

Burden trends of Alzheimer's disease and other dementias in China, 1990–2023: Sex, age, and risk-attributable patterns

Yao Li¹ MD, Shuai Wang² MD, Kaiyue Xie¹ MD, Siyv Qian¹ MD, Mingyue Ma¹ MD, Haining Zhang¹ MD

ABSTRACT

Introduction: China's population has aged rapidly in recent decades, accompanied by a steady rise in Alzheimer's disease and other dementias (ADOD). Understanding long-term national trends is important for anticipating future healthcare needs.

Methods: The authors analysed Global Burden of Disease (GBD) 2023 estimates for China from 1990 to 2023, following the Guidelines for Accurate and Transparent Health Estimates Reporting, with STROBE used as a secondary reporting reference. Deaths, disability-adjusted life years (DALYs), incidence, and prevalence were examined together with crude rates, age-standardised rates (ASRs), and average annual percentage changes. Results were evaluated and stratified by sex and broad age group. Modelled risk-attributable burden was assessed for selected GBD risk factors—ambient particulate matter pollution, high fasting plasma glucose, smoking, and household air pollution from solid fuels.

Results: Over the study period, the number of people affected increased markedly. Deaths rose from 122,411 in 1990 to 586,002 in 2023, while DALYs and prevalent cases more than tripled. In contrast, ASR showed only modest upward changes. Women had higher ASRs in 2023, although mortality- and DALY-related rates increased more quickly among men. The burden remained concentrated in those aged 75 years and older. Among the selected exposures, ambient particulate matter pollution accounted for the largest attributable share in 2023, whereas household air pollution declined over time.

Conclusion: The marked increase in absolute ADOD burden, together with smaller changes in ASR, is consistent with demographic ageing being an important contributor to rising dementia-related service needs in China. The risk-attributable estimates suggest changing population-level patterns for selected environmental and metabolic exposures, but they should not be interpreted as individual-level causal effects.

Keywords: ageing, Alzheimer's disease and other dementias, China, disease burden, risk factors, trend analysis

CLINICAL IMPACT

What is New

- This study provides an updated national profile of the burden of Alzheimer's disease and other dementias in China from 1990 to 2023, based on Global Burden of Disease 2023 estimates.
- By comparing absolute counts, crude rates, and age-standardised rates, this study distinguishes health-system service demand from age-adjusted epidemiological change.

Clinical Implication

- The study summarises sex, age, and selected risk-attributable patterns to support dementia surveillance, ageing-adapted care planning, and prevention-oriented policy discussion.

INTRODUCTION

Alzheimer's disease and other dementias (ADOD) are now central to the global non-communicable disease agenda, because they combine high late-life prevalence, prolonged disability, substantial caregiver burden, and major health-system costs.^{1,2} As life expectancy rises and fertility declines, population age structures shift towards older age groups, and the number of people living with cognitive disorders is expected to keep growing in many countries, including China.^{3,4}

China represents a critical setting for ADOD burden monitoring for several reasons. First, the speed and scale of demographic transition are historically unusual, with rapid expansion of the elderly population. Second, regional heterogeneity in socioeconomic development, healthcare access, vascular risk profiles, and environmental exposures may shape both diagnosis and disease progression. Third, shifts in

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¹ Department of Neurology and Neuroscience Centre, The First Hospital of Jilin University, Changchun, China

² Department of Gastric and Colorectal Surgery, General Surgery Center, The First Hospital of Jilin University, Changchun, China

Correspondence: Dr Haining Zhang, Department of Neurology and Neuroscience Centre, The First Hospital of Jilin University, Changchun 130021, China. Email: zhanghaining@jlu.edu.cn.

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major risk factors, including ambient particulate exposure, metabolic risk, and smoking, may alter future trajectories even when age-standardised rates (ASR) remain relatively stable.⁵⁻⁷ In this context, separating absolute burden growth from standardised rate change is essential for interpretation and policy planning.

Current evidence indicates that dementia burden is influenced by both non-modifiable and modifiable factors. Age is the strongest determinant, while sex-related biological and social pathways may contribute to differential susceptibility, clinical presentation, and survival.⁸⁻⁹ Major prevention frameworks have highlighted potentially modifiable contributors, including vascular and metabolic factors, smoking, and environmental exposures.¹⁰⁻¹² At the same time, diagnostic criteria and disease conceptualisation have evolved, from syndrome-based to biologically informed frameworks, complicating temporal interpretation across decades.¹³ Robust trend analyses must therefore pair epidemiological indicators with cautious interpretation of changing detection patterns and competing mortality.

Large comparative platforms, such as the Global Burden of Disease (GBD) programme, offer internally consistent time series on incidence, mortality, prevalence, disability, and risk-attributable burden, providing a robust basis for long-horizon national assessment.^{14,15} For policy decisions, however, country-level interpretation remains essential. Interpretation is further complicated by the 2020–2023 COVID-19 period, during which many settings reported reduced access to routine cognitive care, delayed diagnosis, and disruption of community support.¹⁶ Although annual burden models may smooth short-term shocks, these disruptions can still influence recent slope estimates and endpoint levels.

Against this background, the present study provides a policy-oriented, non-causal trend analysis of ADOD in China from 1990 to 2023, integrating 4 dimensions: (1) long-run changes in deaths, disability-adjusted life years (DALYs), incidence, and prevalence; (2) contrasts between absolute burden and ASR; (3) sex-specific and age-group trajectories; and (4) temporal shifts in selected risk-attributable burden (ambient particulate matter pollution, high fasting plasma glucose, smoking, and household air pollution from solid fuels).

