Predicting asthma in later childhood: a general and high-risk population approach

Wheezing is common in children; most of them grow out of it but others will develop true 'asthma' that will persist through adolescence and young adulthood.

Several studies tried to establish 'tools' to forecast persistent asthma (up to the age of 14 years); they haven't been very successful in clinical practice and they haven't been tested properly.

Our aim was to develop and test a robust tool for the prediction of asthma up to the age of 20 years using simple information collected in the first 5 years of life. We used data from the STELAR consortium including 5 birth cohorts located across the UK: Ashford (Kent), Aberdeen, Manchester, Bristol (ALSPAC) and the Isle of Wight. We studied 2 groups of kids: all children recruited at birth and, separately, children with wheezing symptoms at 2/3 and 5 years, considered to be at higher risk of persistent asthma. In the first group, we included nearly 15,000 children from the Ashford and ALPSAC cohorts and externally validated the predictive tools we so developed, in around 4,500 children from the remaining cohorts. In the second, high-risk group we developed predictive tools in 1,360 children from Ashford/ALSPAC and tested them on the remaining 569 children. In both cases we considered 40 potential predictors collected at recruitment and at 1, 2/3 and then 5 years of age: demographic and perinatal information, eczema, hay-fever, respiratory symptoms, environmental and family-related factors. We defined asthma up to the age of 20 years by the presence of both current wheeze and current asthma treatment; the prevalence ranged from 8-19% in the general population and from 24-41% in the high risk group.

We compared predictive models using 5 novel and sophisticated statistical methods to select variables and estimate coefficients: stepwise regression, and classical (LASSO and Elastic-Net, EN), empirical Baye's (EB) and Bayesian (BM) regularization methods. We assessed their predictive performance by calibration and discrimination measures including the area under the ROC curve (AUC). The Bayesian method resulted in the best model in terms of number of predictors selected and predictive performance.

Overall, the frequency of early wheezing, sensitisation to house dust mite, and a doctor's diagnosis of asthma and eczema by the age of 5 years were important predictors for asthma at the age of 10-20 years in both groups. Other selected predictors included history of parental allergies, hay fever and sensitisation to cat. Specifically, any by way of example, the risk to a child of developing asthma up to the age of 20 years increases by 77% when they have eczema in the first 2/3 years of life. Interestingly, we observed that the risk of persistent asthma in a high risk child whose family have a pet dog decreases by 45%.

Our Bayesian-derived method showed good performance measures with a sensitivity and positive predictive value of around 80% and 60% respectively, in the high risk group with an overall accuracy of 80%. This suggests that the tool is good at identifying children who will have persistent asthma up to the age of 20 years of age.