

Trends and Risk Factors in Noncommunicable Diseases: A Comprehensive Review of India's Health Scenario

Anantha Krishnan S.

Sardar Patel Institute of Economic and Social Research, Ahmedabad, Gujarat

Email: ananth0406@gmail.com

Hansa Jain

Sardar Patel Institute of Economic and Social Research, Ahmedabad, Gujarat



Abstract:

Noncommunicable Diseases (NCDs) have become a major public health challenge in India, contributing to approximately 60% of all deaths (IHME, 2022). This study evaluates the trends in the prevalence and mortality of NCDs in India from 2008 to 2021, particularly in the context of the implementation of Sustainable Development Goal 3 (SDG 3), which aims to reduce premature mortality from NCDs by one-third by 2030. Using secondary data from the Global Burden of Disease Study 2021, the study examines the impact of key risk factors- environmental/occupational, behavioural, and metabolic risks- on the rising burden of NCDs. The findings reveal a continued increase in NCD prevalence, particularly cardiovascular diseases, diabetes, chronic respiratory diseases, and mental health disorders. Despite the implementation of national programs like the NPCDCS, which targets NCD prevention and control, the effectiveness of these interventions remains limited. The analysis also reveals that while mortality rates have shown slight improvement, the burden of years lived with disability (YLDs) has significantly increased, indicating that chronic conditions are resulting in prolonged disability, even with improved survival rates. The study underscores the need for more targeted, equitable public health policies and interventions to address the root causes of NCDs, reduce risk factors, and meet the targets of SDG 3.

1. Introduction:

Noncommunicable diseases (NCDs) have emerged as a significant public health challenge globally, accounting for approximately 74% of all deaths worldwide (World Health Organization [WHO], 2022). In India, the burden of NCDs has escalated, with diseases such as cardiovascular disorders, diabetes, chronic respiratory diseases, and cancers contributing to nearly 60% of total fatalities (Institute for Health Metrics and Evaluation [IHME], 2022). This growing crisis is fueled by lifestyle changes, rapid urbanization, and demographic transitions, including an aging population, which collectively strain the healthcare system and undermine economic productivity (Ministry of Health and Family Welfare [MoHFW], 2021).

In recognition of this alarming trend, the United Nations introduced Sustainable Development Goal 3 (SDG 3) in 2015, which includes a target to reduce premature mortality from NCDs by one-third by 2030 through prevention, treatment, and health promotion strategies (United Nations, 2015). In India, this goal aligns with national programs such as the National Programme for the Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases, and Stroke (NPCDCS), designed to enhance the prevention, early detection, and management of NCDs (MoHFW, 2021). Despite these efforts, the prevalence of key NCDs

such as hypertension and diabetes are projected to rise significantly, with an anticipated increase of 17% and 24%, respectively, by 2025 (IHME, 2022).

Lifestyle-related factors such as tobacco use, physical inactivity, unhealthy diets, and excessive alcohol consumption play a central role in driving the NCD epidemic in India (WHO, 2022). Addressing these risk factors requires a multisectoral approach involving policymakers, healthcare providers, and community stakeholders to implement targeted interventions and strengthen health infrastructure. Furthermore, the lack of focus on social, economic, and environmental determinants of health limits the effectiveness of existing programs, necessitating a comprehensive review of policy frameworks and resource allocation strategies. This study aims to critically examine the trends in prevalence and mortality associated with NCDs in India since the adoption of SDG 3. It also evaluates the effectiveness of national programs and explores potential policy interventions to mitigate the growing burden of NCDs. By emphasizing the need for enhanced data collection, innovative partnerships, and equitable healthcare access, the study contributes to the ongoing discourse on sustainable health outcomes and health equity in India.

2. Statement of Problem

Noncommunicable diseases (NCDs) such as cardiovascular disorders, diabetes, chronic respiratory diseases, and cancers have become a pressing public health challenge in India. These diseases now account for approximately 60% of all deaths in the country, placing immense strain on healthcare systems and socio-economic structures. The rise in NCD prevalence has been driven by lifestyle changes, urbanization, and an aging population, which have collectively intensified the healthcare and economic burden. The situation is further compounded by lifestyle and behavioural factors such as tobacco use, poor diet, physical inactivity, and excessive alcohol consumption, which significantly contribute to the increasing prevalence of these diseases. While the Sustainable Development Goals (SDG 3) aim to reduce premature mortality from NCDs by one-third by 2030, achieving this target requires addressing the complex interplay of risk factors and disease burden.

This raises critical research questions that must be addressed to develop effective strategies. What are the trends in the prevalence and mortality rates of NCDs in India since the implementation of SDG 3? How do lifestyle and behavioural factors such as tobacco use, poor dietary habits, and physical inactivity contribute to the escalating prevalence of NCDs? Finally, how effective have policy interventions, including the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases, and Stroke (NPCDCS), been in mitigating the NCD burden and advancing the goals of SDG 3?

