Data S1. Supplemental Methods

ARIC is an ongoing population-based cohort study which enrolled 15,792 participants from four communities in the United States (North Carolina, Mississippi, Minnesota and Maryland) between 1987-1989\textsuperscript{12}. This analysis included 3,854 HF-free participants who underwent echocardiography and had acceptable quality spirometry\textsuperscript{13} at the 5\textsuperscript{th} study visit (2011-2013; age $\geq$65 years) (Figure S1). For analyses with obstructive ventilatory pattern based on FEV\textsubscript{1}/FVC ratio as the primary exposure, we excluded participants with an FVC below the lower limits of normal for age, sex, race, and height based on the NHANES III equation\textsuperscript{14} to exclude those with mixed obstructive and restrictive deficits. This analysis included 3,476 participants. Conversely, for analyses with restrictive ventilatory pattern based on FVC as the primary exposure, we excluded participants with an FEV\textsubscript{1}/FVC below the lower limit of normal according to the NHANES III equation, leaving 3,325 participants in this group. The ARIC study was approved by Institutional Review Boards from each site and all participants provided written informed consent.

Clinical Characteristics

Prevalent hypertension and diabetes were defined based on self-report, medication use, or measurements at any study visit (blood pressure above 140/90 mmHg and fasting glucose $\geq$126 or random glucose$\geq$200mg/dL, respectively) as previously described\textsuperscript{4}. Smoking status was ascertained through questionnaires at each study visit\textsuperscript{15}. Atrial fibrillation was defined based on ECG from any study visit or ARIC surveillance of relevant ICD codes from hospitalizations as previously described\textsuperscript{16}. Chronic kidney disease was defined as estimated glomerular filtration $<$60 mL/min/1.73m\textsuperscript{2} using the CKD-Epi equation\textsuperscript{17}. Coronary artery disease (myocardial infarction or coronary intervention) was ascertained through ongoing ARIC surveillance of deaths and hospitalizations and annual phone interviews, with chart abstraction and central physician adjudication as previously described\textsuperscript{18,19}. N-terminal fragment of prohormone for B-type natriuretic peptide (NT-proBNP; Elecsys 2010
Immunoassay analyzer; Roche Diagnostics, Indianapolis, Indiana) and high-sensitivity C-reactive protein (hs-CRP; Immunoturbidimetric Modular P chemistry analyzer; Roche Diagnostics) were measured at Visit 5. Participants with prevalent HF at Visit 5 were excluded from this analysis. Prevalent HF was ascertained from multiple sources: physician committee adjudicated HF hospitalization occurring since 2005 as previously published; International Classification of Disease, 9th Revision and 10th Revision with codes associated to heart failure; HF self-report at Visits 3 through 5 or on annual follow-up phone calls.

Assessment of Lung Function

Lung function was assessed based on the following spirometric variables: FEV₁, FVC and their ratio. FEV₁ was obtained as the volume of gas exhaled in the first second of expiration. FVC was obtained as the volume of gas vigorously exhaled after maximal inspiratory effort. At ARIC visits 1 (1987-1989) and 2 (1990-1992), spirometry was conducted using a water-sealed Collins Survey II volume displacement spirometer (Collins Medical, Fairfield, Connecticut) and Pulmo-Screen II software (PDS Healthcare Products, Brookfield, Wisconsin). At Visit 5 (2011-2013) a dry SensorMed 827-Spirometer (Ohio Medical Instruction Company, Cincinnati-OH) was used, connected to a software (Occupational Marketing, Inc., Houston-TX). Spirometry was performed following the American Thoracic Society quality criteria. Three or more acceptable spirograms were obtained from at least 5 forced expirations. The best single spirogram was identified and confirmed by a trained technician. Predicted reference values for all three visits were derived from NHANES III equations, according to age, sex, race, and height. The primary exposures were FEV₁/FVC and percent predicted FVC (ppFVC) assessed at Visit 5. Secondary analyses further assessed longitudinal changes in these spirometric measures by calculating the differences between the Visit 5 value and the highest value at Visits 1 or 2.

Assessment of Cardiac Structure and Function
Echocardiography in ARIC at Visit 5 has been previously described in detail\textsuperscript{23-25}. Briefly, all studies were acquired using uniform imaging equipment and acquisition protocol. All quantitative measures were performed in a dedicated Echocardiography Reading Center, blinded to clinical information. Quantitative measurements were performed in accordance with the recommendations of the American Society of Echocardiography,\textsuperscript{26,27} including measures of left ventricular (LV) structure, systolic and diastolic function, right ventricular (RV) function and pulmonary hemodynamics\textsuperscript{24}. Pulmonary artery systolic pressure (PASP) was estimated from Doppler-echocardiography tricuspid regurgitation jet peak velocity when available\textsuperscript{23}.

\textit{Incident Heart Failure Post-Visit 5}

ARIC cohort participants undergo active surveillance for incident cardiovascular events, including HF. Incident HF after Visit 5 was based on ARIC Study committee adjudication of hospitalizations with ICD codes associated with HF as previously described\textsuperscript{21}. Centrally trained and certified physicians adjudicated the HF diagnosis as definite or possible acute decompensated HF or chronic stable HF.\textsuperscript{21} LV ejection fraction (LVEF) at the time of hospitalization was abstracted if available. Outcomes of interest included all incident HF post-Visit 5, incident HF with LVEF \( \geq 50\% \) at hospitalization (HFpEF), and incident HF with LVEF <50\% at hospitalization (HFrEF). If LVEF at time of hospitalization was not available, then the most recent LVEF available within 6 months of the index hospitalization was used if no intercurrent myocardial infarction was present. Death was ascertained through the National Death Index. Participants were followed up through December 31, 2018.

\textit{Statistical Analysis}

For the cross-sectional analysis, participants were categorized according to sex- specific quartiles of FEV\textsubscript{1}/FVC and ppFVC, with the first quartile representing the worst and the fourth quartile the best lung function. For comparability of the orders of magnitude, FEV\textsubscript{1}/FVC is expressed using
percentage, in which the ratio was multiplied by 100. Baseline characteristics at Visit 5 were described using mean and standard deviation or median and 25\textsuperscript{th}-75\textsuperscript{th} percentile for continuous variables and absolute numbers and percentages for categorical variables. Linear and logistic regressions and chi-square tests for trend were used to assess associations between characteristics and measures of lung function in both unadjusted and demographically (age, sex, and race) adjusted models. For the association of lung function with echocardiographic outcomes, additional models also adjusted for potential confounders (body mass index, current or prior smoking, hypertension, diabetes, atrial fibrillation, and log-transformed NT-proBNP and hsCRP). The continuous associations between FEV\textsubscript{1}/FVC and ppFVC and echocardiographic measurements were assessed using restricted cubic splines to assess for possible nonlinear associations. Similar analyses were performed using lung function change as the exposure.

