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Trends in incidence, prevalence, and mortality of non-communicable diseases in Iraq (2003–2021)

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Abstract

Background Non-communicable diseases (NCDs) have become a major public health concern in Iraq, playing a significant role in the country's morbidity and mortality rates. To offer a thorough overview of the patterns and the overall impact of NCDs on public health, this study aims to map the trends in the incidence, prevalence, and mortality rates of NCDs in Iraq between 2003 and 2021.

Methods Data from the Global Burden of Disease (GBD) Study 2021 were utilized. The focus was on Iraq from 2003 to 2021, a period marked by significant social and political changes. Using the GBD results tool, age-standardized prevalence, incidence, and mortality rates (ASPR, ASIR, ASMR) for 12 major NCDs were extracted and expressed per 100,000 population. Descriptive statistics with 95% uncertainty intervals were calculated, and trends were analyzed.

Results The analysis revealed a nuanced trajectory of NCDs in Iraq between 2003 and 2021. The ASPR of all NCDs increased slightly (change %: 0.1, 95% UI: -2.2 to 2.4), with a notable decline in chronic respiratory diseases (change %: -14.4, 95% UI: (-30.9 to 6.1) and a significant rise in neoplasms (change %: 32.7, 95% UI: -5.9 to 81.3). The ASIR of diabetes and kidney diseases showed the largest increase (change %: 42.9, 95% UI: 28.4 to 59.3), while chronic respiratory diseases had the greatest decline (change %: -12.1, 95% UI: -36.8 to 22.5). Cardiovascular diseases remained the leading cause of mortality in both sexes, with ASMRs increasing slightly for males and decreasing for females over the period. Skin and subcutaneous diseases showed the highest increase in ASMR (change %: 48.2), while digestive diseases experienced the largest decline (change %: -21.4).

Conclusion The GBD 2021 study highlights progress in reducing NCD mortality in Iraq, especially among younger people. However, older males still face high death rates from cardiovascular diseases. Rising cases of cancer, diabetes, and kidney diseases signal the need for targeted interventions. Continued focus on risk factors and healthcare access is essential.

Keywords NCDs, Iraq, Trend, Incidence, Prevalence, Mortality, Non-communicable diseases

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Introduction

The evolving landscape of Iraqi healthcare faces a formidable challenge with the emergence of non-communicable diseases (NCDs) [1]. While significant strides have been made in combating infectious diseases, the escalating burden of NCDs demands immediate attention. Lifestyle shifts and the adversities following prolonged conflict have propelled conditions such as cardiovascular diseases, diabetes, and cancer to the forefront of healthcare concerns [2, 3]. The burden of these diseases poses significant socio-economic implications and strains healthcare infrastructures, necessitating a realignment of healthcare priorities and resources to address the growing incidence and impact of NCDs effectively.

Implementing robust strategies emphasising prevention, early diagnosis, and effective management is crucial to mitigate the adverse effects on public health and enhance the quality of life for the Iraqi population [4]. NCDs have emerged as a significant public health challenge in Iraq, contributing substantially to morbidity and mortality. The leading NCDs—cardiovascular diseases, diabetes, cancers, and chronic respiratory conditions—are responsible for the majority of deaths in the country [5, 6]. According to the World Health Organization (WHO), NCDs account for more than half of all fatalities in Iraq, with cardiovascular diseases alone contributing nearly 40% of these deaths [6].

Several factors contribute to the growing prevalence of NCDs in Iraq, including lifestyle changes such as increased consumption of unhealthy foods, reduced physical activity, and widespread tobacco use [7]. Prolonged conflict and instability have weakened healthcare systems, restricting access to preventive and treatment services [8, 9]. Furthermore, the stress and trauma associated with extended conflict have indirectly fueled the rise of NCDs through increased risk behaviours, such as smoking and poor dietary habits [10, 11].

The Iraqi healthcare system struggles to cope with the increasing burden of NCDs [12]. Ongoing economic and political instability has obstructed the creation of robust public health policies and delayed the rollout of widespread screening and prevention initiatives [12]. Consequently, many NCDs are diagnosed at advanced stages, complicating treatment and management efforts.

Throughout the last decade, Iraq has implemented public health measures to address the rising burden of NCDs, including the National NCD Strategy aligned with WHO's Global Action Plan [6]. Efforts have focused on tobacco control, promoting healthy lifestyles, and expanding primary care for early detection and management of NCDs. Public health campaigns have targeted addressed lifestyle risk factors but have faced limited reach due to socio-political challenges [12]. Addressing the growing NCD crisis in Iraq requires a multifaceted

approach that involves strengthening healthcare systems, implementing effective public health campaigns to raise awareness about risk factors, and promoting healthier lifestyles. Collaborative efforts among the government, international organizations, and local communities are essential to curbing the rise of NCDs and improving the overall health of the Iraqi population.

This study aims to map the incidence, prevalence, and mortality rates of NCDs in Iraq from 2003 to 2021, providing a comprehensive understanding of the trends and burden of these diseases. By analysing these data, the study seeks to inform future healthcare strategies that address the urgent NCD crisis in the country.

Methods

Data source

Data from the Global Burden of Disease (GBD) Study 2021 was utilized for this analysis. These data provide standardized estimates of health metrics for different diseases and injuries across 204 countries and territories. The GBD study enables a detailed assessment and measurement of health loss and trends in non-communicable diseases (NCDs) over time. This study analyzed trends for 12 major NCDs, such as cardiovascular diseases and diabetes.

Study population and time frame

Iraq faced significant social and political changes after 2003, including post-conflict scenarios, which may have had consequences on health. Due to the nature of GBD data, which includes populations of all ages and both sexes, and with the most recent available data from 2021, the period of focus for this analysis is from 2003 to 2021.

