

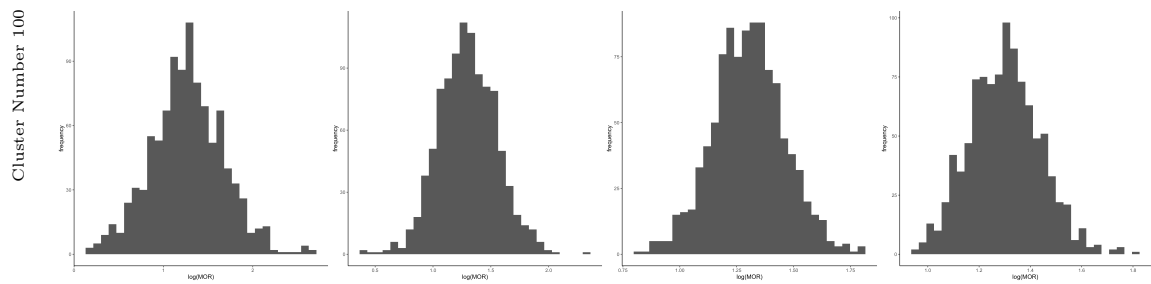
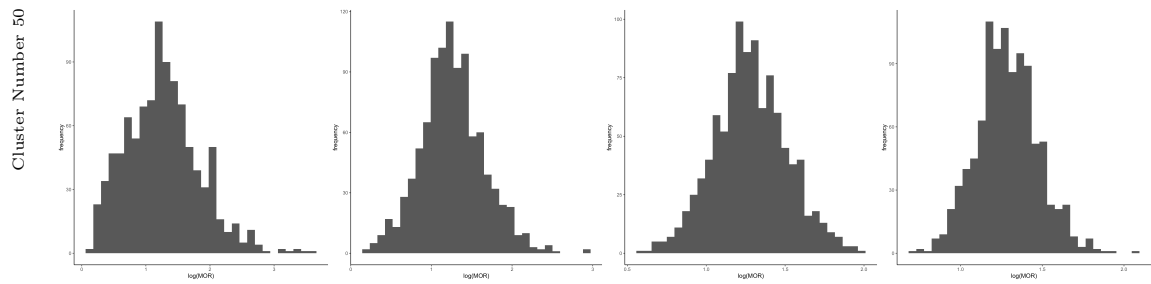
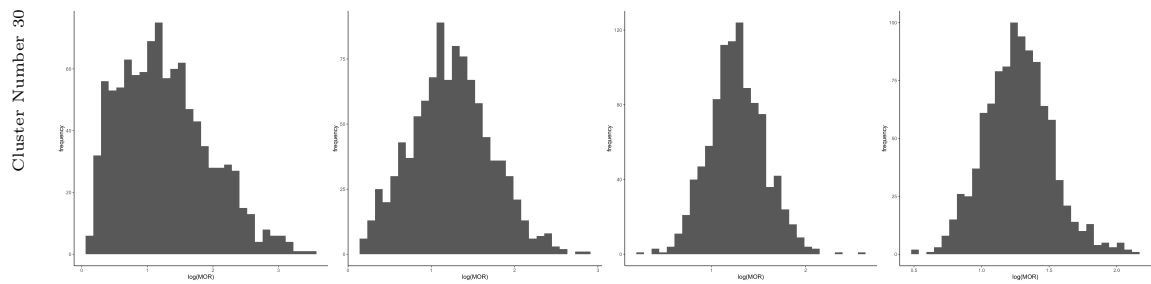
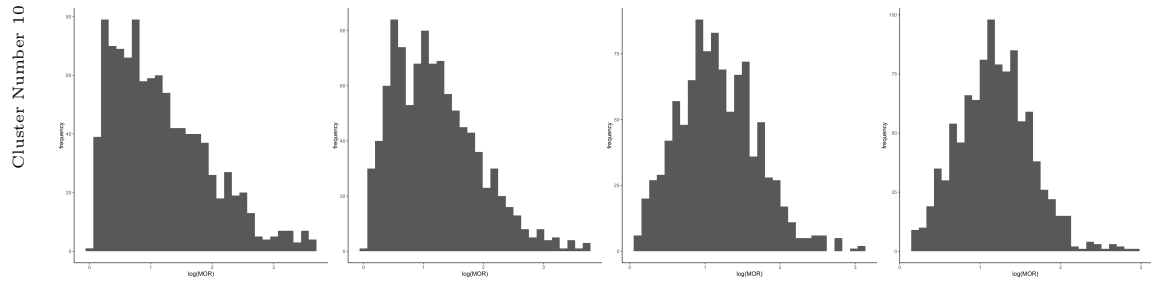
Simulation Result For Two-Level Slope Model With High Prevalence

