Methods for estimating disease transmission rates: Evaluating the precision of Poisson regression and two novel methods

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Supplementary material

Supplementary table

Symbol	Name	Description	Value	Reference
β	Transmission rate	Transmission (infection) rate for individuals entering subclinical or clinical state	0.0179	[1]
$1-\rho$	Probability of clinical state	Probability of acquiring clinical infection when infected	0.83	[2]
ρ	Probability of subclinical state	Probability of acquiring clinical infection when infected	0.17	[3]
γ_S	Flare up rate	Rate of subclinical individuals going to clinical state	0.008	[3]
α_S	Spontaneous cure probability	Probability of spontaneous cure for subclinical individuals	0.0064	[1]
α_C	Recovery rate	Rate of recovery for clinical individuals that are treated going to either susceptible or subclinical individuals	0.33	[4]
η	Recovery probability	Probability of recovery for clinical individuals that are treated	0.40	[4]
$1-\eta$	Remission probability	Probability of remission of individuals going from clinical to subclinical state	0.60	[4]

Table 1. Rates and probabilities used in the SIScom simulation model. All parameters are implemented in daily time steps, for all quarters. The parameters are shown in Figure 1.

References

1. References

1. van den Borne, B. H., Halasa, T., van Schaik, G., Hogeveen, H. & Nielen, M. Bioeconomic modeling of lactational antimicrobial treatment of new bovine subclinical intramammary infections caused by contagious pathogens. *J. dairy science* **93**, 4034–4044 (2010).
2. Swinkels, J., Hogeveen, H. & Zadoks, R. A partial budget model to estimate economic benefits of lactational treatment of subclinical staphylococcus aureus mastitis. *J. dairy science* **88**, 4273–4287 (2005).
3. Halasa, T., Nielen, M., Huirne, R. & Hogeveen, H. Stochastic bio-economic model of bovine intramammary infection. *Livest. Sci.* **124**, 295–305 (2009).
4. Steeneveld, W., van Werven, T., Barkema, H. W. & Hogeveen, H. Cow-specific treatment of clinical mastitis: An economic approach. *J. Dairy Sci.* **94**, 174–188 (2011).

Supplementary figures

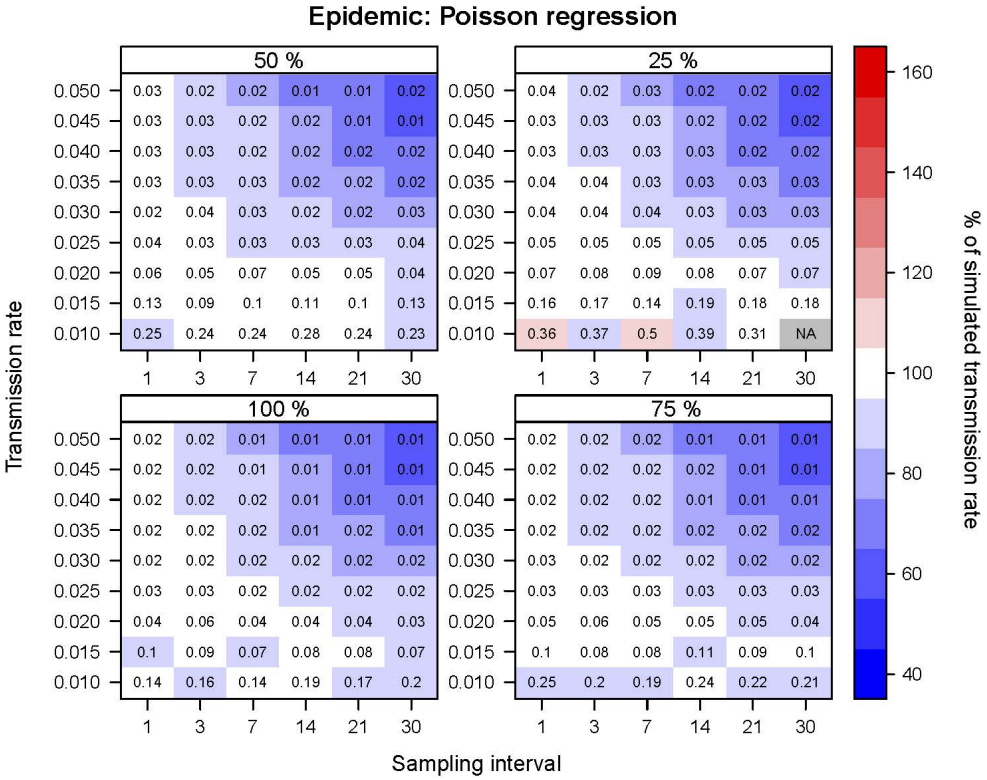

Figure 5. SISsim model, epidemic situation, poisson regression: Heatmaps showing the estimated transmission rates as percentage of the simulated transmission rate. The estimates are shown for four subsampling levels: 100%, 75%, 50% and 25%. Values in each cell show the relative standard deviation of the estimated rate divided by the simulated rate.

