# RESEARCH

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# Burden of non-communicable diseases in South Asia: a decomposition analysis



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# Abstract

**Background** This study examines the incidence, prevalence, deaths, and disability-adjusted life years (DALYs) related to non-communicable diseases (NCDs) in South Asia, exploring the environmental, metabolic, and behavioural risk factors, and exploring changes in deaths and DALYs driven by population growth, aging, and mortality rates.

**Methods** Using data from the Global Burden of Disease (GBD) study 2021, we estimated age-standardized incidence, prevalence, deaths, and DALYs for four major NCDs: cardiovascular diseases, cancer, diabetes, and chronic respiratory diseases from 2010 to 2021. Gender and age-specific estimations were conducted across all NCDs, with 95% uncertainty intervals and a decomposition analysis was employed to estimate change in death and DALYs attributable to NCDs.

**Findings** The burden of NCDs in South Asia increased by 3.00% in incidence from 2010 to 2021, while overall prevalence decreased by 1.00%, yet the age-standardized prevalence rate remains above the global rate (91,570 per 100,000 population). Incidences of cardiovascular and respiratory diseases declined by 3.00% and 13.00%, respectively, whereas diabetes and cancer rose by 21.00% and 13.00% in South Asia. Nepal faced the highest environmental impact (23.4% of DALYs), Bangladesh the greatest metabolic impact (25.62%), and India the highest from behavioural factors (23.95%). Population growth and aging were primary drivers of changes in deaths and DALYs across the region.

**Conclusion** This finding emphasizes the need for targeted public health interventions addressing environmental, metabolic, and behavioral risks for NCDs in South Asia, alongside strategies to support healthy aging and effective disease management across diverse demographic groups.

Keywords Non-communicable diseases, South Asia, Risk factors, Global burden of disease

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# Introduction

The world has experienced a major transformation, with non-communicable diseases (NCDs) emerging as leading cause of mortality, particularly in low- and middle-income countries (LMICs) [1]. In 2019, NCDs accounted for 73.9% of global deaths, up from 59.5% in 2000 [2]. Annually, around 15 million people aged 30–69 die prematurely due to NCDs. Studies indicate the global age-standardized death rate (ASDDR) for NCDs is 510.54 per 100,000 people, with NCDs comprising 75.26% of total deaths globally [3].

Research indicate that four major NCD groups cardiovascular diseases (17.9 million deaths), cancer (9 million), respiratory diseases (3.9 million), and diabetes (1.6 million)—are among major contributors to global mortality. Nearly 80% of these NCD-related deaths are premature [4], creating substantial socioeconomic burden, especially in LMICs. The global NCDs Action Plan includes a monitoring system and establishes nine targets to be achieved by 2025 [5], aligning with 2030 Sustainable Development Goals [6].

South Asian Region (SAR), home to a quarter of the global population, faces a growing NCDs burden due to globalization, urbanization, sedentary lifestyles, and dietary shifts [7]. Age differences, especially among older adults, heighten the region's NCD-related mortality risk [8]. Rising Deaths and Disability-Adjusted Life Years (DALYs) underscore the need to address key risk factors like inappropriate lifestyle and air pollution for NCDs [9, 10]. Addressing these factors are essential for safeguarding health and promoting well-being.

Several research evidence underscore regional disparities in NCD burden and emphasize on the critical need for targeted health interventions tailored to regional contexts to reduce the disease burden [11, 12]. Research evidence has documented that the risk profiles of the populations vary significantly not only between the countries but also within the population [13]. The population also have lifestyle issues concerning to the choices of food consumption, which needs to be modified by awareness regarding healthier food choices and for better lifestyle within the socio-economic strata [14]. Additionally, research findings indicate that the South Asian countries, particularly India and Nepal have been going through an epidemiological transition with an increase in the proportion of disease burden attributable to NCDs [15, 16]. Hence, tackling the burden of NCDs especially the burden of cardiovascular diseases, diabetes, and chronic respiratory diseases and cancer collectively is pivotal as it accounts for more than 17 million deaths across globe each year with more than 86% death in resource constrained countries such as SAR [16-19].