The mean prevalence for this simulation is 27 %

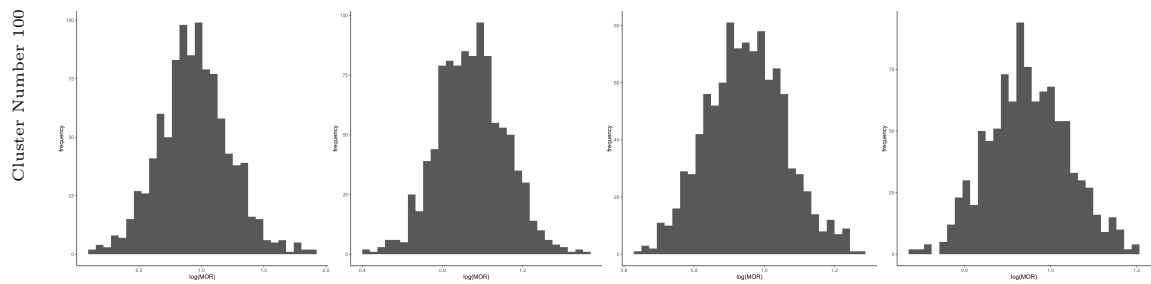
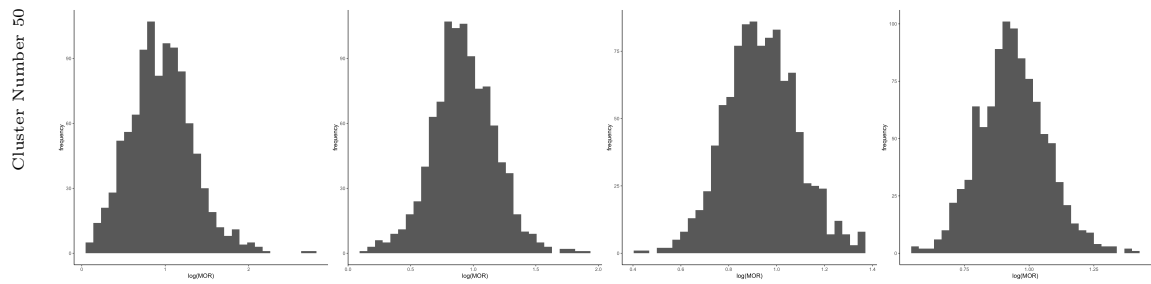
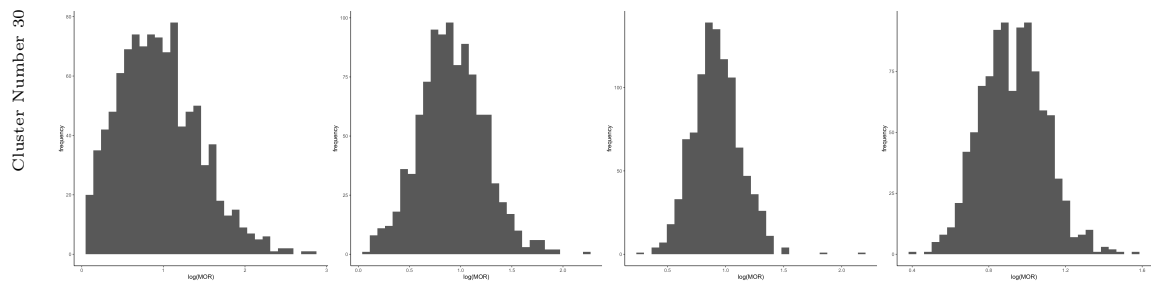
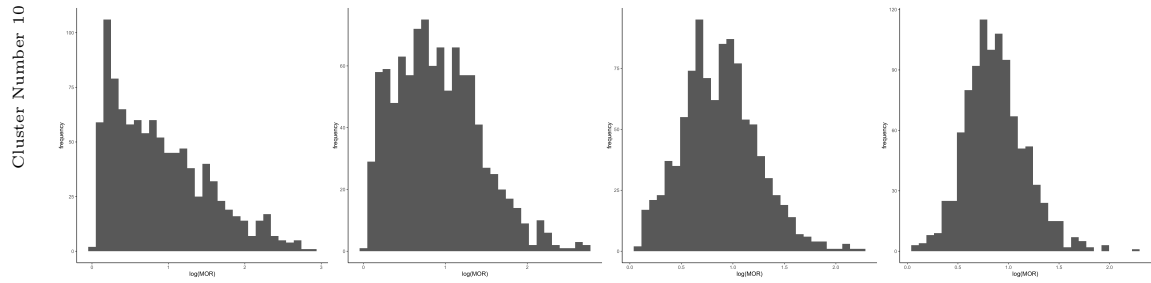
Shafayet Khan Shafee

