

Bias and Estimation under Misspecification of the Risk Period in Self-Controlled Case Series Studies

**Supplemental Materials: Patterns of Bias for Models with One Age
Group**

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Additional simulation results

We provide results from additional simulations for the characterization of the bias of the relative incidence, $R^* = \exp(\beta^*)$, under different exposure models with no age effects.

Figures 1-3, 4-6 and 8-9 show the theoretical characterization of the bias of the relative incidence for the single Uniformly distributed exposure model and true risk length $\tau = 15, 30$ and 45 respectively.

Figures 10-12, 13-15 and 16-18 show the theoretical characterization of the bias of the relative incidence for the multiple Uniformly distributed exposures model and true risk length $\tau = 15, 30$ and 45 respectively.

Figures 19-21, 22-24 and 25-27 show the theoretical characterization of the bias of the relative incidence for the single Normally distributed exposure model and true risk length $\tau = 15, 30$ and 45 respectively.

Figures 28-30, 31-33 and 34-36 show the theoretical characterization of the bias of the relative incidence for the multiple Normally distributed exposures model and true risk length $\tau = 15, 30$ and 45 respectively.

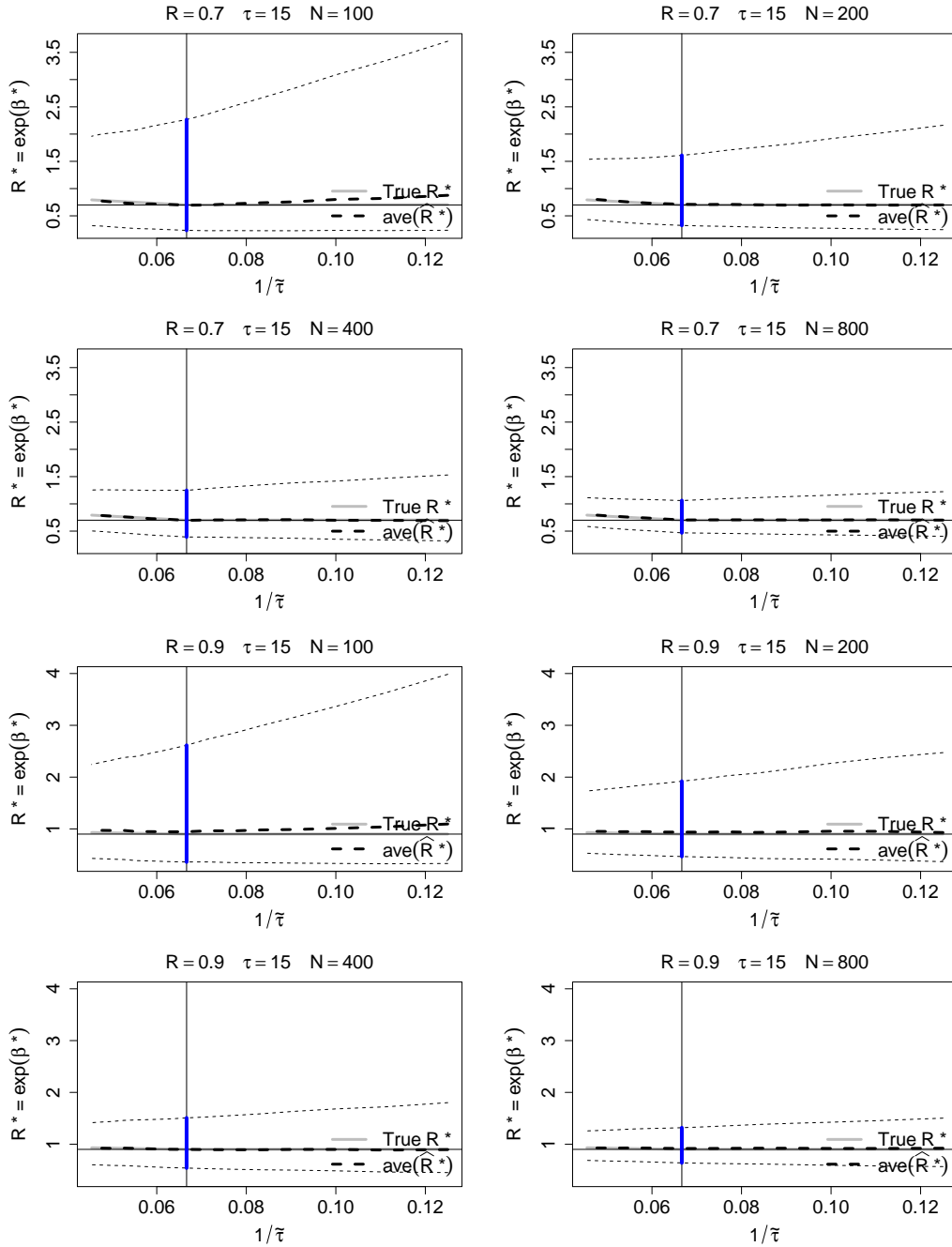


Figure 1: **Single Uniformly distributed exposure with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages ($\text{ave}(\hat{R}^*)$) over 200 simulated datasets. The true risk length is $\tau = 15$; $R = 0.7$ and 0.9 displayed in the top and bottom panels, respectively.