Health metrics analyzed

Using the GBD results tool, age-standardized rates (ASRs) were extracted for Iraq from the GBD 2021 database. The study focused on the following metrics: age-standardized prevalence rate (ASPR), age-standardized incidence rate (ASIR), and age-standardized mortality rate (ASMR). The ASPR represents the total number of existing cases, the ASIR refers to the number of new cases of a disease, and the ASMR represents the number of deaths due to a disease. All ASRs were expressed per 100,000 population, adjusted for age, in a specific year.

Statistical analysis

Descriptive statistics of ASRs with 95% of uncertainty intervals (UI) were done for all major NCDs. Trends in rates from 2003 to 2021 were calculated using Eq. 1. However, the percentage change for the UL and LL of the UI have been calculated using Eqs. 2 and 3. All calculation was done using SPSS V. 25.

$$\text{Percentage change} = \frac{(\text{ASR in 2021} - \text{ASR in 2003})}{\text{ASR in 2003}} \times 100 \quad (1)$$

$$\text{LL percentage change} = \frac{(\text{LL in 2021} - \text{UL in 2003})}{\text{UL in 2003}} \times 100 \quad (2)$$

$$\text{UL percentage change} = \frac{(\text{UL in 2021} - \text{LL in 2003})}{\text{LL in 2003}} \times 100 \quad (3)$$

Ethical considerations

Due to the nature of the publically available GBD data and the lack of direct involvement of human subjects, no ethical approval was required.

Results

Utilizing data from the Global Burden of Disease (GBD) study 2021 (<http://ghdx.healthdata.org/gbd-results-tool>), this analysis observed a nuanced trajectory of NCDs in Iraq from 2003 to 2021. While the age-standardized prevalence of all NCDs among both sexes exhibited a slight increase (change: 0.1%), chronic respiratory diseases showed a marginal decline (change: -14.4%). Conversely, neoplasms demonstrated a worrisome escalation (change: 32.7%) (Table 1).

Regarding the age-standardized incidence rate (ASIR) for both sexes, the ASIR of all NCDs increased slightly (change: 0.7%). Diabetes and kidney diseases showed the highest increase from 2003 to 2021 (change: 42.9%), while chronic respiratory diseases showed the largest decline (change: -12.1%). Among males, skin and subcutaneous diseases was the highest in both years, with ASIRs of 36,588.1/100,000 (95% UI: 35,102.9 to 38,054.5) in 2003 and 38,270.2/100,000 (95% UI: 36,723.9 to 39,724.6) in 2021. Similarly, among females, skin and subcutaneous diseases also had the highest ASIR, with rates of 36,409.70/100,000 (95% UI: 35,058.8 to 37,874.2) in 2003 and 38,088.8/100,000 (95% UI: 36,701.9 to 39,616.1) in 2021 (Table 2).

In terms of age-standardized mortality rates (ASMR) among both sexes, skin and subcutaneous diseases showed the highest increase (change: 48.2%). However, digestive diseases showed the largest decline from 2003 to 2021 (change: -21.4%). Among males and females separately, cardiovascular disease was the dominant cause of death in 2003, with ASMRs of 530.1/100,000 (95% UI: 421.1 to 664.2) for males and 414.2/100,000 (95% UI: 329.9–514.7) for females. In 2021, the ASMRs were 565.8/100,000 (95% UI: 448.8 to 656.3) for males and 399.6/100,000 (95% UI: 336.4 to 462.9) for female (Table 3).

Figure 1 comparing CVD mortality rates in Iraq between 2003 and 2021 shows clear age-related trends, with mortality rates increasing steadily with age, particularly after the age of 55. Males consistently exhibit higher

mortality rates compared to females across all age groups, with the gap widening significantly in older populations. From 2003 to 2021, there is a notable decline in ASMR across almost all age groups, particularly among younger individuals of both sexes (20–44 years), indicating the success of preventive measures and early interventions.

Similarly, the ASIR demonstrated a comparable trend, increasing with age; however, a notable decline was observed in the age group ≥ 70 years. Specifically, the ASIR sharply decreased in the ≥ 70 age group compared to the 65–69 age group in both sexes in both 2003 and 2021. In 2003, the ASIR for males declined from 7,239.9/100,000 in the 65–69 age group to 4,942.5/100,000 in the ≥ 70 age group, while for females, it dropped from 7,386.8/100,000 to 4,675.3/100,000. Likewise, in 2021, the ASIR for males fell from 575.8/100,000 in the 65–69 age group to 412.7/100,000 in the ≥ 70 age group, and for females, it decreased from 743.0/100,000 to 512.1/100,000 (Supplementary Fig. S1).

Furthermore, the trends in the ASIR of diabetes and kidney diseases, neoplasms, and CVDs increased steadily from 2003 to 2021 in both males and females. Females had higher ASIRs for diabetes and kidney diseases and neoplasms, whereas males exhibited higher ASIRs for CVDs. In terms of ASMR, males had consistently higher rates than females. For more details, please refer to Supplementary Figs. S2 and S3.

Comparing the ASRs of NCDs in Iraq to those in neighboring countries and the Middle East and North Africa (MENA) region, a 0.07% increase in ASPR was observed in Iraq from 2003 to 2021. In contrast, the average ASPR in MENA decreased by 0.26% during the same period. The rates declined in Turkey, Saudi Arabia, Jordan, and Iran from 2003 to 2021, while an increase was noted in Syria and Kuwait (Fig. 2).