Some of the studies has mentioned that majority of the SAR have reported a higher CVD burden as compared to the developed countries due to various socio-economic and demographic disadvantages for population [19, 20]. Additionally, various studies mentioned the resource constraints and deprivation due to less-resourced health systems and smoking as among the major causes adding in premature deaths due to respiratory diseases [21–23]. Similarly, literature based on cancer has mentioned that cancer will soon become the leading cause of death across the globe majorly in South Asia [24, 25].

Comprehensive literature on NCDs in SAR, particularly for CVDs, cancer, respiratory disease, and diabetes, remains limited. There is a paucity of research findings that identify the various risk factors associated with the growing burden of NCDs, particularly in SAR. Additionally, the contribution of various demographic and epidemiologic factors to the increased burden of NCDs is SAR is less explored. Therefore, identifying various risk factors (environmental, behavioural, and metabolic) associated with NCDs and assessing their impact in SAR is essential for tackling NCDs challenges effectively. Further, the growing burden of NCDs necessitates an in-depth analysis of the contribution of specific level 2 risk factors. Moreover, understanding how key demographic factors like aging, population growth, and epidemiological driver like mortality rates impact NCD-related deaths and DALYs is crucial for a comprehensive public health policy aimed to enhance the overall quality of life of individuals. Assessment of gender gap and age-specific incidence, death and DALYs related to NCDs is crucial to get deeper insights to the burden of NCDs. This study assesses the incidence, prevalence, deaths, and DALYs attributed to major NCDs specifically for CVDs, respiratory diseases, cancer, and diabetes across five SAR namely, India, Bhutan, Nepal, Bangladesh, and Pakistan. We examined how demographic factors-population aging, growth, and mortality rates-contribute to changing death-rates and DALYs due to NCDs. By focusing on level 2 risk factors rather than just level 1, the study provides a detailed view of epidemiological transitions, evaluating the impact of environmental, metabolic, and behavioural risk factors on NCDs.

## Methods

#### Data and sample

We analysed data from the Global Burden of Disease (GBD) 2021 study, spanning 204 countries, including subnational estimates for 21 countries. Detailed methodologies used in GBD-2021 are provided elsewhere [26]. The GBD study assesses the prevalence,

incidence, Years of Life Lost (YLLs), Years Lived with Disability (YLDs), and DALYs and deaths for 371 diseases and injuries accounting for 88 risk factors across different levels.

We obtained GBD 2021 data for SAR from the publicly available Global Health Data Exchange GBD Results Tool (https://ghdx.healthdata.org). The present study analysed data on NCDs and their associated Level 1 risk factors (environmental and occupational, behavioural, and metabolic) and Level 2 risk factors, which comprise 20 specific risks such as air pollution and dietary habits, clustered under five Level 1 risk factors for five SAR: India, Pakistan, Bhutan, Nepal, and Bangladesh, based on data availability. We examined the change in incidence, prevalence, death, and DALYs (per 100,000 population) for all NCDs, with a focus on four major NCDs: cardiovascular diseases, respiratory diseases, cancer, and diabetes from 2010 to 2021 with 95% uncertainty intervals (UI). Additionally, we provide gender- and age-specific estimates for all NCDs, categorizing by male and female and across age groups (<5, 5-9, 10-14, 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, 70-74, 75-79, 80+).

Based on the methodology given by Das Gupta, the present study has employed decomposition analysis to understand major contributors to risk factors such as population growth, aging, and change in age specific rate (mortality and DALYs) to change in NCDs mortality and disability from 2010 to 2021 [27, 28]. The age-specific rate takes into account all the changes that are not explained by demographic change (the population growth and aging), rather it may include the combined effects of life-style risk factors and health care. The formula used in our analysis has been written as follows:

$$Death_{i,y} = \sum_{i=1}^{17} (P_{iy} * A_{iy} * S_{iy})$$
(1)

$$DALYs_{i,y} = \sum_{i=1}^{17} \left( P_{iy} * A_{iy} * S_{iy} \right)$$
(2)

