

### Additional file 5. Features and most important features in prediction models

Studies (author, year)	Features used in final model				Top 10 important features
	Demographic	Clinical	Social- economic	Other factors	
Lieu, 1999	√	√			Oral steroid prescription (past 12m); ED visit (past 6m); Asthma medication prescription (past 6m); anti-inflammatory/beta2-agonist (past 6m)
Schatz, 2004		√			ED visit or hospitalization; any oral corticosteroids; >14 beta agonist canisters
Schatz, 2006		√			Medication intensity Scale (include two elements: beta agonist canisters and oral corticosteroid)
Xu, 2011	√	√			SNPs
van Vliet, 2017		√			7 volatile organic compounds
Luo, 2020	√	√	√	Facility feature; primary care provider features	Asthma visit number; systemic steroid ordered; the number of days since the last ED visit; age; the last visit's admission type; asthma duration; ED visit number; SABA ordered
Luo, 2020	√	√	√	Primary care provider features	Nebulizer medications filled; asthma reliever orders; days since last asthma exacerbation or status asthmaticus diagnosis; ED visit for asthma; ED visits; age; primary/principal asthma diagnoses
Tong, 2021	√	√	√	Primary care provider feature	Asthma related ED visit number; length of stay of an ED visit; days since the most recent ED visit; primary/principal asthma diagnoses; days since last asthma exacerbation or status

					asthmaticus diagnosis; race; ED visit number; asthma diagnosis number; asthma duration; nebulizer medication orders
Zein, 2021	√	√			Non-severe: ICS+LABA; sinusitis; LTRA; nasal steroids; BMI; eosinophil; albumin; age; IgE; gastroesophageal reflux disease ED: oral steroid burst; age; race; ICS+LABA; albumin; eosinophil; BMI; creatinine; Hispanic; smoking status HP: oral steroid burst; creatinine; ICS+LABA; haemoglobin; BMI; LTRA; eosinophil; race; hypertension; albumin
Noble, 2021	√	√			BMI; smoking status; blood eosinophil counts; diabetes diagnosis/therapy; ischemic heart disease diagnosis; anaphylaxis history; GINA management step; consultation for LRTIs; acute oral steroids; hospitalization number
Hond, 2022		√			PEF; nocturnal awakening; beta2 reliever

Demographic factors: age, sex, and race.

Clinical factors: medical history, symptoms, comorbidities, signs, auxiliary examination, medicine, visit types/status, et al.

Social economic factors: insurance, income, population information, residence, et al

ICS: Inhaled corticosteroid; LABA: Long-acting  $\beta$ 2-agonists; LTRA: Leukotriene-receptor antagonists; SAAC: Short-acting anticholinergics; SABA: Short-acting  $\beta$ 2-agonists; LRTI: Lower respiratory tract infection; PEF: peak expiratory flow.