In terms of ASIRs, the rate was declined by 0.90% in 2008 (138,040.8/100,000) compared to 2003 (139,299.3/100,000). However, this rate increased by 0.57%, 0.74%, and 0.34% over the periods 2008–2013, 2013–2018, and 2018–2021, with ASIRs of 138,826.3, 139,857.1, and 140,336.3 per 100,000 at the end of each respective period. Overall, Iraq had the lowest ASIR during the period 2018–2021 compared to all neighboring countries and to the average of the ASIR in the MENA region (Fig. 3).

The ASMR in Iraq showed a 2.9% increase from 2003 (724.8/100,000) to 2021 (745.5/100,000). Compared to neighboring countries and the MENA region, Iraq's ASMR in 2021 was lower than Syria's but higher than those of other neighboring countries.

The MENA regional average ASMR declined over the same period, with Iraq's decrease being similar to the regional trend but still leaving the country with a relatively high ASMR compared to most of its neighbors.

Table 1 The age-standardized prevalence rate of non-communicable diseases in Iraq 2003–2021

Non communicable diseases	Gender	ASPR in 2003 Rate (95% UI: LL, UL)	ASPR in 2021 Rate (95% UI: LL, UL)	Change (%) from 2003 to 2021 (95% UI: LL, UL)
All causes	Male	88,773.9 (87,431.7 to 90,095.3)	88,935.7 (87,652.6 to 90,241.9)	0.2 (-2.7 to 3.2)
	Female	94,245.0 (93,411.0 to 95,029.5)	94,150.9 (93,284.4 to 94,987.7)	-0.1 (-1.8 to 1.7)
	Both sexes	91,389.6 (90,323.3 to 92,418.0)	91,451.3 (90,397.5 to 92,473.3)	0.1 (-2.2 to 2.4)
Cardiovascular diseases	Male	11,635.4 (11,157.5 to 12,085.6)	11,779.2 (11,159.9 to 12,437.7)	1.2 (-7.7 to 11.5)
	Female	8,885.6 (8,488.3 to 9,263.5)	9,125.6 (8,612.6 to 9,658.4)	2.7 (-7 to 13.8)
	Both sexes	10,230.4 (9,796.2 to 10,631.9)	10,418.9 (9,875.4 to 11,011.5)	1.8 (-7.1 to 12.4)
Chronic respiratory diseases	Male	5,982.3 (5,380.9 to 6,692.9)	5,100.2 (4,536.6 to 5,800.7)	-14.7 (-32.2 to 7.8)
	Female	6,032.3 (5,486.1 to 6,639.6)	5,185.2 (4,679.1 to 5,798.7)	-14.0 (-29.5 to 5.7)
	Both sexes	5,985.9 (5,430.6 to 6,643.7)	5,124.1 (4,592.5 to 5,759.3)	-14.4 (-30.9 to 6.1)
Diabetes and kidney diseases	Male	16,833.9 (16,032.9 to 17,703.7)	21,535.0 (20,415.7 to 22,773.9)	27.9 (15.3 to 42)
	Female	16,747.9 (15,996.1 to 17,479.8)	20,889.3 (19,834.3 to 22,073.1)	24.7 (13.5 to 38)
	Both sexes	16,784.4 (16,040.3 to 17,544.9)	21,210.9 (20,180.1 to 22,305.9)	26.4 (15 to 39.1)
Digestive diseases	Male	33,493.1 (31,695.0 to 35,443.9)	35,808.8 (33,926.8 to 37,840.9)	6.9 (-4.3 to 19.4)
	Female	35,184.3 (33,418.9 to 36,962.4)	37,461.3 (35,662.8 to 39,419.3)	6.5 (-3.5 to 18)
	Both sexes	34,310.5 (32,605.4 to 36,124.3)	36,604.4 (34,815.7 to 38,573.4)	6.7 (-3.6 to 18.3)
Mental disorders	Male	12,820.0 (11,745.4 to 14,056.5)	13,527.7 (12,008.6 to 15,240.1)	5.5 (-14.6 to 29.8)
	Female	15,350.8 (14,075.5 to 16,788.9)	16,831.4 (14,558.0 to 19,552.9)	9.7 (-13.3 to 38.9)
	Both sexes	14,028.1 (12,899.2 to 15,347.4)	15,121.9 (13,269.3 to 17,153.8)	7.8 (-13.5 to 33)
Musculoskeletal disorders	Male	14,720.8 (13,628.7 to 15,856.9)	15,491.5 (14,296.0 to 16,747.1)	5.2 (-9.8 to 22.9)
	Female	22,242.3 (20,666.9 to 23,727.7)	23,180.7 (21,562.5 to 24,844.6)	4.2 (-9.1 to 20.2)
	Both sexes	18,366.8 (17,083.3 to 19,622.5)	19,218.8 (17,873.3 to 20,560.1)	4.6 (-8.9 to 20.4)
Neoplasms	Male	603.6 (511.3 to 711.8)	830.3 (676.4, 968.5)	37.5 (-5 to 89.4)
	Female	1,154.0 (975.2 to 1,386.2)	1,504.9 (1,244.8 to 1,790.5)	30.4 (-10.2 to 83.6)
	Both sexes	865.9 (737.9 to 1,018.8)	1,148.6 (958.7 to 1,337.5)	32.7 (-5.9 to 81.3)
Neurological disorders	Male	32,256.1 (28,971.1 to 35,655.2)	32,279.2 (29,032.8 to 35,641.9)	0.1 (-18.6 to 23)
	Female	38,164.1 (34,968.2 to 41,693.4)	38,174.2 (35,086.9 to 41,718.6)	0 (-15.9 to 19.3)
	Both sexes	35,083.7 (31,999.6 to 38,305.5)	35,124.9 (32,069.5 to 38,353.1)	0.1 (-16.3 to 19.9)
Other non-communicable diseases	Male	65,214.1 (61,356.7 to 69,416.9)	64,792.9 (60,831.4 to 69,082.5)	-0.7 (-12.4 to 12.6)
	Female	86,073.8 (84,108.4 to 87,850.2)	85,491.5 (83,446.0 to 87,507.7)	-0.7 (-5 to 4)
	Both sexes	75,154.6 (72,400.6 to 78,037.7)	74,726.5 (71,949.6 to 77,909.1)	-0.6 (-7.8 to 7.6)
Sense organ diseases	Male	23,299.7 (21,779.3 to 25,227.7)	23,309.4 (21,855.5 to 25,162.2)	0 (-13.4 to 15.5)
	Female	24,152.7 (22,178.8 to 26,826.4)	24,136.9 (22,158.9 to 26,935.6)	-0.1 (-17.4 to 21.5)
	Both sexes	23,715.4 (22,044.9 to 25,965.4)	23,704.4 (22,053.4 to 25,953.0)	-0.1 (-15.1 to 17.7)
Skin and subcutaneous diseases	Male	17,200.6 (16,720.3 to 17,661.6)	18,616.5 (18,122.3 to 19,131.1)	8.2 (2.6 to 14.4)
	Female	17,760.4 (17,265.1 to 18,289.5)	19,168.2 (18,647.4 to 19,703.4)	7.9 (2 to 14.1)
	Both sexes	17,464.8 (17,013.6 to 17,923.8)	18,876.2 (18,373.4 to 19,380.9)	8.1 (2.5 to 13.9)
Substance use disorders	Male	978.9 (845.8 to 1,124.6)	936.9 (808.7 to 1,072.8)	-4.3 (-28.1 to 26.8)
	Female	554.9 (478.2 to 636.6)	529.8 (461.5 to 604.5)	-4.5 (-27.5 to 26.4)
	Both sexes	777.2 (675.6 to 885.5)	741.5 (645.0 to 845.8)	-4.6 (-27.2 to 25.2)