Cox proportional hazards regression models were used to determine the association of continuous and categorical lung function at baseline (Visit 5) and subsequent incident HF and death. Multivariable models adjusted for demographics, obesity, coronary artery disease, atrial fibrillation, diabetes, hypertension, and NT-proBNP. We quantified the magnitude to which each covariate attenuated the association of ppFVC with incident HF by comparing the model coefficient for ppFVC in models with or without each covariate. All models adjusted for demographics, and 95% confidence intervals were derived from 2000 bootstrap samples. Non-linear association were investigated using restricted cubic spline regression with the number of knots selected to minimize the model AIC (3 to 7 knots tested). The proportional hazards assumption was tested for all models using Schoenfeld residuals.

A two-sided p-value $<0.05$ was considered significant for all analyses. Statistical analysis was performed using Stata software Version 14.2 (Stata Corp LP, College Station, TX).
**Table S1.** Baseline characteristics in all participants who attended the 5th visit of ARIC study (n=6538). Values are expressed as mean±SD, n(%) or median[25th-75th percentile].

| Demographics | Excluded (n=2684) | Included (n=3854) | p     |
|--------------|-------------------|-------------------|-------|
| Age, years   | 76.93 ± 5.50      | 75.03 ± 4.96      | <0.001|
| Male, n(%)   | 1141 (42%)        | 1552 (40%)        | 0.07  |
| Black, n(%)  | 797 (30%)         | 746 (19%)         | <0.001|
| Center, n(%) |                   |                   | <0.001|
| Forsyth      | 283 (24%)         | 496 (22%)         |       |
| Jackson      | 319 (27%)         | 430 (19%)         |       |
| Minneapolis  | 308 (26%)         | 699 (31%)         |       |
| Washington   | 257 (22%)         | 661 (29%)         |       |
| Medical history |             |                   |       |
| Hypertension, n(%) | 2413 (90%)     | 3086 (80%)        | <0.001|
| Diabetes, n(%) | 1212 (45%)      | 1303 (34%)        | <0.001|
| Smoking status, n(%) |            |                   |       |
| Ever         | 1680 (63%)        | 2335 (61%)        | 0.10  |
| Current      | 139 (6%)          | 224 (6%)          | 0.85  |
| Atrial fibrillation, n(%) | 323 (12%)    | 174 (4%)          | <0.001|
| Chronic Kidney disease, n(%) | 927 (36%)    | 936 (24%)         | <0.001|
| Myocardial infarction, n(%) | 524 (21%)     | 267 (7%)          | <0.001|
| Physical examination |           |                   |       |
| Height, cm   | 165.5 ± 9.8       | 165.7 ± 9.4       | 0.46  |
| BMI, kg/m²   | 29.2 ± 6.4        | 28.5 ± 5.4        | <0.001|
| Heart rate, bpm | 64 ± 11           | 62 ± 10           | <0.001|
| Systolic BP, mmHg | 132 ± 20          | 130 ± 17          | <0.001|
| Diastolic BP, mmHg | 66 ± 12           | 67 ± 11           | 0.033 |
| Laboratory tests |            |                   |       |
| Hemoglobin, g/dL | 13.1 ± 1.5       | 13.4 ± 1.5        | <0.001|
| Hemoglobin A1c, % | 6.1 ± 1.9        | 5.9 ± 0.8         | <0.001|
| eGFR, mL/min/1.73m² | 66.5 ± 18.9       | 71.3 ± 16.5       | <0.001|
| Hs-CRP, mg/L  | 2.3 [1.1, 5.2]    | 1.9 [0.9, 4.0]    | <0.001|
| NT-proBNP, pg/mL | 176.1 [85.9, 407.7] | 119.2 [62.2, 225.7] | <0.001|

BMI: body mass index; FEV1: forced expired volume in 1 second; FVC: forced vital capacity; eGFR: estimated glomerular filtration rate; CRP: C-reactive protein; NT-pro-BNP: N-terminal fragment of prohormone for B-type natriuretic peptide.
Table S2. Echocardiographic parameters of the study population according to continuous FEV1/FVC at ARIC baseline visit 5.

| Structure                  | Model 1 Coefficient (95%CI) p-value | Model 2 Coefficient (95%CI) p-value |
|----------------------------|-------------------------------------|-------------------------------------|
| Mean wall thickness, cm    | 0.0005 (0.0001; 0.0011) 0.04        | 0.0005 (-00002; 0.0010) 0.06        |
| Relative wall thickness    | 0.0001 (-0.0002; 0.0004) 0.43       |                                     |
| LV mass index, g/m²        | 0.027 (-0.071; 0.076) 0.94          |                                     |
| LV mass, g                 | 0.154 (-0.013; 0.309) 0.05          |                                     |
| LVEDV index, mL/m²         | -0.011 (-0.050; 0.028) 0.58         |                                     |
| **Systolic function**      |                                     |                                     |
| LV ejection fraction, %    | 0.022 (-0.020; 0.045) 0.07          |                                     |
| Longitudinal strain, %     | -0.012 (-0.022; -0.002) 0.02        | -0.007 (-0.017; 0.003) 0.16         |
| Stroke volume index, mL/m² | 0.003 (-0.055; 0.061) 0.91          |                                     |
| **Diastolic function**     |                                     |                                     |
| E wave                     | -0.042 (-0.115; 0.030) 0.25         |                                     |
| A wave                     | 0.074 (-0.018; 0.151) 0.06          |                                     |
| E/A ratio                  | -0.0012 (-0.0025; -0.0002) 0.02     | -0.0003 (-0.014; 0.0009) 0.65       |
| Lateral e’, cm/s           | -0.010 (-0.018; -0.002) 0.014       | -0.006 (-0.014; 0.003) 0.19         |
| E/e’ lateral               | 0.003 (-0.012; 0.017) 0.72          |                                     |
| LA volume index, mL/m²     | 0.001 (-0.033; 0.035) 0.96          |                                     |
| **Right ventricle and Pulmonary pressure** | | |
| Estimated PASP, mmHg       | -0.039 (-0.067; -0.011) 0.007       | -0.043 (-0.072; -0.014) 0.004       |
| RV fractional area change  | -0.0001 (-0.0004; 0.0003) 0.67      |                                     |

BMI: body mass index; FEV1: forced expired volume in 1 second; FVC: forced vital capacity; eGFR: estimated glomerular filtration rate; CRP: C-reactive protein; NT-pro-BNP: N-terminal fragment of prohormone for B-type natriuretic peptide; LV: left ventricle; LVEDV: LV end diastolic volume; LA: left atrium; TAS’: tricuspid annular peak systolic myocardial velocity; PASP: pulmonary artery systolic pressure.