The expression  $Death_{i,y}$  and  $DALYs_{i,y}$  denotes the death and DALYs rate due to NCDs. The term *i* and *y* denotes different age groups (<5 years, 5–9, 10–14, 15–19, 20–24, 25–29, 30–34, 35–39, 40–44, 45–49, 50–54, 55–59, 60–64, 65–69, 70–74, 75–79, 80 and above) and time period from 2010 to 2021. The term  $P_{iy}$ ,  $A_{iy}$ , and  $S_{iy}$  represents population growth, aging, and age specific death/ DALYs rate by each age group within the specified time period. The analysis has been done by holding one factor constant at a time and calculating the expected deaths or years of disability under that counterfactual scenario.

### Findings

#### Incidence and prevalence of NCDs in SAR countries

The incidence of NCDs in SAR increased by 3% over the past decade (Table 1). In 2021, India reported the highest age-standardized incidence rate (ASDIR) at 166,492.25, while Bhutan had the lowest at 154,678.14. The ASDIR for CVDs in SAR was 912.17 in 2021, reflecting a 3% reduction from 2010 to 2021 (Table S1). Respiratory diseases saw a 13% decline in incidence over the same period (Table S2). In contrast, diabetes incidence rose by 21% and cancer by 13% from 2010 to 2021 (Tables S3 and S4). The age-standardized prevalence rate (ASDPR) of NCDs in SAR decreased by 1%, reaching 91,570.03. India had the highest ASDPR in 2021 (92,134.39), despite a 1% decline over the past decade, while Nepal had the lowest (88,866.31). CVD prevalence in SAR increased by 2%, whereas respiratory diseases saw an 8% decline in ASDPR (Tables S1 and S2). Cancer and diabetes prevalence, however, surged by 26% over the past decade (Tables S3 and S4).

#### Deaths and DALYs associated with NCDs in SAR countries

SAR have an ASDDR of 612.08, reflecting a 3% reduction from 2010 to 2021. Pakistan reported highest ASDDR (732.16), while Bhutan has the lowest at 555.46 (Table 1). The ASDDR for CVDs and respiratory diseases in SAR decreased by 2% and 8%, respectively (Tables S1 and S2). Cancer-related ASDDR rose by 5%, and diabetes-related ASDDR increased by 15% over the last decade (Tables S3 and S4). SAR reports an agestandardized DALY rate of 23,033.05, a 4% reduction but still above the global rate (Table 1). Within SAR, Pakistan reported highest DALY rate (26,330.3), while Bhutan has the lowest (20,594.36). CVD-related DALYs declined by 5% in the past decade (Table S1). The 2021 age-standardized DALYs for respiratory diseases in SAR was 2662.79 (Table S2). DALYs from diabetes increased by 18% over the decade (Table S3), and cancer-related DALYs rose by 3%, reaching 2123.92 in 2021 (Table S4).

#### Incidence, deaths and DALYs of NCDs by age and gender

The incidence of NCDs by age and gender in 2021 is illustrated in Figure S1. The data shows that the highest incidence cases are reported among both males and females in the age group of 5–9 years. Conversely the lowest incidence is observed in individuals aged 80 years and older. Additionally, for the age groups under 5 years, and 5–9 years the incidence of NCDs is higher in males as compared to females. In contrast, in all other age groups, females exhibit a higher the incidence of NCDs than males. Whereas, the age specific