3. Objectives of the Study

The broad objective of this study is to assess the trends, risk factors and effectiveness of policy interventions in addressing the rising burden of noncommunicable diseases (NCDs) in India, in alignment with the Sustainable Development Goals (SDG 3), with a focus on achieving a reduction in premature mortality by 2030. Specific objectives are:

1. To examine the trends in prevalence and mortality rates of noncommunicable diseases (NCDs) in India since the implementation of SDG 3.
2. To analyse the contribution of lifestyle and behavioural risk factors, such as tobacco use, poor diet, and physical inactivity, to the prevalence of NCDs.
3. To evaluate the effectiveness of policy interventions, including NPCDCS, in mitigating the burden of NCDs and achieving the targets of SDG 3.

4. Review of Literature

The escalating prevalence of noncommunicable diseases (NCDs) has drawn considerable attention globally, with significant implications for public health and socio-economic development. India, in particular, faces a severe NCD crisis, accounting for nearly 60% of total deaths due to diseases such as cardiovascular disorders, diabetes, respiratory ailments, and cancers (Institute for Health Metrics and Evaluation [IHME], 2022). A critical review of existing literature highlights the multifaceted dimensions of this epidemic, including its risk factors, socio-economic consequences, and the effectiveness of policy responses.

Prevalence and Mortality Trends: The prevalence of NCDs in India has risen sharply over recent decades. Cardiovascular diseases (CVDs) have emerged as the leading cause of death, accounting for 28% of total fatalities in 2020 (Gupta *et al.*, 2020). Similarly, diabetes prevalence among adults increased by 26% from 2000 to 2020, driven by changing lifestyles and urbanization (Mathur *et al.*, 2021). Respiratory diseases and cancers also contribute significantly to the disease burden, with mortality rates reflecting a consistent upward trend. These findings align with global trends, where NCDs account for 74% of deaths worldwide (WHO, 2022). Thakur *et al.* (2020) noted regional disparities in the burden of NCDs, with urban areas reporting higher rates of diabetes and hypertension due to sedentary lifestyles, while rural regions face challenges related to access to healthcare. Such insights highlight the critical need to monitor incidence and mortality trends to inform policy decisions effectively.

Risk Factors and Lifestyle Changes: Lifestyle-related factors such as poor dietary habits, physical inactivity, and substance abuse are key drivers of the NCD epidemic in India. Gopalan *et al.* (2018) emphasized that tobacco use, excessive alcohol consumption, and unhealthy diets significantly elevate the risk of NCDs. Allender *et al.* (2010) linked rapid urbanization to

increased sedentary behaviour, leading to a surge in hypertension and diabetes cases. The WHO (2022) further highlights the role of behavioural risk factors in amplifying disease prevalence, noting that targeted interventions to promote healthy lifestyles are crucial for NCD prevention. Additionally, Tiwari *et al.* (2024) underscored the importance of addressing socio-economic determinants of health, such as poverty and education, to mitigate NCD risks effectively.

Socio-Economic Implications: NCDs pose significant socio-economic challenges by increasing healthcare costs and reducing workforce productivity Huffman and Engelgau (2012) estimated that NCDs cost the Indian economy \$8.7 billion annually, primarily due to premature deaths and reduced labour force participation. Lower-income households are disproportionately affected, as they lack access to affordable healthcare services and preventive measures (MoHFW, 2021). The dual burden of disease and poverty exacerbates existing inequalities, making it imperative to address the socio-economic implications of NCDs. Thakur *et al.* (2020) highlighted the need for enhanced public health financing and equitable healthcare access to alleviate the financial strain on vulnerable populations.

Policy Responses and Effectiveness: India has implemented several initiatives to combat NCDs, including the National Programme for the Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases, and Stroke (NPCDCS). This program focuses on prevention, early diagnosis, and management of NCDs. However, Thakur *et al.* (2020) identified significant gaps in resource allocation and implementation, particularly in rural areas. The integration of Sustainable Development Goal 3 (SDG 3) into national policies reflects India's commitment to reducing premature mortality from NCDs by one-third by 2030 (United Nations, 2015). While progress has been made, Tiwari *et al.* (2024) stressed the importance of adopting a multisectoral approach involving policymakers, healthcare providers, and community stakeholders to enhance the effectiveness of NCD interventions. Enhanced data collection, innovative public-private partnerships, and health education campaigns are essential to bridge existing gaps and achieve the SDG targets (IHME, 2022).

5. Theoretical Framework

The study on the prevalence, risk factors, socio-economic implications, and policy responses to noncommunicable diseases (NCDs) in India draws from several theoretical models and frameworks.

