagnosis and management and integration with the primary health care system through NCD cells at different levels for optimal operational synergies [32] as shown in [Figure 4](#).

b. National Tobacco Control Program (NTCP): The National Tobacco Control Programme (NTCP) was launched by the Ministry of Health and Family Welfare (MoHFW), Government of India in 2007- 08, during the 11th five year plan [33] with the objectives to bring about greater awareness about the harmful effects of tobacco use and about the Tobacco Control Laws and to facilitate effective implementation of the Tobacco Control Laws. The interventions under the National Tobacco Control Programme (NTCP) have been largely planned at the primordial and primary levels of prevention. The NTCP is presently under implementation in 21 states covering 42 districts (2 districts per state). The programme is being under expansion and is to be extended in a phase-wise manner to cover the entire country during the 12th Five Year Plan. In order to carry forward the momentum generated by NTCP during the 11FYP and baseline data generated through the GATS-India Survey, indicating level of prevalence of tobacco use, the program is being up scaled in the 12th FYP with the goal to reduce the prevalence of tobacco use by 5% at the end of 12th FYP. To facilitate the effective implementation of the Tobacco Control Laws and to bring about greater awareness about the harmful effects of tobacco and to fulfill the obligations under the WHO-FCTC, integration of services and activities under the program from national to district level and beyond, will be directed with inter-sectoral coordination and convergence at various level equitable with other NCD program [32].

The Challenges need to be addressed for prevention and control of NCDs.

India is undergoing a very rapid epidemiological transition as in the last few decades it had undergone through rapid socio-economic growth. During this period of transition it has also witnessed rapid health related changes with rising burden of non-communicable diseases and became the major killer of the 21st century. At present, India is at a cross road with dual burden of diseases (communicable and non-communicable diseases) and also dual burden of under and over nutrition and diseases related it. In fact, NCDs are the major cause of concern because of their multifactorial etiology associated with modern lifestyle and affecting the younger people at their active productive life leading

to a greater impact on health as well as socio-economic development of the country. The pace at which the epidemiological transition of the lifestyle related NCDs is undergoing, it is a big challenge for the country's present health care system and infrastructure to combat with it. In response to the rising burden of cardiovascular diseases, diabetes and other major NCDs in India, Government of India has undertaken some actions in various National health programmes. But, most of the governmental efforts initiated are either being implemented or under implementation in phased manner and will take considerable time to gain the momentum to reach each and every part of the country considering its large population and geographical size of India.

In the programmatic approach, there has been emphasis on preventive, promotive and management of NCDs in an integrated manner within the existing health care system. But, for the implementation of the programs and to deliver the services, there are lots of constrains and difficulties for the system to work at the ground level due to the shortage and limited human resources for health as well as infrastructure. The present health care delivery system is heavily loaded in giving mostly curative services with limited diagnostic and other facilities at PHC, CHC/sub district or even at district level. The approach of preventive and promotive health care is almost nonexistent and is still a non-priority area in the primary health care system. Due to the limited facilities and services available at each and every level of health care system, the patients' needs to go a long way from their home to get specialized services required for many chronic diseases and NCDs. In this process, they have to bear a great financial impact for the long duration of treatment and care needed for NCDs and leading to enormous out of pocket expenditure. The present functional status of the public health care system is struggling even for dealing with common illnesses/diseases and to handle the increasing burden of non-communicable diseases will require many radical changes in its functioning along with enormous resources for it.

The major NCDs, heart disease and stroke, diabetes, cancer and chronic lung disease/COPD are largely preventable through effective interventions by tackling the shared modifiable risk factors i.e., physical inactivity, unhealthy diet, harmful use of alcohol and tobacco use. To tackle these modifiable risk factors will require sustained programmatic

approaches through various inter-sectoral cooperation and coordination along with inter-sectoral convergence with various departments like education, women and child development, science and technology, environment, etc., Moreover, a wide group of stakeholders, including civil society, the private sector, NGOs and academia needs to be brought together for their role and involvement along with the governmental efforts in the prevention and control of NCDs for winning the battle against the rising burden of NCDs.