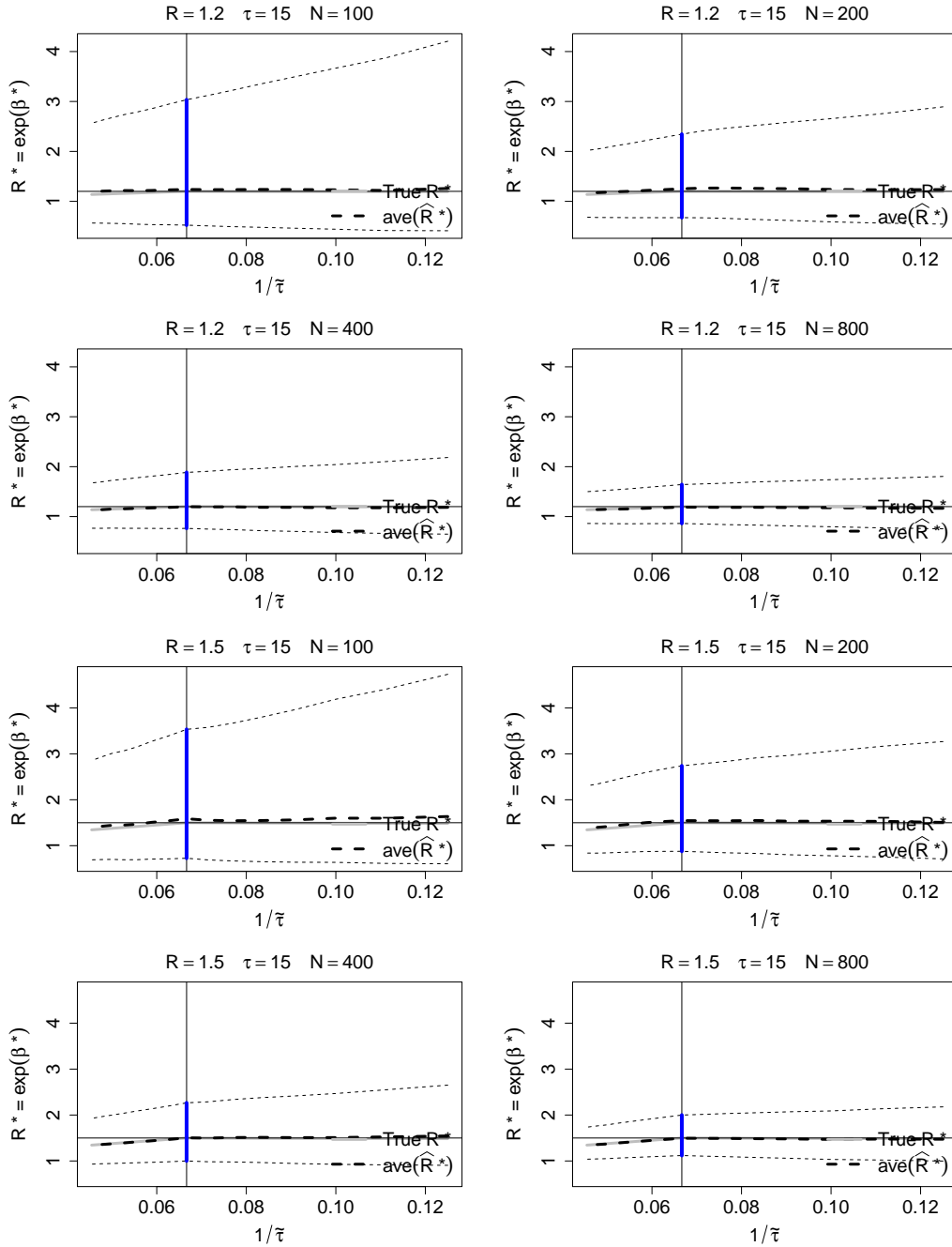


Figure 2: **Single Uniformly distributed exposure with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages ($\text{ave}(\hat{R}^*)$) over 200 simulated datasets. The true risk length is $\tau = 15$. $R = 1.2$ and 1.5 displayed in the top and bottom panels, respectively.

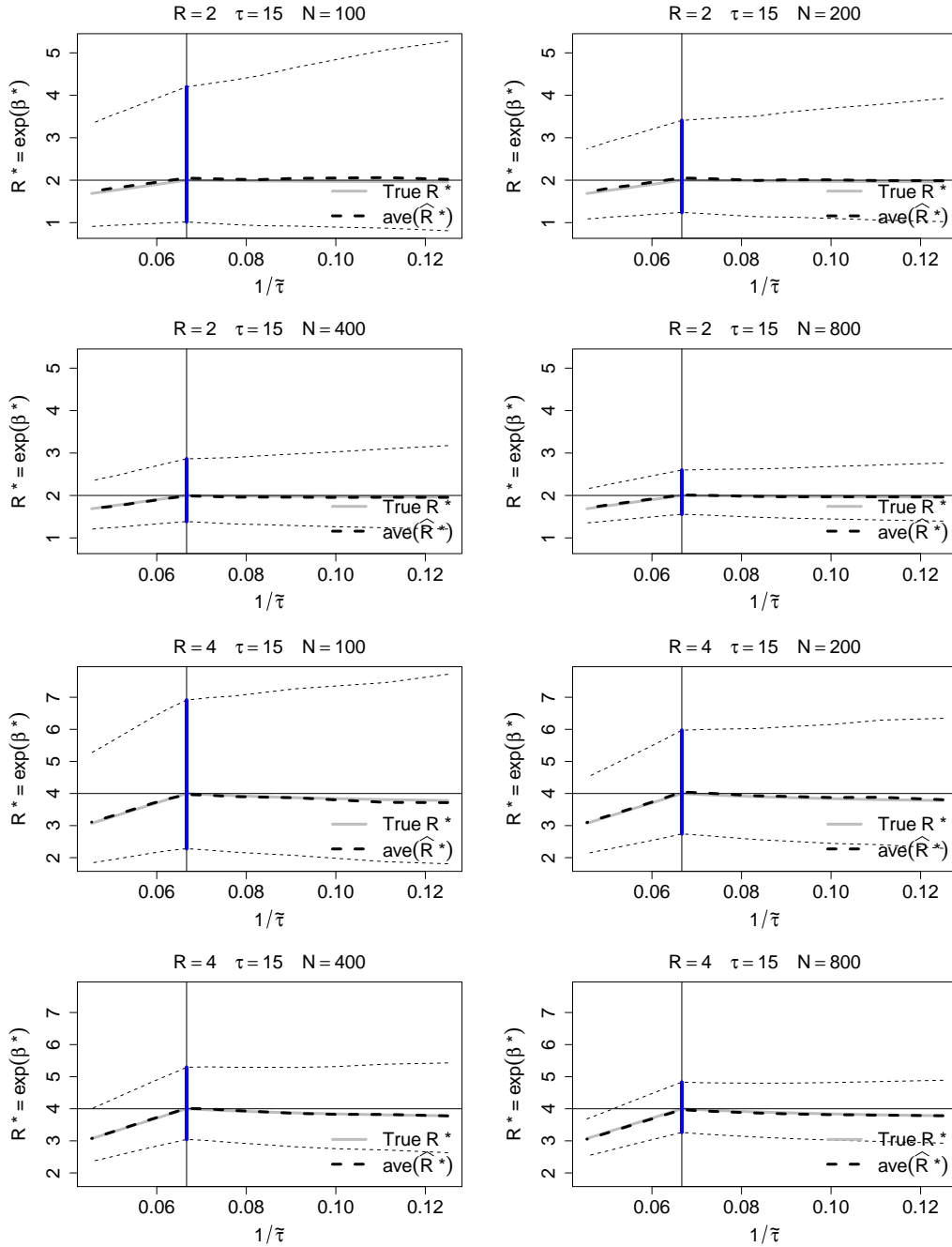


Figure 3: **Single Uniformly distributed exposure with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages ($\text{ave}(\hat{R}^*)$) over 200 simulated datasets. The true risk length is $\tau = 15$. $R = 2$ and 4 displayed in the top and bottom panels, respectively.

