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Review Article

Prevalence of lifestyle diseases in Goa: a comparison between NFHS-5 and NFHS-6

Myla Isha Pereira[1]*, Sandesh Chodankar[2], Chitralekha Nayak[3], Maheen Noushad[4], Aishwarya Loliyekar[1], Krishna Prakash P.[5]

[1]Department of Research, Healthway Hospitals, Goa, India
[2]Department of ENT, Healthway Hospitals, Goa, India
[3]Department of General Medicine, Healthway Hospitals, Goa, India
[4]Department of Health Services, Community Health Centre, Erumeli, Kerala, India
[5]Department of General Medicine, Jeyam Multi-speciality Hospital, Tiruchirapalli, Tamil Nadu, India

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***Correspondence:**
Myla Isha Pereira,
E-mail: pereiramyla31@gmail.com

ABSTRACT

Non-communicable diseases (NCDs) account for 74% of all global deaths and represent the foremost public health challenge of the twenty-first century. India is home to over 101 million adults with diabetes, the second-highest national burden in the world, and an estimated 315 million with hypertension. Goa, with its high urbanisation, above-average per capita income, rapidly ageing population, and distinct dietary practices, is expected to be at an advanced stage of India's epidemiological transition. The sixth round of the National Family Health Survey (NFHS-6, 2023-24), released by the Ministry of Health and Family Welfare in May 2026, provides, for the first time, the opportunity to compare key lifestyle disease indicators in Goa across two consecutive NFHS rounds. This study undertakes a comparative secondary analysis of published state and national fact sheet data for three core indicators: overweight/obesity, hyperglycaemia, and hypertension, disaggregated by sex and residential setting. The findings reveal a sharp and accelerating rise in obesity, from 36.1% to 45.1% among women (+9.0 percentage points) and from 32.6% to 43.6% among men (+11.0 pp), both exceeding the national trajectory. Hyperglycaemia similarly rose from 20.8% to 27.5% in women (+6.7 pp) and from 24.1% to 32.1% in men (+8.0 pp), with Goa's rates substantially above national averages. Hypertension remained stable overall, but with a notable compositional shift towards better pharmacological control. These findings place Goa's NCD burden among the highest in India and call for urgent, evidence-based community medicine responses, including population-level obesity prevention, expanded metabolic screening, and culturally adapted dietary intervention.

Keywords: Non-communicable diseases, NFHS-6, Goa, Obesity, Hyperglycaemia, Hypertension, Epidemiological transition, Lifestyle diseases

INTRODUCTION

Non-communicable diseases (NCDs) are responsible for nearly three-quarters (74%) of global deaths and represent a growing challenge for health systems in low and middle-income countries.[1] India's epidemiological transition has been underway for decades, characterised by increasing prevalence of obesity, diabetes mellitus, hypertension, and cardiovascular disease. The ICMR-INDIAB-17 study, the largest nationally representative

survey of metabolic NCDs in India, documented overall diabetes prevalence of 11.4%, prediabetes of 15.3%, generalised obesity of 28.6% and hypertension of 35.5% with wide inter-state variation driven by socioeconomic development, urbanisation, and dietary patterns.[2] A parallel analysis using Global Burden of Disease (GBD) data found that diabetes incidence in India increased from 162.74 to 264.53 per 100,000 between 1990 and 2021, with southern and western states, including Tamil Nadu and Goa, exhibiting the highest age-standardised prevalence rates and disability-adjusted life years (DALYs).[3]

Goa presents a particularly instructive setting within this national transition. It is India's smallest state by area and among its wealthiest in terms of per capita GSDP, with an urbanisation rate exceeding 62% and 17.2% of its population aged 60 years and above, one of the highest ageing proportions nationally.[4–6] Previous studies have identified Goa as one of the Indian states with a high burden of diabetes and obesity; however, comprehensive evaluation of temporal changes in major lifestyle diseases using NFHS (National Family Health Survey)-6 data remains limited.[2,3] The present study aimed to compare the prevalence of obesity, hyperglycemia, and hypertension in Goa between NFHS-5 and NFHS-6 and to examine these trends in relation to national estimates.