Conclusion

NCDs constitute not only a major threat to the health of the people of India but also a major challenge for overall development of the country. The rising disease burden along with the undergoing demographic and epidemiological transition is a cause of great concern. It is increasingly affecting the younger population at their active productive life. Thereby, it is not only increasing the number of productive life years lost, but also creating a big financial burden due to prolong health care cost. Study has shown an increasing prevalence of NCDs in rural areas and is no more a disease of urban cities and towns in India. With more than 68% of country's population living in rural areas where the public health care system is struggling in dealing with common illness/diseases. To deal with the increasing burden of NCDs, the present public health care system need to be reoriented along with the radical changes required for tackling the NCDs. The four major NCDs are the result of four common shared lifestyle related modifiable risk factors. They are tobacco use, physical inactivity, unhealthy diet and alcohol use which in turn lead to key metabolic and or physiological changes like high blood pressure, overweight/obesity, high blood glucose and high cholesterol. So, more focus should be given on the interventional programs and activities directed for reducing shared modifiable lifestyle risk factors for the prevention and control of NCDs. The national policies and planning needs to be more strengthened for promoting partnership with a wide group of stakeholders like civil society, professional bodies, private sector, NGO, etc., along with the governmental efforts in the prevention and control NCDs. The present monitoring mechanisms need to be further strengthened for better implementation of policies and programs of NCDs and also the surveillance system with a strong database.

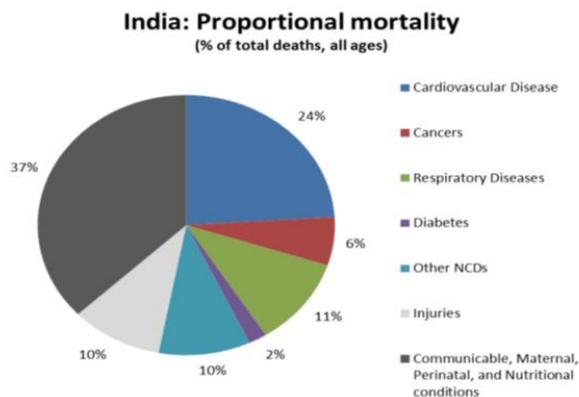
References

1. Kaushik R, Khanna P. Changing trends in diet and lifestyle: A disease itself. *Spectrum: A Journal of Multidisciplinary Research*. 2012;1(7).
2. Mathew Jomon. Lifestyle Diseases in India: Facts, Threats and Remedies, *Employment News*, Vol. XXXVII, No.48, dated, 1-7th March, 2014.
3. Jasmine. A. Life style diseases-Indian scenario, 2nd International Conference and Exhibition on Food Processing & Technology, October 28 – 30, Kansas City, USA. Source: <http://www.omicsgroup.com/conferences/food-processing-technology-2013/>
4. Pappachan MJ. Increasing prevalence of lifestyle diseases: high time for action. *Indian J Med Res*. 2011 Aug;134: 143-5. PubMed PMID: 21911964; PubMed Central PMCID: PMC3181012. [[PubMed](#)]
5. World Health Organization. Suicide prevention. Available from: http://www.who.int/mental_health/prevention/suicide/suicideprevent/en/
6. National Institute of Medical Statistics, Indian Council of Medical Research (ICMR), 2009, IDSP Non-Communicable Disease Risk Factors Survey, Phase-I States of India, 2007-08. National Institute of Medical Statistics and Division of Non-Communicable Diseases, Indian Council of Medical Research, New Delhi, India.
7. Divakaran B, Muttapillymyalil J, Sreedharan J, Shalini K. Lifestyle riskfactors of noncommunicable diseases: awareness among school children. *Indian J Cancer*. 2010 Jul;47 Suppl 1:9-13. doi: 10.4103/0019-509X.63864. PubMed PMID: 20622407. [[PubMed](#)]
8. Srinath Reddy K, Shah B, Varghese C, Ramadoss A. Responding to the threat of chronic diseases in India. *Lancet*. 2005 Nov 12;366(9498):1744-9. PubMed PMID: 16291069. [[PubMed](#)]
9. World Health Organization, Chronic Disease Report, 2005.
10. Wayne Taylor, D. The Burden of Non-Communicable Diseases in India, Hamilton ON: The Cameron Institute, 2010.
11. World Health Organization. Non-communicable Diseases Country Profile 2011.
12. Sharma K. Burden of Non Communicable Diseases in India: Setting Priority for Action. *Int J Med Sci Public Health* 2013;2(1):7-11.
13. David E. Bloom, et. al. The Economic Impact of Non-communicable Disease in China and India: Estimates, Projections, and Comparisons, Program on the Global Demography of Ageing, Working Paper No. 107. Available at <http://www.hsph.harvard.edu/pgda/working.htm>
14. Dikid T, Jain SK, Sharma A, Kumar A, Narain JP. Emerging & re-emerging infections in India: an overview. *Indian J Med Res*. 2013;138:19-31. Review. PubMed PMID: 24056553; PubMed Central PMCID: PMC3767269. [[PubMed](#)]
15. Reddy K. Srinath and Sailesh Mohan. Chronic diseases in India: Burden and implications. *Chronic Diseases in India | Swiss Re - Centre for Global Dialogue*. Source at http://cgd.swissre.com/global_dialogue/topics/Cardiovascular_risks_in_HGM/Chronic_Diseases_in_India_Burden_and_Implications.html