Model 1: age, sex, race; Model 2: age, sex, race, ever smoking, atrial fibrillation, hypertension, diabetes, body mass index, log Hs-CRP, log NT-proBNP. Model 2 analyses were only performed when p<0.05 in Model 1.
Table S3. Association of spirometric function at the 5th ARIC visit with incident heart failure with preserved (HFpEF) and with reduced ejection fraction (HFrEF) (median follow up time 5.6 years), and overall mortality (median follow up time 5.7 years), in participants free from moderate or greater valvular heart disease (64 exclusions).

| Outcome          | Model 1* |                      | Model 2* |                      |
|------------------|----------|----------------------|----------|----------------------|
|                  | Events   | HR (95%CI) per 10%-point decrease | p        | HR (95%CI) per 10%-point decrease | p        |
| FEV1/FVC (n=3419) |          |                      |          |                      |
| HFpEF            | 75       | 1.29 (0.99-1.66)    | 0.05     | 1.33 (1.00-1.77)    | 0.05     |
| HFrEF            | 61       | 1.24 (0.94-1.65)    | 0.13     | 1.19 (0.88-1.62)    | 0.26     |
| Heart Failure    | 153      | 1.27 (1.06-1.51)    | 0.008    | 1.17 (1.04-1.54)    | 0.017    |
| Mortality        | 329      | 1.38 (1.28-1.54)    | <0.001   | 1.28 (1.13-1.45)    | <0.001   |
| Percent predicted FVC (n=3267) |          |                      |          |                      |
| HFpEF            | 74       | 1.29 (1.12-1.48)    | <0.001   | 1.18 (1.02-1.38)    | 0.03     |
| HFrEF            | 56       | 1.00 (0.86-1.17)    | 0.98     | 0.90 (0.77-1.06)    | 0.22     |
| Heart Failure    | 151      | 1.19 (1.08-1.31)    | <0.001   | 1.07 (0.97-1.19)    | 0.17     |
| Mortality        | 305      | 1.14 (1.07-1.22)    | <0.001   | 1.13 (1.05-1.21)    | 0.001    |

*Model 1: age sex and race. Model 2: age, sex, race, body mass index, prevalent coronary artery disease, ever smoking, hypertension, diabetes, log(NT-proBNP), and stratified by prevalent atrial fibrillation, all at baseline Visit 5. Definitions of moderate or greater valvular disease have been previously published14.
Table S4. Characteristics of the study population according to sex-specific quartiles of FEV₁/FVC ratio change (Visit 5 - highest of Visits 1 or 2) in ARIC cohort from 1987 to 2013 (n=3476). Values are expressed as mean±SD, n(%) or median[25th-75th percentile].

| Participants, n | Quartile 1 | Quartile 2 | Quartile 3 | Quartile 4 | Model 1 p-trend | Model 2 p-trend | Model 3 p-trend |
|-----------------|------------|------------|------------|------------|-----------------|-----------------|-----------------|
| Mean FEV₁/FVC change | 870        | 869        | 869        | 868        |                 |                 |                 |
| -11.5 ± 5.0      | -5.6 ± 1.2 | -2.7 ± 1.1 | 1.5 ± 2.4  |            |                 |                 |                 |

**CLINICAL**

**Demographics**

- **Age at visit 5, years**: 75.7 ± 5.1, 75.3 ± 4.9, 74.7 ± 4.9, 75.0 ± 5.1, <0.001*
- **Age at visit 1, years**: 51.8 ± 5.0, 51.6 ± 4.9, 51.2 ± 4.7, 51.4 ± 5.0, 0.005*
- **Male, n(%)**: 338 (40%), 338 (40%), 338 (40%), 337 (40%), -
- **Black, n(%)**: 168 (19%), 153 (18%), 167 (19%), 191 (22%), 0.02*
- **Center, n(%)**: Forsyth 182 (21%), 195 (22%), 171 (20%), 191 (22%), 0.11*
  - Jackson: 154 (18%), 145 (17%), 151 (17%), 185 (21%)
  - Minneapolis: 278 (32%), 277 (32%), 296 (34%), 239 (27%)
  - Washington: 254 (29%), 252 (29%), 251 (29%), 253 (29%)

**Medical history**

- **Hypertension, n(%)**: 676 (78%), 702 (81%), 674 (77%), 709 (82%), 0.15
- **Diabetes, n(%)**: 246 (28%), 293 (34%), 295 (34%), 297 (34%), 0.02
- **Smoking status, n(%)**
  - Current: 82 (10%), 42 (5%), 35 (4%), 22 (3%), <0.001
  - Ever: 571 (66%), 501 (58%), 511 (59%), 492 (57%), <0.001
- **Atrial fibrillation, n(%)**: 52 (6%), 37 (4%), 33 (4%), 28 (3%), 0.02
- **Chronic kidney disease, n(%)**: 221 (26%), 214 (25%), 193 (22%), 217 (25%), 0.85
- **Coronary artery disease, n(%)**: 81 (10%), 85 (10%), 81 (9%), 74 (9%), 0.86
- **Myocardial infarction, n(%)**: 69 (8%), 64 (8%), 54 (6%), 47 (6%), 0.04

**Physical examination**

- **Height, cm**: 165.1 ± 9.3, 166.0 ± 9.6, 165.3 ± 9.3, 165.2 ± 9.3, 0.19
- **BMI, kg/m²**: 26.8 ± 5.1, 28.4 ± 5.2, 28.8 ± 5.2, 29.0 ± 5.1, <0.001
- **BMI >30 kg/m², n(%)**: 201 (23%), 285 (33%), 309 (36%), 303 (35%), <0.001
- **Heart rate, bpm**: 62 ± 10, 62 ± 11, 61 ± 10, 62 ± 10, 0.89
- **Systolic pressure, mmHg**: 129 ± 17, 130 ± 17, 131 ± 18, 130 ± 17, 0.17
- **Diastolic pressure, mmHg**: 66 ± 10, 67 ± 10, 67 ± 10, 67 ± 10, 0.02

**Laboratory tests**
|                         | 13.4 ± 1.4 | 13.4 ± 1.7 | 13.5 ± 1.3 | 13.3 ± 1.4 | 0.7 |
|-------------------------|------------|------------|------------|------------|-----|
| Hemoglobin, g/dL        |            |            |            |            |     |
| Hemoglobin A1c, %       | 5.8 ± 0.7  | 5.9 ± 0.8  | 5.9 ± 0.8  | 6.0 ± 0.8  | <0.001|
| eGFR, mL/min/1.73m²     | 71.0 ± 17.0| 71.2 ± 15.8| 71.5 ± 15.3| 71.4 ± 16.9| 0.47 |
| High sensitivity-CRP, mg/L | 1.7 [0.8, 3.6]| 1.8 [0.9, 3.9]| 1.8 [0.8, 4.0]| 2.0 [0.9, 4.1]| 0.24# |
| NT-proBNP, pg/mL        | 134.3 [71.8, 261.5] | 122.1 [66.2, 219.2] | 105.2 [53.9, 204.1] | 101.0 [57.3, 212.9] | <0.001# |