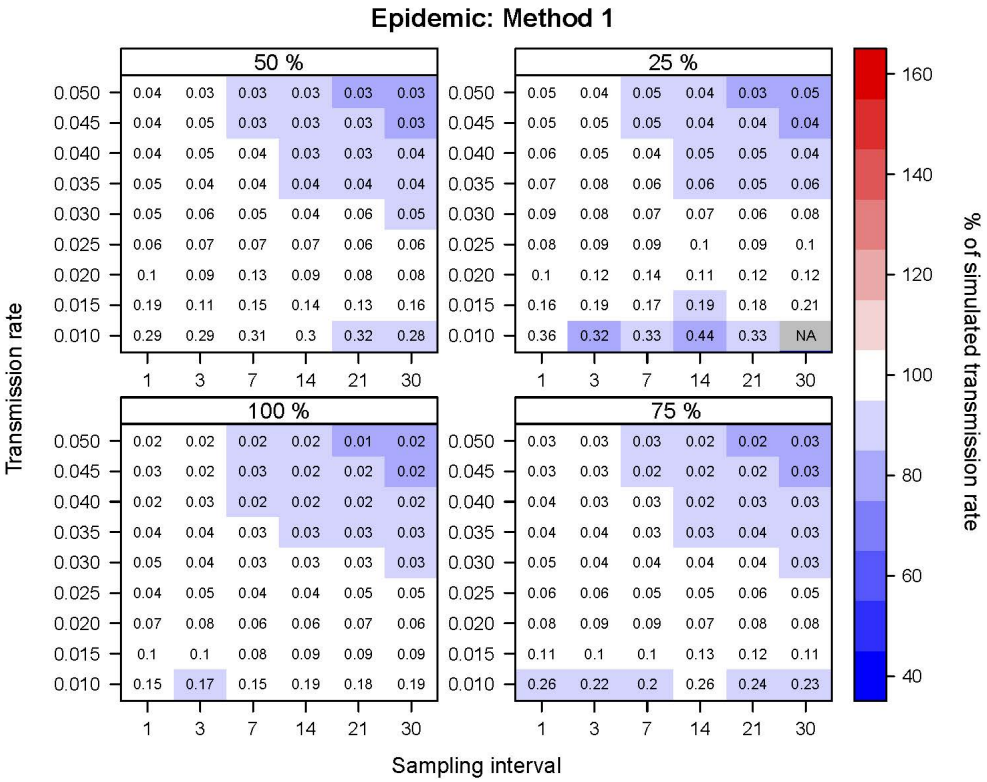

Figure 6. SISsim model, epidemic situation, Method 1: Heatmaps showing the estimated transmission rates as percentage of the simulated transmission rate. The estimates are shown for four subsampling levels: 100%, 75%, 50% and 25%. Values in each cell show the relative standard deviation of the estimated rate divided by the simulated rate.

