**APPENDIX: Calibration of model**

Model was calibrated to produce predictions consistent with published empirical data on prevalence of asthma and the distribution of asthma control across the population.

Previously published models differed in how they depicted the natural history asthma. Most models used various healthcare use outcomes as their Markov states (severe exacerbation, emergency department visit etc.). However, we preferred to model asthma control, rather than acute healthcare use events, and we wanted to be able to distinguish small changes in control in response to climate exposures. With expert input, we decided to use a 5-level asthma control framework (ranging from “completely controlled” to “not controlled at all”), loosely based on GINA recommendations for asthma treatment steps. Further support for this framework was found in several publications in which 5-category physician assessment scores were used to validate the 3-level Asthma Control Test (ACT).

We therefore needed a transition probability matrix for transitions between 5 states. Starting from a population with “somewhat controlled” asthma, we ran the model through several iterations until equilibrium was reached. We then compared the equilibrium distribution of asthma control to the published distribution of 5-level asthma control. We repeated this until a transition probability matrix was achieved that produced predictions consistent with empirical data on prevalence of asthma control. The calibrated model approached equilibrium within 5 iterations, with a cumulative 0.048 difference in asthma control distribution (Table I).

**Table I. Calibration for distribution of asthma control**

|  |  |  |  |
| --- | --- | --- | --- |
| **Control status** | **Literature distribution** | **Model @ equilibrium** | **Delta** |
| Completely controlled | 0.091 | 0.073 | -0.0172 |
| Well-controlled | 0.391 | 0.390 | -0.0011 |
| Somewhat controlled | 0.285 | 0.280 | -0.0055 |
| Poorly controlled | 0.194 | 0.196 | 0.0016 |
| Not controlled at all | 0.039 | 0.061 | 0.0222 |
| *Sum* | *1.000* | *1.000* | *0.0476* |

We were able to identify one empirical study which reported a Markov transition probability matrix for 3-levels of asthma control. However, this model predicted a high proportion of uncontrolled asthma at equilibrium, with the probability of becoming and remaining uncontrolled being substantially higher than in our calibrated model (the probability of remaining controlled was similar). These 3-state Markov probabilities were based on several clinical trials assessing various asthma therapies, which might suggest poorer control and/or more severe asthma in the study sample that is not comparable to the general population. As such, we did not do further calibration on transition probabilities.