**Spirometry**

|                         |            |            |            |            |     |
|-------------------------|------------|------------|------------|------------|-----|
| V1 FEV1/FVC             | 75.0 ± 7.2 | 76.7 ± 5.6 | 76.7 ± 5.2 | 75.9 ± 5.6 | 0.02 |
| V5 FEV1/FVC             | 64.7 ± 9.3 | 72.1 ± 5.5 | 74.8 ± 5.2 | 78.4 ± 5.5 | <0.001|
| Change in FEV1, L       | -10.7 ± 13.4| -4.0 ± 10.7| -1.3 ± 11.5| 1.8 ± 11.3 | <0.001|
| Change in FVC, L        | -0.96 ± 0.39| -0.98 ± 0.33| -1.00 ± 0.35| -1.09 ± 0.37| <0.001|
| Change in ppFVC, %      | 1.5 ± 14.8 | -0.84 ± 11.5| -1.8 ± 12.3| -4.7 ± 11.9| <0.001|

**ECHOCARDIOGRAPHIC**

**Structure**

|                         | 0.96 ± 0.14 | 0.98 ± 0.13 | 0.97 ± 0.13 | 0.98 ± 0.12 | 0.04 | 0.03 | 0.13 |
|-------------------------|------------|------------|------------|------------|-----|-----|-----|
| Mean wall thickness, cm |            |            |            |            |     |
| Relative wall thickness | 0.42 ± 0.07| 0.43 ± 0.07| 0.42 ± 0.07| 0.43 ± 0.07| 0.28 | 0.45 |
| LV mass index, g/m²     | 77.1 ± 19.2| 76.9 ± 17.5| 77.7 ± 18.6| 77.0 ± 17.1| 0.52 | 0.45 |
| LV mass                | 140.0 ± 43.7| 143.9 ± 40.3| 145.1 ± 41.5| 144.0 ± 38.1| 0.02 | 0.15 |
| LVEDV index, mL/m²      | 43.4 ± 9.7 | 42.7 ± 9.7 | 43.8 ± 10.5| 43.2 ± 10.3| 0.82 | 0.49 |

**Systolic function**

|                         | 65.8 ± 6.0 | 65.8 ± 5.5 | 66.0 ± 5.8 | 66.2 ± 6.0 | 0.32 | 0.06 |
|-------------------------|------------|------------|------------|------------|-----|-----|
| LV ejection fraction, % |            |            |            |            |     |
| Longitudinal strain, %  | -18.2 ± 2.5| -18.2 ± 2.3| -18.1 ± 2.3| -18.3 ± 2.3| 0.64 | 0.22 |
| Stroke volume index, mL/m²| 48.7 ± 13.5| 47.7 ± 13.2| 47.9 ± 12.8| 48.2 ± 17.2| 0.73 | 0.73 |

**Diastolic function**

|                         | 67.7 ± 19.0| 65.6 ± 17.2| 65.4 ± 16.6| 66.1 ± 17.1| 0.08 | 0.19 |
|-------------------------|------------|------------|------------|------------|-----|-----|
| E wave                  | 78.9 ± 19.2| 78.7 ± 18.5| 79.2 ± 17.8| 80.5 ± 19.8| 0.01 | 0.09 |
| A wave                  | 0.88 ± 0.28| 0.86 ± 0.27| 0.85 ± 0.25| 0.85 ± 0.29| 0.01 | 0.19 |
| E/A ratio               | 7.24 ± 2.02| 7.08 ± 2.02| 7.05 ± 1.96| 7.17 ± 2.03| 0.10 | 0.83 |
| Lateral e', cm/s        | 10.00 ± 3.93| 9.87 ± 3.50| 9.88 ± 3.49| 9.81 ± 3.50| 0.71 | 0.47 |
| E/e' lateral            | 25.61 ± 8.11| 25.32 ± 9.47| 25.34 ± 8.24| 25.37 ± 7.61| 0.95 | 0.91 |

**Right ventricle and Pulmonary hemodynamics**

|                         | 27.7 ± 5.4 | 27.7 ± 5.5 | 27.6 ± 4.9 | 27.5 ± 5.1 | 0.63 | 0.14 |
|-------------------------|------------|------------|------------|------------|-----|-----|
| Estimated PASP, mmHg    |            |            |            |            |     |
| RV fractional area change| 0.53 ± 0.08| 0.53 ± 0.08| 0.52 ± 0.07| 0.53 ± 0.07| 0.72 | 0.91 |

BMI: body mass index; FEV1: forced expired volume in 1 second; ppFVC: percent predicted forced vital capacity; eGFR: estimated glomerular filtration rate; CRP: C-reactive protein; NT-pro-BNP: N-terminal fragment of prohormone for B-type natriuretic peptide; LV: left ventricle; LVEDD:
LV end diastolic diameter; LVESD: LV end systolic diameter; LVEDV: LV end diastolic volume; LVESV: LV end systolic volume; LA: left atrium; PASP: pulmonary artery systolic pressure.

Model 1: age, sex, race; Model 2: Model 1 + FEV1/FVC at visit 5. Model 3: Model 2 + ever smoking, hypertension, diabetes, body mass index, log Hs-CRP, log NT-proBNP, myocardial infarction and atrial fibrillation. Model 3 analyses were only performed when p<0.05 in Model 2.

*unadjusted p-value for trend. # p-value for the log transformed CRP and NT-pro-BNP trend.
Table S5. Association of spirometric function change (5th ARIC visit minus the peak function at 1st or 2nd study visit, with incident heart failure (HF) (median follow up time 5.6years), including HF with preserved (HFpEF) and with reduced ejection fraction (HFrEF), and overall mortality (median follow up time 5.7years).