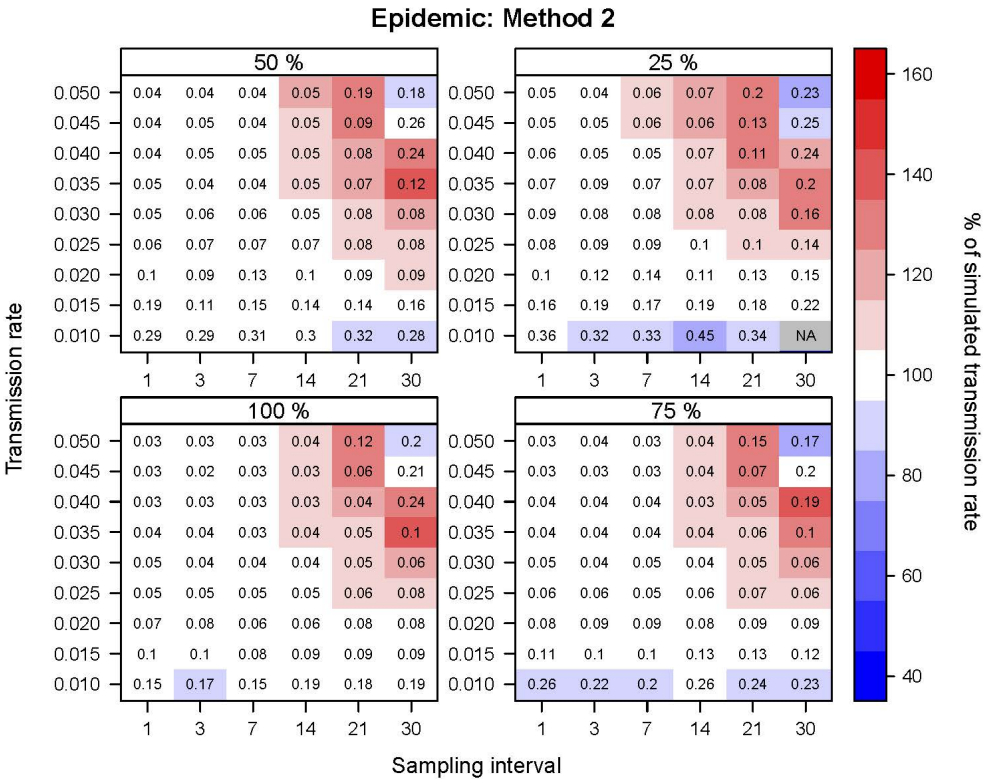

Figure 7. SISsim model, epidemic situation, Method 2: Heatmaps showing the estimated transmission rates as percentage of the simulated transmission rate. The estimates are shown for four subsampling levels: 100%, 75%, 50% and 25%. Values in each cell show the relative standard deviation of the estimated rate divided by the simulated rate.

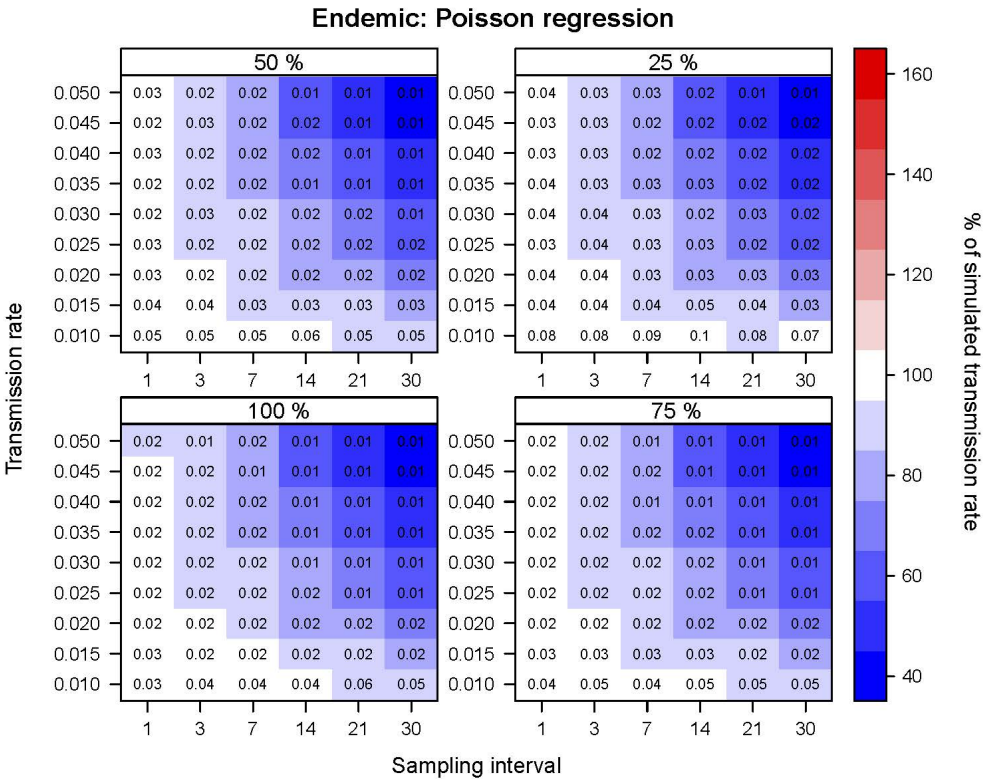

Figure 8. SISsim model, endemic situation, Poisson regression: Heatmaps showing the estimated transmission rates as percentage of the simulated transmission rate. The estimates are shown for four subsampling levels: 100%, 75%, 50% and 25%. Values in each cell show the relative standard deviation of the estimated rate divided by the simulated rate.

