World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(RESEARCH ARTICLE)

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Comparing leading causes of mortality from 2011 to 2021 in India

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World Journal of Advanced Research and Reviews, 2025, 26(03), 001–006

Publication history: Received on 10 February 2025; revised on 29 May 2025; accepted on 01 June 2025

Article DOI: https://doi.org/10.30574/wjarr.2025.26.3.0873

Abstract

Introduction: The ranking lists used by most countries (1) for leading causes of deaths (CODs) comprise broad category such as communicable; non-communicable and injuries. To provide specific information; the World Health Organization (WHO) and the institute of Health Metrics and Evaluation (IHME) proposed lists that splitting broad categories into specific categories. We examined the changes in ranking of leading causes of deaths in India 2011 and 2021 between WHO and IHME data. The objectives of this study are 1. To discuss and compare the top 10 causes of death in India in 2011 and 2021 based on data from WHO and IHME 2. To evaluate the trends in crude death rates for top 10 causes of death identified by WHO between 2011 and 2021 3. To assess the changes in Disability-Adjusted Life Years (DALYs) for the top 10 causes of deaths according to WHO data from 2011-2021. The aim of this study is to provide the shift of number of deaths from 2011 to 2021 (a decade) in India.

Methods: The data was obtained from WHO and IHME regarding the top 10 leading causes of deaths in India as well as changes in deaths per 100;000 population between 2011 and 2021. collected the number of deaths from the top 10 causes of death listed by the world health organization for the year of 2011 and 2021 then calculate the Crude death rate for the data and compared those data and collect the DALY of top 10 causes of death for the year of 2011 and 2021 then compute the absolute change and percentage

Results: In both WHO and IHME data; the top seven causes of death in India remained consistent between 2011 and 2021; with COVID-19 emerging as the leading cause in 2021. Non-communicable diseases such as ischemic heart disease; COPD; stroke; and diabetes showed an increase in crude death rates 8.95 to 11.09; 5.94 to 7.05; 4.52 to 5.35; 1.58 to 2.31 respectively and Disability adjusted life years increase over 1.03 million; 5.58 million; 4.41 million; and 5.33 million respectively over the decade. In contrast; communicable diseases like diarrheal diseases; tuberculosis; and lower respiratory infections exhibited a significant decline. COVID-19 contributed the largest DALY increase in 2021; reflecting its severe impact. Overall; non-communicable diseases saw a rise; while communicable diseases decreased in both crude death rates and DALYs.

Conclusion: This study compared the leading causes of death in india between 2011 and 2021; based on WHO and IHME data; focusing on changes in crude death rates and DALYs for the top 10 causes. This revels the transition of the disease burden of non-communicable disease and injury dominating the communicable diseases. Ischemic heart disease; chronic obstructive pulmonary disease (COPD); and stroke have become the most significant contributors to mortality; reflecting the rising prevalence of lifestyle-related risk factors. In contrast; communicable diseases like tuberculosis and diarrheal diseases have shown a significant decline. These findings call for intensified public health efforts focused on NCD prevention; along with policies aimed at mitigating the effects of emerging health crises like COVID-19.

Keywords: Causes of death; WHO; IHME; Crude Death rate; DALY

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1. Introduction

The ranking of leading causes of death (CODs) are highly cited health statistics by media and health related advocacy organizations to illustrate the relative important of various health issues. Organizations such as WHO, IHME/GHD releases publish ranking of 10 leading CODs each year. The ranking lists encompass general categories like communicable, non-communicable and injuries (1). To provide more specific information for health policy decision making and planning, the World Health Organization (WHO) and the Institute of Health Metrics and Evaluation (IHME) proposed that the broad categories in the ranking list should be divided into more specific categories (1).

A combination of modifiable and non-modifiable risk factors is shared by communicable disease, non-communicable disease, and injuries. lifestyle choices including physical inactivity, unhealthy eating, alcohol consumption, smoking, and exposure to environmental hazards like are modifiable. On the other hand, characteristics like age, gender, family history and socioeconomic status are non- modifiable. While, diseases like obesity, hypertension, and high blood cholesterol significantly impact on NCDs (2) (3) (4) (5) (6) (7).

For communicable disease, poor hygiene, malnutrition, limited access to healthcare are important risk factors. Aging and physical weakness and cognitive decline, which have an impact on injuries like falls (8) (9) (10) (11) (12).