| Outcome       | Events | FEV1/FVC (3476) |       | Model 1* |       | Model 2* |       |
|---------------|--------|-----------------|-------|----------|-------|----------|-------|
|               |        | HR (95%CI)      | p     | per 10% point decrease | p    | HR (95%CI) | p     | per 10% point decrease | p    |
| Heart Failure | 160    | 0.89 (0.60-1.33) | 0.58  | 0.95 (0.63-1.42) | 0.79 | 0.66 (0.37-1.18) | 0.16  | 0.78 (0.43-1.41) | 0.43 |
| HFpEF         | 78     | 1.19 (0.64-2.24) | 0.57  | 1.11 (0.59-2.10) | 0.74 |
| HFrEF         | 64     | 1.10 (0.83-1.45) | 0.52  | 1.08 (0.81-1.43) | 0.61 |
| Mortality     | 335    |                 |       |          |       |          |       |
| Heart Failure | 157    | 1.11 (0.95-1.29) | 0.20  | 1.00 (0.85-1.17) | 0.99 | 1.29 (1.02-1.62) | 0.03  | 1.13 (0.88-1.44) | 0.34 |
| HFpEF         | 78     | 0.91 (0.71-1.16) | 0.45  | 0.88 (0.69-1.12) | 0.31 |
| HFrEF         | 58     | 1.03 (0.92-1.15) | 0.60  | 1.02 (0.91-1.15) | 0.70 |
| Mortality     | 310    |                 |       |          |       |          |       |

Model 1: age sex, race and respective pulmonary function at visit 5 (FEV1/FVC or ppFVC).
Model 2: Model 1 plus visit 1 body mass index (BMI), visit 5 BMI, ever smoking, prevalent coronary artery disease at visit 5, hypertension, diabetes, logNT-proBNP at visit 5 and stratified by prevalent atrial fibrillation at visit 5.
Table S6. Echocardiographic parameters of the study population according to percent predicted FVC at ARIC baseline visit 5.

|                        | Model 1 |               | Model 2 |               |
|------------------------|---------|---------------|---------|---------------|
|                        | Coefficient (95%CI) | p-value | Coefficient (95%CI) | p-value |
| **Structure**          |         |               |         |               |
| Mean wall thickness, cm | -0.0013 (-0.0015; -0.0010) | <0.001 | -0.0005 (-0.0007; -0.0002) | <0.001 |
| Relative wall thickness| -0.0002 (-0.0004; -0.0001) | 0.001 | -0.0001 (-0.0002; 0.00001) | 0.07   |
| LV mass index, g/m²    | -0.112 (-0.147; -0.076) | <0.001 | -0.026 (-0.062; 0.009) | 0.15   |
| LV mass, g             | -0.425 (-0.501; -0.350) | <0.001 | -0.127 (-0.198; -0.056) | <0.001 |
| LVEDV index, mL/m²     | 0.037 (0.018; 0.056) | <0.001 | 0.042 (0.023; 0.062) | <0.001 |
| **Systolic function**  |         |               |         |               |
| LV ejection fraction, % | 0.012 (-0.0001; 0.023) | 0.05   |                   |        |
| Longitudinal strain, % | -0.010 (0.015; -0.006) | <0.001 | -0.005 (-0.010; -0.0003) | 0.04   |
| Stroke volume index, mL/m² | -0.010 (-0.019; 0.038) | 0.51   |                   |        |
| **Diastolic function** |         |               |         |               |
| E wave                 | -0.133 (-0.169; -0.098) | <0.001 | -0.093 (-0.130; -0.056) | <0.001 |
| A wave                 | -0.114 (0.151; -0.077) | <0.001 | -0.056 (-0.095; -0.018) | 0.004  |
| E/A ratio              | -0.0002 (-0.0008; 0.0003) | 0.37   |                   |        |
| Lateral e’, cm/s       | 0.006 (0.002; 0.010) | 0.002 | 0.004 (0.0005; 0.009) | 0.03   |
| Septal e’, cm/s        | 0.0025 (-0.0004; 0.0054) | 0.10   |                   |        |
| E/e’ lateral           | -0.029 (-0.036; -0.021) | <0.001 | -0.020 (-0.027; -0.012) | <0.001 |
| E/e’ septal            | -0.031 (0.039; -0.023) | <0.001 | -0.019 (-0.027; -0.011) | <0.001 |
| LA volume index, mL/m² | -0.030 (-0.046; -0.014) | <0.001 | -0.001 (-0.017; 0.014) | 0.84   |
| **Right ventricle and Pulmonary pressure** |         |               |         |               |
| Estimated PASP, mmHg   | -0.050 (-0.063; -0.036) | <0.001 | -0.026 (-0.040; -0.012) | <0.001 |
| TAS’ (cm/s)            | 0.006 (0.0005; 0.012) | 0.03   | 0.005 (-0.001; 0.011) | 0.14   |
| RV fractional area change | 0.0002 (0.000001; 0.0003) | 0.05 | 0.00005 (-0.0001; 0.0002) | 0.60   |

BMI: body mass index; FEV1: forced expired volume in 1 second; ppFVC: percent predicted forced vital capacity; eGFR: estimated glomerular filtration rate; CRP: C-reactive protein; NT-pro-BNP: N-terminal fragment of prohormone for B-type natriuretic peptide; LV: left ventricle; LVEDD: LV end diastolic diameter; LVESD: LV end systolic diameter; LVEDV: LV end diastolic volume; LVESV: LV end systolic volume; LA: left atrium; TAS’: tricuspid annular peak systolic myocardial velocity; PASP: pulmonary artery systolic pressure.

Model 1: age, sex, race; Model 2: age, sex, race, ever smoking, body mass index, hypertension, diabetes, log Hs-CRP, log NT-proBNP. Model 2 analyses were only performed when p<0.05 in Model 1.
Table S7. Biomarkers and Echocardiography variables of the study population according to sex-specific FVC quartiles at ARIC baseline visit 5 (n=3325). Values are expressed as mean±SD or median [25th-75th percentile].