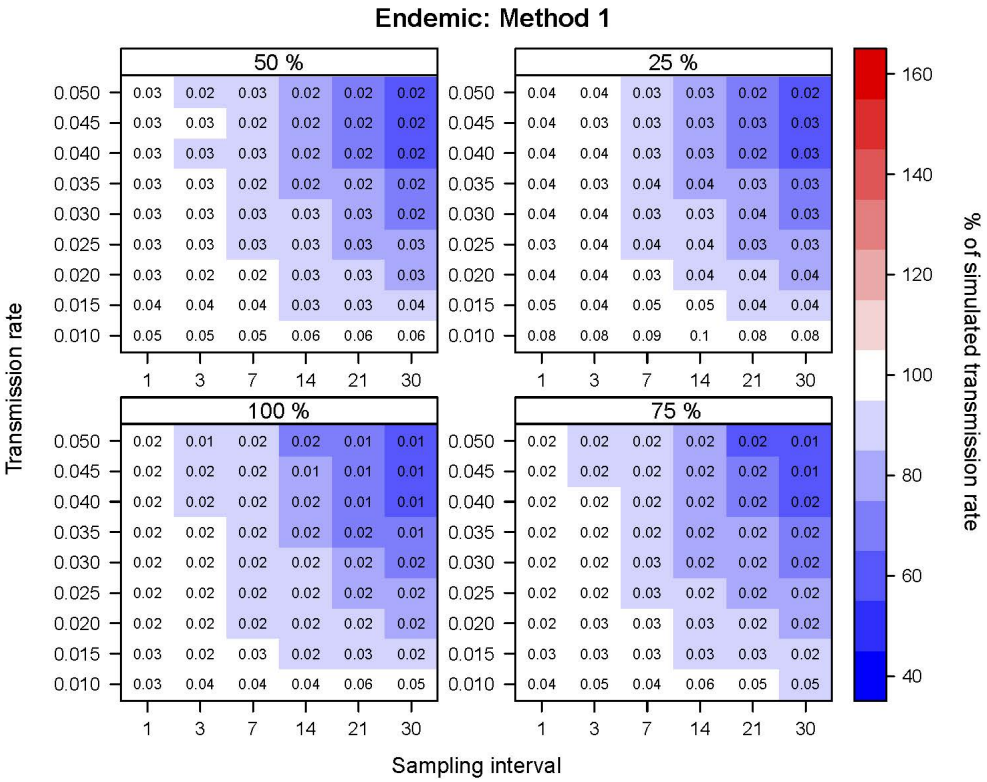

Figure 9. SISsim model, endemic situation, Method 1: Heatmaps showing the estimated transmission rates as percentage of the simulated transmission rate. The estimates are shown for four subsampling levels: 100%, 75%, 50% and 25%. Values in each cell show the relative standard deviation of the estimated rate divided by the simulated rate.