METHODS

This is a comparative secondary analysis of aggregated, publicly available data from two rounds of the NFHS, which were conducted by the Ministry of Health and Family Welfare, coordinated by the International Institute for Population Sciences, Mumbai and implemented by a group of survey organisations and Population Research Centres, selected following a rigorous selection procedure. No primary data collection was undertaken, and ethical clearance is therefore not applicable. NFHS-5 data for Goa were extracted from the published state report, which covered fieldwork conducted from 30 August to 26 November 2019.[7] The sample comprised 1,856 households, 2,030 women aged 15-49 years, and 313 men aged 15-54 years. All biomarker measurements, including blood pressure, random blood glucose, and anthropometry, were collected using standardised Clinical, Anthropometric and Biochemical (CAB) protocols. NFHS-6 data for Goa were extracted from the NFHS-6 India and State/UT Fact Sheets, which covered approximately 6,79,238 households nationally.[8]

The three primary outcome indicators were compared: overweight or obesity, defined as body mass index (BMI) ≥25 kg/m^2 among adults aged 15-49 years (excluding pregnant women and those with a birth in the preceding two months); hyperglycemia, defined as blood glucose level >140 mg/dl or current use of antidiabetic medication among individuals aged ≥15 years; and hypertension, defined as systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg or current use of antihypertensive medication among individuals aged ≥15 years. Lifestyle risk factors (tobacco, alcohol, food consumption frequency) from NFHS-5 Goa Table 94 and 77, and NFHS-6 Goa factsheet indicators 98-101, were extracted as contextual determinants.

The study was based on data available in the public domain. For each indicator, absolute percentage-point changes and relative percentage changes were calculated. All statistical analyses were performed in Microsoft Excel. As only aggregate published figures were used, inferential statistics and confidence intervals could not be calculated.

RESULTS

The prevalence of overweight and obesity among women aged 15-49 years in Goa rose from 36.1% in NFHS-5 to 45.1% in NFHS-6, an increase of 9.0 pp or a relative rise of 24.9%. The increase among men was even larger: from 32.6% to 43.6%, representing 11.0 pp or a relative increase of 33.7%. Both figures substantially exceeded the national trajectory, where the increase was 6.7 pp among women and 4.4 pp among men. Goa's female obesity rate has now been shown to exceed the national average (30.7%) by 14.4 pp, and the male rate (43.6%) exceeds the national average (27.3%) by 16.3 pp. The near-elimination of the urban-rural gap in Goa in male obesity is notable: urban men recorded 44.1% and rural men 42.9%, compared with a national urban figure of 36.3% and a rural figure of 23.0%. Urban women in Goa (48.3%) and rural women (41.1%) both exceeded the corresponding national figures (42.8% and 25.5%, respectively) (Table 1 and 2).

Table 1: Lifestyle disease indicators in Goa and India: NFHS-5 and NFHS-6.[7,8]

Indicators	Goa NFHS-5	Goa NFHS-6	India NFHS-5	India NFHS-6
Overweight or obesity (BMI ≥25.0 kg/m2; age 15-49 years; excludes pregnant women)				
Women	36.1	45.1	24.0	30.7
Men	32.6	43.6	22.9	27.3
Blood glucose level (random blood glucose; age 15+ years)				
Women				

Continued.

Indicators	Goa NFHS-5	Goa NFHS-6	India NFHS-5	India NFHS-6
High or very high or on medication (>140mg/dl or on medication)	20.8	27.5	13.5	17.8
High (141-160 mg/dl)	8.6	8.8	6.1	7.5
Very high (>160mg/dl)	9.6	15	6.3	9.1
Men				
High or very high or on medication (>140 mg/dL or on medication)	24.1	32.1	15.6	20.9
High (141-160mg/dl)	10.3	10.1	7.3	8.8
Very high (>160mg/dl)	11.6	17.3	7.1	10.9
Hypertension (age 15+ years)				
Women				
Elevated BP (SBP ≥140 mm of Hg and/or DBP ≥90 mm of Hg) or taking medicine to control BP	27.5	26.2	21.3	19.4
Mildly elevated BP (SBP 140-159 mm of Hg and/or DBP 90-99 mm of Hg)	12.1	8.3	12.4	9.4
Moderately or severely elevated BP (SBP ≥160 mm of Hg and/or DBP ≥100 mm of Hg)	3.6	5.1	5.2	4.8
Men				
Elevated BP (SBP ≥140 mm of Hg and/or DBP ≥90 mm of Hg) or taking medicine to control BP	26.8	27.5	24.0	22.1
Mildly elevated BP (SBP 140-159 mm of Hg and/or DBP 90-99 mm of Hg)	14.8	9.7	15.7	12.4
Moderately or severely elevated BP (SBP ≥160 mm of Hg and/or DBP ≥100 mm of Hg)	4.7	4.4	5.7	3.3