Country,	Incidence cases (9:	5% uncertainty ii	nterval)	Deaths (95% ur	certainty int	erval)	Prevalence cases	(95% uncertaint	ty interval)	DALYs (95% uncer	rtainty interval)	
Kegion	2021 total cases	ASDIR 2021	% changes in age standardised rates 2010–2021	2021 total cases	ASDDR 2021	% changes in age standardised rates 2010–2021	2021 total cases	ASDPR 2021	% changes in age standardised rates 2010–2021	2021 total cases	DALYs ASDR 2021	% changes in age standardised rates 2010–2021
Global	12,364,222,888 (11,859,103,110 to 12,922,829,056)	156,214.83 (149,373.11 to 163,580.89)	2.00 (1.00–3.00)	43,768,182 (41,841,301 to 45,882,469)	529.67 (506.58 to 554.52)	– 11.00 (– 15 to – 7)	7,255,129,087 (7,201,504,217 to 7,305,480,908)	91,033.98 (90,296.74 to 91,725.48)	0.00 (0.00 to 0.00)	1,727,188,945 (1,537,884,455 to 1,941,634,668)	20,783.00 (18,495.72 to 23,367.89)	- 6.00 (- 10.00 to - 4.00)
South Asia	3,045,247,611 (2,918,633,696 to 3,184,623,125)	165,913.29 (159,335.6 to 173,100.82)	3.00 (1.00 to 5.00)	8,120,840 (7,567,223 to 8,709,941)	612.08 (571.84 to 655.58)	- 3.00 (- 10.00 to 5.00)	1,694,937,499 (1,681,266,263 to 1,708,531,620)	91,570.03 (90,852.48 to 92,285.25)	- 1.00 (- 1.00 to 0.00)	369,823,631 (325,029,016 to 419,566,044)	23,033.05 (20,460.81 to 25,878.84)	- 4.00 (- 9.00 to 1.00)
India	2,345,624,282 (2,254,237,174 to 2,448,467,490)	166,492.25 (159,950.06 to 173,617.81)	3.00 (1.00 to 5.00)	6,471,469 (5,979,897 to 7,033,437)	603.13 (558.32 to 655.56)	- 1.00 (- 10.00 to 9.00)	1,311,095,948 (1,301,621,039 to 1,320,632,392)	92,134.39 (91,442.45 to 92,849.01)	- 1.00 (- 1.00 to 0.00)	289,485,725 (252,332,141 to 329,752,707)	22,776.87 (20,067.31 to 25,730.04)	- 3.00 (- 9.00 to 3.00)
Pakistan	383,541,608 (364,326,329 to 403,824,041)	166,431.00 (159,470.4 to 174,096.39)	2.00 (0.00 to 4.00)	811,950 (701,390 to 962,900)	732.16 (634.94 to 862.21)	- 6.00 (- 21.00 to 17.00)	204,989,666 (202,242,428 to 207,609,188)	89,501.15 (88,562 to 90,390.60)	0.00 (0.00 to 1.00)	42,592,433 (36,114,870 to 49,683,870)	26,330.3 (22,632.04 to 30,765)	- 4.00 (- 16.00 to 11.00)
Nepal	47,716,848 (45,341,920 to 50,361,832)	155,498.72 (148,300.7 to 163,900.04)	2.00 (0.00 to 5.00)	136,225 (115,936 to 163,899)	670.54 (579.16 to 799.91)	4.00 (- 11.00 to 23.00)	27,459,495 (27,059,950 to 27,817,291)	88,866.31 (87,708.74 to 89,952.07)	- 1.0 (- 2.00 to 0.00)	6,101,979 (5,135,345 to 7,182,536)	23,881.81 (20,274.27 to 28,000.71)	1.00 (- 10.00 to 12.00)
Bhutan	1,168,229 (1,114,093 to 1,229,592)	154,678.14 (147,631.08 to 162,809.3)	2.00 (0.00 to 3.00)	3140 (2624 to 3659)	555.46 (469.01 to 640.16)	- 2.00 (- 15.00 to 10.00)	680,273 (671,326 to 680,273)	88,912.58 (87,668.57 to 90,049.97)	0.00 (0.00 to 0.00)	137,600 (114,708 to 161,646)	20,594.36 (17,284.93 to 24,020.84)	- 4.00 (- 13.00 to 5.00)
Bangladesh	267,196,588 (251,376,627 to 285,104,680)	162,932.74 (153,499 to 173,354.95)	2.00 (0.00 to 3.00)	698,055 (575,530 to 843,251)	571.18 (475.97 to 681.86)	- 20.00 (- 33.00 to 4.00)	150,712,117 (148,911,470 to 15,236,634)	91,348.64 (90,283.28 to 92,345.00)	0.00 (0.00 to 0.00)	31,505,894 (26,312,213 to 37,202,034)	21,487.25 (18,075.89 to 25,274.17)	- 12.00 (- 21.00 to - 2.00)

**Table 1** Incidence case, death case, prevalence case and DALYs and age-standardised rate for non-communicable disease in 2021 with age-standardised percentage rates from 2010 to 2021 in South Asia

incidence rates among females were substantially higher than their males' counterpart.