ASPR=Age-standardized prevalence rate (per 100,000); LL=lower limit; UL=upper limit, UI=uncertainty intervals. Bold fonts represent the highest increase or decrease in percentage changes

Notably, Iraq experienced the most significant reductions in ASMR between 2008 and 2013, followed by a sharp increase from 2018 (656.6/100,000) to 2021 (745.5/100,000), reflecting a percentage change of 13.5% (Fig. 4).

Discussion

The findings from the GBD study 2021 offer a comprehensive overview of the shifting landscape of NCDs in Iraq from 2003 to 2021. The nuanced trajectory observed highlights progress and emerging challenges in managing

the burden of NCDs over nearly two decades. These findings point to a complex public health landscape, where challenges in others offset progress in some areas, necessitating targeted interventions to address the evolving burden of NCDs in Iraq.

The increase in the age-specific mortality rate for CVDs with advancing age aligns with the well-documented cumulative impact of cardiovascular risk factors and aging. The rising mortality rates highlight the significant burden of CVDs in older populations, particularly those over 40 years of age. This decline could reflect

Table 2 The age-standardized incidence rate of non-communicable diseases in Iraq 2003–2021

Non-communicable diseases	Gender	ASIR in 2003 Rate (95% UI: LL, UL)	ASIR in 2021 Rate (95% UI: LL, UL)	Change (%) from 2003 to 2021 (95% UI: LL, UL)
All causes	Male	120,431.8 (112,626.2 to 130,135.3)	120,094.8 (113,250.9 to 127,925.9)	-0.3 (-13 to 13.6)
	Female	160,173.9 (152,527.8 to 168,362.4)	162,548.5 (154,491.9 to 171,160.9)	1.5 (-8.2 to 12.2)
	Both sexes	139,299.3 (131,967.4 to 147,524.4)	140,336.3 (132,817.8 to 147,916.9)	0.7 (-10 to 12.1)
Cardiovascular diseases	Male	1,689.1 (1,509.8 to 1,906.7)	1,744.4 (1,560.0 to 1,964.5)	3.3 (-18.2 to 30.1)
	Female	1,191.5 (1,079.4 to 1,323.9)	1,183.1 (1,066.1 to 1,317.2)	-0.7 (-19.5 to 22)
	Both sexes	1,436.7 (1,302.5 to 1,608.1)	1,455.3 (1,320.0 to 1,620.4)	1.3 (-17.9 to 24.4)
Chronic respiratory diseases	Male	780.2 (664.9 to 947.4)	679.9 (578.4 to 821.4)	-12.9 (-39 to 23.6)
	Female	728.4 (629.6 to 865.2)	646.8 (555.2 to 784.9)	-11.2 (-35.8 to 24.7)
	Both sexes	752.9 (649.3 to 902.5)	661.9 (570.1 to 795.0)	-12.1 (-36.8 to 22.5)
Diabetes and kidney diseases	Male	752.4 (709.3 to 799.8)	1,113.2 (1,051.4 to 1,188.3)	48 (31.5 to 67.5)
	Female	851.3 (804.8 to 903.1)	1,180.2 (1,118.6 to 1,247.2)	38.6 (23.9 to 55)
	Both sexes	802.3 (760.5 to 846.1)	1,146.7 (1,086.2 to 1,211.8)	42.9 (28.4 to 59.3)
Digestive diseases	Male	6,492.9 (5,968.9 to 7,020.3)	6,655.4 (6,135.6 to 7,181.0)	2.5 (-12.6 to 20.3)
	Female	7,839.4 (7,231.8 to 8,470.8)	7,953.4 (7,376.4 to 8,581.9)	1.5 (-12.9 to 18.7)
	Both sexes	7,143.6 (6,569.4 to 7,698.4)	7,280.5 (6,711.1 to 7,844.3)	1.9 (-12.8 to 19.4)
Mental disorders	Male	4,120.6 (3,742.1 to 4,634.1)	5,169.1 (4,220.2 to 6,385.7)	25.5 (-8.9 to 70.7)
	Female	5,979.8 (5,386.6 to 6,826.8)	7,612.5 (6,050.7 to 9,545.5)	27.3 (-11.4 to 77.2)
	Both sexes	5,013.8 (4,538.8 to 5,675.9)	6,345.7 (5,170.5 to 7,869.7)	26.6 (-8.9 to 73.4)
Musculoskeletal disorders	Male	4,042.6 (3,661.4 to 4,435.3)	4,025.0 (3,628.8 to 4,420.8)	-0.4 (-18.2 to 20.7)