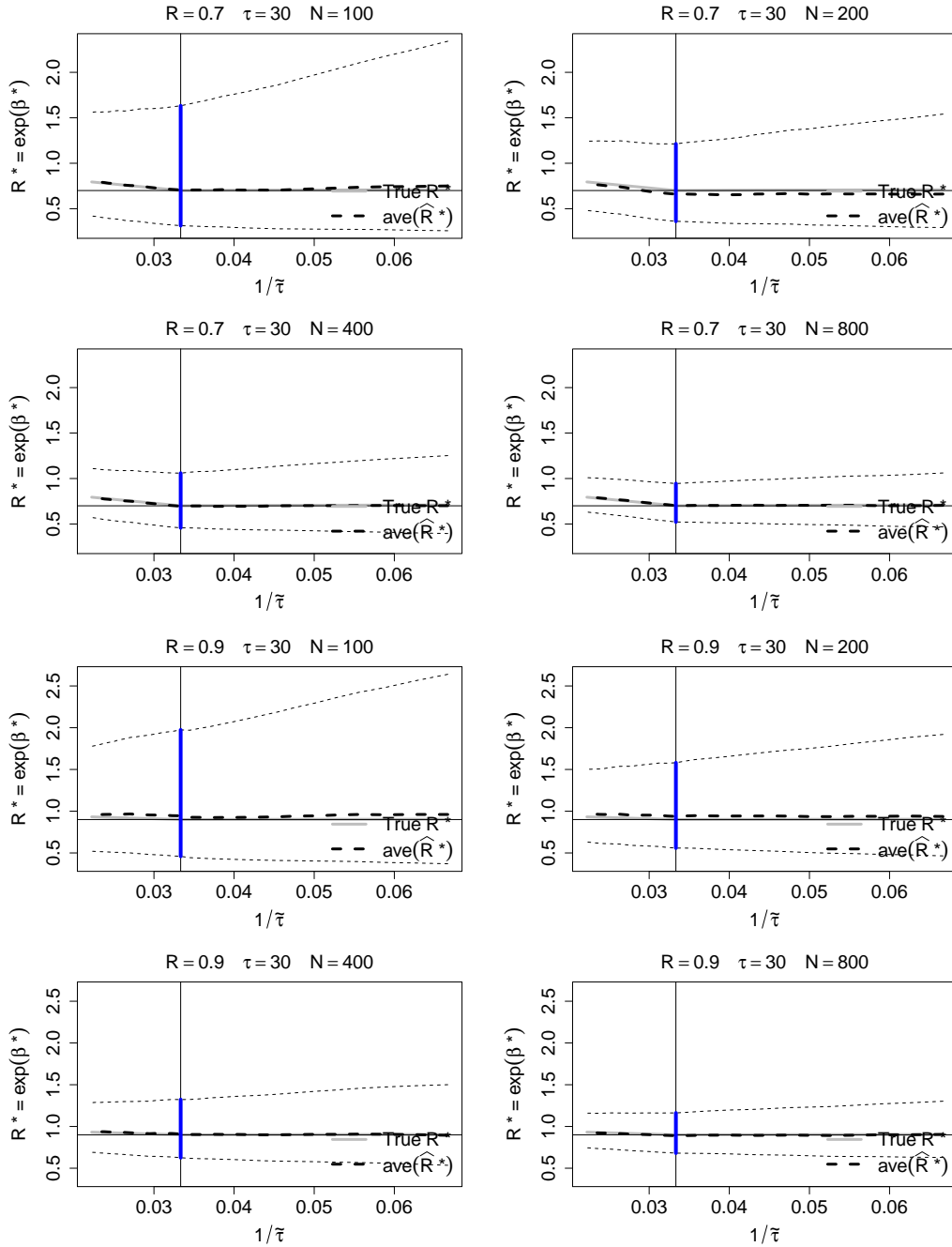


Figure 4: **Single Uniformly distributed exposure with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages ($\text{ave}(\hat{R}^*)$) over 200 simulated datasets. The true risk length is $\tau = 30$; $R = 0.7$ and 0.9 displayed in the top and bottom panels, respectively.

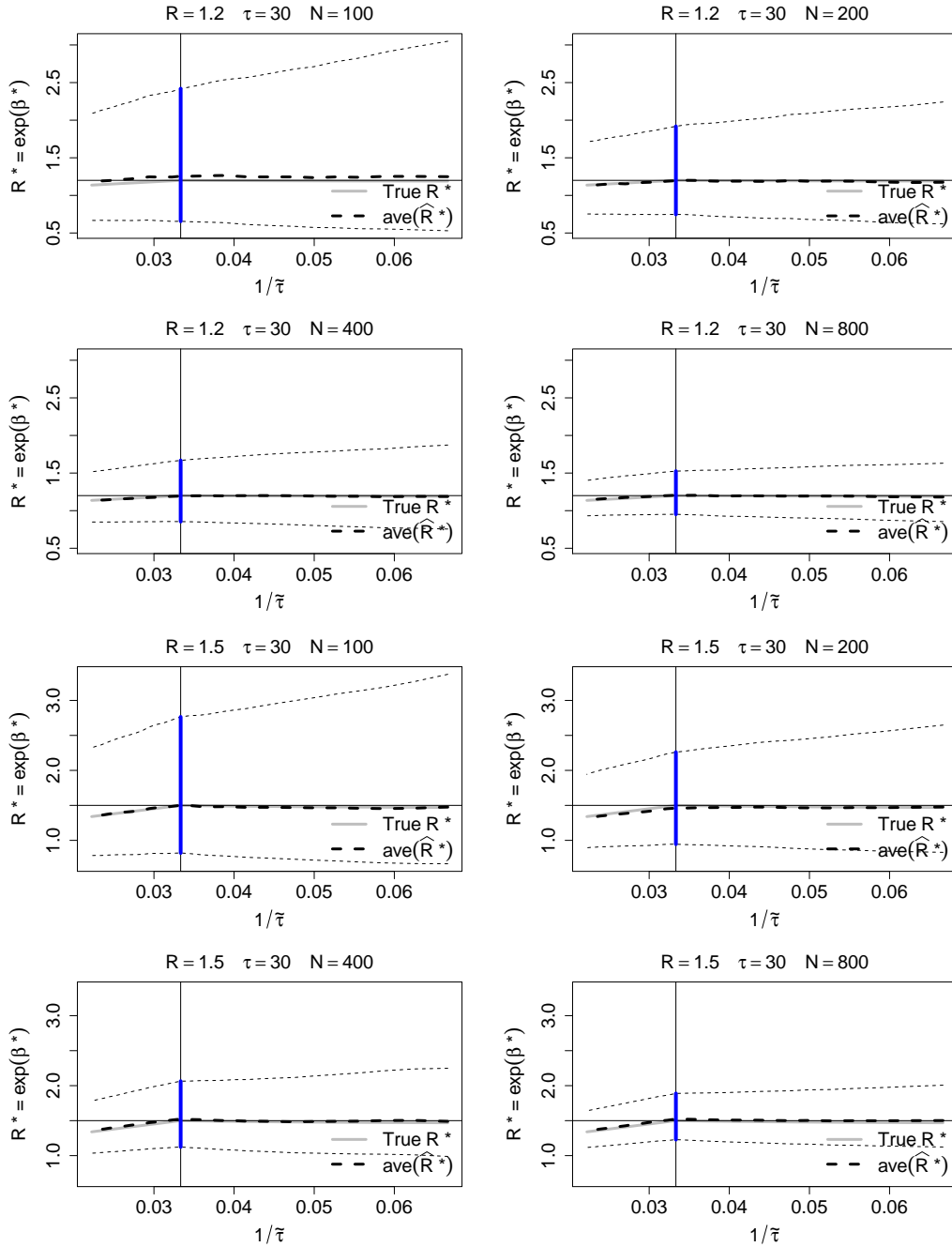


Figure 5: **Single Uniformly distributed exposure with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages ($\text{ave}(\hat{R}^*)$) over 200 simulated datasets. The true risk length is $\tau = 30$. $R = 1.2$ and 1.5 displayed in the top and bottom panels, respectively.