India, the most populated country in the world has been severely impacted by the covid-19 since its emergence. It affects people of all ages; however, the risk of serious infection increases with advancing age, pre-existing co-morbidities like diabetes, asthma and cardiovascular diseases (13).

The COVID-19 pandemic has significantly affected global health, reversing steady progress in life expectancy over the past two decades. Prior to the pandemic, global life expectancy rose consistently, from 66.8 years in 2000 to 73.1 years in 2019, reflecting years of improvements in health and related areas. COVID-19 swiftly reversed this positive trend, with global life expectancy plummeting to 71.4 years by 2021, back to the level of 2012. Before pandemic, NCDs had been steadily increasing as the leading cause of death. The share of communicable diseases dropped from 32.2% in 2000 to 18.2% in 2019. As COVID-19 emerged, the share of deaths due to communicable diseases jumped back to the 2005 level (28.1 per cent) in 2021. COVID-19 ranked among the top 3 leading COD globally as well as india 2021(14).

India's disease transition says india is undergoing a disease transition with a growing burden of NCDs are emerging leading cause of death (15). NCD's and Injuries together seize infectious diseases. The major non-communicable disease categories to the total disease burden have increased since 1990. These include cardiovascular diseases, diabetes, chronic respiratory disease, mental health, and neurological disorders, musculoskeletal disorders, cancer, and chronic kidney disease (16).

The ranking of leading CODs is cited broadly in health statistics to highlight the situation of health status. Many countries like india have experienced a significant epidemiological disease transition over the past decade, that escalating the burden of non-communicable and injuries over communicable diseases. This switch is conspicuous in the World Health Organization (WHO) and Institute of Health Metrics and Evaluation (IHME) data. To provide more understanding of this shift, we compare the leading causes of deaths in india from 2011 to 2021 using Who and IHME and to capture the disease burden in india, we calculate the crude death rate and changes in DALY. The aim of this analysis is to provide more understanding of the shifts in CD, NCD, and Injuries in india.

2. Methods

The data was obtained from World Health Organization (WHO) and The Institute of Health Metrics and Evaluation (IHME) regarding the top 10 leading causes of deaths in India as well as changes in deaths per 100,000 population between 2011 and 2021. The number of deaths from the top 10 causes of death listed by the world health organization for the year of 2011 and 2021 then calculate the Crude death rate.

Crude death rate was calculated using this formula:

$$\text{Crude death rate (per 10,000 population)} = \frac{Number\ of\ deaths}{Estimated\ midyear\ population} x\ 10{,}000$$

Absolute change and percentage change of DALYs were calculated for top 10 causes of death for the year of 2011 and 2021.

3. Results

Table 1 Top 10 causes of deaths per 100k in 2021 and rate change 2011–2021 IHME

Causes of deaths	2011 rank	2021 rank	Change in deaths per 100k 2011-2021	Causes of deaths	2011 rank	2021 rank	Change in deaths per 100k 2011-2021
COVID-19	-	1	117.8	COVID-19	-	1	221.26
Ischemic heart disease	1	2	20.5	Ischaemic heart disease	1	2	21.31
COPD	2	3	10.5	COPD	2	3	11.1
Stroke	4	4	6.3	Stroke	4	4	8.23
Diarrheal diseases	3	5	-25	Diarrhoeal diseases	3	5	-20.95
Lower respiratory infect	6	6	-10.7	Lower respiratory infections	6	6	-9.79
Tuberculosis	7	7	-9.9	Tuberculosis	5	7	-18.11
Neonatal disorders	5	8	-19.4	Diabetes mellitus	-	8	7.3
Diabetes	10	9	6.6	Cirrhosis of the liver	8	9	-2.14
Cirrhosis liver	8	10	-1.7	Falls	-	10	2.64

Top 10 causes of deaths in 2021 have shifted significantly compared to 2011, reflecting disease burden and impact of emerging global health crises like covid-19. According to IHME dataset there were totally 1.4 billion population. While comparing IHME and WHO India data the first leading seven causes of deaths were one and the same. In IHME the 8th leading CODs was neonatal disorder. Diabetes mellitus was the 9th and 8th leading CODs in IHME and WHO accordingly. Cirrhosis liver was the 10th and 9th leading CODs in IHME and WHO respectively and the 10th leading CODs in WHO was falls.