Additionally, the study highlights that the death cases attributable to NCDs are highest among both males and females aged 80 years and above and lowest among individuals aged 5–9 years. The females experience higher death counts in the age groups of 15–19 years, and 80 and above years. (Fig. 1). Along with that age specific death rates were gradually increased for both sexes in 2021.

The DALY count across gender and age groups has varied notably in 2021. The highest DALY counts are reported among the individuals aged 65–69 years followed by those aged 60–64 years. In contrast, individuals aged 5–9 years have the lowest DALY count as compared to all other age groups. Additionally, females in age-groups of 10–14 years, 15–19 years, 20–24 years, 25–29 years, 30–34 years, 35–39 years, 80 years and above report higher DALY count than their male counterparts. However, there was a consistent increase in age specific DALYs rate for both sexes during this timeframe (Figure S2).

#### **Risk factors associated with NCDs**

In 2021, environmental factors were a major contributor to NCDs, accounting for 20.25% of cases in SAR (Table 2). Nepal leads with the highest percentage of DALY cases due to environmental factors (23.4%). Among environmental risks, air pollution is the primary contributor to DALYs for CVDs (32.79%) and respiratory diseases (51.09%) across SAR (Tables S5 and S6). It also leads in DALYs for cancer (3.55%-globally; 2.73%-SAR) and diabetes, affecting 16.34% globally and 18.81% in SAR (Tables S7 and S8). Metabolic factors account for 24.69% of DALY cases in SAR, with high systolic blood pressure (HSBP) contributing 44.75% to CVD DALYs and high LDL adding 20.49%. For cancer, high fasting glucose accounts for 1.67% of cases, and high body mass for 1.51% (Table S7). About 2.07% of respiratory disease cases are caused by high body mass. High fasting glucose drives 100% of diabetes-related DALYs in SAR, with high body mass contributing to 37.49% of cases.

Furthermore, behavioural factors contributed to 23.67% of NCDs in SAR. In SAR, India has the highest contribution to behavioural factors for DALY cases from NCDs at 23.95%. Tobacco consumption is the prime behavioural risk factor that contributes 26.69% in SAR as the cause of respiratory diseases. Among the behavioural risk factors, dietary risks are the most significant contributor for NCDs accounting for 38.34% of CVD cases and 26.69% cases of respiratory diseases. Among various behavioural risk factors, tobacco use is the primary contributor to cancer in SAR, accounting for 14.1% of cases, followed by dietary risks at 5.18%, and high alcohol consumption at 3.53%. In the SAR, dietary risks were the primary factor for diabetes that contribute 20.13% of DALY cases with tobacco use at 9.68%, low physical activity at 6.34%, and high alcohol use at 1.01%.

#### Demographic and epidemiologic drivers of NCDs

Table S9 presents the results of decomposition analysis to assess the impact of major risk factors like population growth, population aging, and age-specific mortality rate change on the change in deaths attributable to major NCDs from 2010 to 2021. It shows that in SAR, the overall change in death counts from the period 2010–2021 due to NCDs is 34.1%. Among all NCDs, the overall change in deaths is highest for diabetes (63.1%), followed by cancer (44.7%), CVDs (37.9%), and respiratory diseases (31.7%). The change in deaths due to NCDs in SAR could have led to a 6.9% reduction, if the impact



Fig. 1 Age specific death cases and rate of NCDs by male and female in South Asia, 2021