Epidemiological Transition Theory: Omran's (1971) Epidemiological Transition Theory serves as a foundational framework for this study. The theory explains the shift in disease patterns from infectious diseases to chronic and lifestyle-related illnesses, which is characteristic of societies undergoing economic and demographic changes. India is

experiencing this transition, with NCDs now accounting for over 60% of deaths (WHO, 2022). Factors such as urbanization, industrialization, and lifestyle changes have accelerated this shift. This framework provides a lens to analyse the rising burden of NCDs in India, emphasizing the role of modernization and its associated lifestyle changes.

Health Belief Model (HBM): The Health Belief Model (HBM), developed by Rosenstock et al. (1966), is instrumental in understanding individual behaviour concerning NCD risk factors. The model posits that individuals' likelihood of adopting health-promoting behaviours is influenced by their perceived susceptibility, severity, benefits, and barriers, as well as cues to action. For instance, the perceived risk of diabetes may motivate individuals to adopt healthier dietary habits or engage in physical activity (Tiwari *et al.*, 2024). HBM informs the study's analysis of behavioural risk factors such as tobacco use, poor diet, and physical inactivity, highlighting the importance of health education and awareness campaigns in reducing NCD prevalence.

Social Determinants of Health Framework: The Social Determinants of Health Framework by the World Health Organization (WHO, 2008) underscores the impact of socio-economic, cultural, and environmental factors on health outcomes. This framework is crucial for understanding the socio-economic disparities in NCD prevalence and mortality in India. Research indicates that poverty, lack of education, and unequal access to healthcare services exacerbate the NCD burden, particularly among vulnerable populations (Huffman & Engelgau, 2012). Addressing these determinants is vital for designing equitable health interventions.

Multi-Sectoral Action Framework: The Multi-Sectoral Action Framework, advocated by the WHO (2013), emphasizes the need for collaborative approaches to address the NCD epidemic. It highlights the role of various stakeholders, including government, private sectors, and community organizations, in implementing comprehensive policies for prevention, early diagnosis, and management of NCDs. India's National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases, and Stroke (NPCDCS) is an example of applying this framework at a national level (MoHFW, 2021). This study evaluates the effectiveness of such policy initiatives in addressing the rising burden of NCDs.

Sustainable Development Goals (SDG) Framework: The study also integrates the Sustainable Development Goals (SDG) Framework, particularly SDG 3, which aims to reduce premature mortality from NCDs by one-third by 2030 through prevention and treatment (United Nations, 2015). This framework provides a global perspective on tackling NCDs and serves as a benchmark for India's progress in achieving health equity.

6. Conceptual Framework

The conceptual framework for this study is designed to explore the prevalence of noncommunicable diseases (NCDs) in India, their risk factors, socio-economic implications, and policy responses. It integrates multiple dimensions of NCD epidemiology, addressing the study's objectives through key constructs and their interconnections.

Risk Factors → Prevalence: Behavioural and lifestyle factors such as tobacco use and poor diets lead to higher NCD prevalence. This relationship is amplified by socio-economic determinants like poverty and lack of education.

Policy Interventions → Prevalence and Impact: Effective policies targeting prevention, early diagnosis, and management can mitigate both NCD prevalence and its socio-economic consequences. Programs like NPCDCS and alignment with SDG 3 emphasize this relationship.

Feedback Mechanism: Improved health outcomes (reduced NCD prevalence) can positively impact socio-economic conditions, creating a virtuous cycle of health and development.

Figure 1: Conceptual Framework



Source: Estimated by Author

7. Data and Methodology

This study relies exclusively on secondary data obtained from the Global Burden of Disease Study 2021 (GBD 2021), which provides comprehensive information on the prevalence, incidence, and mortality rates of noncommunicable diseases (NCDs) from 2000 to 2021. The

GBD dataset includes valuable health metrics for major NCDs such as cardiovascular diseases, diabetes, chronic respiratory diseases, and cancers, across different age groups, sexes, and geographical regions, including India. The data is analysed to identify trends in the prevalence and mortality rates of NCDs over the past two decades, with a specific focus on India.