METHODS

Study design and analytical scope

This was a nationwide, longitudinal burden analysis of ADOD in China from 1990 to 2023. The analysis focused on temporal changes in incidence, deaths, prevalence, and DALYs, with emphasis on both absolute burden expansion and rate-based epidemiological dynamics. To avoid relying on a single statistical

expression of disease burden, the authors jointly evaluated all-age rates and age-standardised rates, and further examined sex-specific and age-specific heterogeneity.

Data source, reporting framework, and acquisition

This study was reported primarily in accordance with Guidelines for Accurate and Transparent Health Estimates Reporting, with STROBE used as a secondary reference for observational reporting structure.^{17,18} All estimates were extracted from GBD 2023 using the China-specific series for the cause category “Alzheimer’s disease and other dementias”.^{14,15} The extracted variables included location, year, sex, age group, cause, measure, metric, point estimate, and 95% uncertainty interval (UI). The measures were incidence, prevalence, deaths, and DALYs; the metrics were numbers, crude rates, and ASR per 100,000 population (age-standardised to the GBD standard population). The extraction date, data filters, and analysis code are provided in Supplementary Appendix S1 to improve reproducibility.

In GBD 2023, ADOD is a modelled population-level cause category that includes Alzheimer’s disease and other dementias rather than biomarker-confirmed Alzheimer’s disease alone.^{13,15,19} The estimates are therefore interpreted as dementia burden estimates at the population level. They do not provide subtype-specific clinical diagnoses and may be influenced by changes in case ascertainment, diagnostic practice, mortality coding, and data availability across calendar years.

GBD estimates are derived from multiple data sources and statistical modelling procedures.^{14,15} For this reason, all results are presented as health estimates with uncertainty rather than as directly observed registry counts. Where possible, the authors report 95% UIs for GBD estimates and 95% confidence intervals (CIs) for joinpoint-derived average annual percentage changes (AAPCs).

Outcomes and epidemiological metrics

The primary burden indicators were incident cases, deaths, prevalent cases, and DALYs. DALYs were used because they combine years of life lost due to pre-mature mortality and years lived with disability, and therefore capture both fatal and non-fatal health loss relevant to dementia service planning. For each indicator, absolute numbers and rates per 100,000 population were reported. Crude rates were used to reflect overall service demand in the population, whereas ASRs were used to describe age-adjusted temporal patterns.^{14,15}

Stratified analysis framework

Sex-stratified analyses were used to describe burden levels and rates of change among females and males

across all 4 outcomes.¹⁹ Age-stratified analyses were used to describe whether burden and trends were concentrated in older groups. The current age grouping of 15–49, 50–74, and ≥75 years was retained to maintain consistency across the extracted outcome and risk-attributable datasets. The authors recognise that more detailed older-age strata, such as 65–74, 75–84, and ≥85 years, would be more informative for geriatric policy interpretation and have noted this as a limitation.

Trend estimation and statistical interpretation

Long-term temporal trends were quantified using log-linear regression in the Joinpoint Regression Program version 5.2.0.0 (National Cancer Institute, Bethesda, US).²⁰ Annual rates or ASRs were used as dependent variables. The maximum number of joinpoints was set to 6 according to the number of annual observations and the default settings of the Joinpoint Regression Program. Join-points were selected using the programme's permutation-based model-selection procedure,²⁰ and AAPCs with 95% CIs were calculated for 1990–2023.²¹ GBD 95% UIs were reported for burden estimates but were not propagated into the joinpoint regression models; therefore, AAPCs should be interpreted as descriptive trend summaries based on point estimates.^{15,21} AAPCs were interpreted descriptively: an AAPC greater than 0 with a CI excluding 0 indicated an increasing trend, an AAPC less than 0 with a CI excluding 0 indicated a decreasing trend, and a CI including 0 indicated no clear long-term directional change.²¹ Because multiple subgroup-specific AAPCs were estimated, statistical significance was not used as confirmatory evidence of causal differences between groups. Data cleaning and figure production were conducted in R version 4.3.1 (R Foundation for Statistical Computing, Vienna, Austria).

Risk-attributable burden assessment

Risk-attributable burden was analysed for 4 selected GBD-attributable risk factors: (1) ambient particulate matter pollution, (2) high fasting plasma glucose, (3) smoking, and (4) household air pollution from solid fuels. These estimates represent modelled population-level attributable burden based on exposure distributions, relative-risk functions, population-attributable fractions, and theoretical minimum risk exposure levels used in the GBD comparative risk assessment framework.²² They should not be interpreted as individual-level causal effects or as evidence that reducing a given exposure would produce proportional reductions in dementia burden. The analysis did not cover all potentially modifiable dementia risk factors.

Data validation and reporting control

All values included in the narrative were checked. Count-level values, rates, percentage changes, and

AAPCs were aligned to table source values to ensure textual consistency with figures and tables. Results are presented as point estimates with 95% UIs or 95% CIs according to the source metrics.

