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Research Article

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Abstract

Purpose. To quantify sex differences in chronic kidney disease (CKD) mortality and incidence among Asian adults aged ≥60 years, and to determine whether the gap reflects disease occurrence or survival after onset.

Methods. From the Global Burden of Disease (GBD) 2023 study we extracted sex-specific CKD deaths and incident cases for 2013 and 2023 across 34 Asian countries and territories, five aetiologies and 13 risk factors. Absolute (rate difference) and relative (male-to-female ratio) disparities were computed by age, region, country and cause. The mortality-to-incidence ratio

(MIR) proxied case fatality; a case fatality index normalised risk-attributable deaths to incident cases. Sex differences in MIR were tested with log-scale Z-tests using standard errors derived from GBD 95% uncertainty intervals.

Results. Deaths rose 35.1% (308,851 to 417,227) and incident cases 41.4%. The male-to-female mortality ratio narrowed from 1.18 to 1.11, rates falling 6.4% in men but 0.6% in women; incidence remained female-predominant (0.90). MIR was higher in men (1.24), significantly so in six countries, five in a Central Asia/Caucasus cluster. The male excess peaked at 80–84 years (1.37), converged by 95+ years (1.11), was widest in Central Asia (1.33) and absent in East Asia (1.01). Dietary risks were the most male-skewed; attributable deaths grew faster in women for all 13 risks.

Conclusion. In older Asians the CKD sex gap is mainly one of case fatality rather than occurrence, peaks in the ninth decade, and is narrowing because female mortality has stagnated. Sex-disaggregated profiling distinguishes countries needing prevention from those needing renal replacement capacity.

Keywords: chronic kidney disease; sex differences; Global Burden of Disease; Asia; older adults; mortality-to-incidence ratio

1. Introduction

Chronic kidney disease (CKD) affected an estimated 788 million adults worldwide in 2023—more than double the 1990 figure[14]—and, according to the Global Burden of Disease (GBD) study, ranks among the leading causes of death, with the burden concentrated in older adults and in low- and middle-income regions.[1,2] Asia hosts more than half of the world's population aged 60 years and older, and demographic ageing is projected to accelerate CKD burden across the region.[3]

Sex is a fundamental, yet incompletely understood, modifier of CKD epidemiology. Registry and cohort data consistently show that women have a higher prevalence of earlier-stage CKD, whereas men progress faster to kidney failure and experience higher mortality.[4,5] Whether these patterns hold uniformly across Asia's diverse health systems—and to what extent they reflect differential exposure to modifiable risks such as hyperglycaemia, hypertension, obesity and dietary factors—has not been systematically quantified for older populations.

Existing GBD-based CKD analyses have described global and regional patterns,[6,7] but few have focused on sex disparities, and none, to our knowledge, has applied a case-fatality framework to disentangle whether sex gaps in mortality reflect differences in disease occurrence versus differences in survival after disease onset. Recently, Bugiardini and colleagues introduced the mortality-to-prevalence ratio (MPR) and a prevalence-normalised case fatality index (CFI) to reveal sex inequities in ischaemic heart disease across European countries.[8] Adapting this framework to CKD—using the mortality-to-incidence ratio (MIR) as the fatality proxy—we present the first multi-country, multi-cause, risk-attributable analysis of sex disparities in CKD burden among older Asians.

2. Methods

2.1 Data sources and study population

This is a secondary analysis of publicly available, de-identified estimates from the GBD 2023 study (Institute for Health Metrics and Evaluation (IHME)), retrieved via the GBD Results Tool. The dataset comprises sex-specific (male, female, both) estimates of deaths and incident cases, in numbers and rates per 100,000, for five CKD aetiologies—CKD due to type 1 diabetes mellitus (T1DM), type 2 diabetes mellitus (T2DM), hypertension, glomerulonephritis, and other/unspecified causes—across 34 Asian countries/territories and five GBD regions (Central Asia, East Asia, High-income Asia Pacific, South Asia, Southeast Asia), for ages 60–64 through

95+ years and the aggregate 60+ group, in 2013 and 2023. A companion dataset provided risk-attributable CKD deaths (number and rate) for 13 modifiable leaf-level risks (metabolic: high fasting plasma glucose (FPG), high systolic blood pressure (SBP), high body-mass index (BMI); dietary: low fruit intake, low vegetable intake, low whole-grain intake, high sodium, high red meat, high processed meat, high sugar-sweetened beverages (SSBs); behavioural/environmental: low physical activity, high temperature, low temperature), using GBD comparative risk assessment methodology with theoretical minimum risk exposure levels.[9]

GBD model definitions and estimation procedures (DisMod-MR 2.1; CODEm) have been published elsewhere.[1,2] Because the analysis uses only publicly available, de-identified, country-level aggregate estimates, ethical approval was not required.

2.2 Measures of sex disparity

For each stratum we computed (i) **absolute disparity**: the male–female rate difference per 100,000; and (ii) **relative disparity**: the male-to-female (M/F) rate ratio, with values >1 indicating male excess. Because GBD reports rates for the 60+ aggregate but population denominators are not released in the extract, we back-calculated stratum-specific populations as number ÷ rate × 100,000 (internal consistency verified: inferred 60+ populations matched published GBD age-sex population estimates,[12] e.g., China ≈296 million in 2023), enabling correct population-weighted pooling of Asian totals rather than invalid summation of rates.

2.3 Mortality-to-incidence ratio (MIR) and case fatality index (CFI)

Adapting the MPR/CFI framework of Bugiardini et al.[8] (prevalence was not available in our extract; incidence was), we defined:

- **MIR = mortality rate ÷ incidence rate**, a population-level proxy for case fatality once CKD develops;

- **CFI (per risk factor) = risk-attributable deaths ÷ incident CKD cases × 100**, normalising risk-specific mortality to the at-risk diseased population.