03 September 2023

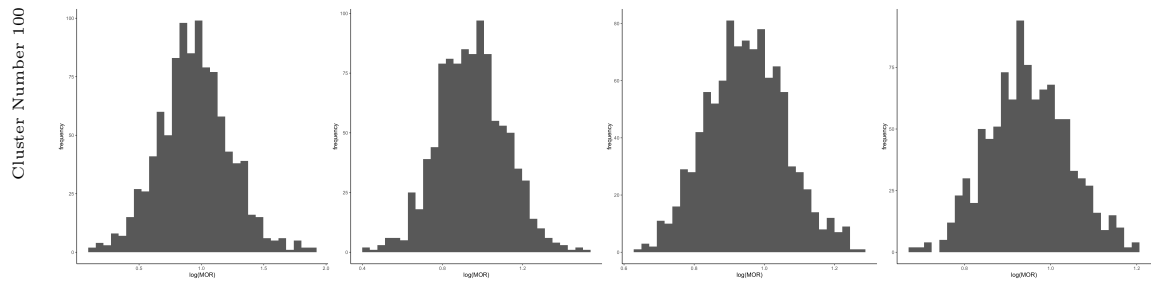
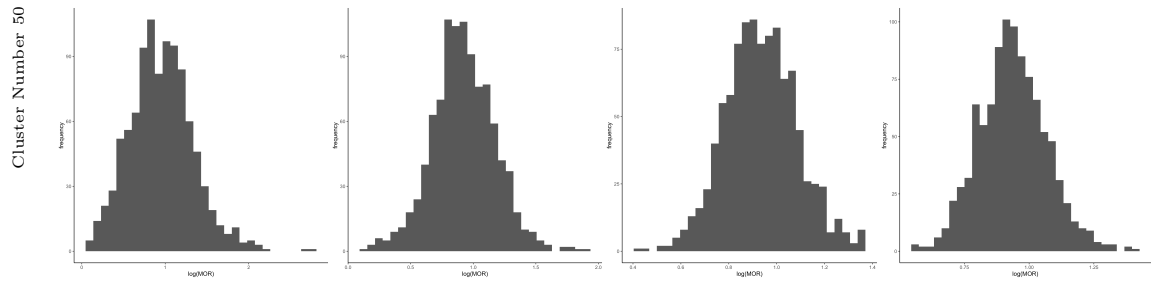
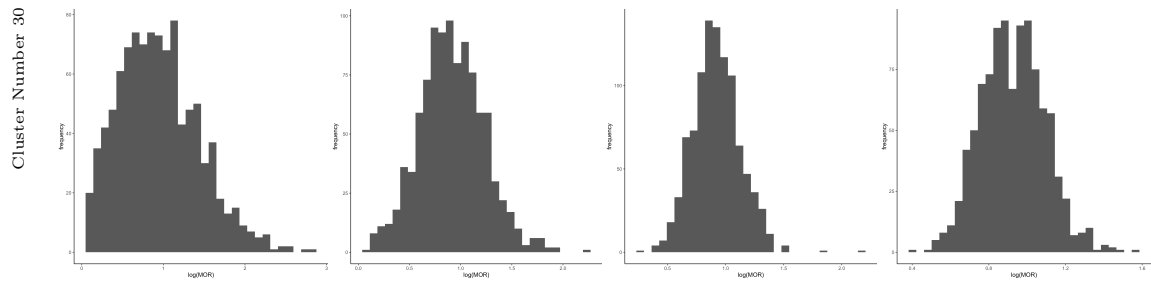
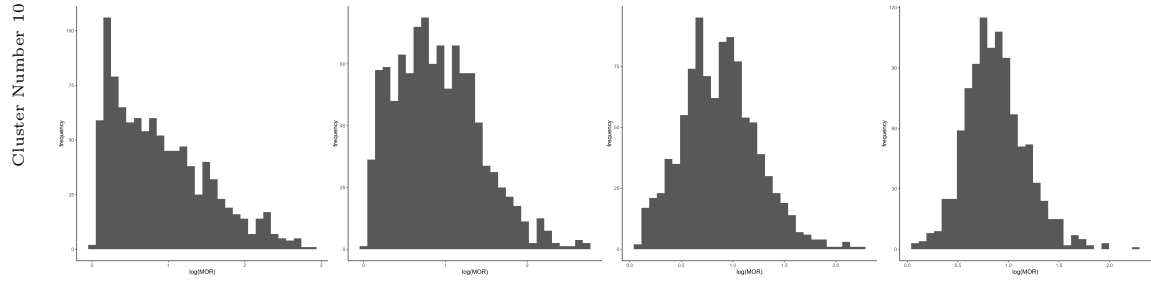
Histograms for $\log(\widehat{MOR})$ when First Quartile of X is used