RESULTS

National burden levels and long-term changes

From 1990 to 2023, the absolute burden of ADOD in China increased across all 4 outcomes (Table 1, Fig. 1). Incident cases rose from 755,780 to 3,476,644 (+360.01%), deaths from 122,411 to 586,002 (+378.72%), prevalent cases from 4,352,315 to 20,299,243 (+366.40%), and DALYs from 2,813,268 to 11,646,909 (+314.00%). Standardised indicators also increased over the same period. Age-standardised incidence rate (ASIR) rose from 126.71 to 156.63 per 100,000 (AAPC 0.67, 95% CI 0.53–0.80), age-standardised mortality rate (ASMR) from 27.91 to 28.65 (AAPC 0.27, 95% CI 0.03–0.51), age-standardised prevalence rate (ASPR) from 735.54 to 918.83 (AAPC 0.71, 95% CI 0.55–0.87), and age-standardised DALY rate (ASDR) from 509.08 to 539.50 (AAPC 0.25, 95% CI 0.08–0.42) (Table 1, Fig. 1). At the all-age crude-rate level, mortality increased from 10.38 to 40.96 per 100,000 (AAPC 4.50, 95% CI 4.30–4.69), DALY rate from 238.59 to 814.10 (AAPC 3.92, 3.79–4.05), incidence rate from 64.10 to 243.01 (AAPC 4.14, 3.99–4.29), and prevalence rate from 369.11 to 1418.89 (AAPC 4.18, 4.02–4.35) (Table 2, Fig. 1).

Sex-specific burden trends

In 2023, females showed higher standardised levels than males for all 4 indicators (Table 1, Fig. 2). Female versus (vs) male values were 179.64 vs 129.45 for ASIR, 32.13 vs 23.87 for ASMR, 1059.87 vs 743.39 for ASPR, and 617.86 vs 439.61 for ASDR (per 100,000).

Sex-specific trend slopes differed by outcome. For mortality and DALYs, AAPCs were higher in males than females (ASMR 0.60 [95% CI 0.15–1.06] vs 0.18 [–0.04–0.40]; ASDR 0.54 [0.33–0.74] vs 0.22 [0.06–0.38]). For incidence and prevalence, females showed slightly higher AAPCs than males (ASIR 0.74 [0.58–0.89] vs 0.68 [0.57–0.80]; ASPR 0.81 [0.63–0.98] vs 0.67 [0.54–0.81]) (Table 1).

In absolute terms, 2023 female counts were 2,177,773 incident cases, 378,647 deaths, 12,830,656 prevalent cases, and 7,424,090 DALYs; corresponding male counts were 1,298,871, 207,355, 7,468,587, and 4,222,818 (Table 1).

Age-specific burden trends

Age-stratified analyses showed that burden levels were highest in older adults (Table 2, Fig. 1). In 2023, the ≥75 years group recorded the largest counts in

Table 1. Age-standardised rates and burden of Alzheimer's disease and other dementias in China, 1990–2023.