	Female	5,703.8 (5,126.4 to 6,280.7)	5,712.7 (5,172.2 to 6,322.0)	0.2 (-17.7 to 23.3)
	Both sexes	4,844.1 (4,390.9 to 5,317.9)	4,838.8 (4,377.2 to 5,322.9)	-0.1 (-17.7 to 21.2)
Neoplasms	Male	307.2 (261.8 to 356.9)	349.5 (296.5 to 399.8)	13.8 (-16.9 to 52.7)
	Female	470.9 (390.4 to 568.1)	517.2 (437.8 to 619.0)	9.8 (-22.9 to 58.6)
	Both sexes	383.5 (324.1 to 450.3)	426.3 (365.9 to 500.2)	11.2 (-18.7 to 54.3)
Neurological disorders	Male	9,587.9 (8,435.6 to 10,705.2)	9,591.8 (8,441.1 to 10,718.3)	0 (-21.2 to 27.1)
	Female	10,243.4 (9,090.7 to 11,278.8)	10,244.7 (9,086.6 to 11,325.8)	0 (-19.4 to 24.6)
	Both sexes	9,903.8 (8,808.4 to 10,948.6)	9,911.3 (8,814.5 to 10,977.3)	0.1 (-19.5 to 24.6)
Other non-communicable diseases	Male	55,717.1 (48,037.8 to 64,757.1)	52,163.8 (45,013.6 to 59,886.3)	-6.4 (-30.5 to 24.7)
	Female	90,644.9 (83,552.6 to 98,800.2)	89,319.4 (81,552.6 to 97,672.8)	-1.5 (-17.5 to 16.9)
	Both sexes	72,291.3 (65,251.1 to 80,359.3)	69,896.4 (63,125.1 to 77,396.8)	-3.3 (-21.5 to 18.6)
Sense organ diseases	Male	2.8 (1.3 to 6.8)	2.9 (1.4 to 6.9)	6.8 (-79.9 to 449.6)
	Female	4.3 (2.1 to 9.2)	4.6 (2.2 to 9.6)	6.8 (-76.2 to 367.5)
	Both sexes	3.5 (1.6 to 8.1)	3.8 (1.8 to 8.4)	6.8 (-78.2 to 414.7)
Skin and subcutaneous diseases	Male	36,588.1 (35,102.9 to 38,054.5)	38,270.2 (36,723.9 to 39,724.6)	4.6 (-3.5 to 13.2)
	Female	36,409.7 (35,058.8 to 37,874.2)	38,088.8 (36,701.9 to 39,616.1)	4.6 (-3.1 to 13)
	Both sexes	36,490.1 (35,151.7 to 37,877.7)	38,157.8 (36,700.3 to 39,610.6)	4.6 (-3.1 to 12.7)
Substance use disorders	Male	414.4 (354.1 to 489.6)	401.9 (339.3 to 468.1)	-3 (-30.7 to 32.2)
	Female	239.2 (204.3 to 282.1)	232.5 (198.3 to 273.7)	-2.8 (-29.7 to 34)
	Both sexes	331.1 (284.7 to 386.8)	320.6 (272.1 to 373.1)	-3.2 (-29.7 to 31.1)

ASIR=Age-standardized incidence rate (per 100,000); LL=lower limit; UL=upper limit; UI=uncertainty intervals. Bold fonts represent the highest increase or decrease in percentage changes

underdiagnoses or underreporting of CVD in older individuals due to overlapping symptoms with other comorbidities or limitations in healthcare access for this age group. Alternatively, it could indicate survival bias, where individuals with severe CVD do not survive into the older age brackets, thus reducing the observed incidence rates.

Neoplasms underscore a growing concern in Iraq during the studied period in terms of prevalence, incidence, and mortality. A recent study reported a rise in the crude incidence rate of all types of cancer from 2012 to 2020

¹³. Similarly, another study revealed that all cancers, particularly lung and gastrointestinal, steadily increased after 2007, affecting both sexes equally [3]. The burden of neoplasms is not limited to Iraq but is also a significant concern in other Arab countries. A study using GLOBOCAN data highlighted a high incidence of cancers among younger Arabs [14].

The incidence of diabetes and kidney diseases increased significantly in 2021 compared to 2003. This trend aligns with an analysis assessing the burden of

Table 3 The age-standardized mortality rate of non-communicable diseases in Iraq 2003–2021