16. Irina A. Nikolic. *et. al.*, Chronic Emergency: Why NCDs Matter, Health, Nutrition and Population (HNP) Discussion Paper, July 2011. © 2011 The International Bank for Reconstruction and Development / The World Bank 1818 H Street, NW Washington, DC 20433.
17. Joshi R, Cardona M, Iyengar S, Sukumar A, Raju CR, Raju KR, Raju K, Reddy KS, Lopez A, Neal B. Chronic diseases now a leading cause of death in rural India--mortality data from the Andhra Pradesh Rural Health Initiative. *Int J Epidemiol.* 2006 Dec;35(6):1522-9. Epub 2006 Sep 22. PubMed PMID: 16997852. [[PubMed](#)]
18. Bhardwaj SD, Shewte MK, Bhatkule PR, Khadse JR. Prevalence of risk factors for non-communicable disease in a rural area of nagpur district, maharashtra--A WHO STEP wise approach. *Int J Biol Med Res.* 2012; 3(1): 1413-1418.
19. Srivastava RK, Bachani D. Burden of NCDs, Policies and Programme for Prevention and Control of NCDs in India. *Indian J Community Med.* 2011 Dec;36(Suppl 1):S7-S12. doi: 10.4103/0970-0218.94703. PubMed PMID: 22628916; PubMed Central PMCID: PMC3354897 [[PubMed](#)]
20. Iyer U, Elayath N, Desai P. Comparative prevalence of non-communicable diseases in the adult population of Vadodara and Godhra in Gujrat and determinants of diabetes melitus in the population. *International J of Applied Biology and Pharaceutical Technology (IJABPT).* 2011;2(1):346-352.
21. Narayan KM, Ali MK, Koplan JP. Global noncommunicable diseases--where worlds meet. *N Engl J Med.* 2010 Sep 23;363(13):1196-8. doi: 10.1056/NEJMp1002024. Epub 2010 Sep 15. PubMed PMID: 20860499. [[PubMed](#)]
22. Cecchini M, Sassi F, Lauer JA, Lee YY, Guajardo-Barron V, Chisholm D. Tackling of unhealthy diets, physical inactivity, and obesity: health effects and cost-effectiveness. *Lancet.* 2010 Nov 20;376(9754):1775-84. doi: 10.1016/S0140-6736(10)61514-0. Epub 2010 Nov 10. PubMed PMID: 21074255. [[PubMed](#)]
23. Whitaker RC, Wright JA, Pepe MS, Seidel KD, Dietz WH. Predicting obesity in young adulthood from childhood and parental obesity. *N Engl J Med.* 1997 Sep 25;337(13):869-73. PubMed PMID: 9302300. [[PubMed](#)]
24. McCarron P, Smith GD, Okasha M, McEwen J. Blood pressure in young adulthood and mortality from cardiovascular disease. *Lancet.* 2000 Apr 22;355(9213):1430-1. PubMed PMID: 10791531. [[PubMed](#)]
25. Kurpad AV, Swaminathan S, Bhat S. IAP National Task Force for Childhood Prevention of Adult Diseases: the effect of childhood physical activity on prevention of adult diseases. *Indian Pediatr.* 2004 Jan;41(1):37-62. PubMed PMID: 14767086. [[PubMed](#)]
26. Singh AK, Maheshwari A, Sharma N, Anand K. Lifestyle associated risk factors in adolescents. *Indian J Pediatr.* 2006 Oct;73(10):901-6. PubMed PMID: 17090902. [[PubMed](#)]
27. R Sogarwal, D Bachani, Bharath Kumar, Gupta S. Risk Factors of Non-Communicable Diseases among Higher Secondary School Students in Selected Districts of India. *American Journal of Public Health Research.* 2014;2(1):16-20.
28. Gujjarlapudi C, Kasyapa VB, Ravinder A. Risk factors for Non Communicable Diseases (NCD) among High School Students in an Urban Setting. *Age.* 2013;10(11),12. [[Google Scholars](#)]
29. Divakaran B, Muttapillymyalil J, Sreedharan J, Shalini K. Lifestyle riskfactors of noncommunicable diseases: awareness among school children. *Indian J Cancer.* 2010 Jul;47 Suppl 1:9-13. doi: 10.4103/0019-509X.63864. PubMed PMID: 20622407. [[PubMed](#)]
30. NCD Policy Brief: India, The World Bank, South Asia Human Development, Health, Nutrition and Population, February 2011.
31. NPCDCS, Operational Guidelines, Directorate General of Health Services, Ministry of Health & Family welfare, Government of India.
32. Proposal for 12th Five Year Plan for prevention and Control of NCDs, Working Group on Disease Burden: Non-Communicable Diseases (NCDs), Directorate General of Health Services, Ministry of Health & Family Welfare, Govt. of India.
33. NTCP, Directorate General of Health Services, Ministry of Health & Family welfare, Government of India.