*NFHS = National Family Health Survey; BP = blood pressure; SBP = systolic blood pressure; DBP = Diastolic blood pressure; BMI = body mass index

Table 2: Absolute and relative changes in NCD indicators: Goa vs India (NFHS-5 and NFHS-6).[7,8]

Indicators	Goa NFHS-5 %	Goa NFHS-6 %	Δpp Goa	Δ relative Goa %	Δpp India
Overweight or obesity (BMI ≥25.0 kg/m²					
Women	36.1	45.1	+9.0	+24.9	+6.7
Men	32.6	43.6	+11.0	+33.7	+4.4
Elevated blood glucose (>140 mg/dL or on anti-diabetic medication)					
Women	20.8	27.5	+6.7	+32.2	+4.3
Men	24.1	32.1	+8.0	+33.2	+5.3
Hypertension (SBP ≥140 mm of Hg and/or DBP ≥90 mm of Hg or taking medicine to control BP)					
Women	27.5	26.2	-1.3	-4.7	-1.9
Men	26.8	27.5	+0.7	+2.6	-1.9

*NFHS = National Family Health Survey; pp = percentage points; Δ relative = relative change, computed as (Δ pp/NFHS-5 value) x 100

The composite indicator for elevated blood glucose (>140 mg/dL or on anti-diabetic medication) among women aged 15 years and above rose from 20.8% to 27.5% (Δ = +6.7 pp; relative +32.2%). Among men, the increase was from 24.1% to 32.1% (Δ = +8.0 pp; relative +33.2%). Goa's male composite rate (32.1%) exceeds the national average (20.9%) by 11.2 pp. The very high blood glucose sub-category (>160 mg/dl, broadly consistent with uncontrolled diabetes) rose from 9.6% to 15.0% in women (+5.4 pp) and from 11.6% to 17.3% in men (+5.7 pp), and accounts for the dominant share of the inter-round increase. Urban-rural disaggregation reveals near-identical composite rates in Goa's urban and rural women (27.4% vs 27.7%) in NFHS-6, contrasting sharply with the national pattern (urban 21.9% vs. rural 16.2%). In men, urban Goa (36.3%) exceeds rural Goa (27.4%), but both are well above national comparators (urban 23.9% vs. rural 19.7%). Composite hypertension prevalence among women declined from 27.5% to 26.2% (Δ = -1.3pp), while the national figure declined from 21.3% to 19.4% (Δ = -1.9 pp). Among men, Goa showed a marginal increase from 26.8% to 27.5% (Δ = +1.7 pp), contrasting again with the national decline (24.0% to 22.1%; Δ = -1.9pp). Goa's female prevalence of

hypertension (26.2%) now exceeds the national average (19.4%) by 6.8 pp. The composition of hypertension shifted between rounds: mildly elevated blood pressure (SBP 140-159 and/or DBP 90-99 mmHg) fell from 12.1% to 8.3% in women and from 14.8% to 9.7% in men. However, moderately or severely elevated blood pressure (SBP ≥ 160 and/or DBP≥ 100 mmHg) increased from 3.6% to 5.1% in women. Rural women (27.8%) showed a higher hypertension rate than urban women (24.9%) in NFHS-6, which contrasted with the national average (urban 23.5% vs. rural 17.8%). The same pattern was observed among men (Goa: urban 26.3% vs. rural 29.0%; India: urban 26.2% vs. rural 20.4%) (Table 3).

Alcohol consumption among men declined sharply from 36.8% (NFHS-5) to 22.4% (NFHS-6), and among women from 5.5% to 2.1%, although Goa's male rate still exceeds the national average (18.9% - NFHS-6). Tobacco use remained low among women (2.6% to 3.1%), and male tobacco use declined marginally (18.1% to 17.1%), both well below national figures (male 36.3%; female 8.4%) (Table 4).