Non-communicable diseases	Gender	ASMR in 2003 Rate (95% UI: LL, UL)	ASMR in 2021 Rate (95% UI: LL, UL)	Change (%) from 2003 to 2021 (95% UI: LL, UL)
All causes	Male	814.1 (649.2 to 1019.5)	875.6 (689.9 to 999.5)	7.6 (-32.3 to 54)
	Female	641.8 (522.5 to 794.5)	632.6 (538.4 to 732.5)	-1.4 (-32.2 to 40.2)
	Both sexes	724.8 (585.4 to 901.4)	745.5 (608.8 to 848.7)	2.9 (-32.5 to 45)
Cardiovascular diseases	Males	530.1 (421.1 to 664.2)	565.8 (448.8 to 656.3)	6.7 (-32.4 to 55.8)
	Females	414.2 (329.9 to 514.7)	399.6 (336.4 to 462.9)	-3.5 (-34.6 to 40.3)
	Both sexes	470.7 (378.9 to 588.5)	477.6 (397.1 to 553.4)	1.5 (-32.5 to 46.1)
Chronic respiratory diseases	Males	25.6 (19.4 to 33.9)	24.1 (17 to 29.7)	-5.9 (-49.9 to 52.8)
	Females	14.1 (10.6 to 19.5)	12.4 (9.6 to 16.3)	-11.6 (-50.9 to 54)
	Both sexes	19.4 (15.1 to 25.3)	17.6 (13.4 to 21.7)	-9.3 (-46.9 to 43.3)
Diabetes and kidney diseases	Males	76.8 (58.1 to 101.1)	100.6 (69.6 to 123)	31 (-31.2 to 111.6)
	Females	70.9 (55.7 to 90.5)	84.7 (67.1 to 105)	19.5 (-25.9 to 88.5)
	Both sexes	73.5 (57.1 to 94.7)	92 (70.3 to 110.5)	25.1 (-25.7 to 93.6)
Digestive diseases	Males	27.9 (20.9 to 37)	23.3 (16.3 to 30.5)	-16.4 (-55.9 to 46.3)
	Females	18.3 (13.6 to 24.3)	13.4 (10.2 to 17.3)	-26.8 (-57.8 to 27.1)
	Both sexes	23 (17.4 to 29.3)	18.1 (13.4 to 22.7)	-21.4 (-54.1 to 30.1)
Musculoskeletal disorders	Males	0.2 (0.1 to 0.3)	0.2 (0.1 to 0.3)	9.1 (-62.5 to 158.3)
	Females	1.1 (0.8 to 1.4)	0.9 (0.7 to 1.2)	-15.2 (-53.9 to 54)
	Both sexes	0.6 (0.5 to 0.9)	0.6 (0.4 to 0.7)	-9.5 (-50.6 to 58.7)
Neoplasms	Males	92.1 (69.7 to 116.2)	109.5 (82.7 to 130.9)	19 (-28.9 to 87.9)
	Females	65.7 (51.2 to 84.9)	75.3 (59.9 to 92.5)	14.6 (-29.5 to 80.7)
	Both sexes	77.9 (60.2 to 99.6)	90.5 (70 to 109)	16.2 (-29.7 to 81.2)
Neurological disorders	Males	32.8 (14.2 to 74.9)	34.7 (16.6 to 72.2)	5.9 (-77.8 to 408.2)
	Females	32.9 (11.8 to 79.5)	32.9 (12 to 76.7)	0.2 (-84.9 to 548.1)
	Both sexes	32.8 (13 to 78.4)	33.7 (14.1 to 74.6)	2.7 (-82.1 to 475.8)
Other non-communicable diseases	Males	25.9 (20.1 to 32.4)	14.4 (11.2 to 18.6)	-44.4 (-65.4 to -7.5)
	Females	23.7 (17.8 to 28.6)	12.3 (9.7 to 15.9)	-47.9 (-66.1 to -10.7)
	Both sexes	24.8 (20.4 to 29.3)	13.3 (10.7 to 16.8)	-46.2 (-63.5 to -17.7)
Skin and subcutaneous diseases	Males	0.3 (0.2 to 0.4)	0.5 (0.3 to 0.6)	64.3 (-18 to 195)
	Females	0.3 (0.2 to 0.4)	0.4 (0.3 to 0.5)	40 (-22.9 to 150)
	Both sexes	0.3 (0.2 to 0.4)	0.4 (0.3 to 0.5)	48.2 (-16.7 to 145)
Substance use disorders	Males	2.4 (1.7 to 3.5)	2.5 (1.8 to 3.7)	2.9 (-48.1 to 114)
	Females	0.9 (0.7 to 1.2)	0.8 (0.6 to 1)	-17.6 (-54.9 to 53.9)
	Both sexes	1.7 (1.2 to 2.2)	1.6 (1.2 to 2.1)	-2.4 (-45.1 to 77.5)

ASMR=Age-standardized mortality rate (per 100,000); LL=lower limit; UL=upper limit; UI=uncertainty intervals. Bold fonts represent the highest increase or decrease in percentage changes

chronic kidney disease among adults with type 2 diabetes, which revealed a 21.8% increase in the ASIR of diabetes and kidney diseases globally since 1990 [15]. A review has also shown a rise in the prevalence and incidence of diabetes worldwide, with changes in clinical practices impacting the epidemiology of chronic kidney disease in recent years [16]. Similarly, a systematic review and meta-analysis reported a high prevalence of kidney diseases among diabetic patients in the Middle East. This finding further emphasizes the growing burden of kidney disease in diabetic populations and highlights the importance of implementing region-specific preventive and management strategies [17].

Our analysis showed a decline in the ASIR of chronic respiratory diseases from 2003 to 2021. Interestingly, a study analyzing GBD 2019 data for North Africa and the

Middle East found a 10.3% rise in ASIR alongside a 32.9% reduction in the ASMR since 1990. However, this upward trend in incidence did not extend to Iraq, Iran, Bahrain, and Yemen, where a decline was observed instead [18].

Our analysis revealed that skin and subcutaneous diseases had the highest increase in cause of death in 2021, although the rate remains low compared to other diseases. Corresponding to this analysis, a study on GBD 2019 data indicated that the highest burden of skin and subcutaneous diseases was observed in lower-middle sociodemographic index countries, where Iraq is categorized [19].