Interpretive boundary. MIR is an *ecological period ratio*, not a cohort case-fatality rate: numerator deaths and denominator incident cases in a given year are not the same individuals, and CKD has a long pre-dialysis course, so MIR is not directly comparable to short-latency MPRs such as those reported for ischaemic heart disease.[8] MIR is therefore used here strictly as a comparative index *between sexes within the same country-year and aetiology*, where numerator–denominator mismatch applies symmetrically; cross-country MIR levels should be read with more caution than cross-sex MIR ratios. The same caveat applies to CFI, which additionally inherits the non-additivity of GBD attributable fractions (see Limitations).

Sex differences in country-level MIRs were tested with two-sample Z-tests on the log scale, with standard errors propagated from the GBD 95% uncertainty intervals (UIs) via the delta method ($|Z| \geq 1.96$, $P < 0.05$; $|Z| \geq 2.58$, $P < 0.01$).

2.4 Decadal comparison (2013 vs 2023) and stratification

Because only two calendar years were available, all time-related quantities in this paper are **two-point (decadal) comparisons, not trend estimates**. Where a per-year figure is quoted it is the geometric average—the tenth root of the 2023-to-2013 rate ratio, minus one—reported **purely as a descriptive rescaling** and not as an estimated annual trend or an estimated annual percentage change (EAPC); no regression-based trend, Joinpoint segment or projection should be inferred from it. Analyses were stratified by five-year age group (60–64 to 95+), period, GBD region, country and CKD aetiology. All analyses were exploratory: no adjustment for multiplicity was applied, and country-level Z-tests are reported with exact P values so that readers can apply their own threshold. Analyses were conducted in Python 3.13 (pandas, NumPy, SciPy); figures were produced with matplotlib and Plotly. Reporting follows the Strengthening the Reporting of

Observational Studies in Epidemiology (STROBE) statement (checklist supplied as supplementary material).

2.5 Methods considered but not applicable

Formal EAPC/Joinpoint regression, age–period–cohort modelling, Das Gupta decomposition and Sociodemographic Index (SDI)-correlation analysis were pre-specified but **not estimable from the available data**: trend regression and annual percentage change (APC) modelling require ≥3–5 calendar years (we have two), decomposition requires full population age-structure counts (only rates and outcome counts were extracted), and SDI values were not included in the extract. The implications of each omission and the corresponding remedy are given in the Limitations section.

3. Results

3.1 Overall burden and sex gap, Asia 60+

The Asian population aged ≥60 years grew from 466 million (men 222M, women 244M) in 2013 to 653 million (men 310M, women 343M) in 2023. CKD deaths rose from 308,851 (95% UI 213,455–416,114) to 417,227 (284,692–575,041)—**+39.9% in women versus +30.6% in men** (+35.1% overall)—and incident cases from 5.20 to 7.35 million (+41.4%; Table 1).

Pooled mortality **rates** declined modestly: men 71.96 → 67.35 per 100,000 (−6.4%), women 61.10 → 60.72 (−0.6%). The M/F mortality ratio therefore narrowed from **1.18 to 1.11** (absolute gap 10.9 → 6.6 per 100,000). Incidence rates were stable and **female-predominant** (2023: women 1,183.5 vs men 1,061.8 per 100,000; M/F 0.90). Women therefore carry more incident disease, whereas men experience higher mortality per case (pooled MIR 2023: men 0.0634, women 0.0513; M/F 1.24; 2013: 0.0689 vs 0.0518, M/F 1.33—fatality fell markedly in men but was essentially unchanged in women).

Table 1. Chronic kidney disease burden among adults aged 60 years and older, Asia pooled (34 countries and territories), 2013 and 2023, by sex. Numbers are counts; rates are per 100,000 population. Values are point estimates with 95% uncertainty intervals in parentheses.

Measure	Metric	Sex	2013	2023	Change
Deaths	n	Male	159,821 (102,161–228,644)	208,790 (132,038–304,224)	+30.6%
Deaths	n	Female	149,030 (98,565–210,146)	208,437 (132,262–308,625)	+39.9%
Deaths	n	Both	308,851 (213,455–416,114)	417,227 (284,692–575,041)	+35.1%
Deaths	rate /100,000	Male	71.96 (46.00–102.95)	67.35 (42.59–98.13)	-6.4%
Deaths	rate /100,000	Female	61.10 (40.41–86.16)	60.72 (38.53–89.91)	-0.6%
Deaths	rate /100,000	Both	66.28 (45.81–89.30)	63.87 (43.58–88.03)	-3.6%
Incident cases	n	Male	2,320,868 (2,073,930–2,597,436)	3,291,764 (2,937,207–3,698,610)	+41.8%
Incident cases	n	Female	2,879,121 (2,592,554–3,214,160)	4,062,530 (3,641,059–4,551,562)	+41.1%
Incident cases	n	Both	5,199,989 (4,672,197–5,808,241)	7,354,294 (6,587,789–8,245,064)	+41.4%
Incident cases	rate /100,000	Male	1,045.04 (933.85–1,169.58)	1,061.83 (947.46–1,193.07)	+1.6%

Incident cases	rate /100,000	Female	1,180.40 (1,062.91–1,317.76)	1,183.53 (1,060.74–1,326.00)	+0.3%
Incident cases	rate /100,000	Both	1,115.89 (1,002.63–1,246.42)	1,125.78 (1,008.44–1,262.14)	+0.9%

Uncertainty intervals for pooled Asia were obtained by summing country-level intervals (conservative: assumes perfect correlation between countries). Populations were back-calculated as number ÷ rate × 100,000; pooled rates are population-weighted.

3.2 Cause-specific patterns (Asia pooled, 2023)

Table 2. Sex differences in chronic kidney disease mortality and incidence by aetiology, Asia pooled, adults aged 60 years and older, 2023.