Descriptive analysis is used to summarize and present the trends in NCD prevalence and mortality in India. Measures such as mean, median, standard deviation, and range are applied to describe the distribution of data across different years and disease categories. Graphical representations such as line charts and bar graphs visually depict trends in NCDs from 2000 to 2021. Given the longitudinal nature of the data, time series analysis is employed to examine trends in NCD prevalence and mortality rates over the 2000-2021 period. Time series models, such as the following equation, help forecast future trends in these rates:

$$Y_t = \beta_0 + \beta_1 t + \epsilon_t$$

This model is used to identify whether the trends show a significant change in NCD prevalence or mortality after the adoption of Sustainable Development Goal 3 (SDG 3) in 2015. To evaluate the effectiveness of policy interventions such as the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases, and Stroke (NPCDCS), the study applies a difference-in-differences (DiD) approach. This method compares trends in NCD prevalence before and after the implementation of SDG 3, across regions with and without the intervention. The DiD model is expressed as:

$$Y_{it} = \alpha + \gamma t + \delta X_{it} + \beta D_{it} + \epsilon_{it}$$

Where Y_{it} represents the outcome variable (NCD prevalence) for region i at time t , and D_{it} is a dummy variable indicating the presence of the intervention. This model helps determine whether the implementation of SDG 3 and the NPCDCS intervention has had a measurable effect on the prevalence of NCDs in the post-intervention period.

8. Result and Discussions

Trends in Prevalence and Mortality of Noncommunicable Diseases in India Pre and Post-SDG 3 Implementation

Sustainable Development Goal 3 (SDG 3) was adopted in 2015 as part of the United Nations 2030 Agenda for Sustainable Development. The goal focuses on ensuring healthy lives and promoting well-being for all at all ages, with specific targets such as reducing premature mortality from noncommunicable diseases (NCDs) by one-third by 2030 through prevention and treatment.

The analysis of trends in Disability-Adjusted Life Years (DALYs), mortality, and Years Lived with Disability (YLDs) for non-communicable diseases (NCDs) in India between 2008

and 2021 reveals critical insights into the evolving burden of NCDs. The data is divided into two periods: pre-SDG 3 implementation (2008–2014) and post-SDG 3 implementation (2015–2021), allowing for a comparative evaluation of the impact of Sustainable Development Goal 3 interventions. During the pre-SDG 3 implementation period, DALYs, representing the overall burden of disease, averaged 19,111.45 per 100,000 population and grew at an average annual rate of 0.67%. This increase indicates a steady rise in the burden of NCDs, driven by the increasing prevalence and severity of chronic illnesses. Mortality rates averaged 403.14 per 100,000 during this time, with an annual growth rate of 1.93%. The rising mortality rates suggest inadequate early detection and management of NCDs. Similarly, YLDs averaged 7,802.15 per 100,000, with an annual growth rate of 0.87%, reflecting the growing impact of chronic conditions on long-term disability. In the post-SDG 3 implementation period, DALYs rose to an average of 20,082.95 per 100,000, with a marginally reduced annual growth rate of 0.66%. This slight deceleration suggests the initial effects of health interventions under SDG 3, focusing on NCD prevention and management. Mortality rates averaged 447.6 per 100,000, with a slower annual growth rate of 0.79%, signaling incremental progress in reducing fatal outcomes. However, YLDs surged to an average of 8,318.58 per 100,000, with an annual growth rate of 1.07%. This highlights a persistent challenge in managing the long-term disability burden associated with chronic diseases, despite improvements in reducing mortality.

Table 1: Trends in Disability-Adjusted Life Years, Mortality, and Years Lived with Disability for Non-Communicable Diseases in India (2008-2021) in per 100,000

Period	Year	DALYs (Disability-Adjusted Life Years)		Mortality		YLDs (Years Lived with Disability)	
		Per 100,000	Percent Change	Per 100,000	Percent Change	Per 100,000	Percent Change
Pre-SDG 3 Implementation	2008	18810.4	0.8	386.5	1.94	7607.14	0.62
	2009	18741.9	-0.36	383.58	-0.75	7657.58	0.66
	2010	18858.4	0.62	389.02	1.42	7713.34	0.73
	2011	19077.5	1.16	399.33	2.65	7783.63	0.91
	2012	19276.8	1.04	408	2.17	7866.54	1.07
	2013	19464.4	0.97	422.49	3.55	7952.92	1.1
	2014	19550.9	0.44	433.06	2.5	8033.93	1.02
	Average	19111.45	0.67	403.14	1.93	7802.15	0.87
Post-SDG 3 Implementation	2015	19619.3	0.35	431.24	-0.42	8104.42	0.88
	2016	19738.3	0.61	433.61	0.55	8158.13	0.66
	2017	19922.4	0.93	441.07	1.72	8200.32	0.52
	2018	20140.6	1.1	451.95	2.47	8245.53	0.55
	2019	20264.8	0.62	458.97	1.55	8310.17	0.78
	2020	20429.6	0.81	458.85	-0.03	8557.49	2.98

	2021	20465.7	0.18	457.51	-0.29	8654	1.13
	Average	20082.95	0.657143	447.6	0.792857	8318.58	1.071429

Source: *Global Burden of Disease Collaborative Network, Global Burden of Disease Study 2021 (GBD 2021) Results, Seattle, United States: Institute for Health Metrics and Evaluation (IHME), 2022.*

Table 2: Comparison of Non-Communicable Disease (NCD) Indicators Before and After

