**Table S1** The operational definitions for asthma and related comorbidities from claim DB

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|  | **Operational definition of diagnosis** |
| Asthma related claim | Claim with ICD-8, 9, and 10 codes (J45.x–J46.x) for the principal or four additional diagnoses+ of asthma and at least one asthma-related medication++. |
| Hospital admission due to asthma exacerbation | Asthma-related claim with systemic corticosteroid prescription for ≥ 1 days and nebulizer treatment+++. |
| Emergency visit due to asthma exacerbation | Asthma-related claim plus ER code with systemic corticosteroid prescription for ≥ 1 days and nebulizer treatment. |
| Outpatient visit due to asthma exacerbation | Asthma-related claim with systemic corticosteroid prescription for ≥ 2 days. |
| Patients with Asthma | |
|  | At least two asthma-related claims occurring between 6 months before and after the first claim data of the year. |
| Severe asthma++++ | Patients who were prescribed with a canister of ICSs equivalent to a canister of high-dose ICSs for > 6 months of the year with asthma-related claims. (They had to be prescribed ICS canisters equivalent to greater than the sum of 12 months prescription of low-dose ICS.) |
| Non-severe asthma | All other patients who did not have severe asthma. |
| Comorbidities  One or more claims in a year with the following ICD-10 codes. | |
| Diabetes mellitus | E10.x, E11.x, E13.x, E14.x |
| Cardiovascular disease | I10-13.x, I15, I20-23.x, I25.x, I42.x, I46-50.x, I71.x, I73.x, I74.x, I82.x, I95.x |
| Hypertension | I10.x, I11.x-13.x, I15.x |
| AMI | I21.x, I22.x, I23.x, |
| Psychiatric disorders  Anxiety disorders  Bipolar disorders  Mood disorders  Schizophrenia  Sleep disorders  Somatoform disorders  Depressive disorders  Stress disorders  Obsessive-compulsive disorders  Symptoms and signs involving emotional state | F40.0-F40.9, F41.0-F41.9  F31.0-F31. 9  F30, F34.0-F34.9, F38.0, F38.1, F38.8, **F39**  F20.x  F51, G47  F45.x  F32.x, F33.x  F43.x  F42.x  R45 |
| Fatty liver | K76.0, K70.0 |
| GERD | K21 |
| URI | J00, J01-04.x, J06.x, J39.x |
| Pneumonia | J100, J110, J12.x-J18.x, J69.x |
| Dyslipidemia | E78.x |
| Vasomotor and allergic rhinitis | J30.x |
| Chronic rhinitis | J31.x |
| Gastroenteritis and colitis | A09.x, A04.x, A08.x, K12.x, K29.x, K31.x |
| Bronchitis | J20.x, J40.x |
| Chronic bronchitis | J41.x, J42.x |
| COPD | J44.x |
| Arthritis\*\* | M16.x, M13.x |
| Osteoporosis | M80-82.x |
| Osteoporosis with fracture | M80.0 |
| Dementia | F00-01x. F03, G20, G30 |
| Parkinson’s disease | G20 |
| Alzheimer’s disease | G30 |
| Contact dermatitis | L23.x, L24.x, L25.x |
| Urticaria | L50.x |
| Chronic sinusitis | J32.x |
| Rheumatoid arthritis | M05.x, M06.x, M07.x, M08.x |
| Stroke | I64.x, I62.x, I63.x, G46.4 |
| Obesity | E66.x |
| Food allergy | K52.2, L23.6, T78.0 |
| Drug allergy | Z88.x, Z91.0, L23.3, T88.7, T88.6 |
| Anaphylaxis | T78.2, T78.0, T80.5, T88.6 |
| Cerebrovascular disease | G45-46.x, I60-61.x, I63-69.x |
| Endocrine disease | C73.x, E03-07.x, E10-14.x, E24.x, E50.x, E53.x, E55-56.x, E58.x, M10.x, M80-82.x, N95.x, R81.x |
| Respiratory disease | A15-16.x, A18-19.x, B90.x, C34.x, I26.x, J00-05.x, J06.x, J09.x, J10-11.x, J100-110.x, J12-18.x, J20-22.x, J30-32.x, J37.x, J39.x, J40-44.x, J47.x, J60.x, J64-65.x, J67.x, J69.x, J80-82.x, J84-85.x, J93.x, J96.x, N30.x, R04.x |

\*All participants were aged >18 years.

+Principal or four additional diagnoses: The ICD diagnosis codes that could be applied to the prescription. In the case of prescriptions for which five or more diagnoses were entered, the principal diagnosis code and up to four additional diagnosis codes in the following order were applied to the analysis.

++Asthma-related medication: inhaled corticosteroids (ICSs), long-acting β-2 agonists (LABAs), ICSs and LABAs combined in a single inhaler (ICSs/LABAs), oral leukotriene antagonists, short-acting β-2 agonists (SABAs), long-acting muscarinic antagonists (LAMAs), short-acting muscarinic antagonists (SAMAs), systemic β agonists, and theophylline derivatives.

+++Nebulizer treatment: code for nebulizer treatment or nebulizer medications (ICSs, SABAs, and ipratropium bromide)

++++Severe asthma: we did not apply the definition of severe asthma in the GINA guidelines (2023): asthma that is uncontrolled despite adherence to optimized high-dose ICS-LABA therapy and treatment of contributory factors or that worsens when high-dose treatment is decreased.

\*\* excluded infectious arthritis; M00.x, M01.x and M03.x

ICS: inhaled corticosteroids, URI: upper respiratory infection, GERD: gastroesophageal reflux disease, AMI: acute myocardial infarction, COPD: chronic obstructive pulmonary disease