Table 3: Urban-rural disaggregation of NCD indicators: Goa and India, NFHS-6.[7,8]

Indicators	Goa NFHS-6			India NFHS-6		
	Urban	Rural	Total	Urban	Rural	Total
Overweight or obesity						
Women	48.3	41.1	45.1	42.8	25.5	30.7
Men	44.1	42.9	43.6	36.3	23.0	27.3
Blood glucose level						
Women						
High or very high or on medication (>140mg/dL or on medication)	27.4	27.7	27.5	21.9	16.2	17.8
High (141-160 mg/dL)	8.7	8.9	8.8	8.0	7.3	7.5
Very high (>160mg/dL)	15.0	14.9	15.0	11.9	8.0	9.1
Men						
High or very high or on medication (>140mg/dL or on medication)	36.3	27.4	32.1	23.9	19.7	20.9
High (141-160 mg/dL)	11.2	8.9	10.1	8.8	8.8	8.8
Very high (>160mg/dL)	18.9	15.5	17.3	13.2	10.0	10.9
Hypertension						
Women						
Elevated BP (SBP ≥140 mm of Hg and/or DBP ≥90 mm of Hg) or taking medicine to control BP	24.9	27.8	26.2	23.5	17.8	19.4
Mildly elevated BP (SBP 140-159 mm of Hg and/or DBP 90-99 mm of Hg)	9.1	7.4	8.3	10.5	8.9	9.4
Moderately or severely elevated BP (SBP ≥160 mm of Hg and/or DBP ≥100 mm of Hg)	3.7	6.5	5.1	5.0	4.7	4.8
Men						
Elevated BP (SBP ≥140 mm of Hg and/or DBP ≥90 mm of Hg) or taking medicine to control BP	26.3	29.0	27.5	26.2	20.4	22.1
Mildly elevated BP (SBP 140-159 mm of Hg and/or DBP 90-99 mm of Hg)	10.4	8.9	9.7	13.9	11.7	12.4
Moderately or severely elevated BP (SBP ≥160 mm of Hg and/or DBP ≥100 mm of Hg)	3.7	5.2	4.4	3.6	3.1	3.5

*NFHS = National Family Health Survey; BP = blood pressure; SBP = systolic blood pressure; DBP = Diastolic blood pressure; BMI = body mass index

Table 4: Lifestyle risk factor profile: Goa and India (NFHS-5 and NFHS-6).[7,8]

Indicator	Goa NFHS-5	Goa NFHS-6	India NFHS-5	India NFHS-6
Tobacco use				
Women	2.6	3.1	8.9	8.4
Men	18.1	17.1	38.0	36.3
Alcohol consumption				
Women	5.5	2.1	1.3	1.1
Men	36.8	22.4	18.7	18.9

*NFHS = National family health survey

DISCUSSION

Obesity emerged as the fastest-growing NCD risk factor in the state. Goa's female obesity rate (45.1%) now approaches that of Kerala (46.7%) and Puducherry (46.3%), nationally reported as the highest in NFHS-6, and substantially exceeds Tamil Nadu (44.2%) and Andhra Pradesh (41.5%). Among men, Goa (43.6%) is exceeded only by Tamil Nadu (39.5%) and closely approaches Kerala (37.0%) among NFHS-6's highest-ranking states.[7,8] This trajectory is consistent with findings from the ICMR-INDIAB-17 study, which documented obesity in 28.6% of Indian adults nationally, but with rates in southern and western states substantially above this mean, driven by urbanisation, sedentary occupation, and caloric excess.[2] In a population-based cross-sectional study, Sundaresan et al documented high rates of obesity and hypertension co-existing with women disproportionately affected, with diabetes and hypertension prevalent as comorbidities across suburban and urban populations, a pattern fully consistent with that observed in the NFHS-6 data for Goa.[9] The GBD-based analysis by Chauhan et al had already identified Goa and Karnataka alongside Tamil Nadu as having the highest age-standardised diabetes prevalence rates in India in 2021, with upward trajectories exceeding the national incidence increase from 162.74 to 264.53 per 100,000 between 1990 and 2021, suggesting that the NFHS-6 data is a continuation of a long-term structural trend.[3]