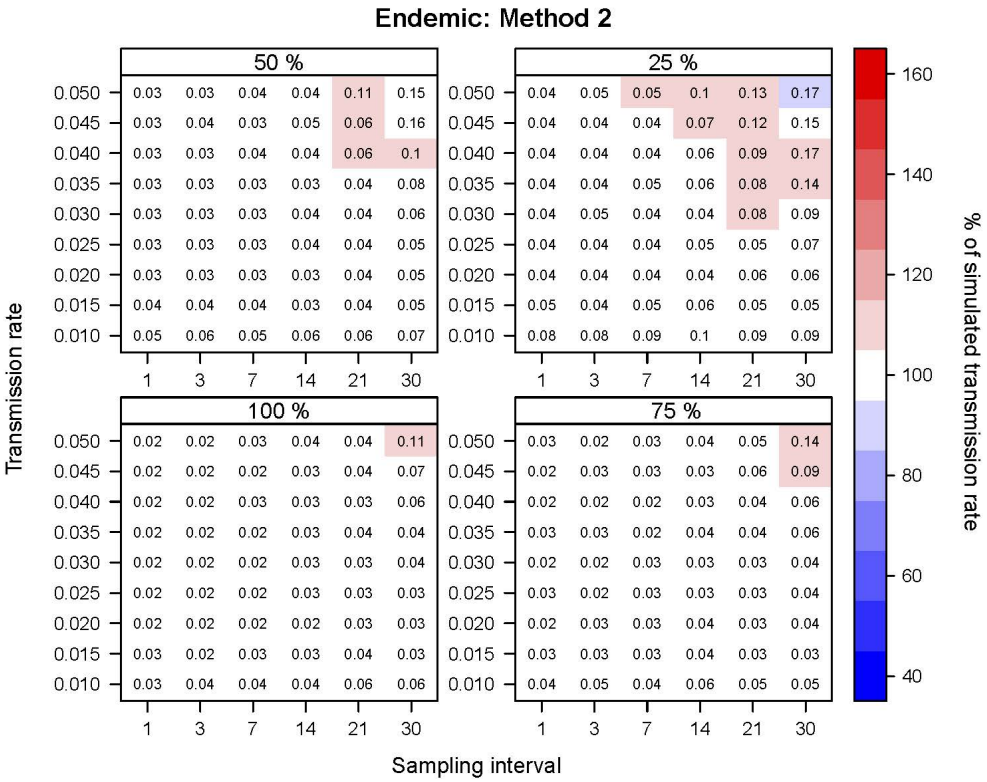

Figure 10. SISsim model, endemic situation, Method 2: Heatmaps showing the estimated transmission rates as percentage of the simulated transmission rate. The estimates are shown for four subsampling levels: 100%, 75%, 50% and 25%. Values in each cell show the relative standard deviation of the estimated rate divided by the simulated rate.

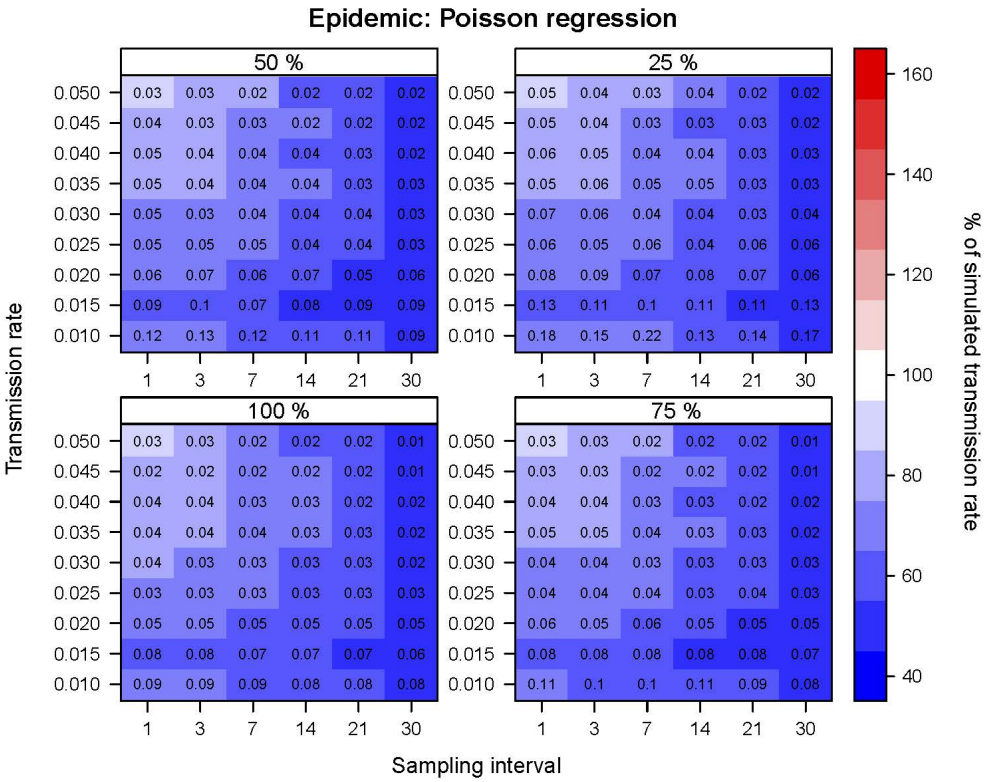

Figure 11. SIScom model, epidemic situation, poisson regression: Heatmaps showing the estimated transmission rates as percentage of the simulated transmission rate. The estimates are shown for four subsampling levels: 100%, 75%, 50% and 25%. Values in each cell show the relative standard deviation of the estimated rate divided by the simulated rate.