Indicator	Period	Average	Std. Deviation	Std. Error Mean
DALYs	Pre SDG 3	19111.4714	325.93860	123.19321
	Post SDG 3	20082.9571	332.31210	125.60217
Deaths	Pre SDG 3	403.1400	19.00273	7.18236
	Post SDG 3	447.6000	12.10358	4.57473
YLDs	Pre SDG 3	7802.1543	156.92845	59.31338
	Post SDG 3	8318.5800	208.40095	78.76815
Independent Sample t-test*		t (12) = -5.522, p=0.000		

Note: *Equal variances assumed; Kolmogorov-Smirnova: - DALYs.107 (.200); Deaths .155 (.200) YLDs 0.091 (.200); (t-test applied in this analysis is appropriate, as the data for DALYs, Deaths, and YLDs is normally distributed, confirmed by the normality tests- Kolmogorov-Smirnov and Shapiro-Wilk). Source: *Estimated from Global Burden of Disease Collaborative Network, Global Burden of Disease Study 2021 (GBD 2021)*

Table 2 presents a comparison of three key Non-Communicable Disease (NCD) indicators-Disability-Adjusted Life Years (DALYs), Deaths, and Years Lived with Disability (YLDs)-before and after the implementation of SDG 3. For DALYs, the average value increased from 19,111.47 before SDG 3 to 20,082.96 after SDG 3, suggesting an increase in the burden of disease due to non-communicable diseases during this period. This increase is accompanied by slight rises in both the standard deviation and standard error mean, indicating some variability in the data. While SDG 3 aimed to reduce the burden of NCDs, the data shows a growing burden, which may point to challenges in the actual implementation of the goal. Similarly, Deaths from NCDs rose from 403.14 before SDG 3 to 447.60 after SDG 3, further supporting the notion that NCD mortality has increased post-SDG 3. Interestingly, the standard deviation and standard error for deaths decreased post-SDG 3, suggesting that the data became less variable over time, but this did not translate into a reduction in deaths. The consistent rise in deaths indicates that NCDs continue to be a significant public health challenge, even with SDG 3's efforts. For YLDs, which measure the number of years lived with disabilities due to NCDs, the average increased from 7,802.15 before SDG 3 to 8,318.58 after SDG 3. This indicates an increase in the number of years lived with disability due to NCDs, which is concerning in the context of SDG 3's objectives. The standard deviation and standard error both increased after the SDG 3 period, suggesting more variability in the data post-implementation,

further emphasizing the growing challenges in reducing NCD-related disabilities. The Independent Sample t-test results show a t-value of -5.522 and a p-value of 0.000, which is below the significance level of 0.05. This indicates that the observed differences in DALYs, Deaths, and YLDs before and after SDG 3 implementation are statistically significant. In other words, the increases in these indicators are unlikely to have occurred by chance, but the rise in NCD burden raises concerns about the effectiveness of SDG 3 in achieving its objectives. The increase in DALYs, Deaths, and YLDs despite the implementation of SDG 3 raises important questions about its effectiveness in addressing the NCD crisis. While SDG 3 is designed to reduce the burden of non-communicable diseases, the data suggests that the burden has continued to rise, which could be attributed to several factors. First, there may have been challenges in the effective implementation of SDG 3, such as inadequate healthcare infrastructure, limited access to prevention and treatment services, or insufficient policy measures to address NCDs. Second, the global rise in NCD rates could be driven by broader factors like lifestyle changes, an aging population, and environmental influences, which may not be fully addressed by SDG 3 alone. Moreover, the increasing standard deviations and standard errors in some of the indicators suggest variability in the data, indicating that the effects of SDG 3 might not have been evenly distributed across different years. This could imply that while SDG 3 has had some impact, it may not have been sufficient to curb the rising burden of NCDs.

Table 3: Chow Breakpoint Test for Structural Change in NCD Indicators Post-SDG 3 Implementation in India (2015)

DALYs	F-statistic	0.462839	Prob. F(1,12)	0.6423
	Log likelihood ratio	1.239429	Prob. Chi-Square(1)	0.5381
	Wald Statistic	0.925677	Prob. Chi-Square(1)	0.6295
Deaths	F-statistic	2.784199	Prob. F(1,12)	0.1093
	Log likelihood ratio	6.197213	Prob. Chi-Square(1)	0.0451
	Wald Statistic	5.568399	Prob. Chi-Square(1)	0.0618
YLDs	F-statistic	1.371802	Prob. F(1,12)	0.2975
	Log likelihood ratio	3.394222	Prob. Chi-Square(1)	0.1832
	Wald Statistic	2.743605	Prob. Chi-Square(1)	0.2536