Histograms for $\log(\widehat{MOR})$ when Mean of X is used



Histograms for $\log(\widehat{MOR})$ when Third Quartile of X is used



Simulation Result Table

| Number of Cluster | Cluster Size | $\widehat{\beta}_0$ | $\widehat{\beta}_1$ | $\widehat{\beta}_2$ | $\widehat{\sigma}_{u_1}^2$ | $\widehat{\sigma}_{u_2}^2$ | $\widehat{\sigma}_{u_{12}}^2$ | Model Convergence (%) |
|-------------------|--------------|---------------------|---------------------|---------------------|----------------------------|----------------------------|-------------------------------|-----------------------|
| 10 | 5 | -1.90 | 1.88 | 0.65 | 1.26 | 2.37 | 0.10 | 60.10 |
| | 10 | -1.97 | 1.90 | 0.68 | 1.18 | 2.36 | 0.04 | 91.66 |
| | 30 | -1.89 | 1.79 | 0.68 | 0.98 | 1.95 | 0.04 | 99.60 |
| | 50 | -1.85 | 1.75 | 0.68 | 0.93 | 1.88 | 0.01 | 99.80 |
| 30 | 5 | -1.95 | 1.83 | 0.71 | 1.23 | 2.40 | 0.04 | 97.09 |
| | 10 | -1.86 | 1.78 | 0.65 | 1.02 | 2.19 | 0.05 | 100.00 |
| | 30 | -1.85 | 1.75 | 0.67 | 0.97 | 1.98 | 0.00 | 100.00 |
| | 50 | -1.85 | 1.74 | 0.66 | 0.97 | 1.94 | 0.01 | 100.00 |
| 50 | 5 | -1.91 | 1.83 | 0.68 | 1.15 | 2.34 | 0.06 | 99.80 |
| | 10 | -1.86 | 1.75 | 0.67 | 1.00 | 2.10 | 0.03 | 100.00 |
| | 30 | -1.85 | 1.74 | 0.67 | 0.98 | 1.98 | 0.02 | 100.00 |
| | 50 | -1.84 | 1.74 | 0.66 | 0.98 | 1.95 | 0.01 | 100.00 |
| 100 | 5 | -1.85 | 1.74 | 0.66 | 1.06 | 2.08 | 0.05 | 99.90 |
| | 10 | -1.86 | 1.75 | 0.67 | 1.01 | 2.04 | 0.01 | 100.00 |
| | 30 | -1.85 | 1.75 | 0.67 | 1.00 | 1.99 | 0.01 | 100.00 |
| | 50 | -1.86 | 1.74 | 0.67 | 1.00 | 1.97 | 0.01 | 100.00 |