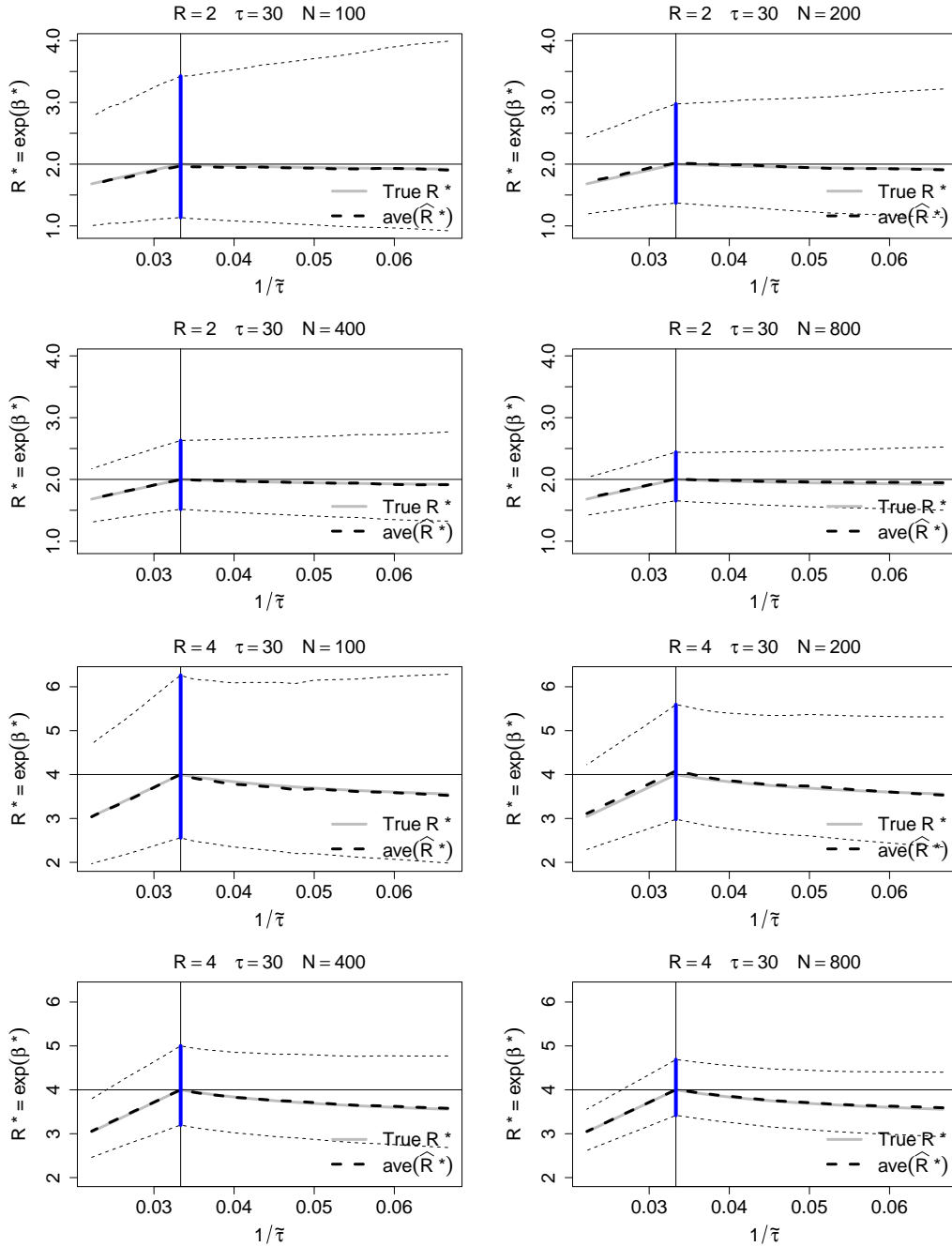


Figure 6: **Single Uniformly distributed exposure with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages ($\text{ave}(\hat{R}^*)$) over 200 simulated datasets. The true risk length is $\tau = 30$. $R = 2$ and 4 displayed in the top and bottom panels, respectively.

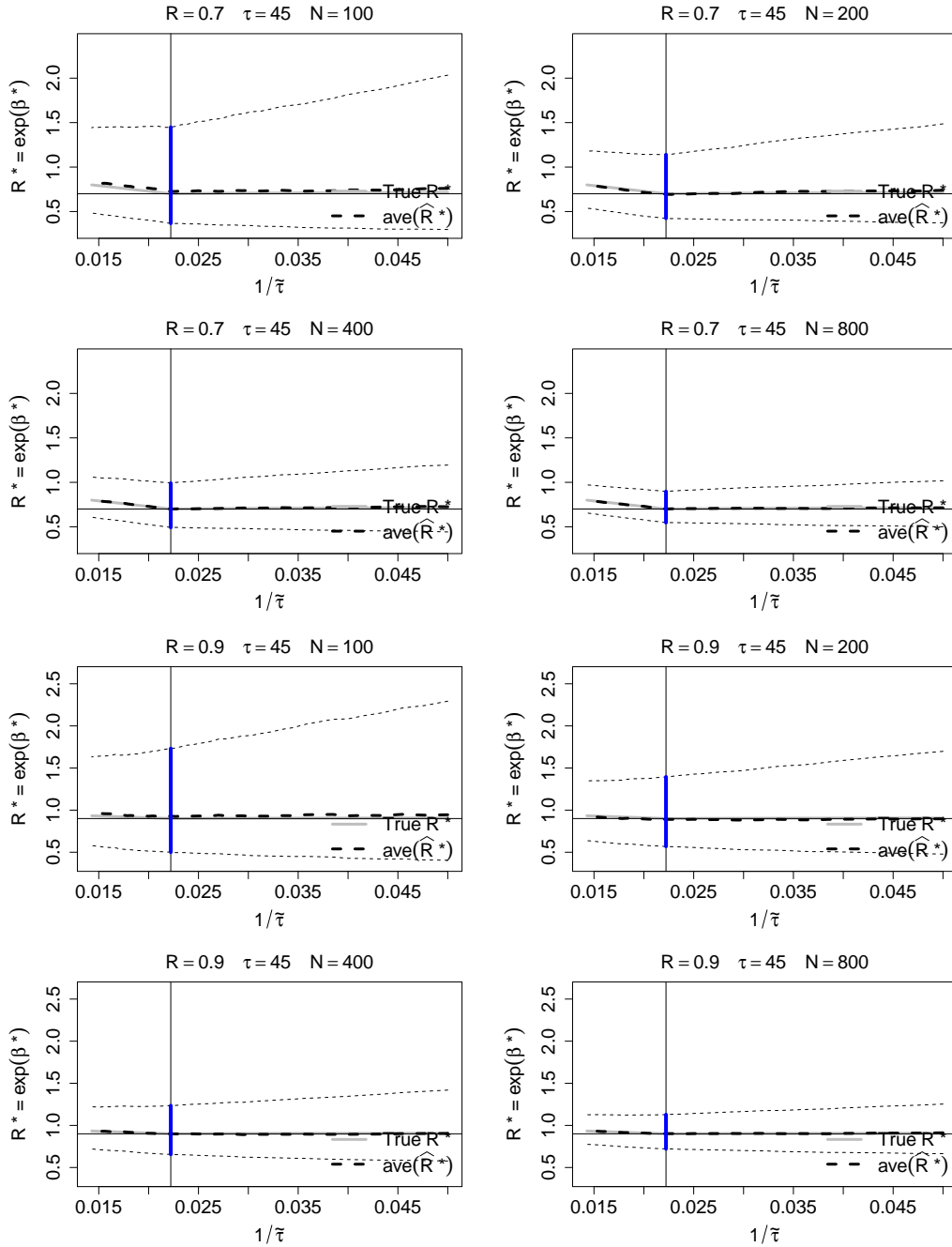


Figure 7: **Single Uniformly distributed exposure with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages ($\text{ave}(\hat{R}^*)$) over 200 simulated datasets. The true risk length is $\tau = 45$; $R = 0.7$ and 0.9 displayed in the top and bottom panels, respectively.