A notable decline in the ASMR among almost all age group and particular among individuals aged 20 to 44 years, indicating the success of preventive measures and early interventions. However, despite this progress,

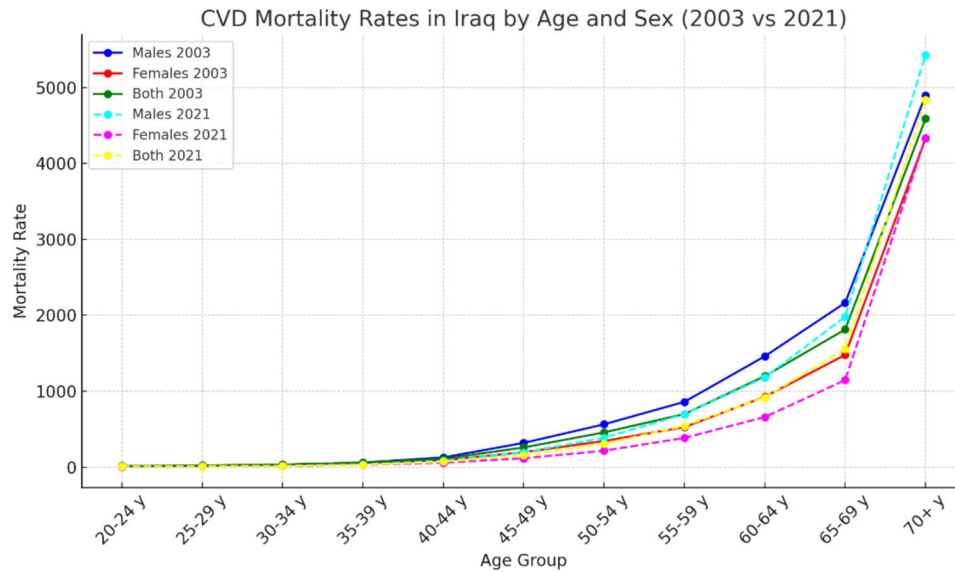


Fig. 1 Trends in the mortality rate caused by CVDs in Iraq by age and sex (2003 vs. 2021)

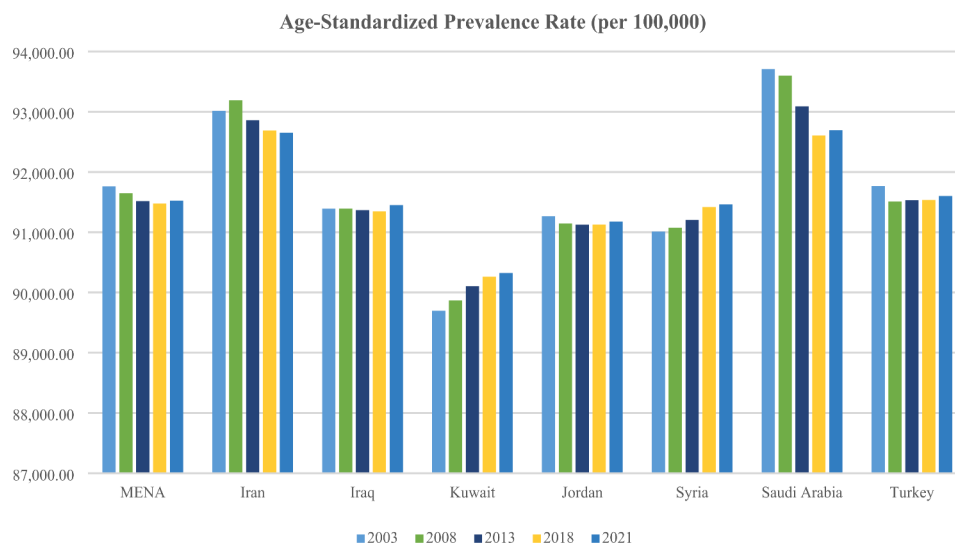


Fig. 2 The age-standardized prevalence rates of non-communicable diseases in Iraq, neighboring countries, and the average in Middle East and North Africa

mortality rates remain persistently high among the elderly, especially males over 60, suggesting the need for targeted healthcare interventions for this group. The gender disparity in mortality highlights the importance of gender-specific strategies to further reduce the CVD burden. Overall, while the improvements are encouraging, especially for younger populations, the data suggest that efforts should continue to focus on managing chronic diseases and addressing risk factors, particularly among older males.

Various factors contribute to the increasing prevalence of non-communicable diseases (NCDs). The aging population, coupled with shifts in lifestyle behaviors such as diet and tobacco use, has intensified the burden of these

diseases [13]. Moreover, disparities in healthcare access exacerbate the situation for at-risk populations, delaying timely interventions. These challenges have been evident in Iraq over the last decade and likely play a significant role in the growing prevalence of NCDs [12].

An analysis of ASPRs across Middle Eastern countries reveals a concerning trend of rising NCD burdens. However, in the case of Iraq, the lack of disease-specific data presents a significant challenge in drawing definitive conclusions. While this analysis offers valuable insights into existing trends, its effectiveness is limited by the absence of detailed disease information. Future research should focus on identifying risk factors and evaluating preventive strategies and treatment approaches.

