

Health and Functional Trajectories and Newly Reported Chronic Lung Disease in Postmenopausal Chinese Women: A Longitudinal Cohort Study

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Research Article

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Additional Declarations: No competing interests reported.

Abstract

Aim

To examine whether perceived-health and physical-function trajectories were associated with newly reported chronic lung disease among postmenopausal Chinese women, with asthma as a secondary outcome.

Methods

China Health and Retirement Longitudinal Study measurements of self-rated health, activities of daily living limitation, and mobility limitation in 2011, 2013, and 2015 were classified using latent class mixed models. Outcome-specific risk sets required an explicit negative report in 2015, no earlier positive report, and valid 2018 status. Multivariable logistic models used 20 multiply imputed data sets and false discovery rate correction.

Results

Risk sets included 6,279 women for chronic lung disease (487 new reports) and 6,773 for asthma (167 new reports); exposure-specific models included 6,072–6,126 and 6,548–6,615 women, respectively. Compared with improving self-rated health, persistently poor/worsening self-rated health was associated with chronic lung disease (adjusted odds ratio 3.54, 95% confidence interval 2.23–5.62; $q < 0.001$) and asthma (4.16, 1.84–9.39; $q = 0.001$). Increasing mobility limitation was also associated with both outcomes (1.78, 1.44–2.19; and 2.24, 1.61–3.13, respectively; $q < 0.001$ for both). ADL associations had $q \geq 0.05$.

Conclusions

Less favorable perceived-health and mobility trajectories were associated with newly reported respiratory disease among women who were postmenopausal in 2018. This study does not establish causation, and the trajectories have not been validated for clinical prediction.

Clinical Trial Registration

Not applicable.

Introduction

Chronic respiratory diseases contribute substantially to disability in middle-aged and older adults, and their effects often coexist with multimorbidity, frailty, and reduced independence.^{1,2} Women may experience respiratory disease differently across the life course because of sex-related airway biology, smoking susceptibility, body composition, and reproductive aging.^{3–9} Menopause is therefore a relevant clinical context, although it should not be treated as an isolated cause of later respiratory disease.

Self-rated health and physical function may capture vulnerability that is not represented by a disease label alone. Limitations in activities of daily living (ADL) and mobility reflect cumulative symptoms, multimorbidity, muscle reserve, and participation. Prospective evidence has linked impaired physical function or frailty with chronic lung disease, respiratory disease, and adverse outcomes among older adults.^{10–16} These measures could therefore identify patterns of vulnerability before a respiratory condition is newly reported, but a single measurement cannot distinguish persistent limitation from recent deterioration.

The China Health and Retirement Longitudinal Study (CHARLS) provides repeated health and function measurements in a national cohort of adults aged 45 years and older.¹⁷ Previous CHARLS studies have examined respiratory multimorbidity, frailty, and asthma-related risk.^{13,14,18} However, it remains unclear whether longitudinal patterns of perceived health and function are associated with newly reported respiratory disease specifically among postmenopausal women. Analyses can also be distorted when disease variables are combined across waves or when prevalent and newly reported disease are not separated.

This study examined whether 2011–2015 trajectories of self-rated health, ADL limitation, and mobility limitation were associated with newly reported physician-diagnosed chronic lung disease in 2018 among postmenopausal women who had reported no chronic lung disease through 2015. Newly reported asthma was evaluated as a secondary outcome. It was hypothesized that poorer or worsening trajectories would be associated with higher odds of both outcomes, while recognizing that these classes are empirical summaries rather than clinical phenotypes.

Methods

Study design and participants

This longitudinal cohort study used Harmonized CHARLS data from the 2011, 2013, 2015, and 2018 waves. CHARLS uses multistage probability sampling to follow community-dwelling Chinese adults aged 45 years and older.¹⁷ The exposure window comprised the 2011, 2013, and 2015 waves, and respiratory outcomes were fixed to 2018. This separation ensured that later disease reports were not used to construct earlier exposure histories.

Women were classified as postmenopausal in 2018 when their 2018 age was at or above the earliest valid age at menopause (20–65 years), taken from the direct age report or derived as menopause year

minus birth year. When age at menopause was unavailable, the 2018 menopause-status response was used. The trajectory cohort included postmenopausal women who were eligible for at least one outcome-specific risk set and had at least two valid measurements for the exposure being modeled. For chronic lung disease, the risk set required no positive report in 2011–2015, a negative report in 2015, and valid 2018 status. The asthma risk set was defined analogously. Participants could contribute to one or both risk sets.