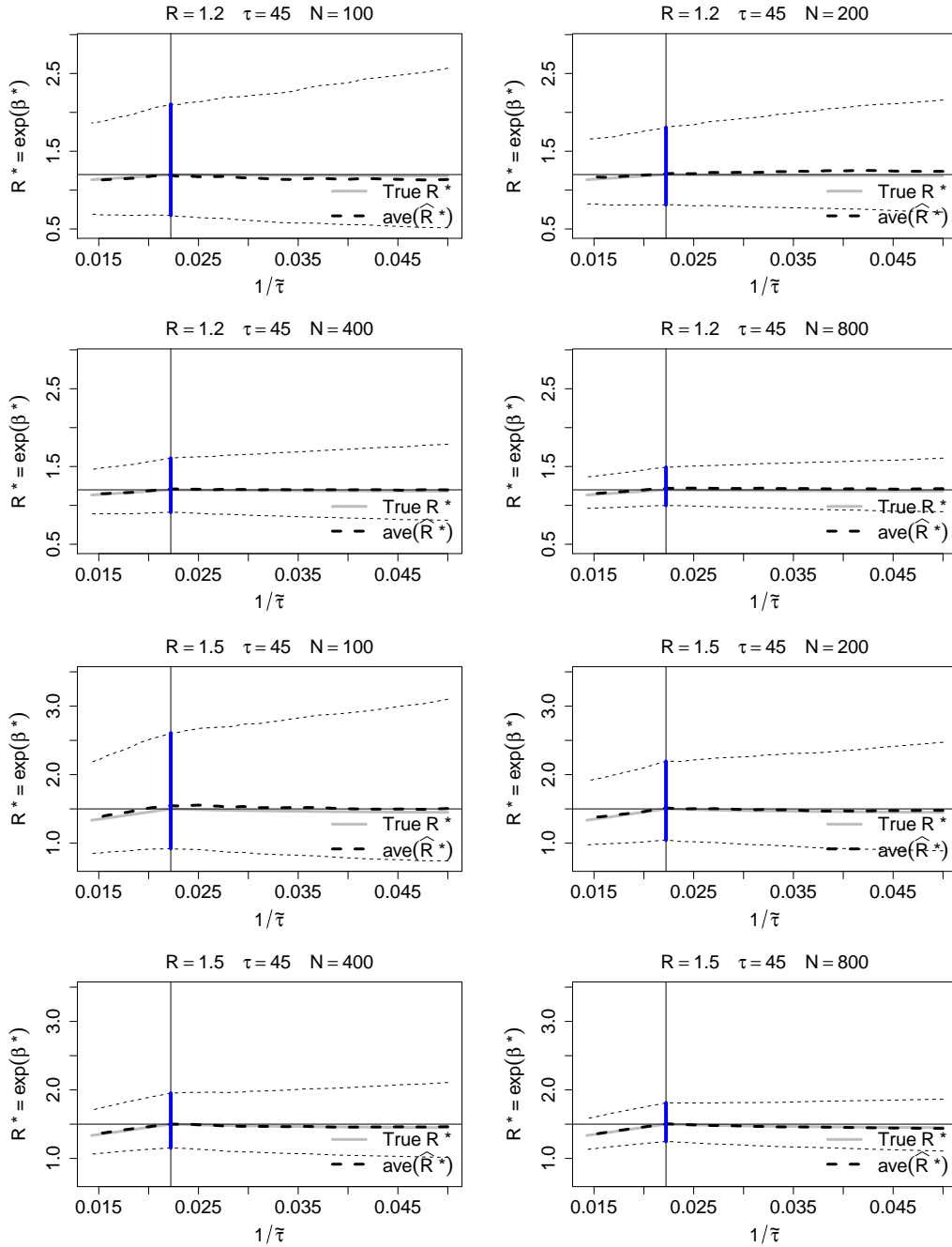


Figure 8: **Single Uniformly distributed exposure with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages ($\text{ave}(\hat{R}^*)$) over 200 simulated datasets. The true risk length is $\tau = 45$. $R = 1.2$ and 1.5 displayed in the top and bottom panels, respectively.