The near-elimination of the urban-rural gap in male obesity in Goa, 44.1% urban versus 42.9% rural, compared with national disparity of 36.3% urban versus 23.0% rural, reflects the rapid penetration of motorised transport, processed food availability, and tourism-associated lifestyle changes into rural Goa. Kaur et al in a comparable NFHS-4 to NFHS-5 comparison from Punjab, another high-burden, high-income state, documented similar convergence of urban and rural obesity rates as a marker of advanced epidemiological transition.[10]

The South Asian metabolic phenotype compounds this risk; Misra et al in their studies, established that South Asians accumulate visceral and hepatic fat at lower absolute BMI thresholds than Caucasian populations, with cardiometabolic risk emerging at BMI levels as low as 23-24.9 kg/m^2, and that the WHO's recommended Asian-specific overweight cut-off of BMI ≥23 kg/m2 should be applied alongside waist circumference criteria.[11,12] This phenotype, sometimes described as the 'thin-fat Indian', implies that Goa's true metabolic risk burden is even higher than the BMI ≥25 kg/m2 figures presented here, since a substantial proportion of those with BMI in the 23-25 range will already carry significant visceral adiposity and insulin resistance.

Goa's composite male hyperglycaemia of 32.1% in NFHS-6 is broadly comparable to that among males in Kerala (31.9%), making Goa and Kerala the two states carrying the heaviest diabetes burden in India by this measure.[8] The ICMR-INDIANB-17, which examined Goa in its Phase 4 using fasting and post-load glucose criteria, had already found state diabetes prevalence of 26.4% and prediabetes of 40.3%, the highest rates of any state surveyed, indicating that Goa's elevated NFHS-6 hyperglycaemia burden is consistent with the fasting glucose-based disease burden.[2]

The NFHS, which uses random rather than fasting glucose, captures a composite of true hyperglycaemia; that Goa's random glucose-based rates are nonetheless the highest in India, reinforces the severity of the burden. Rana et al., analysing NFHS-4 and NFHS-5 national data, found that the odds of diabetes in those aged above 50 years were 14.46 times those of the 15-19 age group (95% CL:13.14-15.7), and that concurrent diabetes and hypertension were associated with adjusted odds of 65.32 (95% CL: 52.26-72.63) in those aged above 50 years.[13] Particularly concerning is that the increase was driven predominantly by the very high blood glucose category (>160 mg/dl), which rose by 5.4-5.7 percentage points and accounted for the dominant share of the overall increase in both sexes. This pattern of worsening severity rather than simply expanding case numbers suggests deteriorating glycaemic control among individuals already affected, or delayed diagnosis, allowing progression to more severe hyperglycaemia. This interpretation is reinforced by national care-cascade data showing that, even where screening identifies new cases, only 46.16% of existing diabetes-hypertension co-morbid cases receive full combined treatment, while 34.71% remain entirely untreated.[14] This suggests that initiating treatment alone, without achieving glycaemic targets, is insufficient. For hypertension specifically, Goa's stable-

to-rising prevalence against a national decline merits comparison with the trajectories of neighbouring states. NFHS-6 data show that Tamil Nadu's female hypertension declined sharply from 31.2% to 24.5%, a 6.7 pp fall, while Kerala's rose from 23.1% to 24.9%. Karnataka showed near-stability (25.0% to 25.1%), and Andhra Pradesh was broadly unchanged.[8] India-wide hypertension control rates have been estimated at just 17.5% of all hypertensives in the community setting, per the Lancet systematic review of 51 non-interventional studies by Koya et al. The hypertension control paradox is evident in the results of a population-based surveillance study by Kaur et al., which found that awareness of hypertension in 9 districts of India, including 2 in Kerala, exceeded 50% but that treatment and control rates remained substantially below awareness.[15,16]