Figures

FIGURE 1 PROPORTIONATE NCDs RELATED MORTALITY IN 2008 IN INDIA [13]



Source: WHO NCDs Country Profile 2011

FIGURE 2 PROJECTION OF DISEASE RELATED MORTALITY BY 2030 IN INDIA [15]

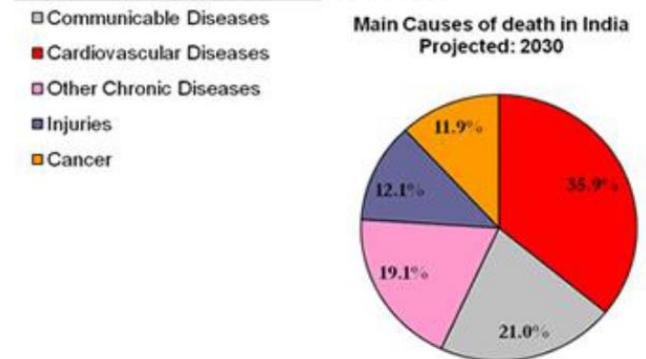


FIGURE 3 SHOWS THE KEY RELATIONS BETWEEN RISK FACTORS AND CHRONIC DISEASES ADDRESSED IN CDP MODEL [WWW.THELANCET.COM VOL. 376 NOVEMBER 20, 2010]

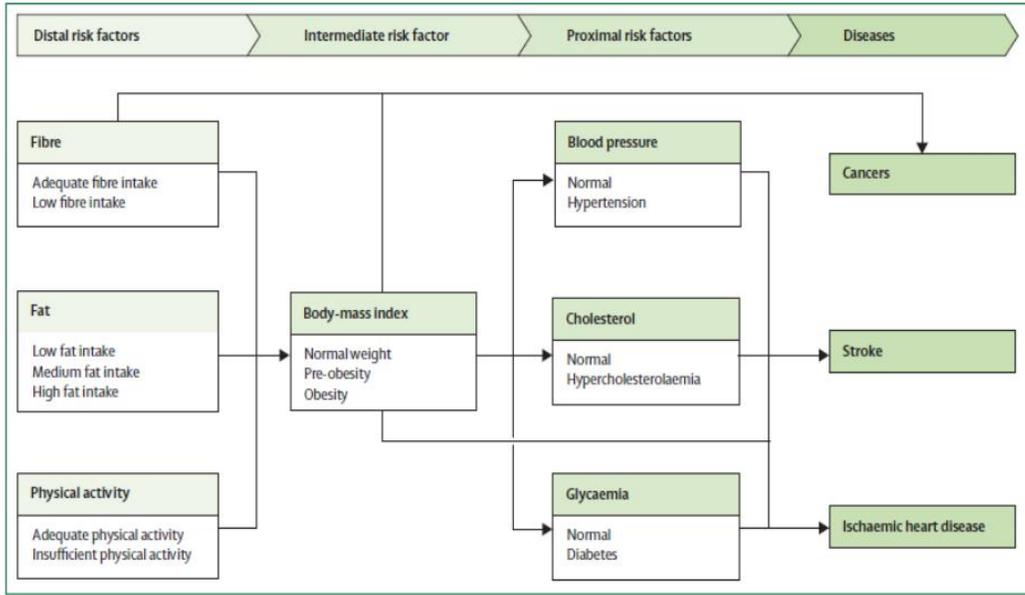


FIGURE 4 PREVENTION, CONTROL AND MANAGEMENT OF NCDs UNDER NPCDCS