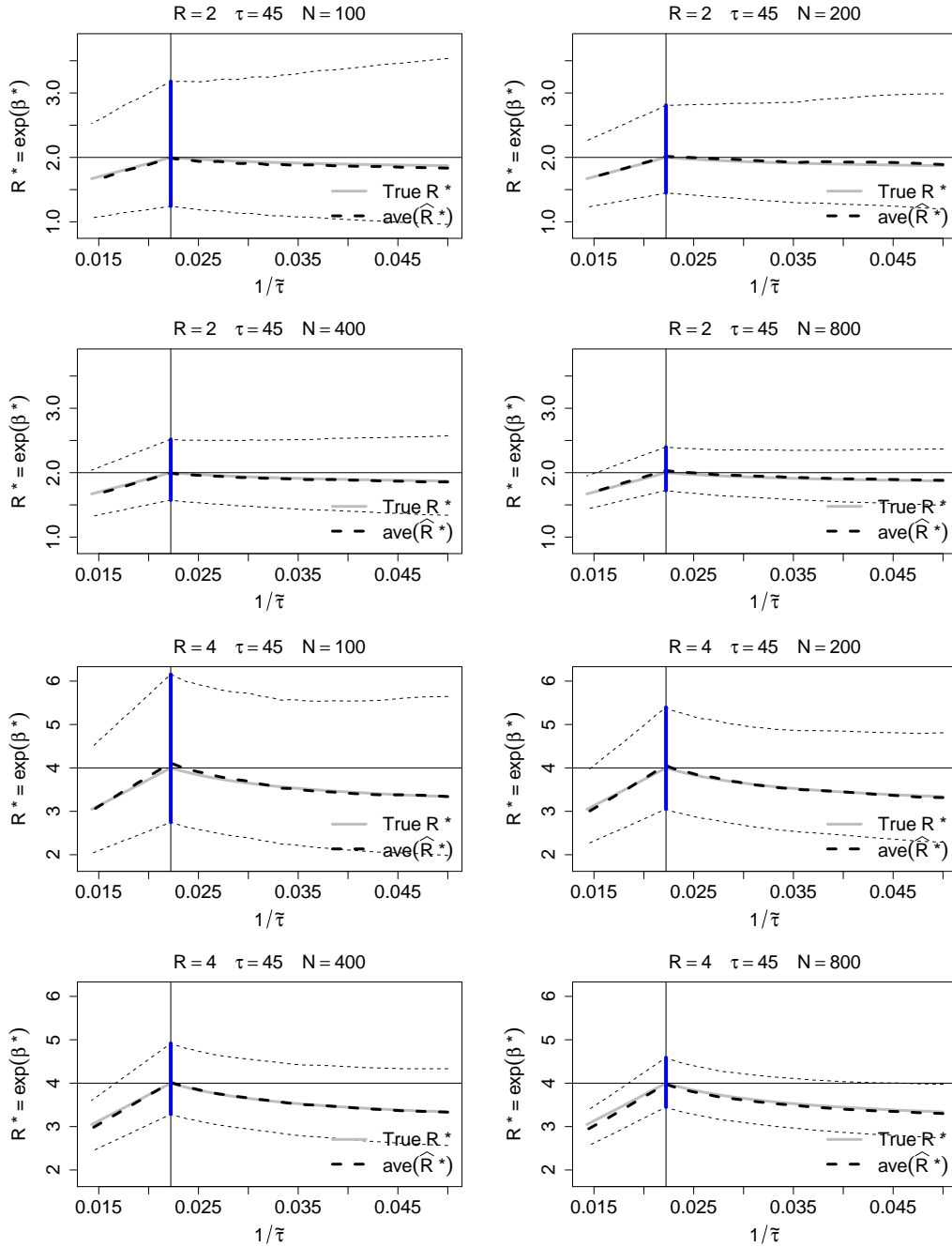


Figure 9: **Single Uniformly distributed exposure with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages ($\text{ave}(\hat{R}^*)$) over 200 simulated datasets. The true risk length is $\tau = 45$. $R = 2$ and 4 displayed in the top and bottom panels, respectively.

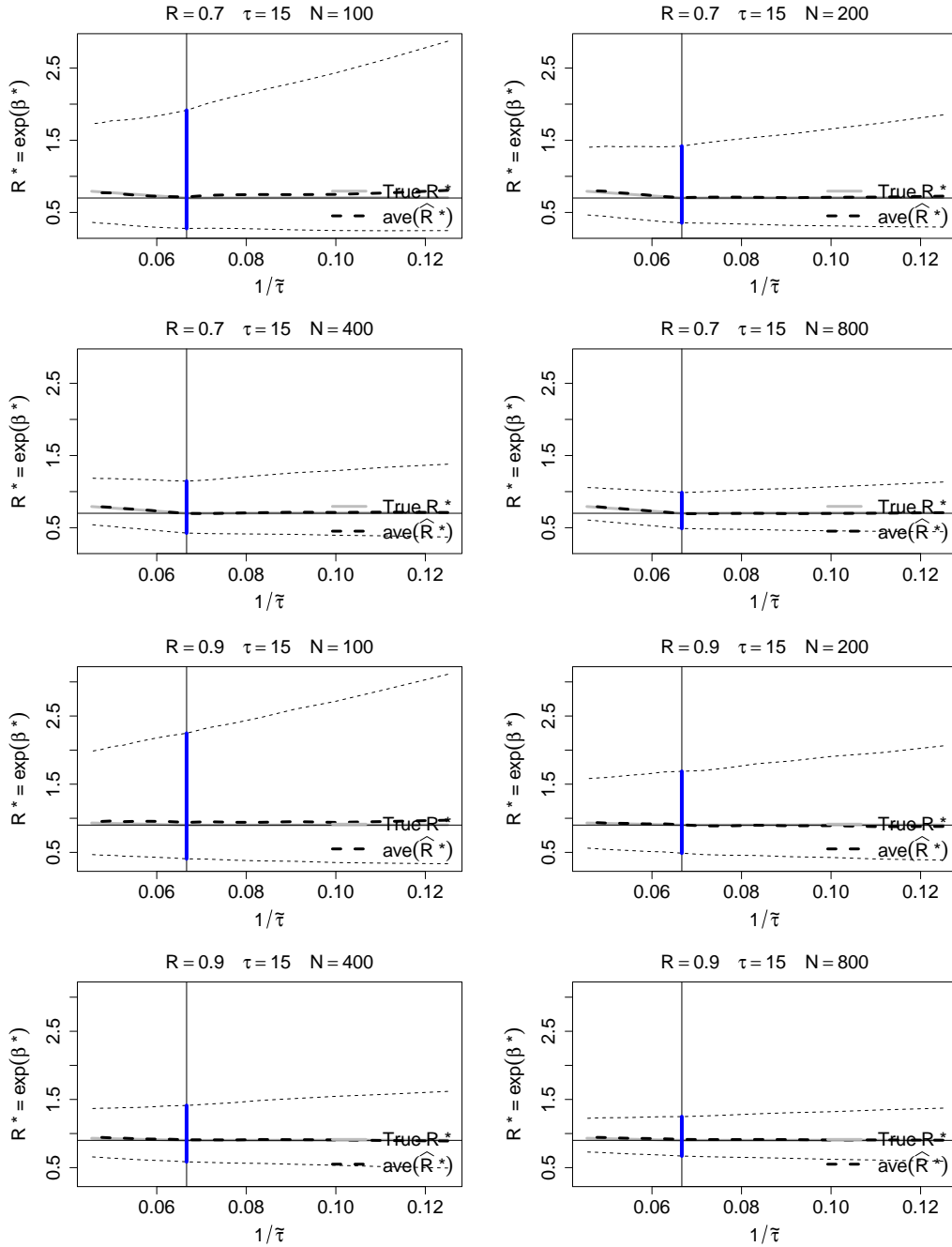


Figure 10: **Multiple Uniformly distributed exposures with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages ($\text{ave}(\hat{R}^*)$) over 200 simulated datasets. The true risk length is $\tau = 15$; $R = 0.7$ and 0.9 displayed in the top and bottom panels, respectively.