Note:

* The mean prevalence for this simulation is 27%

† True $\sigma_{u_1}^2 = 1$, $\sigma_{u_2}^2 = 2$, $\sigma_{u_{12}}^2 = 0$

‡ True Values of $\beta_0 = -1.85$, $\beta_1 = 1.75$, $\beta_2 = 0.67$

Simulation Result Table When First Quartile of X is used

| Number of Cluster | Cluster Size | MOR | \widehat{MOR} | $Bias^1$ | \widehat{SE}_{MOR} | Sim. \widehat{SE}_{MOR}^2 | Ratio ³ | CI Coverage (95%) |
|-------------------|--------------|-------|-----------------|----------|----------------------|--------------------------------|--------------------|-------------------|
| 10 | 5 | 3.76 | 4.66 | 23.87 | 6.94 | 2.18 | 3.18 | 0.99 |
| | 10 | 3.75 | 4.52 | 20.44 | 3.64 | 2.03 | 1.79 | 0.99 |
| | 30 | 3.73 | 3.74 | 0.33 | 1.99 | 1.69 | 1.18 | 0.96 |
| | 50 | 3.74 | 3.64 | -2.50 | 1.65 | 1.57 | 1.05 | 0.95 |
| 30 | 5 | 3.74 | 4.56 | 21.81 | 2.81 | 1.96 | 1.43 | 0.97 |
| | 10 | 3.73 | 3.88 | 3.99 | 1.69 | 1.61 | 1.05 | 0.97 |
| | 30 | 3.73 | 3.72 | -0.47 | 1.31 | 1.35 | 0.97 | 0.93 |
| | 50 | 3.74 | 3.67 | -1.76 | 1.26 | 1.28 | 0.99 | 0.93 |
| 50 | 5 | 3.73 | 4.25 | 13.77 | 2.01 | 1.77 | 1.14 | 0.96 |
| | 10 | 3.74 | 3.83 | 2.22 | 1.42 | 1.48 | 0.96 | 0.95 |
| | 30 | 3.74 | 3.70 | -1.06 | 1.23 | 1.26 | 0.97 | 0.92 |
| | 50 | 3.74 | 3.69 | -1.32 | 1.19 | 1.21 | 0.99 | 0.94 |
| 100 | 5 | 3.74 | 3.86 | 3.24 | 1.49 | 1.50 | 0.99 | 0.96 |
| | 10 | 3.73 | 3.78 | 1.17 | 1.25 | 1.29 | 0.97 | 0.94 |
| | 30 | 3.73 | 3.72 | -0.28 | 1.15 | 1.17 | 0.98 | 0.91 |
| | 50 | 3.74 | 3.70 | -0.87 | 1.13 | 1.15 | 0.99 | 0.93 |

Note:

¹ It is Relative Bias = $\frac{\hat{\theta} - \theta}{\theta} \times 100$

² Simulation Standard Error of MOR

³ Ratio = $\frac{\widehat{SE}_{MOR}}{\text{Simulation } \widehat{SE}_{MOR}}$

* The mean prevalence for this simulation is 27%

Simulation Result Table When Second Quartile of X is used

| Number of Cluster | Cluster Size | MOR | \widehat{MOR} | $Bias^1$ | \widehat{SE}_{MOR} | Sim. \widehat{SE}_{MOR}^2 | Ratio ³ | CI Coverage (95%) |
|-------------------|--------------|-------|-----------------|----------|----------------------|--------------------------------|--------------------|-------------------|
| 10 | 5 | 2.64 | 3.06 | 15.73 | 3.00 | 1.87 | 1.61 | 0.99 |
| | 10 | 2.62 | 2.87 | 9.46 | 1.95 | 1.67 | 1.17 | 0.96 |
| | 30 | 2.60 | 2.57 | -1.24 | 1.42 | 1.44 | 0.99 | 0.90 |
| | 50 | 2.60 | 2.51 | -3.39 | 1.34 | 1.35 | 0.99 | 0.89 |
| 30 | 5 | 2.61 | 2.93 | 12.39 | 1.75 | 1.63 | 1.07 | 0.98 |
| | 10 | 2.60 | 2.62 | 0.84 | 1.39 | 1.37 | 1.01 | 0.97 |
| | 30 | 2.60 | 2.56 | -1.41 | 1.21 | 1.23 | 0.99 | 0.92 |
| | 50 | 2.60 | 2.56 | -1.55 | 1.18 | 1.18 | 1.00 | 0.93 |
| 50 | 5 | 2.61 | 2.81 | 7.72 | 1.51 | 1.46 | 1.04 | 0.97 |
| | 10 | 2.60 | 2.60 | -0.01 | 1.28 | 1.29 | 0.99 | 0.96 |
| | 30 | 2.60 | 2.58 | -0.82 | 1.16 | 1.16 | 1.00 | 0.94 |
| | 50 | 2.60 | 2.57 | -0.86 | 1.14 | 1.14 | 1.00 | 0.93 |
| 100 | 5 | 2.60 | 2.68 | 2.95 | 1.33 | 1.33 | 1.00 | 0.97 |
| | 10 | 2.60 | 2.61 | 0.45 | 1.18 | 1.19 | 1.00 | 0.96 |
| | 30 | 2.60 | 2.60 | 0.00 | 1.11 | 1.12 | 0.99 | 0.92 |
| | 50 | 2.60 | 2.59 | -0.14 | 1.10 | 1.10 | 1.00 | 0.94 |

Note:

¹ It is Relative Bias = $\frac{\hat{\theta} - \theta}{\theta} \times 100$

² Simulation Standard Error of MOR

³ Ratio = $\frac{\widehat{SE}_{MOR}}{\text{Simulation } \widehat{SE}_{MOR}}$

* The mean prevalence for this simulation is 27%

Simulation Result Table When Third Quartile of X is used

| Number of Cluster | Cluster Size | MOR | \widehat{MOR} | $Bias^1$ | \widehat{SE}_{MOR} | Sim. \widehat{SE}_{MOR}^2 | Ratio ³ | CI Coverage (95%) |
|-------------------|--------------|-------|-----------------|----------|----------------------|--------------------------------|--------------------|----------------------|
| 10 | 5 | 3.74 | 5.04 | 34.39 | 6.10 | 1.87 | 3.26 | 1.00 |
| | 10 | 3.74 | 4.71 | 24.79 | 3.43 | 1.67 | 2.05 | 0.98 |
| | 30 | 3.75 | 3.88 | 3.44 | 1.72 | 1.44 | 1.20 | 0.96 |
| | 50 | 3.74 | 3.67 | -1.84 | 1.58 | 1.35 | 1.17 | 0.96 |
| 30 | 5 | 3.75 | 4.67 | 24.52 | 2.66 | 1.63 | 1.63 | 0.98 |
| | 10 | 3.75 | 4.08 | 8.50 | 1.56 | 1.37 | 1.14 | 0.97 |
| | 30 | 3.75 | 3.73 | -0.36 | 1.30 | 1.23 | 1.06 | 0.97 |
| | 50 | 3.75 | 3.71 | -1.06 | 1.26 | 1.18 | 1.07 | 0.96 |
| 50 | 5 | 3.75 | 4.45 | 18.80 | 1.79 | 1.46 | 1.22 | 0.96 |
| | 10 | 3.74 | 3.91 | 4.34 | 1.38 | 1.29 | 1.07 | 0.97 |
| | 30 | 3.75 | 3.76 | 0.27 | 1.22 | 1.16 | 1.05 | 0.97 |
| | 50 | 3.74 | 3.72 | -0.50 | 1.19 | 1.14 | 1.05 | 0.96 |
| 100 | 5 | 3.74 | 4.02 | 7.47 | 1.42 | 1.33 | 1.07 | 0.96 |
| | 10 | 3.75 | 3.83 | 2.14 | 1.25 | 1.19 | 1.05 | 0.96 |
| | 30 | 3.74 | 3.76 | 0.45 | 1.15 | 1.12 | 1.03 | 0.95 |
| | 50 | 3.74 | 3.75 | 0.29 | 1.13 | 1.10 | 1.03 | 0.96 |