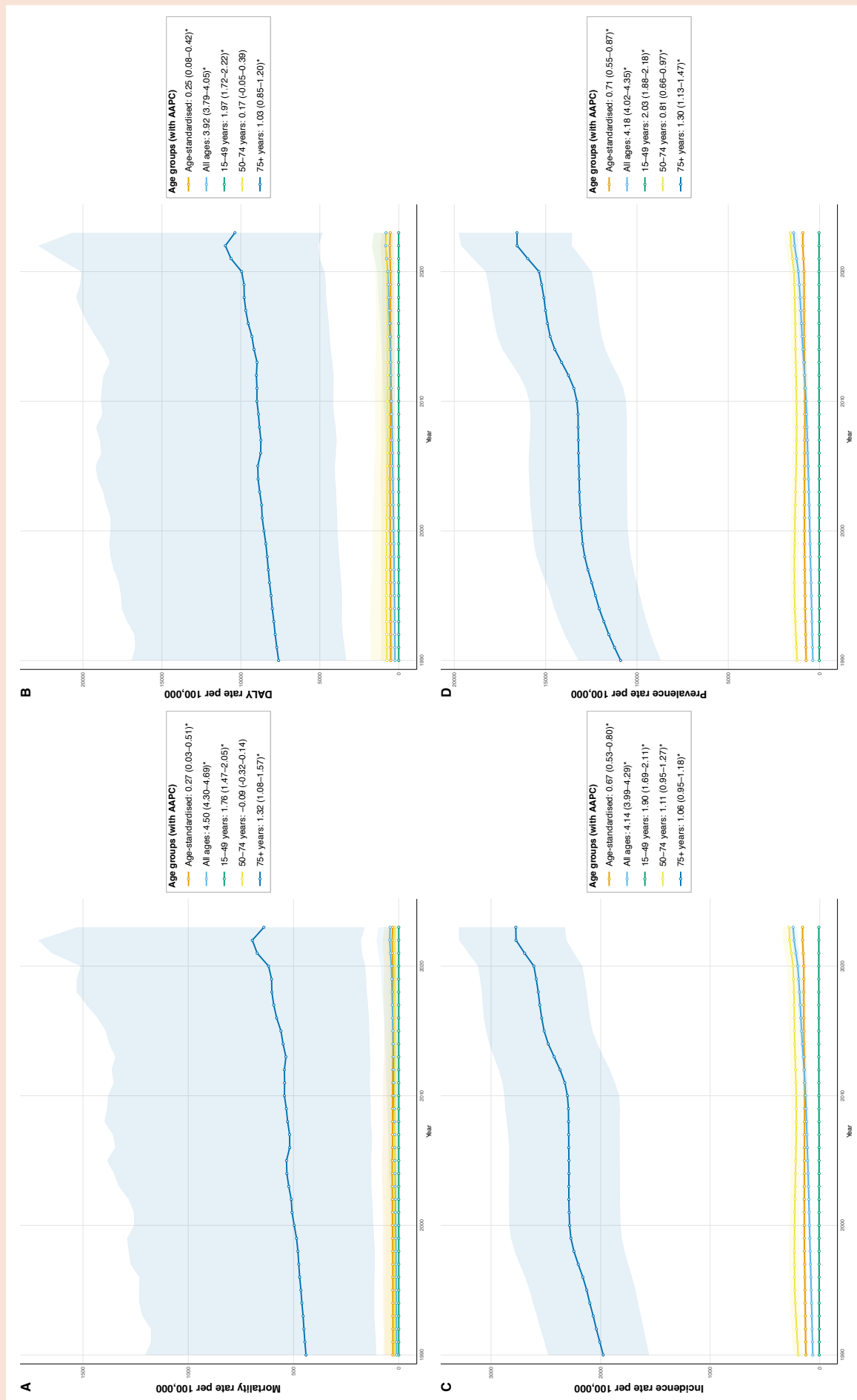
Indicator	Sex	Number (1990, 95% UI)	Number (2023, 95% UI)	Percentage change (%)	ASR (1990, 95% UI)	ASR (2023, 95% UI)	AAPC of ASR (95% CI)
DALYs	Both	2,813,268 (1,276,794–6,411,019)	11,646,909 (5,719,528–22,514,747)	314.00	509.08 (223.96–1146.10)	539.50 (262.25–1051.85)	0.25 (0.08–0.42) ^a
	Female	1,862,725 (825,430–4,077,973)	7,424,090 (3,655,395–14,117,692)	298.56	584.88 (254.25–1315.38)	617.86 (302.41–1171.24)	0.22 (0.06–0.38) ^a
	Male	950,544 (442,767–2,273,633)	4,222,818 (1,933,620–8,413,971)	344.25	386.34 (175.23–868.49)	439.61 (200.23–884.85)	0.54 (0.33–0.74) ^a
Deaths	Both	122,411 (29,124–341,119)	586,002 (146,024–1,385,075)	378.72	27.91 (6.89–73.63)	28.65 (7.10–67.37)	0.27 (0.03–0.51) ^a
	Female	85,376 (20,219–232,011)	378,647 (101,065–894,116)	343.50	31.88 (7.67–84.86)	32.13 (8.53–75.49)	0.18 (–0.04–0.40)
	Male	37,035 (8641–106,083)	207,355 (44,959–494,003)	459.89	20.61 (4.92–57.81)	23.87 (5.15–57.88)	0.60 (0.15–1.06) ^a
Incidence	Both	755,780 (637,685–854,211)	3,476,644 (2,998,723–3,884,422)	360.01	126.71 (108.32–143.87)	156.63 (136.58–175.49)	0.67 (0.53–0.80) ^a
	Female	481,028 (405,077–545,550)	2,177,773 (1,887,505–2,431,095)	352.73	141.86 (121.48–160.77)	179.64 (156.37–200.31)	0.74 (0.58–0.89) ^a
	Male	274,753 (233,423–312,968)	1,298,871 (1,118,042–1,460,288)	372.74	104.24 (88.43–119.41)	129.45 (112.39–146.09)	0.68 (0.57–0.80) ^a
Prevalence	Both	4,352,315 (3,633,202–5,012,549)	20,299,243 (17,341,557–23,309,840)	366.40	735.54 (614.67–845.18)	918.83 (784.59–1058.24)	0.71 (0.55–0.87) ^a
	Female	2,747,076 (2,290,143–3,178,182)	12,830,656 (10,929,366–14,748,557)	367.07	822.38 (687.59–948.16)	1059.87 (905.87–1221.75)	0.81 (0.63–0.98) ^a
	Male	1,605,239 (1,339,491–1,836,615)	7,468,587 (6,362,958–8,563,534)	365.26	598.31 (496.57–690.11)	743.39 (632.99–854.73)	0.67 (0.54–0.81) ^a

AAPC: average annual percentage change; ASR: age-standardised rate; CI: confidence interval; DALY: disability-adjusted life year; UI: uncertainty interval

Rates are per 100,000 population.

^a Indicates that the 95% CI for the AAPC excludes 0.

Fig. 1. Trends in Alzheimer's disease and other dementias indicators in China by age group, 1990–2023. (A) Mortality rate per 100,000 population; (B) DALY rate per 100,000 population; (C) incidence rate per 100,000 population; (D) prevalence rate per 100,000 population.



AAPC: average annual percentage change; DALY: disability-adjusted life year
 Shaded intervals, where shown, represent 95% uncertainty intervals.
 * Indicates that the 95% confidence interval for the AAPC excludes 0.

