Appendix A  Three probability density functions used in our study

(i) Log-normal distribution
\[
p(x) = \begin{cases} 
\frac{1}{\sigma x \sqrt{2\pi}} \left( \frac{\ln x - \mu}{2\sigma^2} \right) & (x > 0) \\
0 & (x \leq 0) 
\end{cases},
\]
where \( \sigma > 0, \mu \) is real, \( (\sigma, \mu) \rightarrow (a, b) \).

(ii) Weibull distribution
\[
p(x) = \begin{cases} 
\alpha \lambda \alpha^{-1} \exp \left( -\lambda x^\alpha \right) & (x > 0) \\
0 & (x \leq 0) 
\end{cases},
\]
where \( \lambda > 0, \alpha > 0 \) is constant, \( (\lambda, \alpha) \rightarrow (a, b) \).

(iii) Gamma distribution
\[
p(x) = \begin{cases} 
\frac{\gamma}{\Gamma(r)} x^{r-1} e^{-\lambda x} & (x > 0) \\
0 & (x \leq 0) 
\end{cases},
\]
where \( \gamma > 0, \lambda > 0 \) is constant, \( (\gamma, \lambda) \rightarrow (a, b) \).

Appendix B  To estimation the population of Beijing in 2008, we used the following method

\[
Popu_{2008} = Popu_{2005} \times \frac{Popu'_{2008}}{Popu'_{2005}},
\]
where \( Popu_{2008} \) is the estimated population in each spatial unit (at the level of street and township) in 2008, \( Popu_{2005} \) is population in each spatial unit from the 9‰ population sample survey conducted in 2005, \( Popu'_{2008} \) is reported population from the Beijing Municipal Bureau of Statistics in 2008, and \( Popu'_{2005} \) is reported population based on the 9‰ population sample survey conducted in 2005.

Appendix C  Bayesian adjustment method

Suppose that the real morbidity rate is a random variable \( \theta_i \) with mean \( \mu_i \) and variance \( \sigma_i^2 \), in the \( i \)-th spatial unit. The observed morbidity rate \( t_i \) is a realization of the random variable \( N(\mu_i, \sigma_i^2) \). It can be shown that the best Bayesian adjustment is given by a linear combination of the observed rate \( t_i \) and the mean \( \mu_i \):

\[
\hat{\theta} = w_i \cdot t_i + (1 - w_i) \cdot \mu_i;
\]

\[
w_i = \frac{\sigma_i^2}{\sigma_i^2 + \mu_i / n_i};
\]
\[ \mu_i = \hat{\mu} = \frac{\sum y_i}{\sum n_i}; \]  
\[ \sigma^2 = \frac{\sum n_i (t_i - \hat{\mu})^2}{\sum n_i} - \frac{\hat{\mu}}{\bar{n}}; \]

In the formulas above, \( n_i \) is the population in the \( i \)-th unit; \( w_i \) is a weighing parameter varying between 0 and 1. The smaller the weight \( w_i \), the closer between the Bayesian estimate \( \hat{\theta}_i \) and the mean \( \mu_i \). Note from Equation (6) that those districts with small population density will have a larger correction. The number \( y_i \) is the number of HFMD infections in the \( i \)-th unit and \( \bar{n} \) is the mean population per spatial unit in Beijing.