CKD aetiology	Death rate M	Death rate F	M/F deaths	Incidence M/F	M/F 2013 (deaths)
T1DM	2.20	1.80	**1.22**	0.96	1.29
T2DM	20.38	18.35	1.11	1.04	1.19
Glomerulonephritis	4.49	3.76	**1.19**	**0.66**	1.27
Hypertension	19.29	16.30	1.18	0.92	1.26
Other/unspecified	21.00	20.52	1.02	0.86	1.09

Rates are per 100,000 population aged 60 years and older; all ratios are male-to-female. The male mortality excess was greatest for T1DM- and glomerulonephritis-related CKD, whereas glomerulonephritis and hypertensive CKD incidence were markedly female-predominant (M/F 0.66 and 0.92). Every aetiology showed M/F convergence between 2013 and 2023.

3.3 Age gradients

The M/F mortality ratio followed an inverted-U across age groups (Fig. 1): 1.34 at 60–64 years, rising to **1.37 at 80–84 years** (1.45 in 2013) and 1.36 at 85–89 years, then declining to **1.11 at 95+** (2023, Asia pooled). Between 2013 and 2023 the ratio fell in all eight age bands, although only marginally at 90–94 years (1.303 → 1.301, effectively stable at 1.30); the largest narrowing was at 75–79 (1.25 → 1.15) and 70–74 (1.35 → 1.25). Mortality rates rose steeply with age in both sexes (2023: 95+ years, men 23,750 and women 21,392 per 100,000).

3.4 Regional and country patterns (2023)

Among GBD regions, the M/F mortality ratio was highest in **Central Asia (1.33)** and **Southeast Asia (1.25)**, intermediate in High-income Asia Pacific (1.17) and South Asia (1.16), and near parity in **East Asia (1.01)**. Across 34 countries/territories (Fig. 2a; Table S1), the male excess was largest in **Indonesia (1.85), Bangladesh (1.79), Kazakhstan (1.58) and Sri Lanka (1.54)**; ten countries/territories showed **female-predominant mortality rates** (M/F < 1), most markedly **Bhutan (0.74), Pakistan (0.76), the Democratic People's Republic of Korea (DPR Korea; 0.79), Singapore (0.84) and Seychelles (0.85)**, with Taiwan, China near parity (0.99).

MIR (case fatality): men had higher MIRs in 26 of 34 countries/territories (Fig. 2b; Fig. 3). The male MIR excess was statistically significant in **Kazakhstan (MIR 0.068 vs 0.033; Z = 3.36, P < 0.01), Turkmenistan (Z = 2.67, P < 0.01), Uzbekistan (Z = 2.45, P < 0.05), Georgia (Z = 2.42, P < 0.05), Mauritius (Z = 2.16, P < 0.05) and Armenia (Z = 1.96, P < 0.05)**—a Central Asia/Caucasus cluster—while no country showed a significant female MIR excess.

3.5 Decadal change, 2013 to 2023, by country and sex

Mortality rates rose in roughly half of the countries (Fig. 4). The steepest increases occurred in **Uzbekistan (men +41%, women +58%)**, Japan (men +34%, women +23%), Sri Lanka and Kazakhstan; the steepest declines in **Georgia (men −33%, women −30%), Azerbaijan (−31%, −27%) and Kyrgyzstan (−26%, −10%)**. In most countries with rising rates, women's rates rose

faster than men's (e.g., Bangladesh: women +16%, men −8%), consistent with the Asia-wide narrowing of the sex gap.

3.6 Risk-attributable deaths and CFI

High FPG and high SBP dominated attributable CKD mortality in both sexes (2023, Asia, 60+: FPG 37.0% of male and 38.7% of female deaths; SBP 30.4% and 32.2%; high BMI 14.0% and 17.1%). CFI analysis (Fig. 5; Table S2) showed that, conditional on having CKD, the fatality burden was male-predominant for **dietary sodium (CFI M/F 1.74), red meat (1.88), SSBs (1.64), processed meat (1.33), low fruit intake (1.33)** and for the two metabolic leaders (FPG 1.18; SBP 1.17); **low physical activity was the only female-predominant CFI (0.91)**, and high BMI was balanced (1.01). From 2013 to 2023, risk-attributable deaths grew faster in **women** for all 13 risks—most steeply for SSBs (+83.7% women vs +74.4% men), high temperature (+69.0% vs +47.5%) and high BMI (+63.4% vs +54.5%).

4. Discussion

4.1 Principal findings

This analysis is, to our knowledge, the first sex-disaggregated, case-fatality–oriented study of CKD in older Asians; it yields four principal findings. **First**, absolute burden is rising steeply in both sexes (+35% deaths, +41% incidence), overwhelmingly from population ageing rather than rising rates. **Second**, the historical male excess in mortality is narrowing (M/F 1.18 → 1.11) because rates fell more than ten times as fast in men as in women—a convergence echoing recent European IHD findings.[8] **Third**, the gap is fundamentally one of *fatality*, not occurrence: women have ~12% higher incidence but ~20% lower MIR, and the countries with the widest mortality gaps (Indonesia, Bangladesh) are not those with significant fatality gaps (Kazakhstan, Turkmenistan, Uzbekistan, Georgia, Armenia, Mauritius)—a dissociation with direct policy implications. **Fourth**, cardiometabolic risks dominate attributable mortality in both sexes, but

dietary risks show the most male-skewed fatality indices and attributable deaths are growing faster in women for all 13 risks.

4.2 Comparison with previous GBD work and novelty

GBD CKD collaborators have mapped global CKD burden[6,14] and its risk attribution,[9] and regional CKD analyses exist for China and South Asia,[7] but these studies report sex as a stratification variable rather than an object of inference.