All participants who met the eligibility criteria were included; no a priori sample-size calculation was performed.

Trajectory exposures

Self-rated health was coded from 1 to 5, with higher scores indicating poorer perceived health. ADL limitation counted difficulties across four basic activities (range 0–4), and mobility limitation counted difficulties across seven activities (range 0–7); higher scores indicated greater limitation. Values outside the documented range and designated missing codes were set to missing. Each exposure was modeled separately using its 2011, 2013, and 2015 measurements. Operational definitions are provided in Supplementary Table S1.

Respiratory outcomes

The primary outcome was a newly reported physician diagnosis of chronic lung disease in 2018. The secondary outcome was newly reported physician-diagnosed asthma in 2018. The term newly reported was used because CHARLS records self-reported physician diagnoses rather than adjudicated dates of onset. A 2018 report could therefore represent a new diagnosis, delayed recognition, or a change in reporting.

Covariates

Covariates were selected before association modeling and taken from the most recent valid pre-2018 wave: age, educational level, rural residence, partnered status, body mass index, ever smoking, alcohol use in the previous year, and a count of five non-respiratory conditions (hypertension, dyslipidemia, diabetes, heart disease, and stroke). Education was grouped as less than lower secondary, upper secondary or vocational, or tertiary. The adjustment set was identical across exposures and outcomes.

Statistical analysis

For each exposure, latent class mixed models were estimated with participant-specific random intercepts and slopes using the lcmm package in R.¹⁹ Linear and quadratic time functions and one to four classes were considered. The one-class model provided a formal comparator and starting values.

Multiclass models used five random starts; the selected solution was challenged with 30 starts. Eligible solutions required convergence, a minimum class proportion of 5%, and a minimum class-specific average posterior probability of 0.70. Among eligible solutions, the lowest Bayesian information criterion (BIC) was selected if it improved BIC by more than 10 relative to the best one-class model. Class labels were assigned after examining predicted levels and direction and are descriptive rather than diagnostic. Complete candidate-model results are provided in Supplementary Table S2 and Supplementary Figure S1; class characteristics and classification certainty are shown in Supplementary Table S3 and Supplementary Figure S2.

Trajectory class was related to each binary outcome using multivariable logistic regression, with the most favorable class as reference. Missing age, rural residence, body mass index, and condition count were imputed by chained equations in 20 data sets with 10 iterations; outcomes and trajectory classes were not imputed.²⁰ Estimates were pooled using Rubin rules. Covariate missingness is summarized in Supplementary Table S5. Benjamini–Hochberg false discovery rate correction was applied across all trajectory-class contrasts in the two outcomes.²¹ All sensitivity analyses used complete covariate cases; additional analyses excluded assignments with posterior probability below 0.70, required all three exposure waves, or modeled age and body mass index with natural splines and condition count categorically. Associations are presented as adjusted odds ratios (ORs) with 95% confidence intervals (CIs). Two-sided P values and false discovery rate q values are reported; $q < 0.05$ was considered evidence after multiplicity correction.

Analyses used R version 4.6.0, lcmm version 2.2.2, and mice version 3.19.0, with a fixed random seed of 20260914. Survey weights were not incorporated into either trajectory estimation or association modeling; estimates therefore describe the analytic sample rather than population prevalence.

OpenAI Codex (accessed September 2026) assisted with drafting and reviewing analysis code, checking consistency between statistical outputs and manuscript text, and English-language editing. Public-use data were processed locally, and all statistical outputs were generated by the documented R scripts; no AI output was treated as scientific evidence. The authors retain responsibility for final verification of the analyses and manuscript.

Ethics

The CHARLS household survey was approved by the Biomedical Ethics Review Committee of Peking University (IRB00001052-11015), and all participants provided written informed consent under the CHARLS protocol. The present study used de-identified public-use data and involved no new participant contact.

Results

Participants

Among 25,586 CHARLS participants, 13,244 were women and 8,489 were classified as postmenopausal in 2018. After outcome-specific disease-history requirements were applied, 6,939 women were eligible for at least one risk set. The chronic lung disease risk set included 6,279 women, of whom 487 (7.8%) newly reported the condition in 2018. The asthma risk set included 6,773 women, with 167 new reports (2.5%) (Fig. 1). Exposure-specific adjusted models included 6,072–6,126 women for chronic lung disease and 6,548–6,615 for asthma. Characteristics of the chronic lung disease risk set are shown in Table 1; characteristics of the asthma risk set are provided in Supplementary Table S6.