Level 1 Risk	Global		South Asia		India		Pakistan		Nepal		Bhutan		Bangladesh	
factors	Total cases	Percentage 95% UI)	Total cases	Percentage 95% UI)	Total cases	Percentage 95% UI)	Total cases	Percentage 95% UI)	Total cases	Percentage 95% UI)	Total cases	Percentage 95% UI)	Total cases	Percentage 95% UI)
Environmental risk factors	249,846,504 (211,813,158 to 285,713,292)	14.49% (12.38 to 16.77)	74,721,188 (64,577,551 to 84,650,604)	20.25% (17.59 to 23.11)	59,126,011 (50,383,712 to 67,910,295)	20.46% (17.64 to 23.43)	7,585,943 (6,221,340 to 9,042,239)	17.82% (15.32 to 20.6)	1,426,148 (1,152,730 to 1,739,567)	23.4% (20.28 to 26.78)	22,648 (17,531 to 27,734)	16.49% (13.83 to 19.34)	6,560,439 (5,179,740 to 8,058,985)	20.86% (17.66 to 24.33)
Metabolic risk factors	455,032,169 (391,184,568 to 517,659,970)	26.4% (22.78 to 30.07)	91,084,721 (81,128,249 to 101,563,748)	24.69% (21.44 to 27.63)	71,086,611 (62,299,277 to 80,336,354)	24.61% (21.44 to 27.66)	10,570,208 (8,795,518 to 12,921,548)	24.84% (21.12 to 28.49)	1,338,525 (1,088,445 to 1,628,887)	21.96% (18.97 to 25.11)	31,836 (24,730 to 39,183)	23.17% (19.19 to 27.13)	8,057,541 (6,474,121 to 9,781,838)	25.62% (21.92 to 29.27)
Behavioural factors	423,794,722 (317,056,853 to 503,323,000)	24.59% (18.56 to 29.05)	87,343,648 (55,141,984 to 106,482,642	23.67% (15.44 to 29.01)	69,190,473 (42,878,819 to 84,714,811)	23.95% (15.51 to 29.43)	9,469,720 (5,808,322 to 12,359,425)	22.25% (14.1 to 27.55)	1,443,669 (1,033,173 to 1,805,206)	23.68% (17.7 to 28.41)	26,895 (17,099 to 34,120)	19.56% (13.1 to 24.04)	7,212,892 (4,828,842 to 9,111,969)	22.91% (15.36 to 28.34)

able 2 Non communicable disease DALYs cases and percentage associated with level 1 risk factors in 2021, South Asia by all ages, both sexes

of population growth and aging that contribute 16.3% and 24.7% respectively to total change in death rate is excluded (Fig. 2). A similar trend arises for CVDs and respiratory diseases, where the reduction in deaths is overshadowed by the impact of population growth and population aging. However, for both cancer and diabetes, the overall change in deaths is attributed to population growth, population aging, and rising mortality rates (Table S9).

In SAR, Pakistan experienced significant NCDrelated deaths due to population growth; however, for countries like India, Bangladesh, Nepal, and Bhutan, population aging plays a crucial role to the overall change in NCD-related deaths. In Bangladesh, population aging has been a primary factor in rising deaths from 2010 to 2021. Without the impact of aging and population growth, deaths from CVDs respiratory diseases, cancer, and diabetes might have decreased by 28.7%, 50.7%, 14.7%, and 22.7% respectively. Bhutan shows similar patterns, with aging contributing significantly to NCD-related deaths, while in Nepal, population growth, population aging, and mortality rate changes are the key drivers for increase in NCDs deaths related to cancer and diabetes (Table S9).

The decomposition analysis from 2010 to 2021 shows a 25% overall change in DALY count due to NCDs in SAR (Fig. 3). Diabetes related DALY recorded highest increase (62.5%), followed by cancer (36.6%), CVDs (29.5%), and respiratory diseases (24.4%). If the impact of population growth (16.3%) and aging (14.3%) were excluded, the change in DALY count would drop to 5.6% in SAR. Diabetes shows the largest impact from changes in disability rates (24%), followed by aging (22%) and population growth (16.3%) (Table S10). While analysing country-specific factors contributing to the overall change in DALYs, for Pakistan, population growth is a prime contributor to the overall change in DALYs across all major NCDs. However, in Bangladesh aging population acts as a significant contributor to the change in DALY counts. Moreover, in India population aging is a major determinant for respiratory diseases (24.3%). Bhutan shows similar trends, with population aging having a significant impact on DALY counts (Table S10).