| FVC Quartile | Participants, n | FVC, L | Demographics | Model 1 p-trend | Model 2 p-trend |
|--------------|-----------------|--------|--------------|-----------------|-----------------|
| Quartile 1   | 833             | 2.25±0.56 | Age, years | 76.5±5.2        | <0.001          |
| Quartile 2   | 830             | 2.78±0.59 | Male        | 326 (39%)       | 0.83            |
| Quartile 3   | 831             | 3.15±0.65 | Black       | 279 (33%)       | <0.001          |
| Quartile 4   | 831             | 3.75±0.83 | Height, cm  | 162±9           | <0.001          |
|              |                 |         | BMI, kg/m²  | 30.5±6.2        | <0.001          |
|              |                 |         | Ever smoker | 469 (56%)       | 0.83            |
|              |                 |         |              |                 |                 |
| Biomarkers   |                 |         |              |                 |                 |
| High sensitivity-CRP, mg/L | 2.4 [1.1, 5.1] | 2.1 [1.0, 4.4] | 1.8 [0.8, 3.6] | 1.5 [0.7, 3.0] | <0.001*         | <0.001*†       |
| NT-proBNP, pg/mL | 134 [68, 262] | 120 [58, 230] | 109 [60, 214] | 105 [57, 184] | <0.001*         | <0.001*        |
| Structure    |                 |         |              |                 |                 |
| Mean wall thickness, cm | 1.00 ± 0.14 | 0.98 ± 0.13 | 0.97 ± 0.13 | 0.96 ± 0.12 | <0.001          | 0.05            |
| Relative wall thickness | 0.44 ± 0.08 | 0.42 ± 0.07 | 0.42 ± 0.07 | 0.42 ± 0.07 | 0.01            | 0.35            |
| LV mass index, g/m² | 80.0 ± 19.0 | 78.5 ± 18.6 | 76.9 ± 18.1 | 75.1 ± 16.6 | <0.001          | 0.09            |
| LV mass, g   | 148 ± 43        | 147 ± 42 | 143 ± 41     | 142 ± 39        | <0.001          | 0.07            |
| Metric                                      | Model 1 Mean ± SD | Model 2 Mean ± SD | p-value 1   | p-value 2   |
|---------------------------------------------|-------------------|-------------------|-------------|-------------|
| **LVEDV index, mL/m²**                      | 42 ± 10           | 43 ± 10           | 43 ± 10     | 45 ± 10     |
| **Systolic function**                       |                   |                   |             |             |
| LV ejection fraction, %                     | 65.6 ± 5.9        | 65.8 ± 6.4        | 66.0 ± 5.9  | 66.1 ± 5.3  | 0.03        | 0.28        |
| Longitudinal strain, %                      | -17.8 ± 2.6       | -18.1 ± 2.5       | -18.4 ± 2.2 | -18.4 ± 2.2 | <0.001      | 0.003       |
| Stroke volume index, mL/m²                  | 50 ± 16           | 48 ± 14           | 48 ± 14     | 47 ± 13     | 0.787       | -           |
| **Diastolic function**                      |                   |                   |             |             |
| E wave, cm/sec                              | 69 ± 19           | 67 ± 17           | 65 ± 17     | 65 ± 16     | <0.001      | <0.001      |
| A wave, cm/sec                              | 84 ± 20           | 80 ± 18           | 79 ± 18     | 75 ± 17     | <0.001      | 0.006       |
| E/A ratio                                   | 0.84 ± 0.29       | 0.85 ± 0.27       | 0.85 ± 0.26 | 0.89 ± 0.27 | 0.53        | -           |
| Lateral e’, cm/s                            | 6.8 ± 2.0         | 7.1 ± 1.9         | 7.1 ± 2.0   | 7.4 ± 2.1   | 0.01        | 0.07        |
| E/e’ lateral                                | 10.7 ± 3.9        | 9.9 ± 3.4         | 9.8 ± 3.5   | 9.3 ± 3.3   | <0.001      | <0.001      |
| LA volume index, mL/m²                      | 26.3 ± 9.3        | 25.6 ± 8.3        | 25.0 ± 7.5  | 24.9 ± 7.3  | 0.001       | 0.94        |
| **Right ventricle and Pulmonary pressure**  |                   |                   |             |             |
| Estimated PASP, mmHg                         | 28.9 ± 6.1        | 27.6 ± 5.3        | 27.4 ± 4.9  | 26.8 ± 4.4  | <0.001      | 0.02        |
| RV fractional area change                   | 0.52 ± 0.08       | 0.52 ± 0.08       | 0.53 ± 0.08 | 0.53 ± 0.07 | 0.06        | -           |

CRP: C-reactive protein  
NT-pro-BNP: N-terminal fragment of prohormone for B-type natriuretic peptide  
LV: left ventricle  
LVEDV: LV end diastolic volume  
LA: left atrium  
PASP: pulmonary artery systolic pressure.

Model 1: age, sex, race, height; Model 2: age, sex, race, height, current or prior smoking, body mass index, hypertension, diabetes, log Hs-CRP, log NT-proBNP. Model 2 analyses were only performed when p<0.05 in Model 1. *p-value for the log transformed CRP and NT-pro-BNP trend. †log NT-proBNP was excluded for Model 2.
**Table S8.** Mediation proportion of covariates in Cox regression models for the association of dichotomic percent predicted FVC and Overall heart failure.

| Models                                      | ppFVC and Overall HF | HR (95% CI) | Coef | Reduction of Coef. (95% CI) |
|---------------------------------------------|----------------------|-------------|------|-----------------------------|
| Demographics (age, sex, and race)          |                      | 1.73 (1.24, 2.46) | 0.56 | REF.                        |
| Demographics + Body mass index             |                      | 1.56 (1.10, 2.21) | 0.44 | 20% (7% to 71%)             |
| Demographics + Coronary disease            |                      | 1.74 (1.24, 2.45) | 0.55 | 0.3% (-5% to 6%)            |
| Demographics + Atrial fibrillation         |                      | 1.82 (1.29, 2.57) | 0.60 | -8% (-31% to 2%)            |
| Demographics + Hypertension                |                      | 1.67 (1.18, 2.35) | 0.51 | 8% (3% to 26%)              |
| Demographics + Diabetes                    |                      | 1.67 (1.18, 2.35) | 0.51 | 8% (1% to -30%)             |
| Demographics + NTproBNP(log)               |                      | 1.47 (1.04, 2.09) | 0.39 | 30% (7% to 92%)             |

The bootstrap derived from 2000 samples indicated that the indirect effect coefficient was significant for NT-proBNP and BMI, which are suggested to be the main contributors for the association of low ppFVC and heart failure in this model, such that HR is mostly attenuated by NT-proBNP followed by BMI.
Table S9. Association of FVC at the 5th ARIC visit with incident HF, HFpEF and HFrEF (median follow up time 5.6years) and overall mortality (median follow up time 5.7years).

| Outcome          | Model 1*          | Model 2*          |
|------------------|-------------------|-------------------|
|                  | HR (95%CI)        | HR (95%CI)        |
|                  | per unit of       | per unit of       |
|                  | decrease          | decrease          |
|                  | p                 | p                 |
| FVC (n=3325)     |                   |                   |
| HFpEF            | 78                | 2.61 (1.66-4.10)  | <0.001 1.85 (1.13-3.04) 0.015 |
| HFrEF            | 58                | 1.13 (0.69-1.86)  | 0.62 0.76 (0.45-1.31) 0.33 |
| Heart Failure    | 157               | 1.98 (1.45-2.71)  | <0.001 1.37 (0.98-1.93) 0.07 |
| Mortality        | 310               | 1.61 (1.23-2.03)  | <0.001 1.61 (1.23-2.07) <0.001 |

*Model 1: age, sex, race and height. Model 2: age, sex, race, height body mass index, prevalent coronary artery disease, ever smoking, hypertension, diabetes, log(NT-proBNP), and stratified by prevalent atrial fibrillation, all at baseline Visit 5.
Table S10. Characteristics of the study population according to sex-specific quartiles of percent predicted FVC ratio change (Visit 5 - highest of Visits 1 or 2) in ARIC cohort from 1987 to 2013 (n=3321). Values are expressed as mean±SD, n(%) or median[25th-75th percentile].