Trajectory selection

All selected models converged and met the predefined class-size and posterior-probability thresholds. The selected self-rated-health model comprised Improving self-rated health (706; 10.5%); Stable fair self-rated health (4,975; 74.1%); Persistently poor/worsening self-rated health (1,031; 15.4%). The selected ADL-limitation model comprised Persistently low ADL limitation (6,317; 93.3%); Increasing ADL limitation (455; 6.7%). The selected mobility-limitation model comprised Stable lower mobility limitation (5,202; 76.7%); Increasing mobility limitation (1,577; 23.3%). Selected solutions improved BIC by substantially more than 10 compared with the corresponding one-class models (Table 2 and Fig. 2).

Newly reported chronic lung disease

Compared with improving self-rated health, the least favorable self-rated-health class had an adjusted OR of 3.54 (95% CI 2.23–5.62; $P < 0.001$; $q < 0.001$). Increasing mobility limitation was also associated with a new chronic lung disease report (adjusted OR 1.78, 95% CI 1.44–2.19; $P < 0.001$; $q < 0.001$). For increasing ADL limitation, the estimate was smaller and did not remain below the false discovery rate threshold (adjusted OR 1.391, 95% CI 1.004–1.928; $P = 0.048$; $q = 0.063$) (Table 3).

Newly reported asthma

The least favorable self-rated-health class was associated with newly reported asthma (adjusted OR 4.16, 95% CI 1.84–9.39; $P < 0.001$; $q = 0.001$), as was increasing mobility limitation (adjusted OR 2.24, 95% CI 1.61–3.13; $P < 0.001$; $q < 0.001$). Increasing ADL limitation was not clearly associated with asthma (adjusted OR 1.37, 95% CI 0.83–2.26; $P = 0.223$; $q = 0.223$) (Table 3).

Sensitivity analyses

All sensitivity estimates remained on the same side of 1.00 as the corresponding multiply imputed estimate, although confidence intervals varied across restrictions. Asthma estimates were generally less precise because only 167 new reports occurred. All four analyses used complete covariate cases; the additional restrictions concerned classification probability, exposure-wave completeness, or nonlinear covariate specification. Full results are provided in Supplementary Table S4 and Supplementary Figure S3.

Note

Sequential exclusions were 12,342 participants not classified as women, 4,755 women not classified as postmenopausal in 2018, and 1,550 postmenopausal women ineligible for both outcome-specific risk sets. The two risk sets overlap. A new report required a negative 2015 report, no positive report in 2011–2015, and valid 2018 status. ADL, activities of daily living; CHARLS, China Health and Retirement Longitudinal Study.

Table 1
Characteristics of the chronic lung disease risk set.

Characteristic	Overall	No new report	New report
Age in 2015, years	61.1 (9.2); 6,273	60.9 (9.2); 5,787	63.0 (8.9); 486
Body mass index, kg/m ²	24.3 (3.9); 6,037	24.3 (3.8); 5,567	24.1 (4.2); 470
Non-respiratory condition count	0.9 (1.0); 6,122	0.8 (1.0); 5,650	1.2 (1.2); 472
Self-rated health score in 2015	3.0 (1.0); 6,048	2.9 (1.0); 5,582	3.4 (0.9); 466
ADL limitation score in 2015	0.2 (0.7); 6,216	0.2 (0.7); 5,729	0.4 (0.9); 487
Mobility limitation score in 2015	1.7 (1.7); 6,216	1.6 (1.7); 5,729	2.4 (1.8); 487
Rural residence	5,117 (81.5); 6,277	4,707 (81.3); 5,790	410 (84.2); 487
Partnered	5,202 (82.8); 6,279	4,833 (83.4); 5,792	369 (75.8); 487
Ever smoked	521 (8.3); 6,279	461 (8.0); 5,792	60 (12.3); 487
Drank alcohol in the previous year	915 (14.6); 6,279	840 (14.5); 5,792	75 (15.4); 487
Education: Less than lower secondary	5,815 (92.6); 6,279	5,350 (92.4); 5,792	465 (95.5); 487
Education: Upper secondary or vocational	407 (6.5); 6,279	386 (6.7); 5,792	21 (4.3); 487
Education: Tertiary	57 (0.9); 6,279	56 (1.0); 5,792	1 (0.2); 487
Note. Values are mean (standard deviation); available N for continuous variables and n (%); available N for categorical variables. No hypothesis tests were used for baseline comparisons. ADL, activities of daily living.			