# Discussion

The present study analyses the burden of major NCDs including incidence, deaths, prevalence, and DALY from 2010 –2021 in SAR, using GBD 2021 data. It highlights the transitioning burden of NCDs across SAR, including India, Pakistan, Bangladesh, Nepal, and Bhutan, to examine various risk factors using decomposition analysis. The findings revealed a notable increase in the burden of NCDs (incidence) across SAR. Although cases of deaths, DALY, and prevalence of NCDs modestly decreased in SAR, variations were recorded for Bangladesh which recorded notable reduction in ASDDR, whereas Nepal reported an increase. ASDPR of NCDs has declined for India and Nepal while remained stagnant in Bhutan, Bangladesh, and Pakistan. The DALY attributable to NCDs decreased sharply for Bangladesh. However, a notable rise in ASDIR, ASDPR, ASDDR, and DALYs attributable to NCDs remain a critical public health challenge across SAR. Previous GBD-based studies indicated reductions in ASDDR and DALY were not the sole measures rather it should be assessed across all major indicators. These findings underscore regional disparities highlighting the need for targeted, region-specific public-health interventions [11].

Additionally, the study reports a significant shift in the burden of CVDs in SAR, with reductions observed in ASDIR, ASDPR, ASDDR, and DALY. SAR faced a higher CVD burden due to transitioning sedentary lifestyles, unhealthy dietary choices, psycho-social concerns, and genetic pre-disposition [3, 29]. Pakistan reported highest ASDIR, ASDPR, ASDDR, and DALY attributable to CVDs linked to dietary, social, economic and access to healthcare as reported in other studies [3, 30].



Fig. 2 Contribution of changes in population growth, population aging, and rates of age-specific mortality to the percentage change in deaths due to NCDs, 2010–2021



Change due population growth Change due to aging Change due to age-specific disability rate

Fig. 3 Contribution of changes in population growth, population aging, and rates of age-specific disability to the percentage change in DALYs due to NCDs, 2010–2021

Bangladesh exhibited significant reduction in ASDDR and DALY, though its ASDPR has increased, sustaining a considerably higher CVD burden. These improvements are attributed to coordinated public health efforts involving government, NGOs, micro financing initiatives, public–private-partnerships, and better community awareness [3, 20].

Our findings revealed notable reductions in the incidence and deaths from respiratory diseases with daunting variability across SAR. Despite the reduction in ASDIR, ASDDR, and DALY, respiratory diseases remained a leading cause of mortality in the region [23, 31]. Key risk factors include smoking, household air pollution from solid fuels, and exposure to ambient particulate matter [22, 23]. Due to undergoing structural transformations for boosting industrialization across SAR, there has been rise in emission exposure [3, 23, 31].

Present study exhibited a significant rise in incidence of diabetes with notable variations in decadal percentage changes across SAR. The DALY due to diabetes increased notably in Nepal, followed by India; devoted to lifestyle factors, dietary behaviours, physical inactivity, and rapid urbanization [16]. Additionally, the burden of cancer in SAR surged as indicated by high ASDDR and DALY. The increase in cancer cases are attributed to local environmental factors, exposure to occupational carcinogens, living conditions, medical factors, and limited healthcare resources [25, 32]. Addressing the burden of NCDs, particularly CVDs, diabetes, respiratory diseases, and cancer are critical, as they account for 41 million deaths globally every year. Notably, over 17 million of these deaths occur before the age of 70, with more than 86% premature deaths occurring in SAR [4, 33].

We found that environmental, metabolic, and behavioural factors significantly impacted NCDs in SAR. Nepal endures the highest burden from environmental factors, while Bangladesh experienced highest cases attributed to metabolic risk factors, and Nepal reporting the lowest DALY. India faced major challenges from behavioural factors. Overall, level 1 risk factors contributed to maximum cases across SAR. Within environmental factors, air pollution is a primary contributor to CVD burden, while dietary risks are the leading behavioral cause [3, 31]. Among metabolic factors, HSBP is leading cause, followed by high LDL cholesterol. These findings indicate a worsening trend in risk exposure and NCDs burden across SAR. Studies suggest that modifying health behaviours, improving access to healthcare, and enhancing living environments are crucial in reducing risk exposure [25]. Air pollution is a significant contributor to cancer and diabetes related DALY. Metabolic factors such as high fasting glucose and high body mass were major risks, aligning with previous studies emphasizing on the growing impact of risk behaviours and dietary patterns. The shift towards high carbohydrate diet, saturated fats, sugars, and salt, coupled with increased disposable income and purchasing power, are added public health concerns.