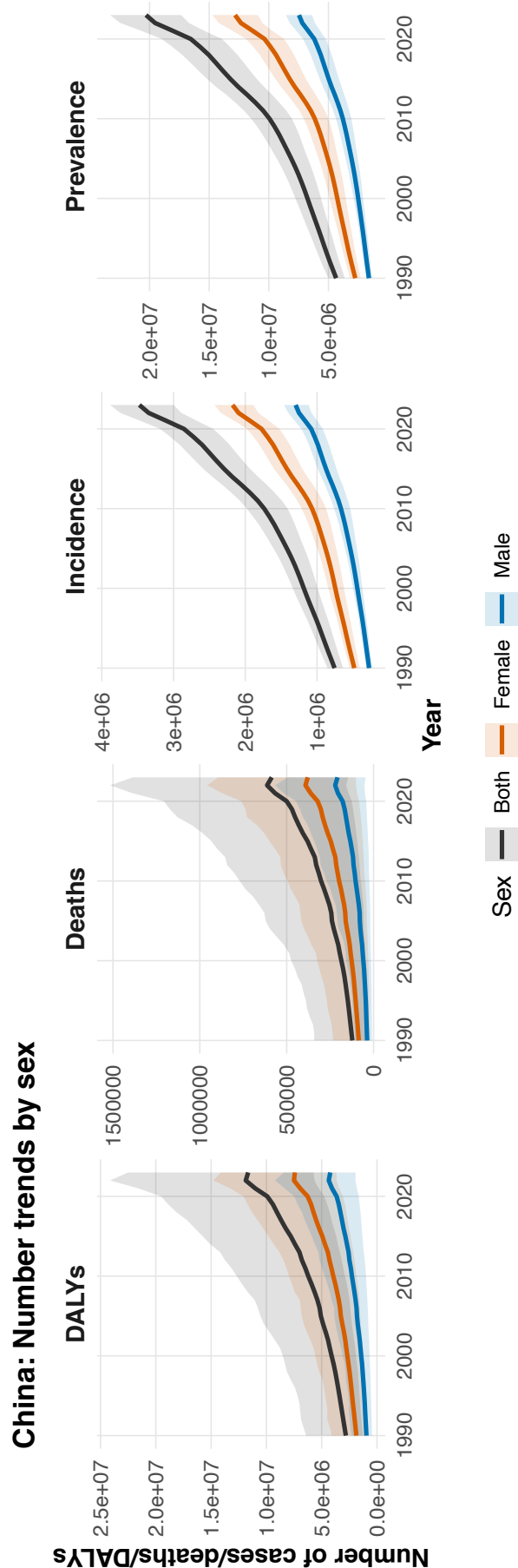
Table 2. Age-specific trends in Alzheimer's disease and other dementias burden in China, 1990–2023.

Metric	Measure	Number (1990, 95% UI)	Number (2023, 95% UI)	Percentage change (%)	Rate (1990, 95% UI)	Rate (2023, 95% UI)	AAPC of rate (95% CI)
Mortality	All ages	122,411 (29,124–341,119)	586,002 (146,024–1,385,075)	378.72	10.38 (2.47–28.93)	40.96 (10.21–96.81)	4.50 (4.30–4.69) ^a
	15–49 years	232 (31–765)	387 (54–1312)	66.38	0.03 (0.00–0.11)	0.06 (0.01–0.20)	1.76 (1.47–2.05) ^a
	50–74 years	36,470 (8267–111,191)	88,993 (19,472–239,427)	144.02	21.07 (4.78–64.24)	19.54 (4.28–52.57)	–0.09 (–0.32–0.14)
	≥75 years	85,708 (20,776–234,089)	496,622 (124,875–1,185,154)	479.43	440.68 (106.82–1203.60)	640.85 (161.14–1529.34)	1.32 (1.08–1.57) ^a
DALY	All ages	2,813,268 (1,276,794–6,411,019)	11,646,909 (5,719,528–22,514,747)	314.00	238.59 (108.28–543.70)	814.10 (399.79–1573.75)	3.92 (3.79–4.05) ^a
	15–49 years	29,006 (14,177–53,153)	51,705 (25,398–89,556)	78.25	4.34 (2.12–7.95)	8.01 (3.93–13.87)	1.97 (1.72–2.22) ^a
	50–74 years	1,304,117 (606,716–3,093,902)	3,552,144 (1,760,535–7,105,274)	172.38	753.49 (350.55–1787.59)	779.98 (386.58–1560.17)	0.17 (–0.05–0.39)
	≥75 years	1,480,145 (647,044–3,290,619)	8,043,060 (3,732,787–16,021,870)	443.40	7610.34 (3326.85–16919.11)	10378.91 (4816.86–20674.91)	1.03 (0.85–1.20) ^a
Incidence	All ages	755,780 (637,685–854,211)	3,476,644 (2,998,723–3,884,422)	360.01	64.10 (54.08–72.44)	243.01 (209.61–271.52)	4.14 (3.99–4.29) ^a
	15–49 years	31,265 (21,765–41,805)	55,221 (39,719–72,454)	76.62	4.68 (3.26–6.25)	8.55 (6.15–11.22)	1.90 (1.69–2.11) ^a
	50–74 years	340,105 (279,784–418,837)	1,271,708 (1,033,726–1,546,066)	273.92	196.51 (161.65–242.00)	279.24 (226.99–339.48)	1.11 (0.95–1.27) ^a
	≥75 years	384,410 (302,822–482,070)	2,149,715 (1,802,110–2,553,325)	459.22	1976.49 (1557.00–2478.62)	2774.03 (2325.48–3294.86)	1.06 (0.95–1.18) ^a
Prevalence	All ages	4,352,315 (3,633,202–5,012,549)	20,299,243 (17,341,557–23,309,840)	366.40	369.11 (308.12–425.10)	1418.89 (1212.15–1629.32)	4.18 (4.02–4.35) ^a
	15–49 years	104,139 (65,485–150,404)	192,464 (121,707–277,120)	84.82	15.57 (9.79–22.49)	29.81 (18.85–42.92)	2.03 (1.88–2.18) ^a
	50–74 years	2,129,515 (1,771,023–2,506,415)	7,266,114 (6,161,748–8,521,135)	241.21	1230.39 (1023.26–1448.15)	1595.49 (1352.99–1871.07)	0.81 (0.66–0.97) ^a
	≥75 years	2,118,661 (1,689,790–2,569,056)	12,840,665 (10,497,187–15,311,086)	506.07	10893.35 (8688.25–13209.10)	16569.83 (13545.76–19757.70)	1.30 (1.13–1.47) ^a

AAPC: average annual percentage change; CI: confidence interval; UI: uncertainty interval

Rates are per 100,000 population.