Table 2
Selected latent class mixed models and classification quality.

Exposure	Trajectory N	Selected model	Class distribution	Entropy	Min AvePP	BIC improvement vs G = 1
Self-rated health	6,712	Quadratic, 3 classes	C1: 706 (10.5%); C2: 4,975 (74.1%); C3: 1,031 (15.4%)	0.743	0.725	542.7
Activities of daily living limitation	6,772	Quadratic, 2 classes	C1: 6,317 (93.3%); C2: 455 (6.7%)	0.996	0.996	6120.6
Mobility limitation	6,779	Quadratic, 2 classes	C1: 5,202 (76.7%); C2: 1,577 (23.3%)	0.754	0.870	952.7
Note. BIC improvement is the best one-class BIC minus the selected-model BIC. AvePP, average posterior probability; BIC, Bayesian information criterion; G, number of classes.						

Note

Solid lines are model-predicted values; points are class-specific observed means. Class names describe empirical patterns and are not clinical diagnoses. ADL, activities of daily living.

Table 3
Adjusted associations of trajectory classes with newly reported respiratory disease in 2018.

Exposure	Contrast	Outcome	N/events	Adjusted OR (95% CI)	P	FDR q
Self-rated health	Stable fair self-rated health vs Improving self-rated health	New chronic lung disease report	6,072/479	1.93 (1.26–2.96)	0.002	0.004
Self-rated health	Persistently poor/worsening self-rated health vs Improving self-rated health	New chronic lung disease report	6,072/479	3.54 (2.23–5.62)	< 0.001	< 0.001
Activities of daily living limitation	Increasing ADL limitation vs Persistently low ADL limitation	New chronic lung disease report	6,119/484	1.391 (1.004–1.928)	0.048	0.063
Mobility limitation	Increasing mobility limitation vs Stable lower mobility limitation	New chronic lung disease report	6,126/484	1.78 (1.44–2.19)	< 0.001	< 0.001
Self-rated health	Stable fair self-rated health vs Improving self-rated health	New asthma report	6,548/161	2.03 (0.93–4.39)	0.074	0.084
Self-rated health	Persistently poor/worsening self-rated health vs Improving self-rated health	New asthma report	6,548/161	4.16 (1.84–9.39)	< 0.001	0.001
Activities of daily living limitation	Increasing ADL limitation vs Persistently low ADL limitation	New asthma report	6,608/166	1.37 (0.83–2.26)	0.223	0.223
Mobility limitation	Increasing mobility limitation vs Stable lower mobility limitation	New asthma report	6,615/166	2.24 (1.61–3.13)	< 0.001	< 0.001

Note. Estimates were pooled across 20 multiply imputed data sets and adjusted for age, education, rural residence, partnered status, body mass index, ever smoking, alcohol use in the previous year, and non-respiratory condition count. CI, confidence interval; FDR, false discovery rate; OR, odds ratio.

Discussion

In this longitudinal analysis of postmenopausal Chinese women, poorer or worsening self-rated health and increasing mobility limitation were associated with newly reported chronic lung disease and asthma in 2018. The largest estimates were observed for the least favorable self-rated-health class: the adjusted odds were 3.54-fold for chronic lung disease and 4.16-fold for asthma relative to the improving class. Increasing ADL limitation showed a weaker association with chronic lung disease and no clear association with asthma after accounting for multiplicity. These findings identify longitudinal health and functional patterns that preceded later respiratory reports, but they do not show that the trajectories caused the outcomes.

The results are consistent with a broader functional-aging view of respiratory vulnerability. Physical limitation and frailty have been associated with chronic lung disease, reduced lung function, and adverse outcomes in older populations.^{10–16} Mobility may be especially informative because it integrates lower-extremity reserve, exertional tolerance, pain, cardiovascular burden, and habitual activity. A worsening mobility score can therefore precede respiratory diagnosis without being specific to pulmonary pathology. The trajectory may mark broader vulnerability in research settings, but it cannot distinguish airway disease from cardiac, musculoskeletal, or general frailty pathways.

The persistently poor/worsening self-rated-health trajectory produced the largest estimates. Self-rated health summarizes symptoms and limitations that may not yet have generated a recorded diagnosis, but it is also influenced by mood, health expectations, and existing multimorbidity. The observed association could reflect early respiratory symptoms, declining reserve, or greater contact with health services. Reverse causation remains possible because undiagnosed respiratory disease could have affected self-rated health and mobility during 2011–2015. The results should therefore be read as temporal risk-marker evidence rather than as evidence that improving perceived health would prevent disease.

