**Appendix**

**Parameter estimation procedure**

Parameters of the model include the prior mean of for the three different lockdown conditions , as well the expected value of the log-infected population at initial point . Parameters were fitted from the data by maximum likelihood estimation, using an expectation-maximization procedure. The procedure also allowed to recover the posterior distribution of true cases for each day and autonomous community. We convert the infected population to the log-scale, defining :

This can be turned into:

In vectorial terms, we have , where is an upper triangular matrix of 1 that implements the summing operation. Since both and have multivariate normal prior distribution, the prior over is normal itself with mean and covariance where is an -by-3 indicator matrix indicating the lockdown state for each day, and is block diagonal with submatrices and . In the Expectation step, we estimate the posterior distribution over log-infected population using a Laplace approximation . We first identified the maximum-a-posteriori variable *m* through gradient search, and then computed *V* as the inverse of the negative of the hessian joint-log-probability evaluated at *m*.

Parameters were updated in the M-step by maximizing the objective function analytically. We run the EM 10 times with different initial values for the parameters to avoid falling into local maxima of the log-likelihood. Confidence intervals for parameters were estimated using parametric bootstrapping using 20 bootstraps. All analyses were implemented in Matlab with custom codes, which will be uploaded on a public repository upon publication of the manuscript.