^a Indicates that the 95% CI for the AAPC excludes 0.



DALY: disability-adjusted life year
The figure shows absolute numbers of DALYs, deaths, incident cases, and prevalent cases among both sexes, females and males.

Fig. 2. Sex-specific number trends in Alzheimer's disease and other dementias burden in China, 1990–2023.

all outcomes, including 496,622 deaths, 8,043,060 DALYs, 2,149,715 incident cases, and 12,840,665 prevalent cases.

For mortality, AAPCs were 1.76 (95% CI 1.47–2.05) in ages 15–49 years, -0.09 (-0.32 to 0.14) in ages 50–74 years, and 1.32 (1.08–1.57) in ages ≥ 75 years. For DALY rates, AAPCs were 1.97 (1.72–2.22), 0.17 (-0.05 to 0.39), and 1.03 (0.85–1.20), respectively. Incidence rates increased across all age groups, with AAPCs of 1.90 (1.69–2.11), 1.11 (0.95–1.27), and 1.06 (0.95–1.18). Prevalence rates also increased across age groups, with AAPCs of 2.03 (1.88–2.18), 0.81 (0.66–0.97), and 1.30 (1.13–1.47), respectively (Table 2, Fig. 1).

Risk-attributable burden profile

In 2023, modelled attributable burden varied across the selected GBD risk factors (Table 3, Fig. 3). Attributable deaths were 190,422 for ambient particulate matter pollution, 103,694 for high fasting plasma glucose, 28,725 for smoking, and 27,759 for household air pollution from solid fuels. The corresponding attributable DALYs were 3,794,481, 2,058,837, 687,815, and 559,148. These estimates should be interpreted as modelled population-level attributable burden among the selected risks rather than as direct causal effects.

From 1990 to 2023, age-standardised attributable death trends differed by risk. AAPCs were 4.29 (95% CI 4.04–4.55) for ambient particulate matter pollution, 0.82 (0.57–1.06) for high fasting plasma glucose, -0.14 (-0.45–0.17) for smoking, and -5.47 (-5.94 to -4.99) for household air pollution from solid fuels. For age-standardised attributable DALY rates, AAPCs were 4.41 (4.24–4.58), 0.74 (0.59–0.89), -0.05 (-0.28–0.19), and -5.41 (-5.87 to -4.96), respectively (Table 3, Fig. 3).

DISCUSSION

This GBD 2023-based analysis describes long-run ADOD burden dynamics in China from 1990 to 2023 using a national health-estimates framework.^{14,15} Across the full period, absolute burden increased across deaths, DALYs, incidence, and prevalence. In contrast, ASR increased more modestly. This contrast is consistent with demographic ageing and population structure change contributing importantly to rising dementia-related service needs, although the present analysis did not formally decompose the increase into population growth, population ageing, and age-specific rate change.^{4,7,19,23}

A central pattern is the divergence between absolute growth and age-standardised growth. Death counts increased markedly over the study window, whereas the corresponding ASMR changed only modestly;

similar contrasts were observed for DALYs, incidence, and prevalence. This pattern is compatible with previous global and China-focused dementia burden studies showing that demographic momentum can substantially increase the number of people affected even when age-adjusted rates change slowly.^{4,7,19,23} Therefore, count-based and rate-based indicators answer different but complementary policy questions.