Relation to the closest prior work. Hockham and colleagues examined sex differences in CKD-associated mortality across the 50 most populous countries using GBD 2019,[13] reporting roughly 30% lower female mortality globally and **no narrowing of the sex difference with age**. Our Asia-focused, 60+ results differ instructively on three counts. First, the gap among older Asians is much smaller than the global all-age gap (M/F 1.11 in 2023 versus roughly 1.4 implied globally), so a global summary masks substantial regional heterogeneity in the magnitude and direction of the gap. Second, we identify a marked age gradient *within* the older population—the male excess peaks at 80–84 years and converges towards unity at 95+—which is invisible to analyses that pool all ages or stop at a broad "older adult" band. Third, because Hockham et al. examined mortality only,[13] they could not locate the gap; by adding incidence, aetiology and risk attribution we show it resides in fatality after onset rather than in occurrence, and that the countries with the widest mortality gaps are not those with the widest fatality gaps.

Our study therefore differs from all prior work in three respects: (i) it is, to our knowledge, the **first Asia-wide CKD analysis designed around sex disparity** as the primary estimand, combining absolute (rate differences) and relative (M/F ratios) measures with formal significance testing; (ii) it **transplants the MPR/CFI case-fatality framework**[8] from cardiology to nephrology, substituting incidence for prevalence (MIR) and thereby separating sex gaps in occurrence from gaps in post-onset survival; (iii) it covers the **60+ population across 34**

countries/territories and five aetiologies simultaneously, revealing the Central Asian fatality cluster and the South/Southeast Asian female-excess cluster that global all-age analyses obscure. Our estimates also come from GBD 2023, extending the evidence base four years beyond GBD 2019 and into the post-pandemic period.

4.3 Mechanistic and policy interpretation

The female predominance of incident CKD—especially glomerulonephritis-related (M/F 0.66), consistent with the epidemiology of autoimmune glomerular disease[4]—contrasts with male predominance in fatality, plausibly reflecting faster male progression, later nephrology referral in men, or competing cardiovascular mortality.[4,5] The narrowing mortality gap, driven by stagnant female rates, warrants attention to whether older women access CKD screening, renin–angiotensin blockade, SGLT2 inhibition and kidney replacement therapy equitably, as recommended irrespective of sex by the current KDIGO guideline.[10] The Central Asian MIR cluster may reflect limited dialysis capacity and post-Soviet health-system constraints; the female mortality excess in Bhutan, Pakistan and DPR Korea may reflect gendered barriers to care. Sex-tailored dietary counselling (sodium and meat reduction in men) and physical-activity promotion in women are directly actionable implications.

4.4 Limitations

1. **Two time points.** Only 2013 and 2023 were available; EAPC/Joinpoint, APC modelling and forecasting were therefore infeasible, and percentage changes may mask non-linear intermediate dynamics. *Remedy:* re-extract GBD 2023 with full annual series (1990–2023) to enable Joinpoint/APC and ARIMA/BAPC prediction.[11]

2. **No prevalence measure.** The extract contained incidence but not prevalence, so the classical MPR[8] could not be computed; MIR (deaths/incidence) is a valid but cruder fatality proxy, and

CKD's long duration means MIR is not directly comparable to IHD MPRs. *Remedy:* include prevalence in the re-extraction to compute MPR and replicate the original CFI definition.

3. **No SDI in the extract**, precluding the pre-specified SDI-correlation analysis. *Remedy:* merge GBD SDI covariates (publicly available) at the country level.

4. **Aggregation uncertainty.** Asian pooled UIs were obtained by summing country UIs (conservative, assumes perfect correlation); pooled populations were back-calculated from number/rate, which is internally consistent but inherits rounding.

5. **Ecological design.** GBD estimates are modelled; country-sex cells with sparse vital registration (e.g., Bhutan, Timor-Leste, Pacific island states) carry wide uncertainty, and ecological associations cannot establish individual-level causality.

6. **Risk overlap.** Attributable fractions are not additive (mediation and joint effects are handled by GBD at the aggregate risk level, not across our leaf risks), so CFI rankings should be read comparatively rather than summed.

7. **Multiplicity.** Country-level MIR comparisons involve 34 simultaneous tests without adjustment for multiple comparisons; with 34 tests at $\alpha = 0.05$, roughly one to two nominally significant results would be expected by chance alone. The six significant countries should therefore be interpreted as a *pattern* (five of six fall in a contiguous Central Asia/Caucasus cluster, which chance would not produce) rather than as six independent confirmations.

8. Mauritius and Seychelles, though GBD-classified with Asia-adjacent regions in this extract, are African island states; sensitivity analyses excluding them did not change conclusions.

4.5 Policy and practice implications

Three findings translate directly into action. **First, disaggregate by sex in CKD surveillance.** A pooled Asian M/F ratio of 1.11 conceals country-level ratios ranging from 0.74 to 1.85; sex-disaggregated reporting is a prerequisite for equity auditing. **Second, separate prevention from**

treatment-access targets. Countries with wide mortality gaps (Indonesia, Bangladesh) differ from those with wide fatality gaps (Kazakhstan, Turkmenistan, Uzbekistan, Georgia, Armenia, Mauritius); the former need earlier detection, the latter dialysis and transplant capacity. **Third, prioritise the 80–84 year band**, where sex-sensitive case-finding yields the largest equity return. Because risk-attributable deaths are growing faster in women for all 13 risks, the gap is likely to close further and may eventually reverse.

5. Conclusions

Among Asians aged 60 years and older, CKD burden grew substantially in both sexes between 2013 and 2023, while the male mortality excess narrowed as female rates stagnated. Sex disparities are driven mainly by differences in case fatality rather than disease occurrence, are largest in Central Asia and parts of South/Southeast Asia, and peak at ages 80–84. Sex-disaggregated MIR/CFI profiling offers a transferable framework for targeting prevention (dietary sodium and meat in men, physical activity in women) and for auditing equity of renal care access.