Note: Null Hypothesis: No breaks at specified breakpoints (2015); Source: Source: Estimated from Global Burden of Disease Collaborative Network, Global Burden of Disease Study 2021 (GBD 2021)

Table 3 presents the results of the Chow Breakpoint Test for structural changes in the indicators of Non-Communicable Diseases (NCDs) in India post-SDG 3 implementation in 2015. The Chow Breakpoint Test results for Non-Communicable Diseases (NCDs) indicators in India post-SDG 3 implementation in 2015 indicate mixed findings. For Disability-Adjusted Life Years (DALYs) and Years Lived with Disability (YLDs), there is no significant structural

change, as all p-values are above the 0.05 threshold, suggesting that SDG 3 had no immediate effect on these indicators. However, for deaths, the Log Likelihood Ratio and Wald Statistic show a slight indication of a structural change, with p-values approaching significance at the 10% level, though not conclusively at the 5% level. Overall, the test suggests that the impact of SDG 3 on NCD indicators in India has been limited or gradual.

Table 4: Cause wise Analysis of NCD Indicators (DALYs, Deaths, and YLDs) Per 100,000 Population for 2015 and 2021

Cause Name	2015			2021		
	DALYs	Deaths	YLDs	DALYs	Deaths	YLDs
Cardiovascular diseases	4977.15	189.37	222.03	5264.94	203.13	243.51
Chronic respiratory diseases	2172.33	91.62	339.44	2260.51	94.19	354.95
Diabetes and kidney diseases	1215.95	30.33	457.03	1425.23	35.85	539.47
Digestive diseases	1360.58	34.80	180.63	1245.86	31.98	187.10
Mental disorders	1736.19	0.00	1736.18	1971.95	0.00	1971.93
Musculoskeletal disorders	1732.74	1.59	1699.27	1843.74	1.77	1806.54
Neoplasms	1680.07	53.23	28.38	1847.41	60.44	33.75
Neurological disorders	1059.81	13.27	760.12	1102.65	14.85	798.50
Other non-communicable diseases	1865.68	13.65	993.49	1632.93	11.62	984.21
Sense organ diseases	1041.84	0.00	1041.84	1114.91		1114.91
Skin and subcutaneous diseases	520.19	1.40	471.70	484.43	1.46	439.03
Substance use disorders	256.78	1.99	174.30	271.11	2.22	180.10

Source: Estimated from Global Burden of Disease Collaborative Network, Global Burden of Disease Study 2021 (GBD 2021)

Table 4 presents a cause-wise analysis of Non-Communicable Disease (NCD) indicators—DALYs, deaths, and YLDs—per 100,000 population for 2015 and 2021, highlighting the ongoing burden of NCDs in India. Cardiovascular diseases remain the leading cause, with an increase in DALYs, deaths, and YLDs between 2015 and 2021, reflecting the continuing challenge in managing heart-related conditions. Chronic respiratory diseases show a modest rise in DALYs and YLDs, while deaths remain relatively stable, suggesting improvements in disease management but ongoing challenges. Diabetes and kidney diseases see a significant increase in DALYs and YLDs, pointing to a growing prevalence of lifestyle-related health issues. Mental disorders show a sharp rise in DALYs and YLDs, though deaths

remain at zero, emphasizing the growing impact of mental health on the population's well-being. Other conditions, such as musculoskeletal disorders and cancers, also show increases in DALYs and YLDs, indicating a rising burden on health systems. The data reflects a concerning trend in the prevalence of NCDs, aligning with the need for stronger implementation of SDG 3, which focuses on ensuring good health and well-being for all. Although some progress is evident, particularly in managing mortality, the increasing disability burden highlights the need for more targeted interventions, lifestyle changes, and better healthcare infrastructure to meet SDG 3's targets.

Risk Factors Contributing to NCDs

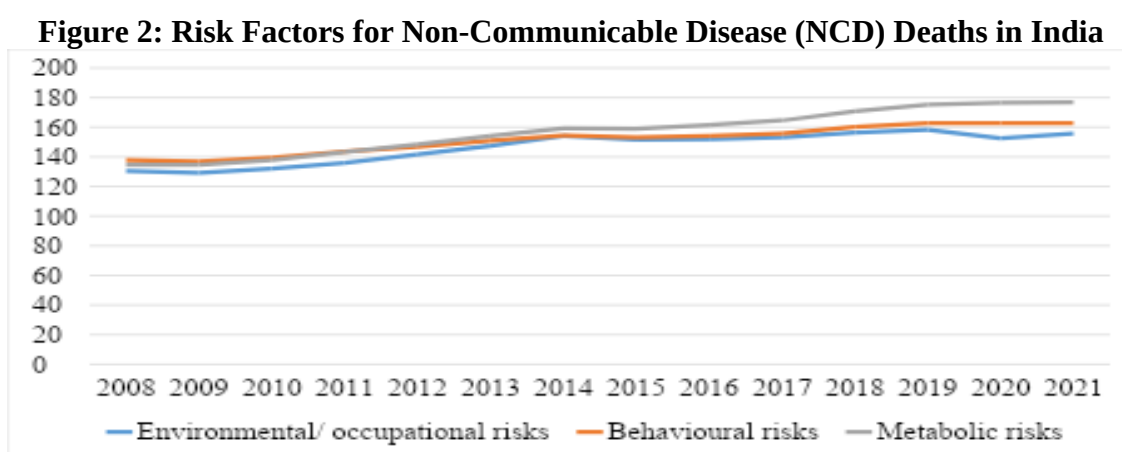
Table 5: Risk Factors for Non-Communicable Disease (NCD) Deaths in India