Note:

¹ It is Relative Bias = $\frac{\hat{\theta} - \theta}{\theta} \times 100$

² Simulation Standard Error of MOR

³ Ratio = $\frac{\widehat{SE}_{MOR}}{\text{Simulation } \widehat{SE}_{MOR}}$

* The mean prevalence for this simulation is 27%

Simulation Result Table (All Together)

| M, N ¹ | Q_{1X} | | | | | | | Q_{2X} | | | | | | | Q_{3X} | | | | | | |
|-------------------|----------|-----------------|----------|----------------------|--------------------------------|--------------------|-------------------|----------|-----------------|----------|----------------------|--------------------------------|--------------------|-------------------|----------|-----------------|----------|----------------------|--------------------------------|--------------------|-------------------|
| | MOR | \widehat{MOR} | $Bias^2$ | \widehat{SE}_{MOR} | Sim. \widehat{SE}_{MOR}^3 | Ratio ³ | Coverage (95%) | MOR | \widehat{MOR} | $Bias^2$ | \widehat{SE}_{MOR} | Sim. \widehat{SE}_{MOR}^3 | Ratio ³ | Coverage (95%) | MOR | \widehat{MOR} | $Bias^2$ | \widehat{SE}_{MOR} | Sim. \widehat{SE}_{MOR}^3 | Ratio ³ | Coverage (95%) |
| 10, 5 | 3.76 | 4.66 | 23.87 | 6.94 | 2.18 | 3.18 | 0.99 | 2.64 | 3.06 | 15.73 | 3.00 | 1.87 | 1.61 | 0.99 | 3.74 | 5.04 | 34.39 | 6.10 | 1.87 | 3.26 | 1.00 |
| 10, 10 | 3.75 | 4.52 | 20.44 | 3.64 | 2.03 | 1.79 | 0.99 | 2.62 | 2.87 | 9.46 | 1.95 | 1.67 | 1.17 | 0.96 | 3.74 | 4.71 | 24.79 | 3.43 | 1.67 | 2.05 | 0.98 |
| 10, 30 | 3.73 | 3.74 | 0.33 | 1.99 | 1.69 | 1.18 | 0.96 | 2.60 | 2.57 | -1.24 | 1.42 | 1.44 | 0.99 | 0.90 | 3.75 | 3.88 | 3.44 | 1.72 | 1.44 | 1.20 | 0.96 |
| 10, 50 | 3.74 | 3.64 | -2.50 | 1.65 | 1.57 | 1.05 | 0.95 | 2.60 | 2.51 | -3.39 | 1.34 | 1.35 | 0.99 | 0.89 | 3.74 | 3.67 | -1.84 | 1.58 | 1.35 | 1.17 | 0.96 |
| 30, 5 | 3.74 | 4.56 | 21.81 | 2.81 | 1.96 | 1.43 | 0.97 | 2.61 | 2.93 | 12.39 | 1.75 | 1.63 | 1.07 | 0.98 | 3.75 | 4.67 | 24.52 | 2.66 | 1.63 | 1.63 | 0.98 |