| Participants, n | Quartile 1 | Quartile 2 | Quartile 3 | Quartile 4 | Model 1 p-trend | Model 2 p-trend | Model 3 p-trend |
|-----------------|------------|------------|------------|------------|----------------|----------------|----------------|
| Mean ppFVC change | -18.6 ± 7.1 | -7.3 ± 2.2 | -0.4 ± 2.3 | 13.8 ± 9.9 | -               | -              | -              |

**CLINICAL**

**Demographics**

|                          | Quartile 1 | Quartile 2 | Quartile 3 | Quartile 4 | Model 1 p-trend | Model 2 p-trend | Model 3 p-trend |
|--------------------------|------------|------------|------------|------------|----------------|----------------|----------------|
| Age at visit 5, years    | 74.0 ± 4.6 | 74.4 ± 4.5 | 74.9 ± 4.9 | 76.7 ± 5.4 | <0.001*        |                |                |
| Age at visit 1, years    | 50.4 ± 4.4 | 50.8 ± 4.4 | 51.3 ± 4.7 | 53.1 ± 5.4 | <0.001*        |                |                |
| Male                     | 325 (39%)  | 324 (39%)  | 325 (39%)  | 324 (39%)  |                |                |                |
| Black                    | 123 (15%)  | 112 (14%)  | 107 (13%)  | 330 (40%)  | <0.001*        |                |                |
| Center                   |            |            |            |            | <0.001*        |                |                |
| Forsyth                  | 161 (19%)  | 166 (20%)  | 202 (24%)  | 152 (18%)  |                |                |                |
| Jackson                  | 120 (14%)  | 107 (13%)  | 93 (11%)   | 299 (36%)  |                |                |                |
| Minneapolis              | 318 (37%)  | 301 (36%)  | 271 (33%)  | 151 (18%)  |                |                |                |
| Washington               | 232 (28%)  | 256 (31%)  | 265 (32%)  | 227 (27%)  |                |                |                |

**Medical history**

|                          | Quartile 1 | Quartile 2 | Quartile 3 | Quartile 4 | Model 1 p-trend | Model 2 p-trend | Model 3 p-trend |
|--------------------------|------------|------------|------------|------------|----------------|----------------|----------------|
| Hypertension             | 676 (81%)  | 665 (80%)  | 650 (78%)  | 680 (82%)  | 0.002          |                |                |
| Diabetes                 | 298 (36%)  | 288 (35%)  | 257 (31%)  | 300 (36%)  | 0.10           |                |                |
| Smoking status           |            |            |            |            |                |                |                |
| Current                  | 51 (6%)    | 32 (4%)    | 31 (4%)    | 42 (5%)    | 0.57           |                |                |
| Ever                     | 505 (61%)  | 463 (56%)  | 467 (56%)  | 473 (57%)  | 0.42           |                |                |
| Atrial fibrillation      | 58 (7%)    | 26 (3%)    | 19 (2%)    | 37 (4%)    | 0.002          |                |                |
| Chronic kidney disease   | 188 (23%)  | 197 (24%)  | 203 (25%)  | 211 (26%)  | 0.21           |                |                |
| Coronary artery disease  | 92 (11%)   | 70 (8%)    | 88 (11%)   | 62 (8%)    | 0.08           |                |                |
| Myocardial infarction    | 70 (9%)    | 44 (6%)    | 56 (7%)    | 51 (6%)    | 0.19           |                |                |

**Physical examination**

|                          | Quartile 1 | Quartile 2 | Quartile 3 | Quartile 4 | Model 1 p-trend | Model 2 p-trend | Model 3 p-trend |
|--------------------------|------------|------------|------------|------------|----------------|----------------|----------------|
| Height, cm               | 166.2 ± 9.2| 166.2 ± 8.9| 165.5 ± 9.1| 164.0 ± 10 | <0.001*        |                |                |
| Body mass index, kg/m²   | 30.8 ± 5.8 | 28.9 ± 5.1 | 27.8 ± 4.7 | 27.3 ± 4.9 | <0.001*        |                |                |
| Body mass index >30 kg/m²| 412 (50%)  | 300 (36%)  | 238 (29%)  | 207 (25%)  | <0.001*        |                |                |
| Heart rate, bpm          | 62 ± 10    | 61 ± 9     | 61 ± 10    | 62 ± 10    | 0.34           |                |                |
| Systolic pressure, mmHg  | 130 ± 18   | 130 ± 17   | 129 ± 17   | 131 ± 17   | 0.003          |                |                |
| Diastolic pressure, mmHg | 68 ± 10    | 67 ± 10    | 66 ± 10    | 66 ± 10    | <0.001*        |                |                |