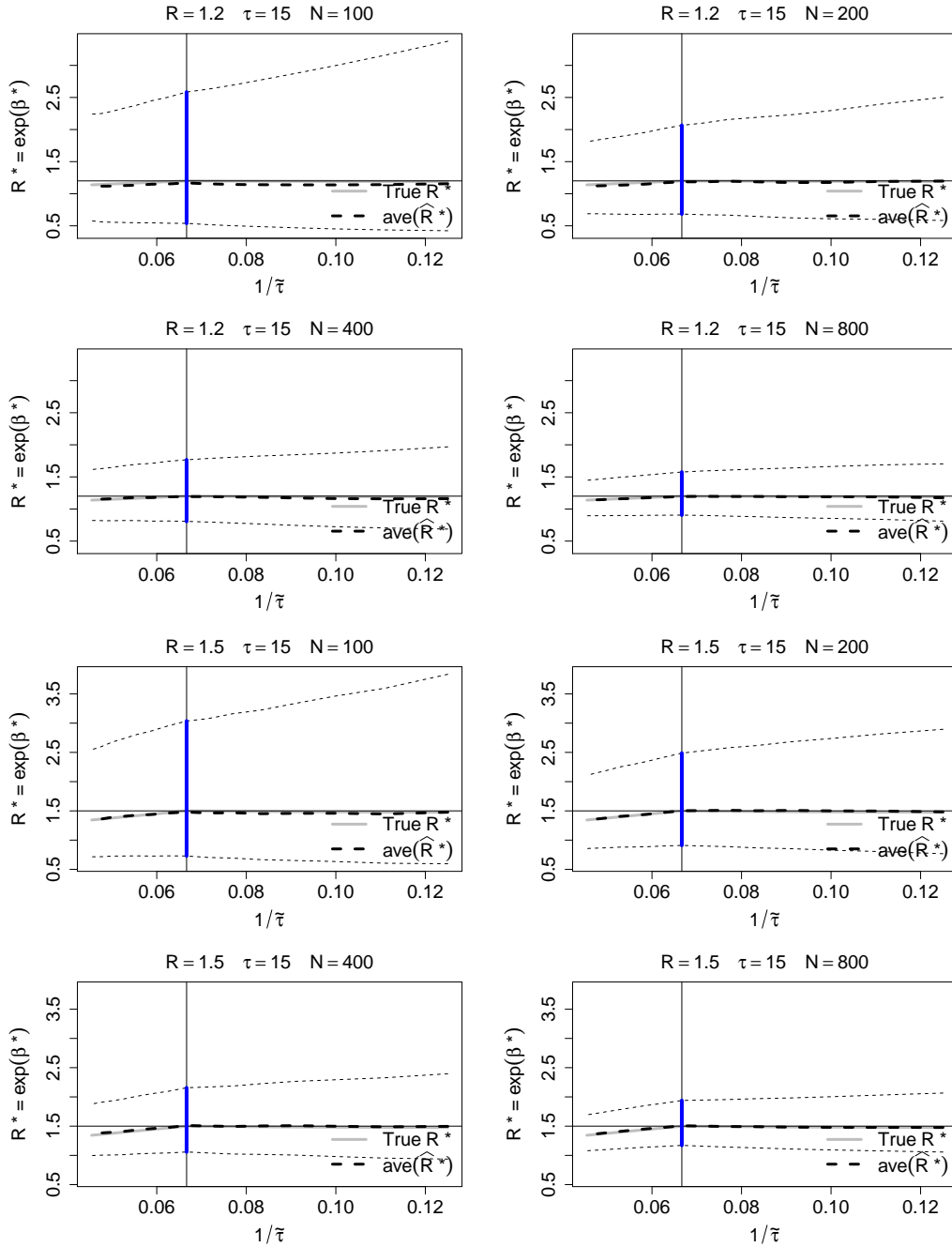


Figure 11: **Multiple Uniformly distributed exposures with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages ($\text{ave}(\hat{R}^*)$) over 200 simulated datasets. The true risk length is $\tau = 15$. $R = 1.2$ and 1.5 displayed in the top and bottom panels, respectively.

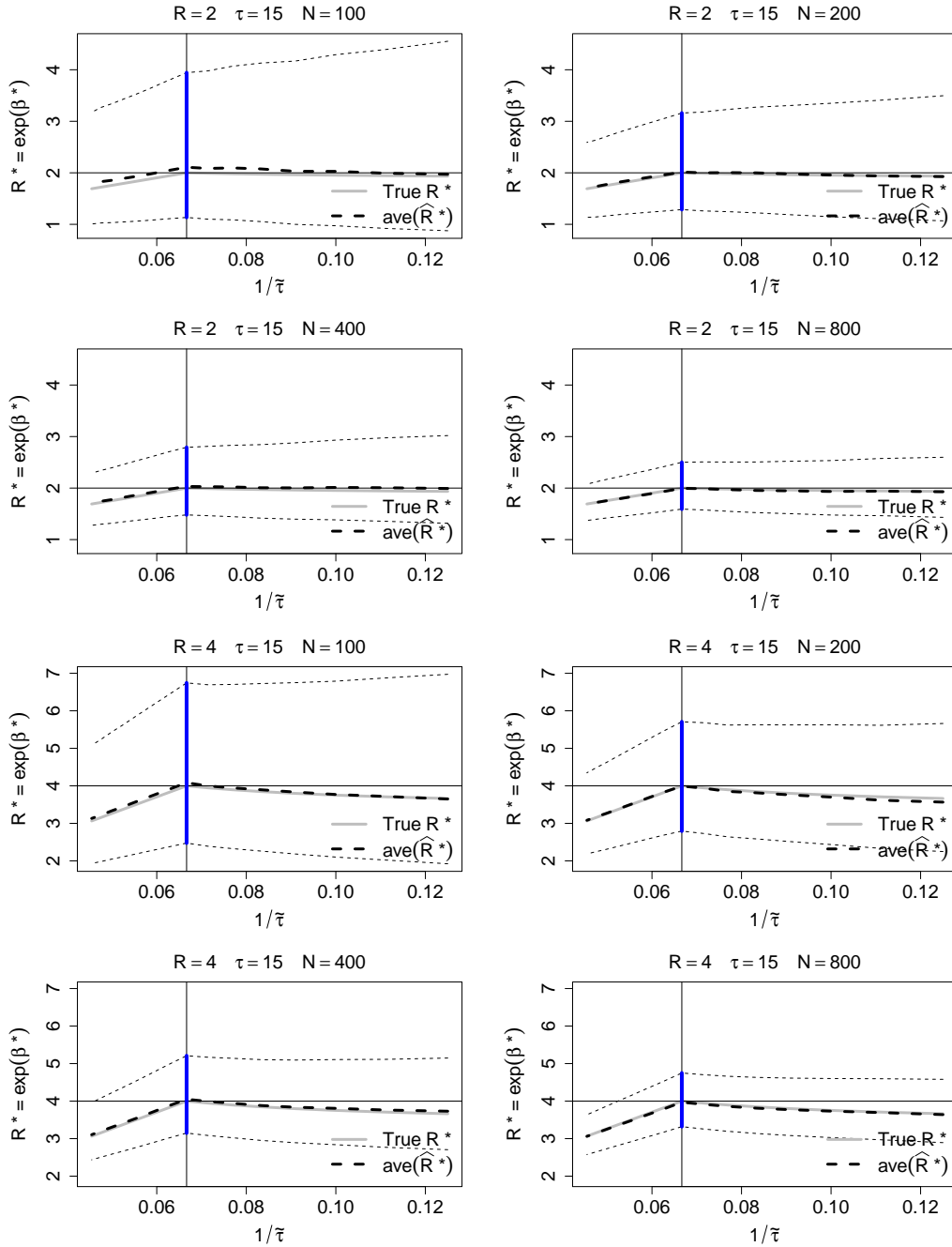


Figure 12: **Multiple Uniformly distributed exposures with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages ($\text{ave}(\hat{R}^*)$) over 200 simulated datasets. The true risk length is $\tau = 15$. $R = 2$ and 4 displayed in the top and bottom panels, respectively.