The changes in deaths per 100 000 population between 2011-2021 for those non- communicable diseases covid-19 (IHME=117.8 and WHO=221.26), IHD (IHME=20.5 and WHO=21.31), COPD (IHME=10.5 and WHO=11.1), Stroke (IHME=6.3 WHO=8.23), diabetes (IHME=6.6 and WHO=7.3), cirrhosis liver (IHME=-1.7 and WHO= -2.14). communicable diseases diarrheal diseases (IHME=-25 and WHO=-20.95), lower respiratory infection (IHME=-10.7 and WHO=-9.79), neonatal disorder (IHME=-19.4), Tuberculosis (IHME=-9.9 and WHO=-18.11) and for injuries (WHO= 2.64). Overall conclusion from this comparison of both the WHO and IHME reflect trends, particularly of non-communicable diseases and the downturn of infectious diseases.

Table 2 Comparison of Top 10 Causes of Death in India 2011 – 2021 Crude Death Rate

Causes of death	Crude death rate 2011 per 10000 population	Crude death rate 2021 per 10000 population
COVID-19	0.00	22.13
Ischaemic heart disease	8.95	11.09
Chronic obstructive pulmonary disease	5.94	7.05
Stroke	4.52	5.35
Diarrhoeal diseases	5.52	3.43
Lower respiratory infections	3.75	2.77
Tuberculosis	4.36	2.54
Diabetes mellitus	1.58	2.31
Cirrhosis of the liver	2.10	1.89
Falls	1.39	1.65

TABLE 2 Represents a comparison of the Crude Death Rate (CDR) for leading top 10 causes of deaths in india between 2011-2021. Covid-19 2011-0.00 and 2021-22.13 per 1,0000 population because covid-19 was doesn't exist in 2011, in 2021 covid-19 was a pandemic disease in 2021 which cause the greatest number of deaths in a short life span.

Ischaemic heart disease 2011-8.95 and 2021-11.09 per 1,0000 population, the increase of 2.14 crude death rate shows the deaths are more due to IHD over a decade.

Chronic obstructive pulmonary disease (COPD) 2011-5.95 and CDR 2021-7.05 per 1,0000 population. There was an increase in deaths due to COPD.

Stroke 2011-4.52 and 2021-5.35 per 1,0000 population, the increase of shows there was more deaths due to stroke in 2021 than 2011.

Diarrheal disease 2011-5.52 and 2021-3.43 per 1,0000 population, there was a significant decline in shows the deaths are decreased over a decade.

Lower respiratory infection 2011-3.75 and 2021-2.77 per 1,0000 population, the decline in represents the deaths in 2021 are decreased compared to 2011.

Tuberculosis 2011- 4.36 and 2021-2.54 per 1,0000 population, this shows there was a notable downturn due to tuberculosis.

Diabetes mellitus 2011-1.58 and 2021-2.31 per 1,0000 population, the increase CDR from 1.58- 2.31 highlighting more deaths happened in 2021 due to DM compared to 2011.

Cirrhosis of the liver 2011-2.10 and 2021-1.89 per 1,0000 population, there is a modest decline in crude death rate shows improvement in deaths from 2011 to 2021.

Falls 2011-1.39 and 2021-1.65 per 1,0000 population reports that there was increase in deaths due to falls more in 2021 than 2011.

Overall non-communicable diseases and injury, which are ischemic heart disease, COPD, stroke, diabetes mellitus, and falls CDR were increased over a decade from 2011-2021 except cirrhosis of liver. In communicable diseases like, diarrheal disease, lower respiratory infection, tuberculosis CDR were significantly decreased from 2011 to 2021 and covid-19 totally altered the mortality pattern, which is the first leading cause of death.

Table 3 Top 10 Causes of Daly in India 2011 - 2021

DALY TOP 10 DALY	DALY 2011	DALY 2021	absolute change N	Percent change
covid 19	-	90222441.31	-	-
Ischaemic heart disease	32601892.06	42984803.98	10382911.92	3184.76%
Chronic obstructive pulmonary disease	18730897.12	24318166.24	5587269.12	2982.92%
Preterm birth complications	36020425.53	23932907.46	-12087518.07	-3355.74%
Stroke	16238389.04	20652837.21	4414448.17	2718.53%
Diarrhoeal diseases	29226851.12	17971421.11	-11255430.01	-3851.06%
Lower respiratory infections	28074191.61	15968616.69	-12105574.92	-4311.99%
Tuberculosis	23859743.51	14471086.88	-9388656.63	-3934.94%
Diabetes mellitus	8978474.05	14313369.26	5334895.21	5941.87%
Back and neck pain	9806819.01	12032756.02	2225937.01	2269.78%

COVID-19 did not exist as a cause of DALY in 2011 and it became the leading contributor in 2021, accounting for a staggering 90.22 million DALYs. This reflects the intense global impact of the pandemic on both mortality and morbidity consequences for health systems worldwide.