| 30, 10 | 3.73 | 3.88 | 3.99 | 1.69 | 1.61 | 1.05 | 0.97 | 2.60 | 2.62 | 0.84 | 1.39 | 1.37 | 1.01 | 0.97 | 3.75 | 4.08 | 8.50 | 1.56 | 1.37 | 1.14 | 0.97 |
| 30, 30 | 3.73 | 3.72 | -0.47 | 1.31 | 1.35 | 0.97 | 0.93 | 2.60 | 2.56 | -1.41 | 1.21 | 1.23 | 0.99 | 0.92 | 3.75 | 3.73 | -0.36 | 1.30 | 1.23 | 1.06 | 0.97 |
| 30, 50 | 3.74 | 3.67 | -1.76 | 1.26 | 1.28 | 0.99 | 0.93 | 2.60 | 2.56 | -1.55 | 1.18 | 1.18 | 1.00 | 0.93 | 3.75 | 3.71 | -1.06 | 1.26 | 1.18 | 1.07 | 0.96 |
| 50, 5 | 3.73 | 4.25 | 13.77 | 2.01 | 1.77 | 1.14 | 0.96 | 2.61 | 2.81 | 7.72 | 1.51 | 1.46 | 1.04 | 0.97 | 3.75 | 4.45 | 18.80 | 1.79 | 1.46 | 1.22 | 0.96 |
| 50, 10 | 3.74 | 3.83 | 2.22 | 1.42 | 1.48 | 0.96 | 0.95 | 2.60 | 2.60 | -0.01 | 1.28 | 1.29 | 0.99 | 0.96 | 3.74 | 3.91 | 4.34 | 1.38 | 1.29 | 1.07 | 0.97 |
| 50, 30 | 3.74 | 3.70 | -1.06 | 1.23 | 1.26 | 0.97 | 0.92 | 2.60 | 2.58 | -0.82 | 1.16 | 1.16 | 1.00 | 0.94 | 3.75 | 3.76 | 0.27 | 1.22 | 1.16 | 1.05 | 0.97 |
| 50, 50 | 3.74 | 3.69 | -1.32 | 1.19 | 1.21 | 0.99 | 0.94 | 2.60 | 2.57 | -0.86 | 1.14 | 1.14 | 1.00 | 0.93 | 3.74 | 3.72 | -0.50 | 1.19 | 1.14 | 1.05 | 0.96 |
| 100, 5 | 3.74 | 3.86 | 3.24 | 1.49 | 1.50 | 0.99 | 0.96 | 2.60 | 2.68 | 2.95 | 1.33 | 1.33 | 1.00 | 0.97 | 3.74 | 4.02 | 7.47 | 1.42 | 1.33 | 1.07 | 0.96 |
| 100, 10 | 3.73 | 3.78 | 1.17 | 1.25 | 1.29 | 0.97 | 0.94 | 2.60 | 2.61 | 0.45 | 1.18 | 1.19 | 1.00 | 0.96 | 3.75 | 3.83 | 2.14 | 1.25 | 1.19 | 1.05 | 0.96 |
| 100, 30 | 3.73 | 3.72 | -0.28 | 1.15 | 1.17 | 0.98 | 0.91 | 2.60 | 2.60 | 0.00 | 1.11 | 1.12 | 0.99 | 0.92 | 3.74 | 3.76 | 0.45 | 1.15 | 1.12 | 1.03 | 0.95 |
| 100, 50 | 3.74 | 3.70 | -0.87 | 1.13 | 1.15 | 0.99 | 0.93 | 2.60 | 2.59 | -0.14 | 1.10 | 1.10 | 1.00 | 0.94 | 3.74 | 3.75 | 0.29 | 1.13 | 1.10 | 1.03 | 0.96 |

Note:

¹ M is Number of Cluster and N is Cluster size

² It is Relative Bias = $\frac{\hat{\theta} - \theta}{\theta} \times 100$

³ Simulation Standard Error of MOR

⁴ Ratio = $\frac{\widehat{SE}_{MOR}}{\text{Simulation } \widehat{SE}_{MOR}}$

* The mean prevalence for this simulation is 27%