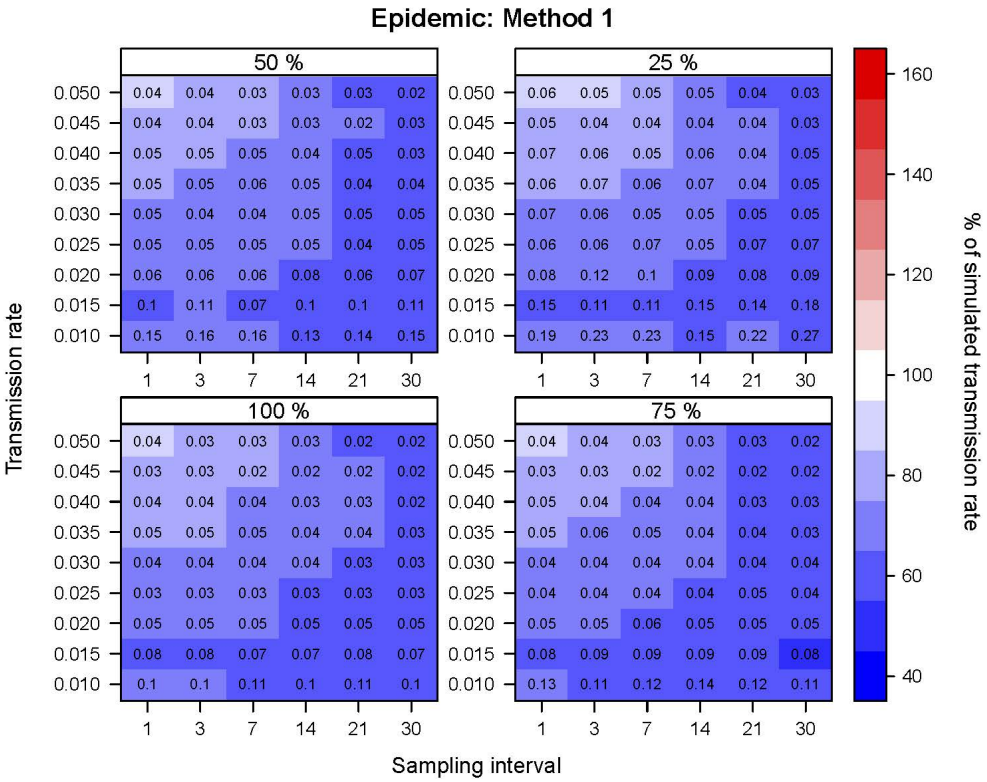

Figure 12. SIScom model, epidemic situation, Method 1: Heatmaps showing the estimated transmission rates as percentage of the simulated transmission rate. The estimates are shown for four subsampling levels: 100%, 75%, 50% and 25%. Values in each cell show the relative standard deviation of the estimated rate divided by the simulated rate.

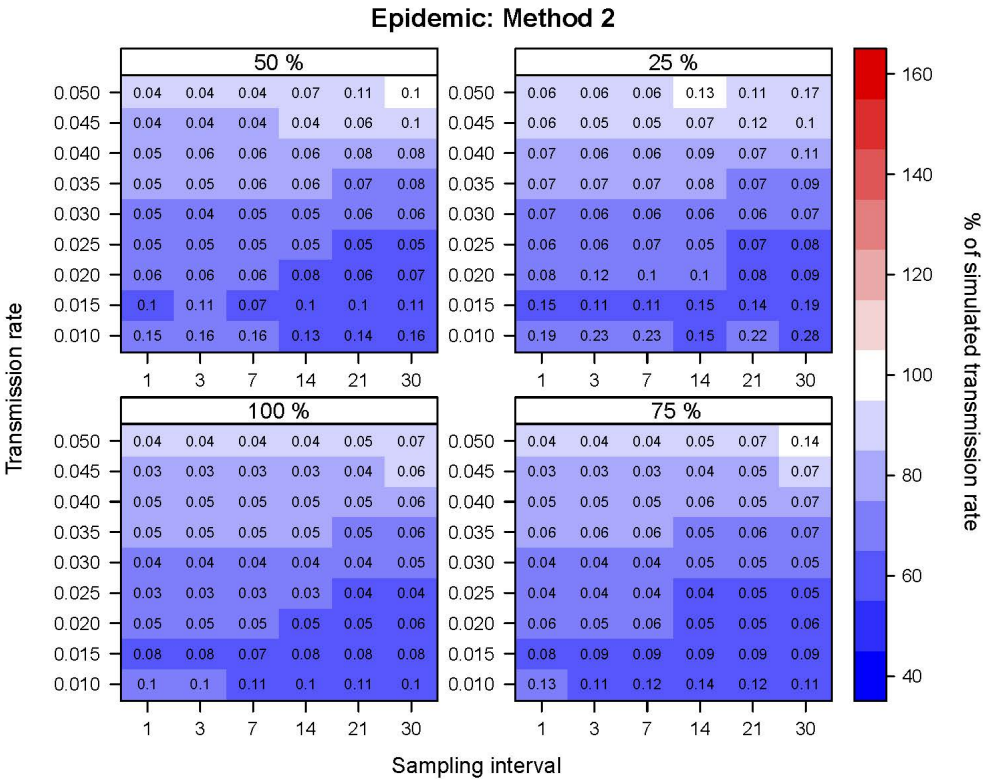

Figure 13. SIScom model, epidemic situation, Method 2: Heatmaps showing the estimated transmission rates as percentage of the simulated transmission rate. The estimates are shown for four subsampling levels: 100%, 75%, 50% and 25%. Values in each cell show the relative standard deviation of the estimated rate divided by the simulated rate.