Year	Environmental/ occupational risks		Behavioural risks		Metabolic risks	
	Per 100,000	Percentage Change	Per 100,000	Percentage Change	Per 100,000	Percentage Change
2008	130.36		137.7		134.62	
2009	129.14	-0.94	136.89	-0.59	134.62	0.00
2010	132.04	2.25	139.39	1.83	137.78	2.35
2011	135.9	2.92	143.58	3.01	143.23	3.96
2012	141.53	4.14	146.75	2.21	148.26	3.51
2013	147.52	4.23	150.95	2.86	154.1	3.94
2014	154.07	4.44	154.55	2.38	159.1	3.24
2015	151.45	-1.70	153.06	-0.96	158.77	-0.21
2016	152.01	0.37	154.09	0.67	161.58	1.77
2017	153.29	0.84	155.7	1.04	164.53	1.83
2018	156.43	2.05	160.18	2.88	170.68	3.74
2019	158.35	1.23	162.67	1.55	175.29	2.70
2020	152.4	-3.76	162.72	0.03	176.65	0.78
2021	155.6	2.10	162.68	-0.02	176.96	0.18

Source: *Global Burden of Disease Collaborative Network, Global Burden of Disease Study 2021 (GBD 2021) Results, Seattle, United States: Institute for Health Metrics and Evaluation (IHME), 2022.*

Table 5 presents data on the risk factors contributing to Non-Communicable Disease (NCD) deaths in India from 2008 to 2021, categorized into environmental/occupational risks, behavioural risks, and metabolic risks, with corresponding annual percentage changes. Environmental/occupational risks show a steady increase in death rates over the years, with a notable rise in 2018 and 2019, but a decrease in 2020, likely due to the COVID-19 pandemic and its impact on industrial activities. Behavioural risks, including factors like tobacco use, alcohol consumption, and poor dietary habits, follow a similar upward trend with a small dip in 2020 and 2021, reflecting fluctuations in lifestyle-related health issues. Metabolic risks, linked to conditions such as obesity, diabetes, and hypertension, show a consistent increase in

deaths per 100,000, indicating a growing burden of these risk factors on the Indian population. Overall, while there are slight variations from year to year, all three categories demonstrate a persistent upward trend, highlighting the increasing role of these risk factors in NCD-related mortality (Figure 2). This underlines the urgent need for preventive measures and public health interventions to reduce these risk factors, aligning with the goals of SDG 3 for improving health and well-being in India.



Source: Global Burden of Disease Collaborative Network, Global Burden of Disease Study 2021 (GBD 2021) Results, Seattle, United States: Institute for Health Metrics and Evaluation (IHME), 2022.

Table 6: Comparison of Risk Factors for Non-Communicable Disease (NCD) Deaths in India Before and After SDG 3 Implementation

Risk Factor	Period	Average	Std. Deviation	Std. Error Mean
Environmental/occupational risks	Pre SDG 3	138.6514	9.44428	3.56960
	Post SDG 3	154.2186	2.60063	.98295
Behavioural risks	Pre SDG 3	144.2586	6.81139	2.57446
	Post SDG 3	158.7286	4.32065	1.63305
Metabolic risks	Pre SDG 3	144.5300	9.67343	3.65621
	Post SDG 3	169.2086	7.56809	2.86047
Independent Sample t-test*		t (12) = -4.205, p=0.001		

Note: *Equal variances assumed; Kolmogorov-Smirnova: - Environmental/ occupational risks .106 (.158); Behavioural risks .138 (.200) Metabolic risks 0.121 (.200); (t-test applied in this analysis is appropriate, as the data for DALYs, Deaths, and YLDs is normally distributed, confirmed by the normality tests- Kolmogorov-Smirnov and Shapiro-Wilk). Source: Estimated from Global Burden of Disease Collaborative Network, Global Burden of Disease Study 2021 (GBD 2021)