SAR are facing double-burden from NCDs: a growing disease prevalence and overcrowded healthcare resources Decomposition analysis indicates disproportionate rise in mortality and DALY linked to population growth, population aging, and age-specific mortality and disability. A detailed analysis of mortality patterns revealed higher vulnerability to NCD-related fatalities among older age groups, highlighting on significant impact of aging population. In contrast, lower fatality rates among younger cohorts suggest a lower prevalence and better overall health, reflecting resilience to chronic conditions [29, 34]. These findings underscore the multifaceted nature of NCD-related deaths, shaped by age-specific vulnerabilities reflecting the cumulative effects of chronic conditions and age-related health challenges [3, 35]. These trends are attributed to demographic shifts, including population growth, aging, decreased mortality, and increased life expectancy, as highlighted by decomposition analysis. Our findings are consistent with previous studies showing an increasing burden of NCDs, with rising incidence and prevalence across SAR [16, 36].

### Conclusion

This study highlights the rising NCDs burden in South Asia from 2010 to 2021. Despite slight declines in NCD-related mortality and DALYs, increasing incidence rates, especially in India and Pakistan, point to a continuing public health crisis. Urgent action is needed to protect well-being and improve health outcomes. Our analysis shows notable regional disparities and demographic variations by age-group, emphasizing the challenges of managing NCDs across diverse populations. Identifying clusters of NCDs risk factors and understanding their contributions are essential for tackling SAR's unique challenges. Targeted policies focusing on primary risk factors for DALYs can enhance quality of life and lower the global NCDs burden. The study showcases the genderbased differences and age-specific incidence, DALYs, and deaths due to NCDs. These findings will help in formulating gender-specific policy interventions catering to various age groups. Emphasis should be laid on reducing risk factors in high-incidence areas and vulnerable populations, promoting healthier lifestyles through dietary changes, physical activity, and reducing risky behaviors like smoking. Strengthening healthcare

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systems to improve access, affordability, detection, and surveillance is also crucial. A multi-sectoral approach, involving collaboration among stakeholders, is vital to mitigating the NCDs epidemic and advancing health equity across the region.

Although, the study has comprehensively assessed the impact of various risk factors attributable to the growing burden of NCDs in SAR nations, the present study has certain limitations. Despite its comprehensive coverage, the study has inherent data limitation based on GBD-2021, limiting its scope for sub-national analysis and exploring the regional disparities across the globe. Being, cross sectional design, the general applicability may subject to region specific tailored approaches. The causal inferences on certain risk factors, such as psychological stress and healthcare system capacity, remain underexplored, leaving the scope for incorporation. Though, the data can be used for the purpose of monitoring global health indicators, there is possibility of reporting bias affecting the wider policy implications. In the future studies, a longitudinal approach assessing the burden of NCDs can be taken into account. Additionally, a comparative assessment of SAR with other developed nations with respect to the burden of NCDs can aid in policy analyses and formulation.

# **Supplementary Information**

The online version contains supplementary material available at https://doi. org/10.1186/s41043-025-00827-0.

Additional file 1.

Additional file 2.

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#### Author contributions

Conceptualization: JP, SVS. Methodology: JP, RK, SVS. Data curation & formal analysis: TB, BM, SB. Writing—original draft: RD, BM, SB. Writing—review & editing: MP, JP, RK, SVS.

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# Data availability

Data is available at: https://ghdx.healthdata.org.

#### Declarations

**Ethics approval and consent to participate** Not applicable.

# Consent for publication

Not applicable.

#### **Competing interests**

The authors declare no competing interests.

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