Figure legends

Fig. 1 Male-to-female ratio of the CKD mortality rate by five-year age group and year, Asia pooled. The inverted-U gradient peaks at 80–84 years in both years, and the ratio declined between 2013 and 2023 in all eight bands, most steeply at 75–79 years and only marginally at 90–94 years

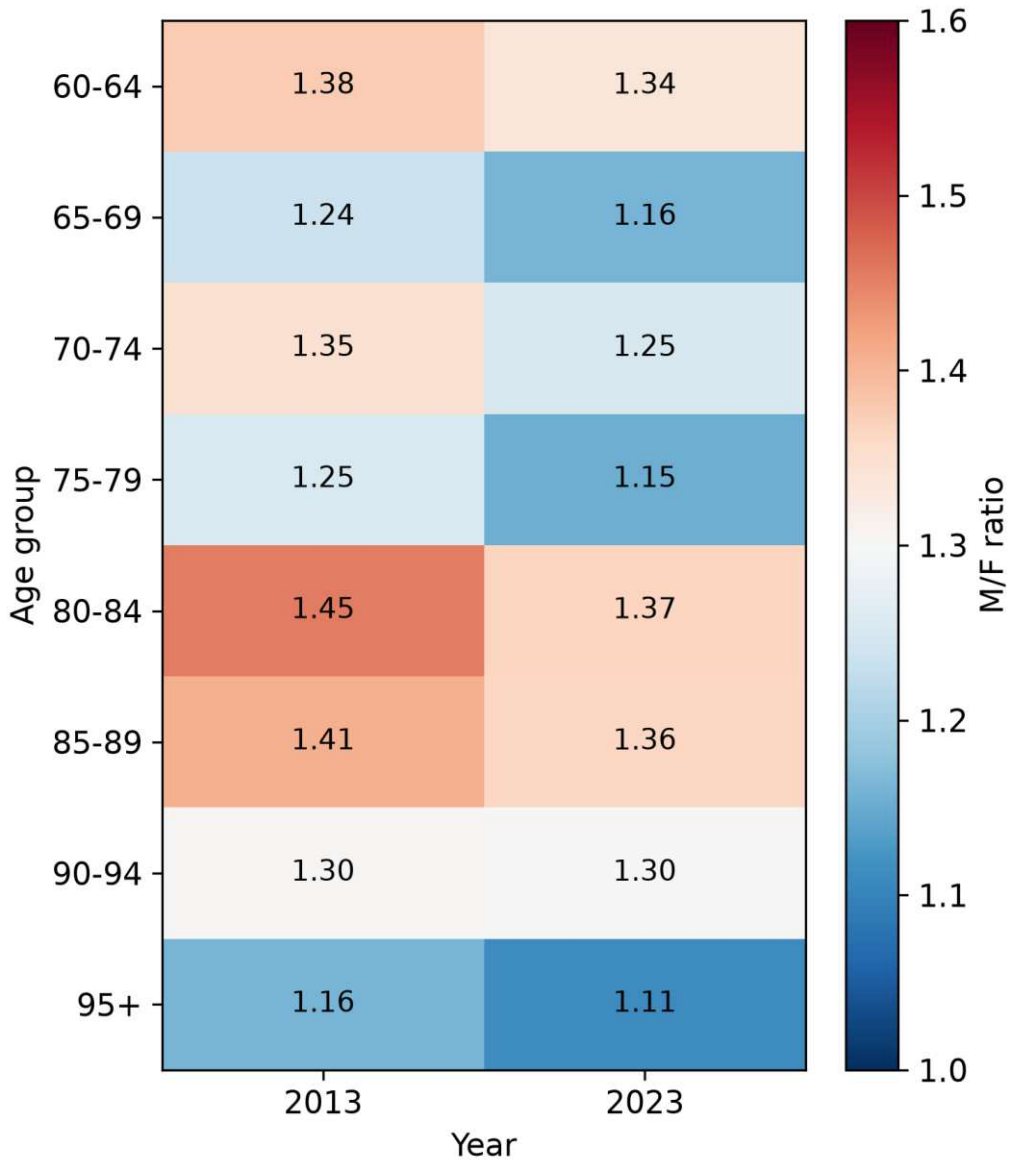
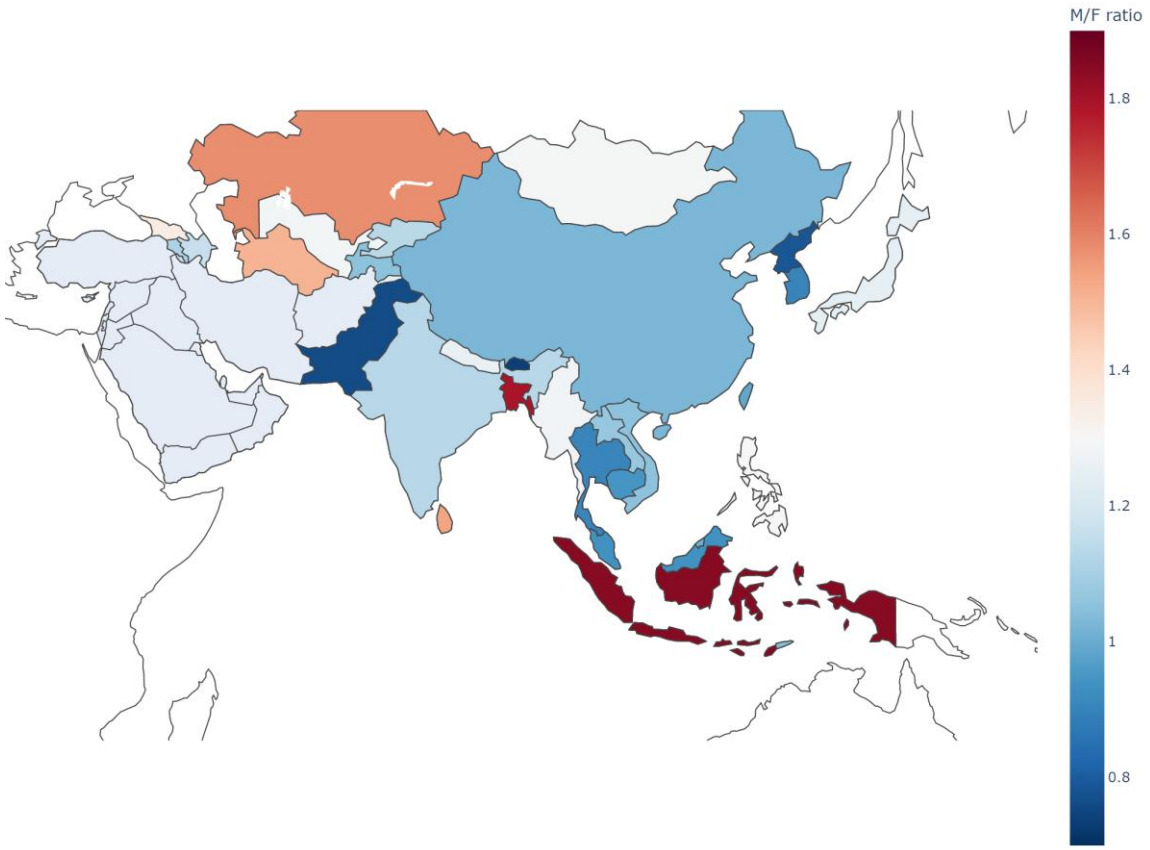