Ischaemic heart disease, a non-communicable disease shows an increase in DALYs from 32.6 million in 2011 to 42.9 million in 2021, indicating a rise of 10.38 million DALYs (a 3184.76% increase). This is consistent with the growing burden of cardiovascular diseases.

Chronic obstructive pulmonary disease (COPD) also shows a substantial increase in DALYs, rising by 5.59 million (a 2982.92% increase), Stroke shows a notable increase in DALYs, with an additional 4.41 million DALYs (a 2718.53% increase) and Diabetes mellitus demonstrated a concerning increase of 5.33 million DALYs (a 5941.87% increase)

In contrast, preterm birth complications, diarrheal diseases, and lower respiratory infections—all of which are largely preventable with effective public health interventions—showed significant reductions in DALYs. Preterm birth complications declined by 12.09 million DALYs (a 3355.74% reduction), while diarrheal diseases and lower respiratory infections saw declines of 11.26 million (a 3851.06% reduction) and 12.10 million (a 4311.99% reduction), respectively. Tuberculosis experienced a significant reduction in DALYs by 9.39 million (a 3934.94% decrease.

Back and neck pain, a common cause of disability, showed a moderate rise in DALYs, increasing by 2.23 million (a 2269.78% increase.

4. Discussion

Several studies also illustrate different ranking of leading CODs Shu-Yu Tai et al conducted a study on changes in the ranking of leading causes of deaths in Japan, Korea, and Taiwan from 1998 to 2018 comparing WHO,IHME and Government list, the number of cancer sites included in the 10 leading CODs in 2018 was 4, 4, and 3 in Japan, Korea, and Taiwan, respectively according to the WHO list and was 4, 4, and 2, respectively according to IHME list likewise in this paper while comparing IHME and WHO India data between 2011 and 2021, the first leading seven causes of deaths were one and the same. In IHME the 8th leading CODs was neonatal disorder. Diabetes mellitus was the 9th and 8th leading CODs in IHME and WHO accordingly. Cirrhosis liver was the 10th and 9th leading CODs in IHME and WHO respectively and the 10th leading CODs in WHO was falls. Jamal S. Rana et al conducted a study on changes in mortality top 10 causes of death from 2011 to 2018, CDC WONDER dataset used to identify national changes in the number of deaths and AAMR due to the top 10 underlying causes of death, and the top 3 caused of deaths were heart disease, cancer, and accidents (17) likewise here the changes of leading causes of deaths crude death rates were compared the top 3 CODs are covid-19, ischemic heart disease, chronic obstructive pulmonary disease.

Abbreviations

- COD- Causes of Death
- WHO-World Health Organization
- IHME- Institute of Health Metrics and Evaluation COPD- chronic obstructive pulmonary disease IHD - ischemic heart disease
- DALY- Disability adjusted life year CD- Communicable disease
- NCD- non-communicable disease
- CDC WONDER- The Centers for Disease Control and Prevention Wide-Ranging Online Data for Epidemiologic Research

5. Conclusion

This study examined the leading 10 CODs in India by using WHO and IHME ranking lists 2011 to 2021, along with crud death rate, DALY of top 10 CODs in india 2011-2021 (WHO). In conclusion india is encountering a rapidly growing burden of NCDs. In india, non-communicable disease and injuries are responsible for 52% of fatalities (18), with ischemic heart disease, chronic obstructive pulmonary disease (COPD), and stroke emerging as the top causes of death and DALY. In contrast the past decade the number of deaths and DALY for communicable disease were significantly dropped. NCDs are rapidly growing in many countries, largely due to globalization, industrialization, and rapid urbanization with demographic and lifestyle changes. India is experiencing a rapid health transition with a rising burden of non-communicable diseases suppressing the burden of communicable diseases like TB, water-borne or vector-borne diseases, HIV, etc. losses due to premature deaths related to heart diseases, stroke, diabetes, COPD are projected to increase over the 10 years (19). While several numbers of programs are already addressing NCDs already exist, focusing on integration and scaling of those initiatives, early detection, health education. Policymakers should prioritize the creation of strong monitoring frameworks that track progress can help to reduce the NCDs.

Compliance with ethical standards

Disclosure of conflict of interest

All authors declare that they have no conflict of interest.

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