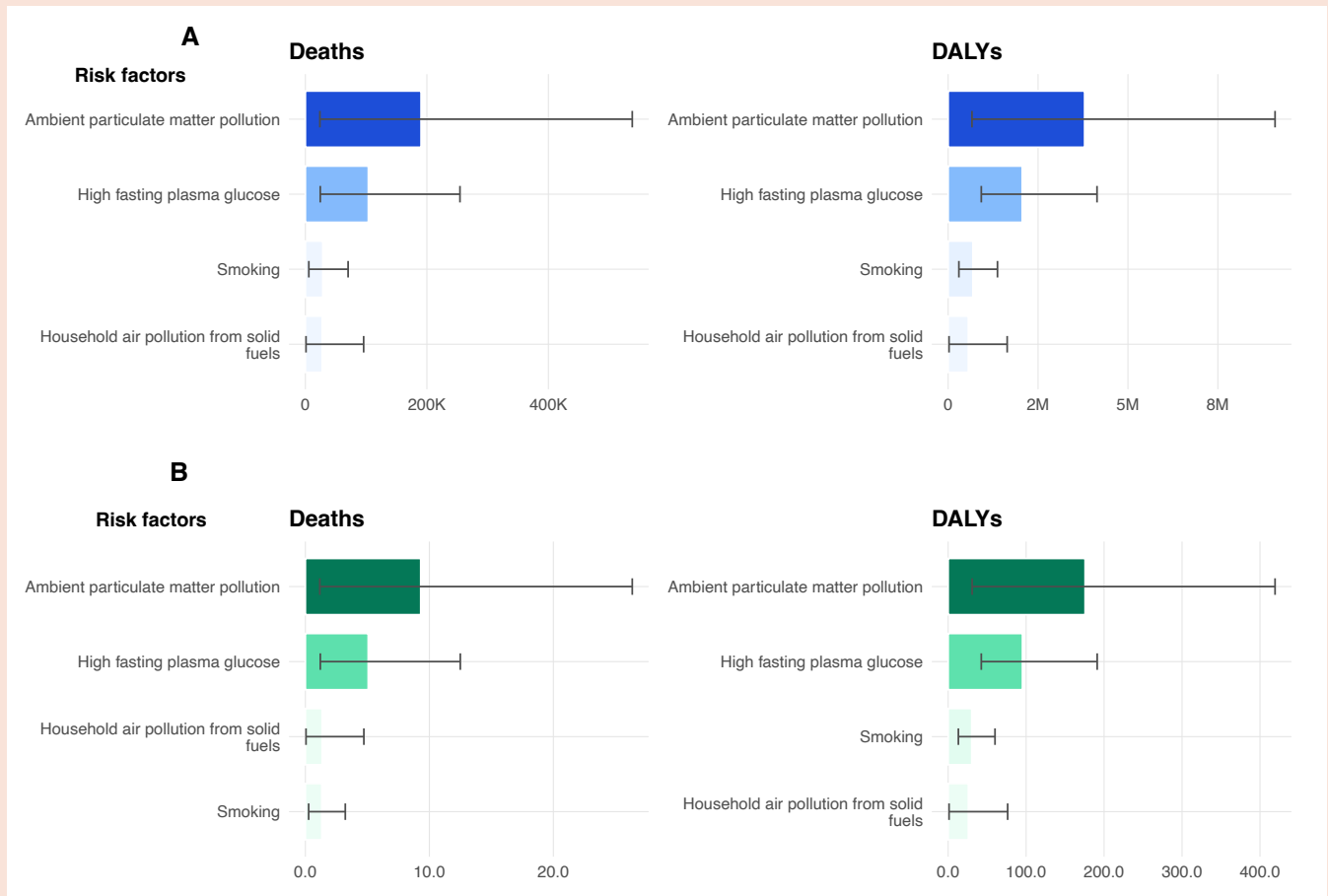
For clinicians, payers, and governments, absolute burden remains the operational denominator for system demand. Memory clinic utilisation, hospital contact volume, community follow-up, long-term care demand, and family caregiving needs are driven primarily by the number of people living with dementia and related disability. Age-standardisation is necessary for temporal and cross-population comparison, but it does not replace count-based planning in a rapidly ageing population.^{5,10}

Sex-specific results show 2 coexisting features. Females had higher levels across major burden indicators in 2023, including both counts and ASR. This is consistent with prior literature indicating that sex and gender differences in ADOD burden may reflect longer female survival, life-course biological factors, and social determinants.^{8,9} However, trend pace differed by endpoint in this dataset, with faster male increases in mortality- and DALY-related standardised trends and slightly faster female increases in incidence- and prevalence-related standardised trends. This pattern indicates that burden level and rate of change do not necessarily move in parallel within sex strata. It also suggests that sex contrasts in ADOD should be evaluated by outcome dimension rather than treated as a single summary effect.

Age-specific trajectories indicate persistent concentration of severe burden in advanced age. The ≥ 75 group contributed the largest numbers of deaths and DALYs in 2023, while younger adult groups carried a smaller but non-zero share of growth across non-fatal outcomes. Near-flat patterns in some middle-age mortality and DALY trends, combined with continued increases in the oldest group, are compatible with an age-gradient structure in which neurodegeneration, frailty accumulation, multimorbidity, and competing-risk dynamics become more prominent late in life.^{10–12,24} Under this pattern, care-system pressure is expected to remain concentrated in very old adults, with implications for continuity of late-life cognitive care, referral pathways, caregiver support, and community-based long-term management.

The risk-attributable component should be interpreted cautiously. Ambient particulate matter pollution had the largest modelled attributable burden among the selected GBD risks in 2023 and showed the steepest increase in age-standardised attributable

Fig. 3. Modelled burden of Alzheimer's disease and other dementias attributable to selected GBD risk factors in China, 2023. (A) Number of attributable deaths and DALYs; (B) age-standardised attributable death and DALY rates per 100,000 population. These estimates are population-level modelled attributable burdens and should not be interpreted as individual-level causal effects.



ASR: age-standardised rate; DALY: disability-adjusted life year

rates. However, these findings reflect GBD comparative risk assessment assumptions and should not be read as direct proof of individual-level causality or proportional preventability.²² Baseline differences between risks may also affect comparisons of relative growth.^{25,26} High fasting plasma glucose also contributed a substantial and increasing modelled burden, which is biologically plausible given previous evidence linking diabetes and chronic hyperglycaemia to cognitive decline and dementia through vascular and metabolic pathways.^{27,28} Smoking-attributable ASRs were broadly stable, while household air pollution from solid fuels declined. These patterns support prevention-oriented surveillance but require cautious translation into policy.²⁹

Practical implications for China and ageing Asian health systems

The findings have several practical implications. First, dementia surveillance should routinely report both

absolute numbers and ASR, because these indicators inform different decisions. Second, primary care and memory-clinic pathways may need expansion to accommodate rising case numbers, particularly among very old adults. Third, community-based long-term care, caregiver support, and payer planning should be strengthened because much of the health loss is concentrated in later life. Fourth, urban–rural and provincial heterogeneity should be assessed in future subnational analyses to avoid masking inequities in diagnosis, access, and long-term care capacity.⁶ Finally, air-quality improvement, diabetes prevention, and tobacco control remain relevant public health priorities, but the present ecological estimates should be used as supportive surveillance evidence rather than causal proof of individual benefit.^{10,22,24}

The 2020–2023 interval overlapped with the COVID-19 pandemic, when disruption of chronic care pathways, delayed diagnosis, and interruption of supportive services were reported in many

Table 3. Risk-attributable burden of Alzheimer's disease and other dementias in China, 1990 and 2023.