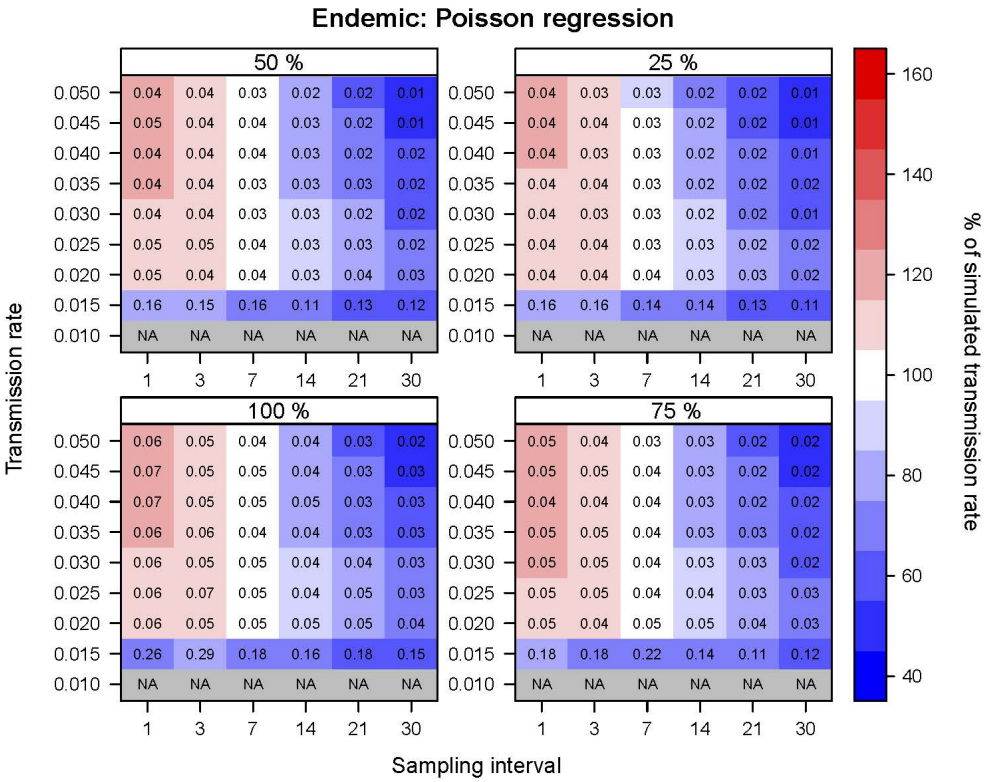

Figure 14. SIScom model, endemic situation, poisson regression: Heatmaps showing the estimated transmission rates as percentage of the simulated transmission rate. The estimates are shown for four subsampling levels: 100%, 75%, 50% and 25%. Values in each cell show the relative standard deviation of the estimated rate divided by the simulated rate.