**Laboratory tests**

|                          | Quartile 1 | Quartile 2 | Quartile 3 | Quartile 4 | Model 1 p-trend | Model 2 p-trend | Model 3 p-trend |
|--------------------------|------------|------------|------------|------------|----------------|----------------|----------------|
| Hemoglobin, g/dL         | 13.4 ± 1.4 | 13.5 ± 1.4 | 13.4 ± 13  | 13.2 ± 1.8 | 0.48           |                |                |
|                           | Mean ± SD       | Mean ± SD       | Mean ± SD       | Mean ± SD       | Significance |
|---------------------------|----------------|----------------|----------------|----------------|--------------|
| **HbA1c, %**              | 5.93 ± 0.77     | 5.88 ± 0.79     | 5.84 ± 0.70     | 5.92 ± 0.83     | <0.001       |
| **eGFR, mL/min,1.73m²**   | 72.5 ± 16.3     | 71.3 ± 16.5     | 70.9 ± 16.5     | 70.6 ± 16.7     | 0.98         |
| **High sensitivity-CRP, mg/L** | 2.5 [1.2, 5.1] | 1.9 [1.0, 4.0] | 1.7 [0.8, 3.6] | 1.6 [0.8, 3.4] | <0.001#      |
| **NT-proBNP, pg/mL**      | 133.0 [65.0, 257.2] | 106.9 [62.1, 209.2] | 113.1 [59.6, 203.5] | 111.0 [55.2, 210.9] | <0.001#      |
| **Spirometry**            |                |                |                |                |              |
| V1 ppFVC                  | 102.4 ± 12.8    | 101.2 ± 11.7    | 100.0 ± 12.8    | 96.5 ± 17.6    | <0.001       |
| V5 ppFVC                  | 84.6 ± 13.7     | 94.8 ± 11.9     | 100.4 ± 12.8    | 111.4 ± 17.9   | <0.001       |
| Change in FEV1, L         | -15.8 ± 9.7     | -5.9 ± 6.8      | 0.01 ± 7.7      | 7.8 ± 12.2     | <0.001       |
| Change in FVC, L          | -1.5 ± 0.4      | -1.1 ± 0.2      | -0.9 ± 0.2      | -0.7 ± 03      | <0.001       |
| Change in FEV1/FVC        | -2.3 ± 4.5      | -3.2 ± 4.1      | -3.6 ± 3.9      | -4.6 ± 4.4     | <0.001       |
| **ECHOCARDIOGRAPHIC**     |                |                |                |                |              |
| **Structure**             |                |                |                |                |              |
| Mean wall thickness, cm   | 1.00 ± 0.14     | 0.97 ± 0.13     | 0.97 ± 0.13     | 0.96 ± 0.12    | <0.001       |
| Relative wall thickness   | 0.43 ± 0.07     | 0.42 ± 0.07     | 0.42 ± 0.08     | 0.43 ± 0.07    | 0.001        |
| LV mass index, g/m²       | 80.2 ± 18.8     | 77.2 ± 17.7     | 77.3 ± 18.2     | 75.6 ± 17.4    | <0.001       |
| LV mass, g                | 155.5 ± 43.4    | 145.9 ± 40.8    | 142.7 ± 40.0    | 136.4 ± 39.5   | <0.001       |
| LVEDV index, mL/m²        | 43.1 ± 9.8      | 42.9 ± 9.8      | 43.7 ± 10.8     | 43.2 ± 9.9     | 0.39         |
| **Systolic function**     |                |                |                |                |              |
| LV ejection fraction, %   | 65.4 ± 6.1      | 66.2 ± 5.3      | 66.0 ± 5.9      | 66.0 ± 6.1     | 0.002        |
| Longitudinal strain, %    | -17.9 ± 2.6     | -18.4 ± 2.3     | -18.3 ± 2.3     | -18.1 ± 2.3    | 0.004        |
| Stroke volume index, mL/mL²| 47.6 ± 13.8     | 47.8 ± 14.8     | 48.5 ± 13.6     | 48.2 ± 15.3    | 0.84         |
| **Diastolic function**    |                |                |                |                |              |
| E wave                    | 69.7 ± 19.2     | 66.6 ± 16.8     | 65.3 ± 16.5     | 64.2 ± 17.5    | <0.001       |
| A wave                    | 79.5 ± 20.0     | 79.2 ± 18.4     | 79.8 ± 18.3     | 80.0 ± 17.9    | 0.04         |
| E/A ratio                 | 0.90 ± 0.31     | 0.86 ± 0.25     | 0.84 ± 0.24     | 0.82 ± 0.28    | <0.001       |
| Lateral e', cm/s          | 7.3 ± 2.2       | 7.1 ± 1.9       | 7.1 ± 1.9       | 7.1 ± 2.1      | 0.88         |
| Septal e', cm/s           | 5.84 ± 1.45     | 5.79 ± 1.35     | 5.75 ± 1.47     | 5.70 ± 1.55    | 0.67         |
| E/e' lateral              | 10.3 ± 3.9      | 9.9 ± 3.5       | 9.8 ± 3.4       | 9.7 ± 3.5      | <0.001       |
| E/e’ septal               | 12.5 ± 4.5      | 12.0 ± 3.7      | 11.9 ± 3.8      | 11.8 ± 3.8     | <0.001       |
| LA volume index, mL/m²    | 26.9 ± 9.6      | 25.0 ± 7.4      | 25.2 ± 7.9      | 24.8 ± 7.4     | <0.001       |
| **Right ventricle and**   |                |                |                |                |              |
| Pulmonary hemodynamics    |                |                |                |                |              |
| TAS’ (cm/s)               | 11.8 ± 3.0      | 11.9 ± 2.7      | 11.8 ± 2.8      | 11.8 ± 2.8     | 0.42         |

# p < 0.05
|                          | Model 1 | Model 2 | Model 3 | Model 3 analyses were only performed when p<0.05 in Model 2. |
|--------------------------|---------|---------|---------|----------------------------------------------------------|
| Estimated PASP, mmHg     | 28.8 ± 5.9 | 27.7 ± 5.5 | 27.2 ± 4.8 | <0.001 | 0.002 | 0.65 |
| RV fractional area change| 0.52 ± 0.08 | 0.53 ± 0.07 | 0.53 ± 0.08 | 0.53 ± 0.08 | <0.001 | <0.001 | 0.004 |

BMI: body mass index; FEV1: forced expired volume in 1 second; FVC: forced vital capacity; eGFR: estimated glomerular filtration rate; CRP: C-reactive protein; NT-pro-BNP: N-terminal fragment of prohormone for B-type natriuretic peptide; LV: left ventricle; LVEDD: LV end diastolic diameter; LVESD: LV end systolic diameter; LVEDV: LV end diastolic volume; LVESV: LV end systolic volume; LA: left atrium; TAPSE: tricuspid annular peak systolic myocardial velocity; PASP: pulmonary artery systolic pressure.

Model 1: age, sex, race; Model 2: Model 1 + ppFVC at Visit 5; Model 3: Model 2 + body mass index from visits 5 and 1, hypertension, atrial fibrillation, log Hs-CRP, log NT-proBNP. Model 3 analyses were only performed when p<0.05 in Model 2.

*unadjusted p-value for trend. # p-value for the log transformed CRP and NT-pro-BNP trend.
**Figure S1.** Flow diagram demonstrating the derivation of the study sample.

- **15792 Participantes enrolled at Visit 1**
  - 9254 did not attend or died before V5
  - **6538 Participants who attended V5**
    - 2684 Excluded
      - 420 Without echo assessment
      - 1475 Without spirometry
      - 746 With Heart failure
      - 43 With poor quality spirometry
    - **3854 Participants included in this analysis**
      - 3476 Participants with obstructive spirometric pattern
      - 3325 Participants with restrictive spirometric pattern
    - 378 Excluded
      - With FVC below the lower limit of normality
    - 529 Excluded
      - With FEV1/FVC below the lower limit of normality
- 9254 did not attend or died before V5

- **3463 Participants included in this analysis**
  - 3476 Participants with obstructive spirometric pattern
  - 3325 Participants with restrictive spirometric pattern

9254 did not attend or died before V5
Figure S2. Continuous associations of FEV₁/FVC (blue) and percent predicted FVC (light red) at Visit 5 with subsequent incidence of HF overall.

Models were adjusted for age, sex, race, and primary exposure variables (FEV₁/FVC and percent predicted FVC) using restricted cubic splines with 3 knots. *p <0.05 in models further adjusted for body mass index, prevalent coronary artery disease, prevalent atrial fibrillation, hypertension, diabetes, ever smoking, log(NT-proBNP) and the other spirometric measure (FEV₁/FVC or ppFVC).