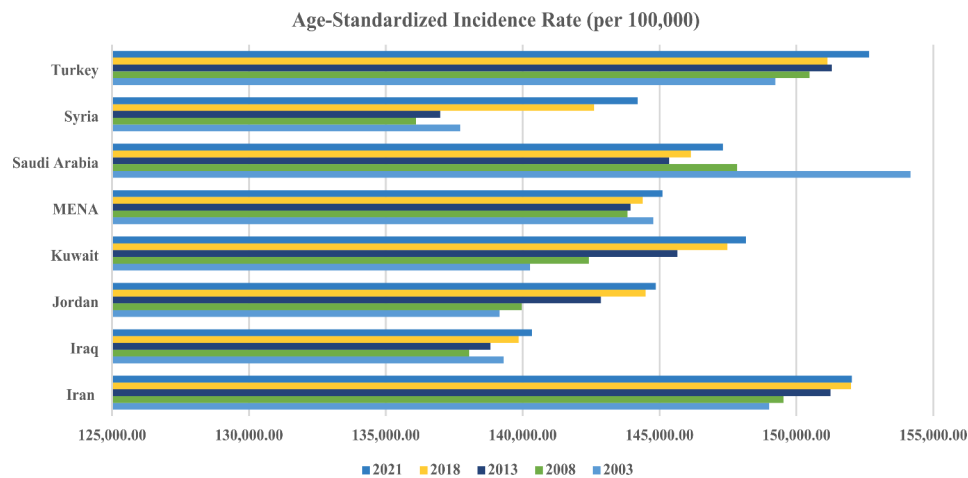


Fig. 3 The age-standardized incidence rates of non-communicable diseases in Iraq, neighboring countries, and the average in Middle East and North Africa

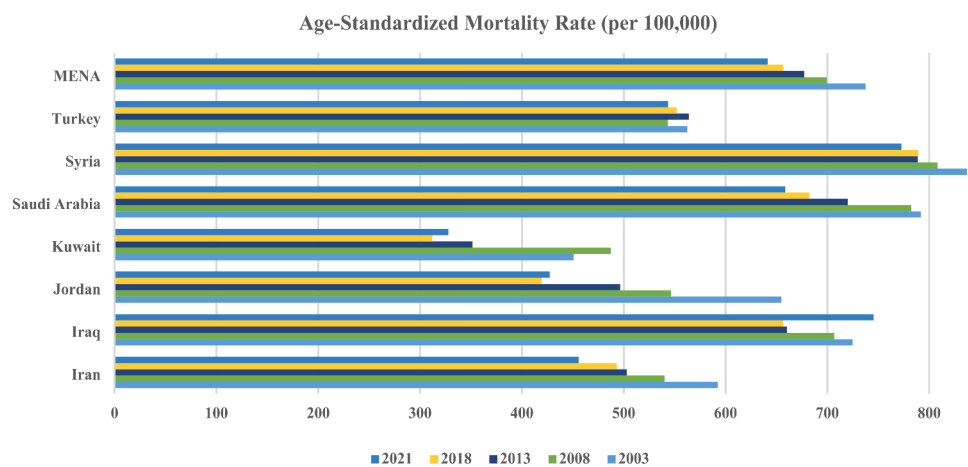


Fig. 4 The age-standardized mortality rates of non-communicable diseases in Iraq, neighboring countries, and the average in Middle East and North Africa

In comparing our study findings with other low- and middle-income countries (LMICs) globally, several parallels and differences emerge. For instance, South Africa, a representative African LMIC, has seen a growing burden of NCDs, which accounted for 39% of total deaths by 2010, with a significant portion occurring before the age of 60 [20]. This is comparable to the rising prevalence of NCDs observed in our study, highlighting the global nature of this transition. In South America, disparities in hypertension care, particularly among low-income populations and marginalized groups, mirror findings from Brazil, where quality of care for hypertension is markedly lower for socioeconomically disadvantaged groups, as highlighted in a national study [21]. Similarly, in Asia, the dual burden of communicable and non-communicable diseases persists, as seen in India, where diabetes is frequently comorbid with tuberculosis, reflecting the syndemic nature of health challenges [22]. Furthermore, studies in China emphasize the increasing incidence

of diabetes and kidney diseases among youth, driven by risk factors like high BMI, a trend we also observed [23]. These comparisons underscore the shared challenges faced by LMICs in managing NCDs, particularly in resource-constrained settings, and the need for targeted, context-specific interventions informed by global insights.

It is important to acknowledge certain limitations in this analysis. The GBD data for Iraq, especially during periods of conflict, may be affected by underreporting or misclassification. Furthermore, this study identifies trends but does not establish causal relationships. Additional research is needed to explore the underlying factors driving NCD trends in Iraq.

Conclusion

The findings from the GBD 2021 study illustrate both progress and ongoing challenges in managing NCDs in Iraq from 2003 to 2021. While significant strides have

been made in reducing mortality among younger populations, particularly for chronic respiratory diseases, the persistent high mortality rates among older males, especially from cardiovascular diseases, indicate the need for more targeted interventions. The rising prevalence of neoplasms, diabetes, and kidney diseases underscores the growing burden of NCDs, exacerbated by lifestyle changes and healthcare disparities. Continued efforts to address risk factors, improve healthcare access, and focus on preventive strategies, particularly for vulnerable and older populations, are essential for further progress.

Abbreviations

ASIR	Age-Standardized Incidence Rate
ASMR	Age-Standardized Mortality Rate
ASPR	Age-Standardized Prevalence Rate
ASRs	Age-Standardized Rates
CVDs	Cardiovascular Diseases
GBD	Global Burden of Diseases
LMICs	Low- and Middle-Income Countries
MENA	Middle East and North Africa
NCDs	Non-communicable Diseases
UI	Uncertainty Interval
WHO	World Health Organization

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12889-024-21080-v>.

Supplementary Material 1

Acknowledgements

I would like to thank the GBD study team for their efforts in producing and maintaining high-quality global health data.

Author contributions

Mohammed Merzah is the sole author of this paper.

Funding

No funding to be disclosed.

Data availability

Utilizing data from the Global Burden of Disease (GBD) study 2021 (<http://ghd.x.healthdata.org/gbd-results-tool>).

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Received: 2 October 2024 / Accepted: 12 December 2024

Published online: 29 January 2025

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