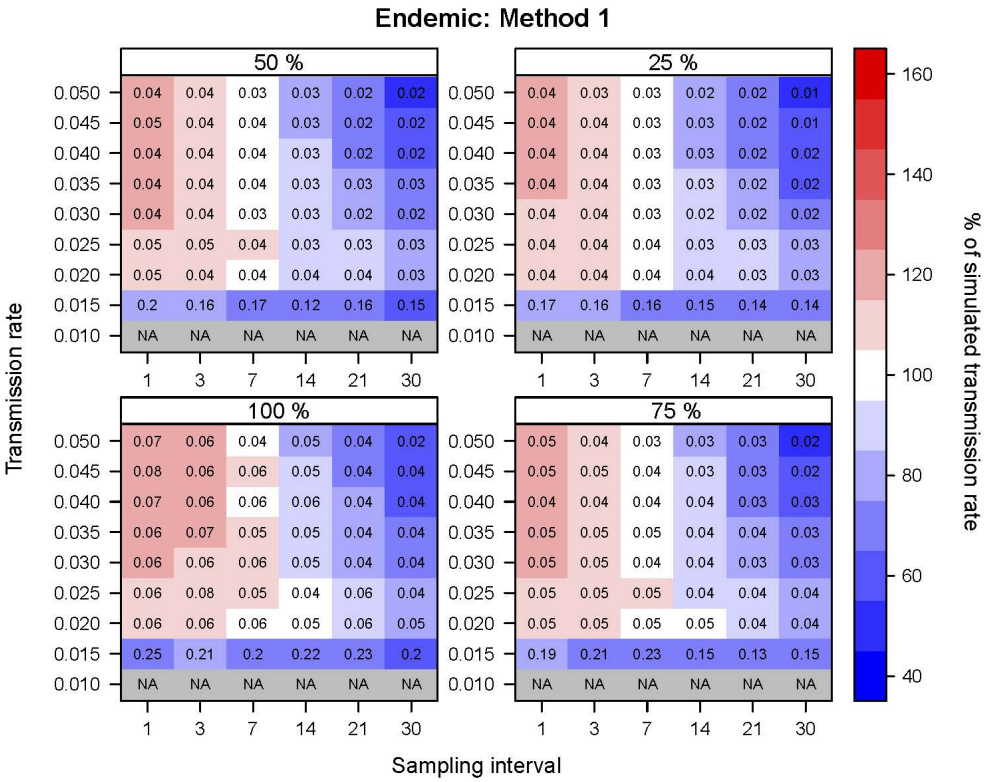

Figure 15. SIScom model, endemic situation, Method 1: Heatmaps showing the estimated transmission rates as percentage of the simulated transmission rate. The estimates are shown for four subsampling levels: 100%, 75%, 50% and 25%. Values in each cell show the relative standard deviation of the estimated rate divided by the simulated rate.

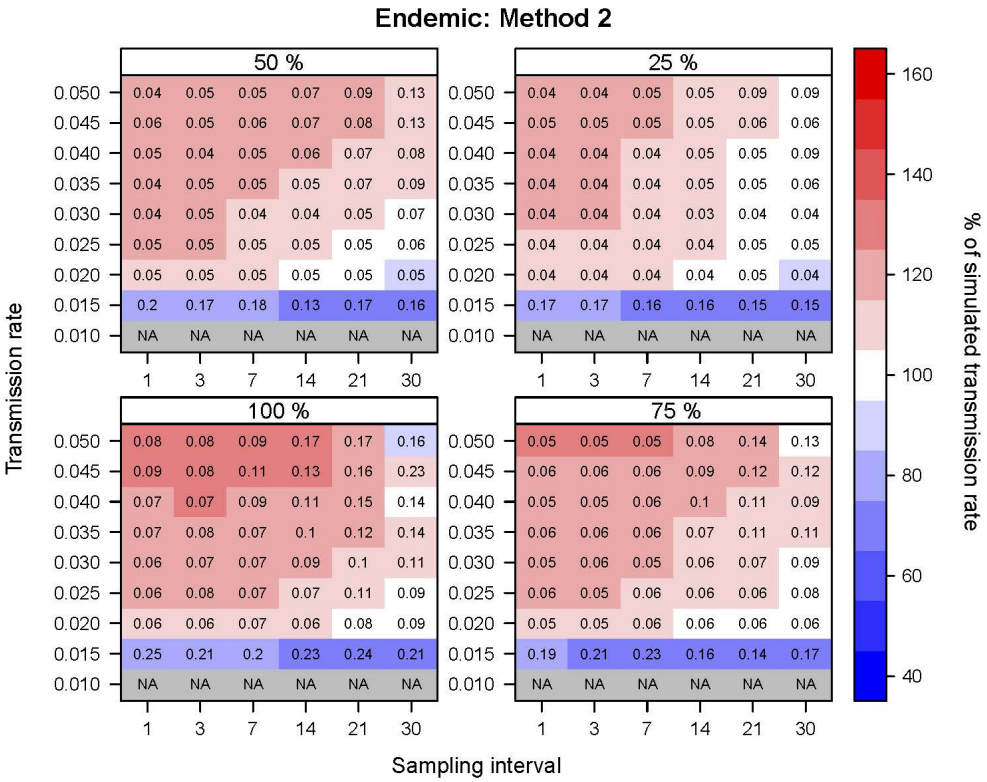

Figure 16. SIScom model, endemic situation, Method 2: Heatmaps showing the estimated transmission rates as percentage of the simulated transmission rate. The estimates are shown for four subsampling levels: 100%, 75%, 50% and 25%. Values in each cell show the relative standard deviation of the estimated rate divided by the simulated rate.