Fig. 2 Sex disparities in chronic kidney disease (CKD) among adults aged 60 years and older, Asia, 2023. (**a**) Male-to-female ratio of the CKD mortality rate. (**b**) Male-to-female ratio of the mortality-to-incidence ratio (MIR). Ratios above 1 (red) denote male excess and below 1 (blue) female excess; grey denotes no estimate. Location names follow GBD naming conventions; Taiwan is designated Taiwan, China



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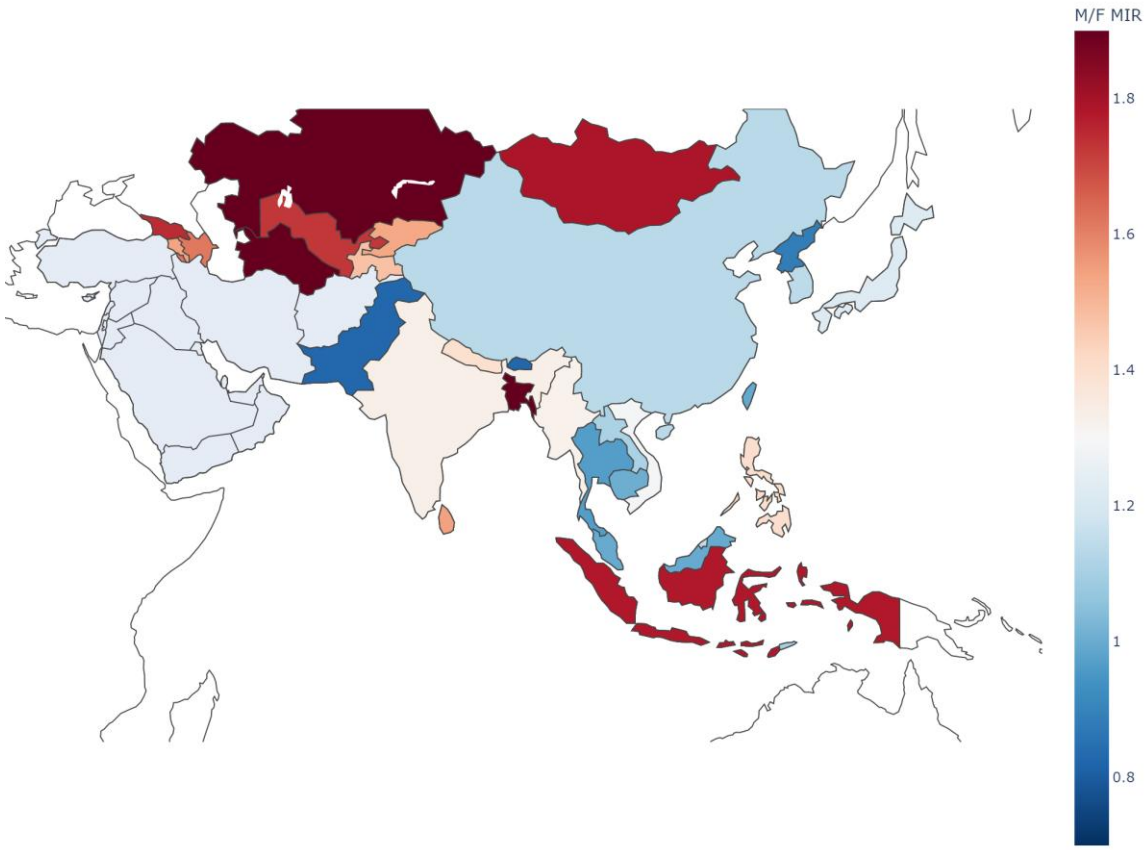


Fig. 3 Mortality-to-incidence ratio in women versus men, 34 Asian countries and territories, 2023. The diagonal denotes parity; points below it indicate higher case fatality in men. Red points are statistically significant ($|Z| \geq 1.96$). Mauritius is an outlier with a high MIR in both sexes