Associations with asthma were directionally similar but less precise. Asthma in women varies across reproductive stages and may be influenced by adiposity, hormonal context, smoking, and environmental exposures.^{6–9,22–25} The present analysis did not identify asthma phenotype, severity, medication use, or age at diagnosis. In addition, a new 2018 report does not necessarily represent biological onset between 2015 and 2018. The secondary outcome nonetheless suggests that the mobility and self-rated-health patterns were not confined to the broader chronic lung disease label.

The study has several strengths. Respiratory outcomes were fixed to one wave, prior positive reports through 2015 were excluded separately for each condition, and trajectory estimation was independent of outcome status. One- through four-class linear and quadratic models were compared using predefined class-quality thresholds. Multiplicity was addressed, and several sensitivity analyses tested missing-data assumptions, classification confidence, exposure completeness, and nonlinear covariate adjustment.

Several limitations remain. Diagnoses were self-reported and were not confirmed by medical records or spirometry; newly reported disease is not equivalent to verified incidence. Smoking intensity, passive smoke, household fuel, outdoor air pollution, occupational exposures, respiratory medication, hormone

therapy, and respiratory infection history were unavailable or incomplete, leaving residual confounding.^{22–25} Age at menopause was missing for approximately 40% of the eligible sample, and time since menopause was not included in adjustment. Only three exposure waves were available, and the scores were modeled as approximately continuous. Latent classes are sample-dependent, and modal assignment does not fully propagate classification uncertainty. Multiple imputation depends on the missing-at-random assumption. Mortality or loss to follow-up before 2018 could introduce selection bias. Finally, survey weights were not used in the trajectory or association models, limiting population-level inference.

In conclusion, less favorable self-rated-health and mobility trajectories from 2011 to 2015 were associated with newly reported chronic lung disease and asthma in 2018 among postmenopausal Chinese women. These patterns describe broader health and functional vulnerability before a respiratory report. Replication with adjudicated diagnoses, spirometry, detailed exposure histories, and external cohorts is required before the trajectories can be used for clinical risk stratification.

Declarations

Acknowledgments

The authors thank the CHARLS research team and all study participants.

Author Contributions

Ling Lin: study design, conceptualization, data curation, statistical analysis, and drafting. Qingmei Xu: data interpretation, and critical revision. supervision, methodological review, critical revision, and correspondence.

Funding

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Disclosure Statement

The authors declare no conflict of interest.

Data Availability Statement

The data that support the findings of this study are available from the official China Health and Retirement Longitudinal Study data platform (<https://charls.pku.edu.cn/>) subject to registration and the platform's data-use requirements.

Ethics Approval Statement

The CHARLS household survey was approved by the Biomedical Ethics Review Committee of Peking University (IRB00001052-11015). This study was performed in accordance with the Declaration of Helsinki. The present study used de-identified public-use data and involved no new participant contact.

Patient Consent Statement

All participants provided written informed consent under the CHARLS protocol.

Clinical Trial Registration

Not applicable.

Consent for publication

Not applicable.

References

1. Wang L, Tang Y, Ji Z, Yang G, Huang J, Feng Y. Global, regional, and national burden of chronic respiratory diseases among perimenopausal women, 1990–2021: an analysis for the Global Burden of Disease Study 2021. *J Thorac Disease*. 2026;18(3):190. <https://doi.org/10.21037/jtd-2025-aw-2279>.
2. Chakraborty A, Yadav S, Kumar AHSA. Chronic lung diseases (Asthma and COPD) among middle-aged and older populations in India: social, individual, and household determinants and their associations with geriatric syndromes. *Archives Public Health*. 2025;83(1):186. <https://doi.org/10.1186/s13690-025-01675-4>.
3. Triebner K, Bui D, Walters EH, et al. Childhood lung function as a determinant of menopause-dependent lung function decline. *Maturitas*. 2021;153:41–7. <https://doi.org/10.1016/j.maturitas.2021.08.001>.
4. Imai R, Ro S, Tukupah AC, et al. Lung Function Changes Across the Menopausal Transition: A Longitudinal Analysis of Annual Examinations. *Chest*. 2026;169(3):710–22. <https://doi.org/10.1016/j.chest.2025.09.011>.
5. Liang C, Chung HF, Dobson A, Sandin S, Weiderpass E, Mishra GD. Female reproductive histories and the risk of chronic obstructive pulmonary disease. *Thorax*. 2024;79(6):508–14. <https://doi.org/10.1136/thorax-2023-220388>.
6. Kesibi D, Rotondi M, Edgell H, Tamim H. The association between age at natural menopause and risk of asthma among postmenopausal women from the Canadian Longitudinal Study on Aging. *Menopause*. 2024;31(12):1069–77. <https://doi.org/10.1097/GME.0000000000002443>.
7. DeMeo DL. Sex, Gender, and COPD. *Annu Rev Physiol*. 2025;87(1):471–90. <https://doi.org/10.1146/annurev-physiol-042022-014322>.