Table 6 presents a comparison of risk factors for Non-Communicable Disease (NCD) deaths in India before and after the implementation of SDG 3, with a focus on environmental/occupational, behavioural, and metabolic risks. The average values for each risk factor show a noticeable increase after the implementation of SDG 3. For environmental/occupational risks, the average increased from 138.65 before SDG 3 to 154.22

post-SDG 3. Similarly, behavioural risks rose from an average of 144.26 to 158.73, and metabolic risks increased from 144.53 to 169.21. The standard deviations indicate some variability in these risks, with post-SDG 3 periods showing smaller variability, especially for environmental/occupational and behavioural risks, which suggests a more concentrated trend in the post-SDG period. The independent sample t-test confirms that these changes are statistically significant, with a t-value of -4.205 and a p-value of 0.001, which indicates that the difference between the pre- and post-SDG periods is unlikely to have occurred by chance. The significant increase in risk factors post-SDG 3, despite the policy focus on NCDs, suggests that while there has been policy implementation aimed at addressing these risks, there might be underlying challenges, such as increased exposure to environmental/occupational risks or worsening behavioural and metabolic trends. These results highlight the need for more effective and comprehensive interventions to reduce these risks, particularly in light of India's ongoing efforts to meet the targets of SDG 3.

The analysis of Non-Communicable Diseases (NCDs) in India, based on the data from the Global Burden of Disease Study 2021, highlights the crucial relationship between risk factors, disease prevalence, and the effectiveness of policy interventions. Behavioural and lifestyle risk factors, including tobacco use, poor dietary habits, and physical inactivity, continue to drive the rising prevalence of NCDs such as cardiovascular diseases, diabetes, and chronic respiratory disorders. These factors, combined with metabolic risks like hypertension and obesity, significantly contribute to the burden of diseases in India.

In terms of policy interventions, India's initiatives such as the National Program for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases, and Stroke (NPCDCS), have targeted key areas of NCD prevention, early diagnosis, and management. Despite the focus on these preventative measures, the data reveals that the effectiveness of these policies has been mixed. While there is a slight improvement in reducing some of the risk factors, as indicated by marginal reductions in certain NCD indicators, challenges persist in reaching the broader population, especially in rural and economically disadvantaged areas. The alignment of India's policies with SDG 3 further emphasizes the importance of reducing premature mortality from NCDs. However, there is a clear need for more comprehensive and integrated approaches that address the root causes of NCDs, beyond healthcare interventions alone.

The feedback mechanism embedded in the conceptual framework suggests that the successful reduction of NCD prevalence through effective policy implementation can lead to better socio-economic conditions. As NCD rates decline, there is potential for improved workforce participation, productivity, and overall economic development. This in turn can lead

to better access to healthcare, improved education, and reduced poverty. However, the analysis also shows that the current pace of NCD reduction is slow, and socio-economic disparities remain a significant challenge in achieving these health and development outcomes. In order to strengthen this virtuous cycle, policies need to be more targeted, equitable, and address the socio-economic conditions that disproportionately affect vulnerable populations. Only with sustained efforts in both healthcare and socio-economic development can India achieve the health and socio-economic benefits envisioned in SDG 3.

9. Conclusion

The study aimed to examine the trends in the prevalence and mortality of Non-Communicable Diseases (NCDs) in India following the implementation of Sustainable Development Goal 3 (SDG 3), which seeks to reduce premature mortality from NCDs by one-third by 2030. Despite the efforts of national programs like the NPCDCS, the findings reveal that the burden of NCDs has continued to rise in India, with an increasing number of years lived with disability (YLDs). While there has been some progress in reducing mortality rates and slowing the growth of Disability-Adjusted Life Years (DALYs), the overall burden of NCDs remains significant, suggesting that the effectiveness of SDG 3 in curbing these diseases is still limited. The analysis also highlighted that the primary risk factors—environmental/occupational, behavioural, and metabolic risks—have all shown upward trends post-SDG 3 implementation, signaling a growing burden of chronic diseases. The rising incidence of cardiovascular diseases, diabetes, chronic respiratory diseases, and mental disorders underscores the persistent challenges in managing these conditions despite policy interventions. One key finding from the study is the growing intensity of risk factors, particularly in rural areas, where healthcare infrastructure remains inadequate. This suggests that although national programs like the NPCDCS have made strides, they face significant challenges in reaching vulnerable populations. The slow reduction in NCD prevalence further hampers the achievement of SDG 3's socio-economic objectives, such as enhanced workforce participation and productivity. So, the study emphasizes the need for more comprehensive, targeted, and equitable health interventions. To achieve the ambitious targets of SDG 3, India must adopt a multisectoral approach, addressing the root causes of NCDs through better healthcare access, health education, and policies that reduce socio-economic disparities. Only by integrating these efforts can India effectively reduce the growing burden of NCDs and improve the overall health and well-being of its population.

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