The finding that rural Goa women had higher hypertension prevalence (27.8%) than urban women (24.9%) is notable and runs counter to the urban-predominant pattern described in ICMR-INDIAB national data, further supporting the interpretation that Goa's rural area no longer represents a lower-risk reference population in the conventional sense.[2] The NFHS-5-based hypertension analysis by Rana et al identified alcohol use, BMI above 25, and urban residence as the principal independent predictors of hypertension nationally, consistent with evidence from the NFHS-4-based study of tobacco and alcohol as discriminant predictors of hypertension irrespective of socioeconomic background, a study by Yadav et al.[17] Goa's historically high alcohol consumption, even as it declines, and its high obesity rate thus acts as persistent hypertension risk factors that may offset the pharmacological gains. The medRxiv preprint by Singh et al., applying JNC-7 and AHA criteria to NFHS-5 data nationally, found that those with BMI above 25 kg/m2 had significantly higher hypertension odds under all classification frameworks, further reinforcing the obesity-hypertension link that is so prominent in Goa's profile. The sharp decline in alcohol consumption (men: 36.8% to 22.4%; women: 5.5% to 2.1%) and modest decline in male tobacco use (18.1% to 17.1%) present an apparent paradox when juxtaposed against the simultaneous rise in obesity and hyperglycaemia.[7,8] This pattern suggests that dietary and physical activity factors, rather than alcohol or tobacco use, are likely the dominant drivers of Goa's metabolic risk escalation, a hypothesis consistent with meta-analytic findings that obesity-related anthropometric risk factors carry substantially elevated odds for metabolic syndrome independent of other behavioural exposures.[18] The persistence of Goa's male alcohol consumption rate above the national average (22.4% vs 18.9%), despite the marked decline, indicates that alcohol-related metabolic contributions (eg- to visceral adiposity and hepatic dysfunction) may still play a partial role and merit further investigation as a modifiable risk factor. Across all three outcomes, the relative magnitude of change was generally larger in men than in women in our data (obesity: 33.7% vs 24.9% relative increase; composite glucose: 33.2% vs 32.2%; hypertension showing an increase in men against stability in women). This contrasts with the female-predominant patterns of abdominal obesity and metabolic syndrome reported in national meta-analyses, where metabolic syndrome prevalence was consistently higher among adult females than males across pooled Indian studies, and where abdominal obesity prevalence nationally was reported at 39.6% in women versus 11.9% in men.[18] The relatively faster male-driven increase observed in Goa may reflect occupational and lifestyle shifts specific to Goan men, potentially linked to declining physical labour in fishing and agriculture and increasing sedentary employment in tourism and hospitality sectors, though the persistently higher absolute prevalence among women across most indicators indicates that women remain the higher absolute-burden group despite men showing steeper relative trajectories.

These findings indicate that Goa's NCD epidemic has progressed beyond the urban-centric, female-predominant pattern described in most national Indian datasets toward a more advanced, geographically uniform, and increasingly severe phenotype affecting both sexes and both urban and rural populations comparably. The observed improvements in pharmacological treatment coverage for both hyperglycaemia and hypertension demonstrate that health system responsiveness has improved, plausibly reflecting strengthened implementation of NCD screening programmes. However, the simultaneous worsening of disease severity distributions (shift toward moderately or severely elevated blood pressure and >160mg/dl glucose) suggests that case detection and treatment initiation, while improved, are not occurring early enough to prevent progression to severe disease in a substantial subgroup. Given that national care cascade data show over a third of comorbid cases remain untreated even after detection, Goa's NCD programme should prioritise earlier-stage screening, particularly targeting rural populations where our data indicates risk has reached parity with or exceeded urban areas, and reversal of the assumptions underlying most existing rural health programming.

CONCLUSION

Using biomarker-confirmed data directly extracted from NFHS-5 and NFHS-6, this study provides the first systematic inter-round comparison of lifestyle disease burden in Goa. Obesity has risen sharply by 9.0 pp among women and 11.0 among men in four years, substantially exceeding national trends and placing Goa alongside Kerala and Tamil Nadu as among the most burdened states in India. Hyperglycaemia has risen in parallel, with Goa's male prevalence (32.1%) now comparable to Kerala's (31.9%). These findings are consistent with the ICMR-INDIAB and GBD evidence that has identified Goa as India's highest-burden diabetes state, with improved pharmacological control but a growing fraction of uncontrolled severe disease. The near-elimination of the urban-rural gap across all three indicators, the steep

age gradient in hyperglycaemia concentrated in the working-age population, and the persistence of a calorie-dense dietary profile together define a state that has moved fully into the NCD transition. Urgent, evidence-based, and culturally adapted community medicine responses, centred on obesity prevention, proactive metabolic screening, treatment intensification, and dedicated elderly NCD care, are essential to alter this trajectory before the human and economic costs become irreversible.

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