8. Tidemandsen C, Halvard Hansen ES, Rasmussen SM, Ulrik CS, Backer V. Unique Aspects of Asthma in Women. *Clin Chest Med*. 2021;42(3):497–506. <https://doi.org/10.1016/j.ccm.2021.04.009>.
9. Murphy VE, Mattes J, Joshi E. Treatment strategies for asthma in women throughout the lifespan - in puberty, pregnancy and menopause. *Expert Rev Respir Med*. 2025;19(12):1221–31. <https://doi.org/10.1080/17476348.2025.2530205>.
10. Chen W, Qiu S, Wu D, Lan Y, Zhao S, Wei H. Joint effects of physical functioning limitations and impaired lung function on all-cause mortality in middle-aged and older adults: A nationwide prospective cohort study. *Heart Lung*. 2026;79:102802. <https://doi.org/10.1016/j.hrtlng.2026.102802>.
11. Dong Y, Hu Q. Association between frailty and frailty change with chronic lung disease: results from two prospective cohort studies. *BMC Public Health*. 2025;25(1):2283. <https://doi.org/10.1186/s12889-025-22601-x>.
12. Li M, Liu Q, Fang Y et al. COPD, pain and frailty in middle-aged and older adults: a nationwide cohort from China, *Geriatric Nursing* 66, pt. B (2025): 103628. <https://doi.org/10.1016/j.gerinurse.2025.103628>
13. Wang Y, Sun J, Zhu X, Yu H, Zhao X. Frailty, depressive symptoms, and incident respiratory disease: a CHARLS cohort study. *BMC Pulm Med*. 2026;26(1):139. <https://doi.org/10.1186/s12890-026-04199-x>.
14. Zhou X, Wang Q, Zhang G, Zhu J, Lei M. Association of the combined triglyceride-glucose and frailty index with incident asthma risk: a prospective cohort analysis from CHARLS. *Respir Med*. 2026;260:108940. <https://doi.org/10.1016/j.rmed.2026.108940>.
15. Liang J, Yang M, Tan S, et al. Probable respiratory sarcopenia trajectories and the risk of incident chronic diseases: findings from the china health and retirement longitudinal study. *J Nutr Health Aging*. 2026;30(8):100903. <https://doi.org/10.1016/j.jnha.2026.100903>.
16. Xu Q, Guo X, Chen L, et al. Developmental trajectories of frailty among Chinese elderly COPD patients: a prospective cohort study. *BMC Pulm Med*. 2026;26(1):283. <https://doi.org/10.1186/s12890-025-03929-x>.
17. Zhao Y, Hu Y, Smith JP, Strauss J, Yang G. Cohort Profile: The China Health and Retirement Longitudinal Study (CHARLS). *Int J Epidemiol*. 2014;43(1):61–8. <https://doi.org/10.1093/ije/dys203>.
18. Wen K, Huang X, Liao X, Guo D, Liu Y, Leng Y. Comorbidity patterns of chronic respiratory diseases in older Chinese adults: A repeated cross-sectional study from CHARLS. *Medicine*. 2026;105(11):e48003. <https://doi.org/10.1097/MD.00000000000048003>.
19. Proust-Lima C, Philipps V, Lique B. Estimation of Extended Mixed Models Using Latent Classes and Latent Processes: The R Package lcmm. *J Stat Softw*. 2017;78(2):1–56. <https://doi.org/10.18637/jss.v078.i02>.
20. van Buuren S, Groothuis-Oudshoorn K. mice: Multivariate Imputation by Chained Equations in R. *J Stat Softw*. 2011;45(3):1–67. <https://doi.org/10.18637/jss.v045.i03>.