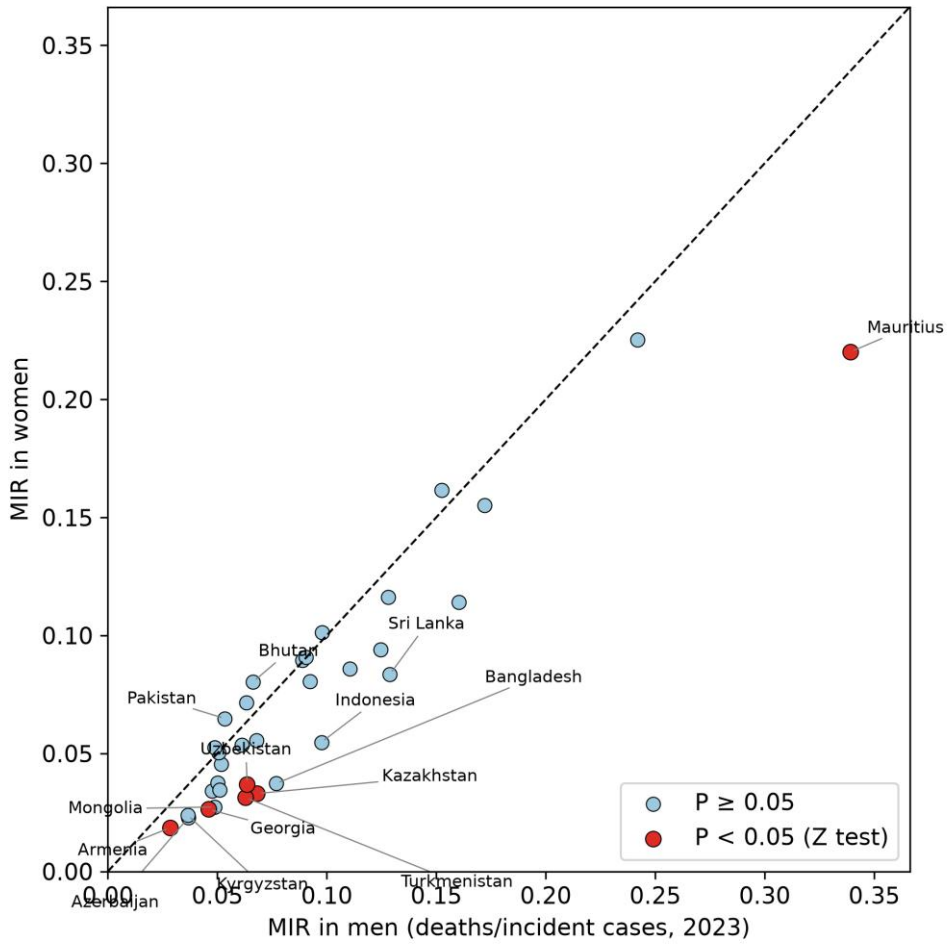


Fig. 4 Percentage change in the CKD mortality rate between 2013 and 2023 by country and sex. Each line joins the male (blue) and female (red) estimate for one country or territory

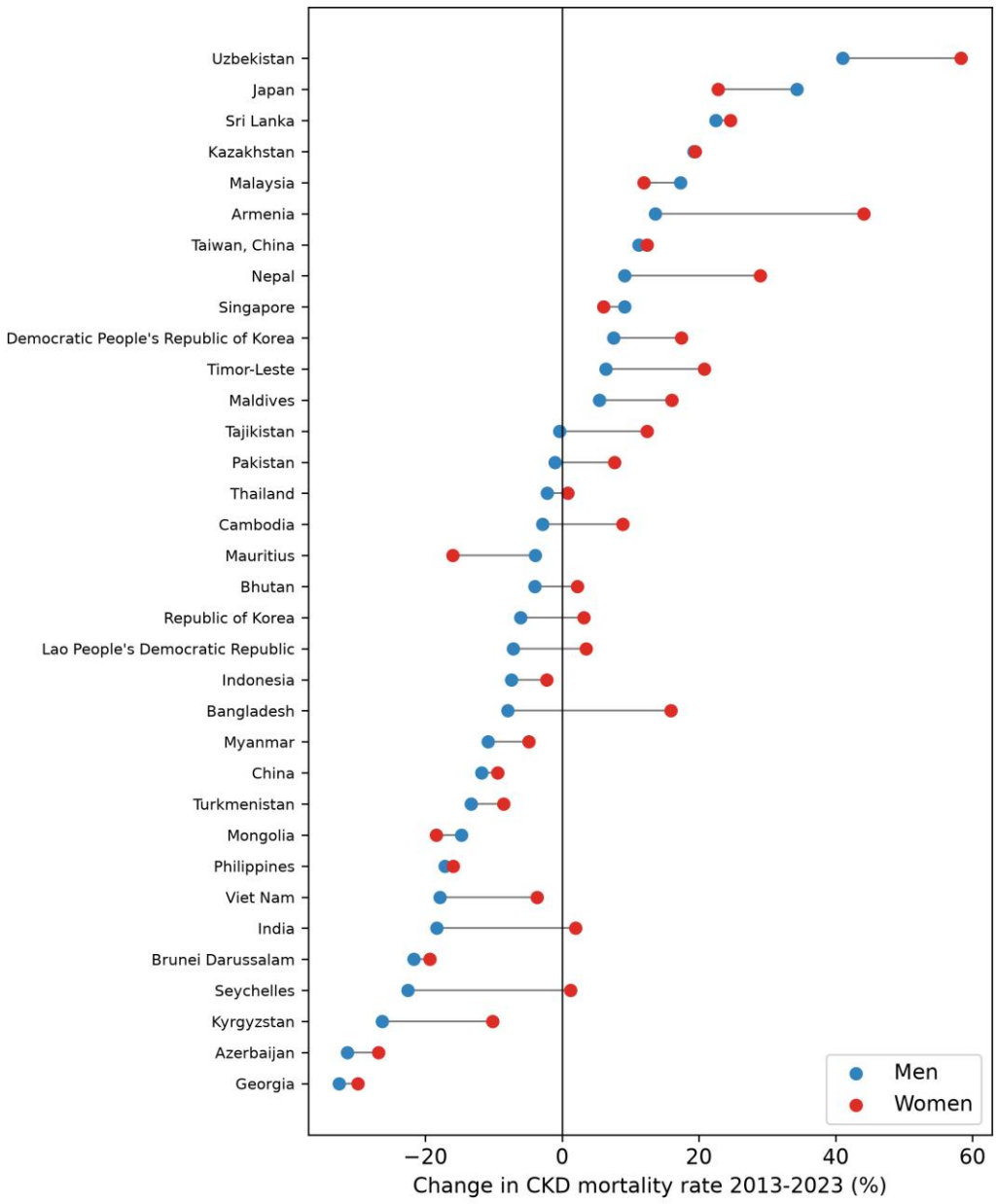
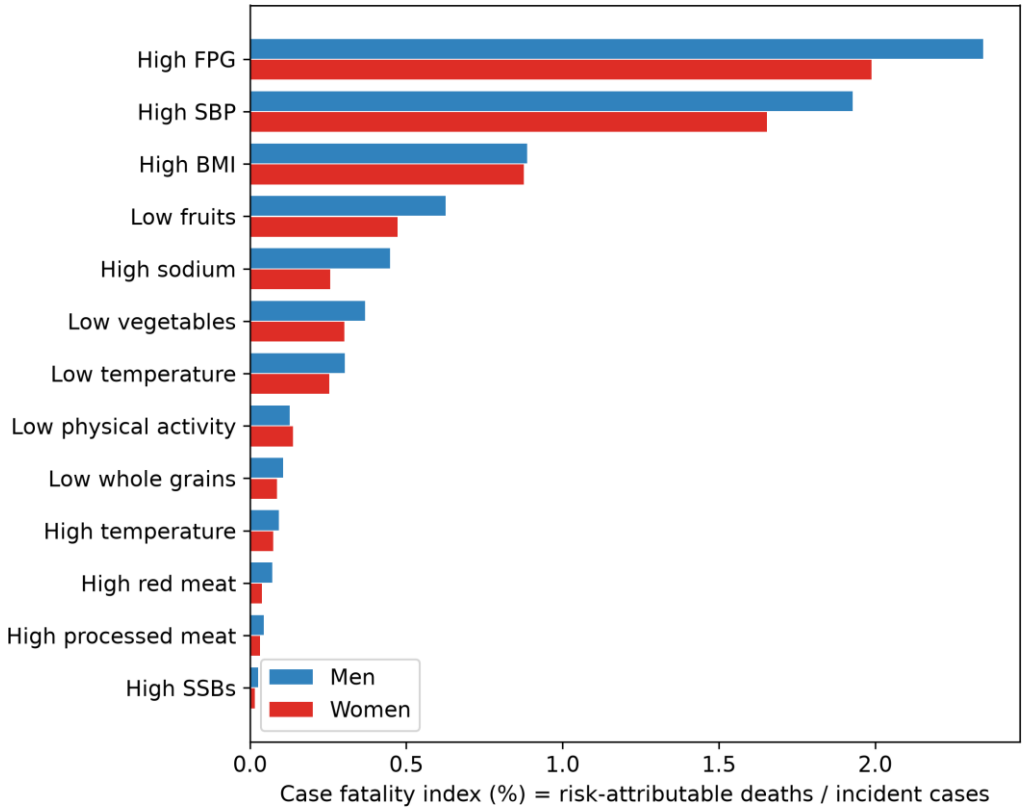