MEASURE	Risk factors	Number (1990, 95% UI)	Number (2023, 95% UI)	Percentage change (%)	ASR (1990, 95% UI)	ASR (2023, 95% UI)	AAPC of ASR (95% CI)
Deaths	Ambient particulate matter pollution	10,421 (1241–36,701)	190,422 (23,908–538,041)	1727.24	2.38 (0.29–8.56)	9.30 (1.16–26.36)	4.29 (4.04–4.55) ^a
	High fasting plasma glucose	18,169 (3795–56,479)	103,694 (24,527–254,439)	470.71	4.13 (0.92–12.82)	5.07 (1.20–12.49)	0.82 (0.57–1.06) ^a
	Smoking	7874 (1610–22,863)	28,725 (5701–70,345)	264.81	1.45 (0.33–4.16)	1.33 (0.26–3.22)	-0.14 (-0.45–0.17)
	Household air pollution from solid fuels	40,518 (4953–122,771)	27,759 (1055–95,909)	-31.49	9.23 (1.09–28.83)	1.36 (0.05–4.72)	-5.47 (-5.94 to -4.99) ^a
DALYs	Ambient particulate matter pollution	240,041 (31,883–700,695)	3,794,481 (662,388–9,091,509)	1480.76	43.32 (5.68–126.19)	175.68 (30.76–419.35)	4.41 (4.24–4.58) ^a
	High fasting plasma glucose	425,507 (162,928–1,119,120)	2,058,837 (921,647–4,139,497)	383.86	76.07 (29.87–199.73)	95.29 (42.50–191.14)	0.74 (0.59–0.89) ^a
	Smoking	213,582 (88,244–498,180)	687,815 (297,893–1,371,736)	222.04	31.80 (13.19–74.79)	30.27 (13.10–60.09)	-0.05 (-0.28–0.19)
	Household air pollution from solid fuels	931,579 (171,286–2,457,493)	559,148 (24,278–1,641,389)	-39.98	168.67 (32.37–442.65)	25.89 (1.14–76.31)	-5.41 (-5.87 to -4.96) ^a

AAPC: average annual percentage change; ASR: age-standardised rate; CI: confidence interval; DALY: disability-adjusted life year; UI: uncertainty interval
 Rates are per 100,000 population.

^a Indicates that the 95% CI for the AAPC excludes 0.

settings.^{16,30,31} However, the present study did not formally estimate pandemic-specific effects or compare pre-pandemic and pandemic-era slopes. The COVID-19 period is therefore discussed as a contextual limitation rather than as an explanatory factor for the observed long-term trends.

Overall, the findings are consistent with previous global and China-focused evidence showing rising dementia burden in absolute terms under demographic pressure, while adding an updated GBD 2023 national profile that jointly tracks fatal burden, non-fatal burden, sex and age patterns, and selected risk-attributable estimates.^{4,7,14,15,19,23} This integrated view may support dementia surveillance, ageing-adapted service planning, and cautious prevention-priority setting.

Several methodological features support interpretability, including the long observation window, the use of internally consistent GBD definitions, and the parallel evaluation of multiple burden indicators. Nevertheless, limitations remain. The estimates are modelled rather than derived from complete nationwide adjudicated registry data. Changes in awareness, diagnostic criteria, coding practice, death-certification quality, and data availability may have influenced long-term trends.¹⁹ ADOD subtype granularity was unavailable, limiting disease-specific interpretation. Risk-attributable estimates are ecological and model-based, so ecological fallacy is possible when translating findings to individuals.²² The study did not formally decompose burden growth into population growth, ageing, and age-specific rates, did not perform age-period-cohort modelling, and did not resolve provincial, urban-rural or socioeconomic heterogeneity. Finally, the broad age groups used here may obscure clinically important differences among older adults, particularly those aged 75–84 and ≥85 years.

CONCLUSION

From 1990 to 2023, China experienced large increases in the absolute burden of ADOD, whereas age-standardised increases were smaller. This pattern is consistent with demographic ageing contributing importantly to rising dementia-related service needs. Burden remained higher in females and was concentrated among older adults, especially those aged ≥75 years. Among selected GBD risk factors, ambient particulate matter pollution and high fasting plasma glucose showed substantial modelled attributable burden, while household air pollution from solid fuels declined. These findings support strengthened dementia surveillance, ageing-adapted care capacity, and cautious integration of risk-factor prevention into public-health planning.

Supplementary materials

Appendix S1. Data extraction filters, derived datasets, and analysis code.

Ethics statement

This study used de-identified, aggregated, and publicly available estimates from the GBD Results Tool. The extraction filters, derived datasets, and analysis code are provided as supplementary files to improve reproducibility. No individual-level data were analysed. Thus, no additional ethics approval or informed consent was required.

Declaration

The authors declare that they have no affiliations or financial involvement with any commercial organisation with a direct financial interest in the subject or materials discussed in the manuscript. There is no funding or conflict of interest to declare.

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