21. Benjamini Y, Hochberg Y. Controlling the False Discovery Rate: A Practical and Powerful Approach to Multiple Testing. *J Royal Stat Society: Ser. B (Methodological)* 1995;57(1):289–300.
<https://doi.org/10.1111/j.2517-6161.1995.tb02031.x>.
22. Chow R, Pham M, Cope M, et al. Sexually dimorphic response to tobacco exposure in COPD: a systematic review and meta-analysis. *BMC Pulm Med*. 2026;26(1):45.
<https://doi.org/10.1186/s12890-025-04079-w>.
23. Wang T, Liang M, Ye X, et al. Ambient air pollution exposure, mediating biomarkers and risk of COPD: a cohort study and meta-analysis. *Eur Respiratory Rev*. 2025;34:177. 250055,
<https://doi.org/10.1183/16000617.0055-2025>.
24. Xu L, Gu W, Li Z, Chen Y, Du G, Liu S. Long-term effects of air pollutants and meteorological factors on asthma in Chinese middle-aged and older adults: A nationwide population-based longitudinal study. *Environ Pollut*. 2026;395:127817. <https://doi.org/10.1016/j.envpol.2026.127817>.
25. Lee CW, Kim H, Nam MJ, et al. Obesity and abdominal obesity are risk factors for airway obstructive diseases in Korean women: nationwide population-based cohort study. *Menopause*. 2022;29(6):734–40. <https://doi.org/10.1097/GME.0000000000001958>.

Figures

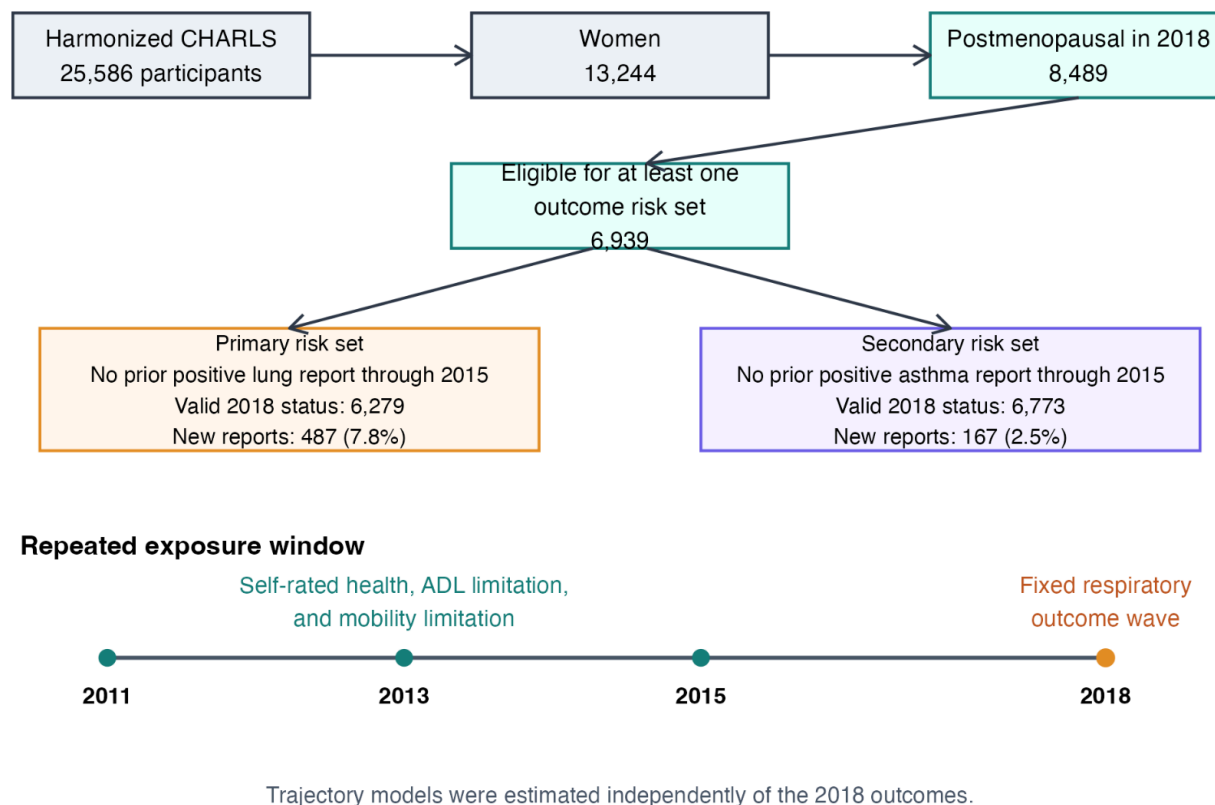


Figure 1

Participant selection, outcome-specific risk sets, and the fixed 2018 outcome design.