Fig. 5 Case fatality index (risk-attributable deaths ÷ incident cases × 100) by risk factor and sex, Asia pooled, adults aged 60 years and older, 2023



Supplementary material

Table S1. Country-level chronic kidney disease mortality and case fatality, 2023, 34 Asian countries and territories, ranked by male-to-female mortality ratio: sex-specific death rates per 100,000, M/F ratio, rate difference, sex-specific and M/F mortality-to-incidence ratios, and Z and P values from the log-scale test.

Table S2. Risk-attributable chronic kidney disease deaths, population attributable fractions, case fatality index and decadal change by sex, Asia pooled, adults aged 60 years and older, 13 risk factors.

Supplementary file 3. Completed STROBE checklist.

Supplementary file 4. Analysis code (Python) and the derived datasets used to generate Tables 1, 2, S1 and S2.

Statements and Declarations

Competing Interests. The authors declare that they have no competing interests. (This information has also been entered at submission via the journal's submission interface.)

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Ethics approval and consent to participate. Not applicable. The study used only publicly available, de-identified, country-level aggregate estimates from the Global Burden of Disease (GBD) 2023 study; no individual-level data were accessed and no human subjects were involved. Under the IHME Global Health Data Exchange (GHDx) terms of use, secondary analysis of released aggregate estimates does not require ethical review.

Consent for publication. Not applicable.

Data availability. All data analysed are publicly available from the Institute for Health Metrics and Evaluation GBD Results Tool (https://vizhub.healthdata.org/gbd-results/). The analysis dataset was extracted on **20 July 2026** from the GBD 2023 release using the following query parameters: measure = Deaths and Incidence; cause = the five CKD aetiologies; location = 34 Asian countries and territories plus five GBD regions; age = 60–64 to 95+ years and the 60+ aggregate; sex = Male, Female, Both; year = 2013 and 2023; metric = Number and Rate. Risk-attributable deaths were extracted for 13 leaf-level risks under the GBD comparative risk assessment framework. The derived datasets underlying Tables 1, 2, S1 and S2 and the analysis code are provided as Supplementary file 4.

Data use agreement. Use of GBD data is governed by the IHME Data Use Agreement for the Global Burden of Disease study; the authors complied with its terms, including attribution of the source and non-redistribution of raw estimates.

Author Contribution. ZT and LP conceived and designed the study. ZT, GL and ZL extracted and verified the GBD data. GL, KLX and XJQ performed the statistical analysis and produced

the figures and tables. ZT, ZL and WX drafted the manuscript. LP critically revised the manuscript for important intellectual content and supervised the study. All authors read and approved the final manuscript and agree to be accountable for all aspects of the work. (Author contribution information has also been provided at submission via the journal's submission interface.)

Reporting guideline. The manuscript was prepared in accordance with the STROBE statement for observational studies; the completed checklist is submitted as supplementary material.

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Supplementary Files

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