Note. Sequential exclusions were 12,342 participants not classified as women, 4,755 women not classified as postmenopausal in 2018, and 1,550 postmenopausal women ineligible for both outcome-specific risk sets. The two risk sets overlap. A new report required a negative 2015 report, no positive report in 2011–2015, and valid 2018 status. ADL, activities of daily living; CHARLS, China Health and Retirement Longitudinal Study.

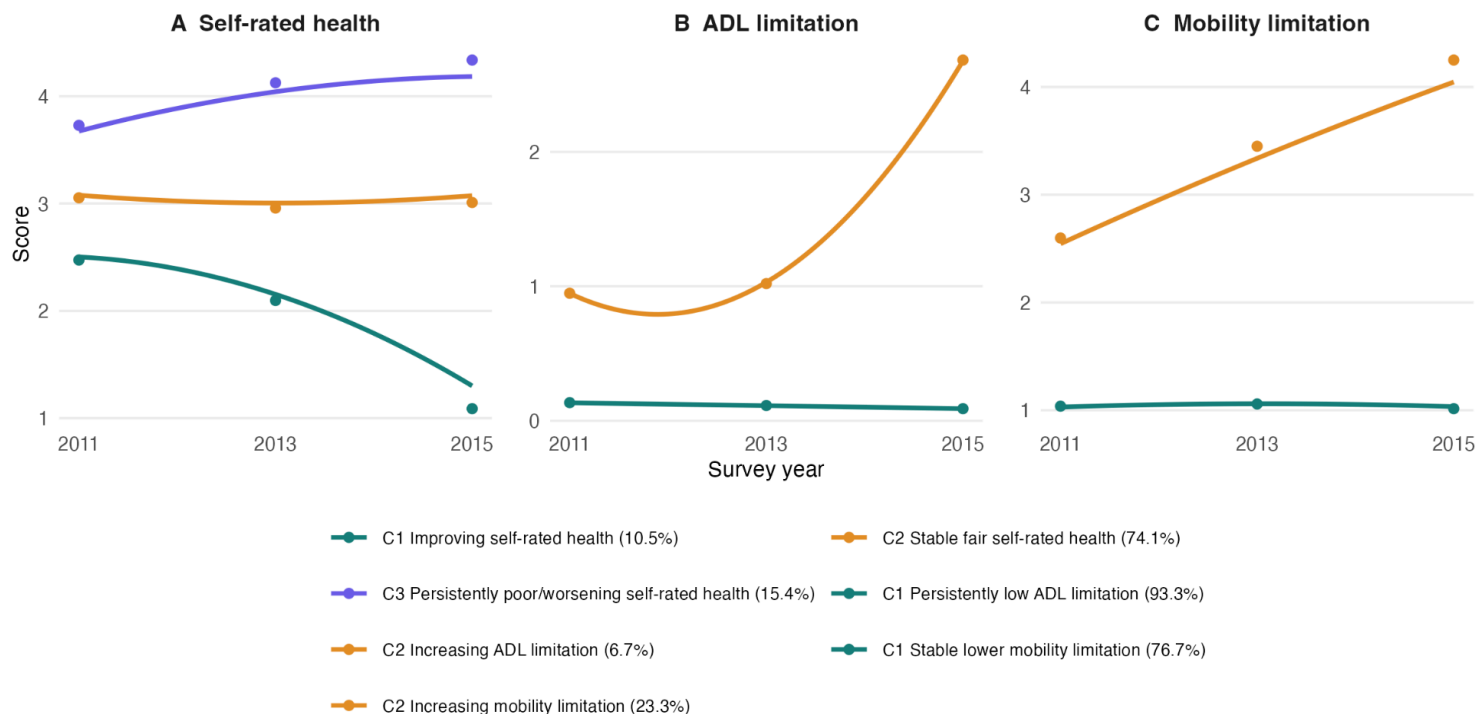


Figure 2

Selected health and functional trajectories from 2011 to 2015.

Note. Solid lines are model-predicted values; points are class-specific observed means. Class names describe empirical patterns and are not clinical diagnoses. ADL, activities of daily living.

Supplementary Files

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