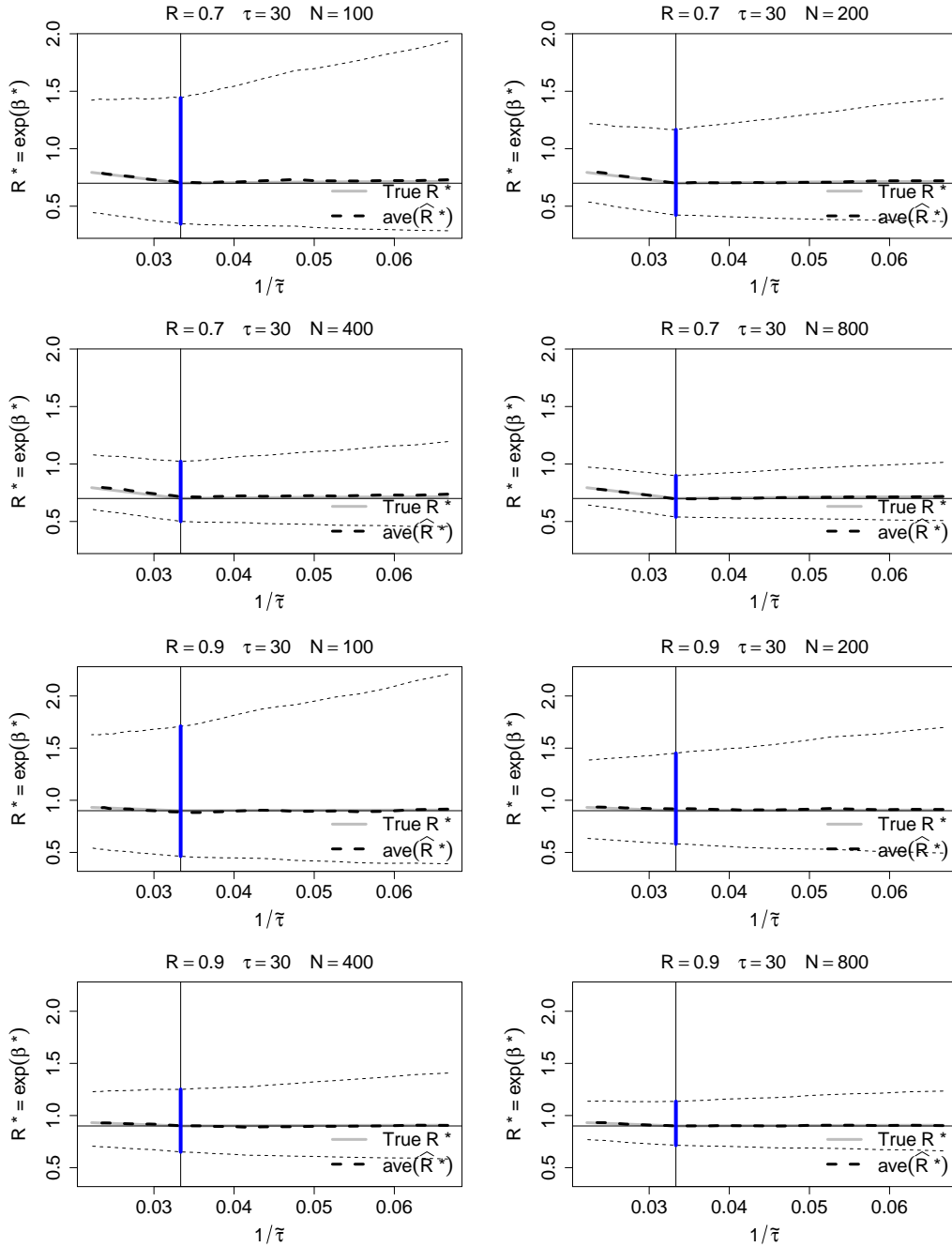


Figure 13: **Multiple Uniformly distributed exposures with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages ($\text{ave}(\hat{R}^*)$) over 200 simulated datasets. The true risk length is $\tau = 30$; $R = 0.7$ and 0.9 displayed in the top and bottom panels, respectively.

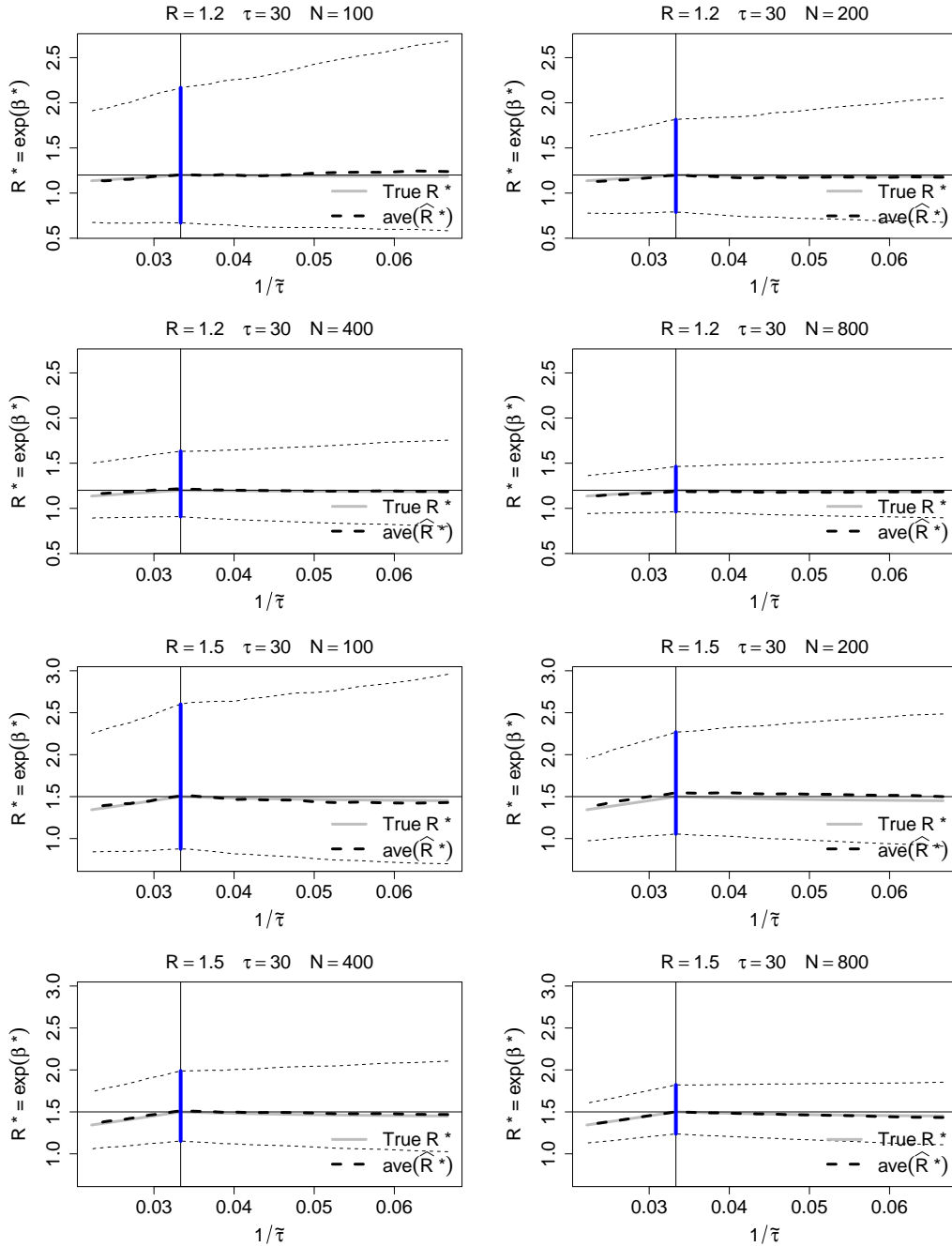


Figure 14: **Multiple Uniformly distributed exposures with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages (ave(\hat{R}^*)) over 200 simulated datasets. The true risk length is $\tau = 30$. $R = 1.2$ and 1.5 displayed in the top and bottom panels, respectively.

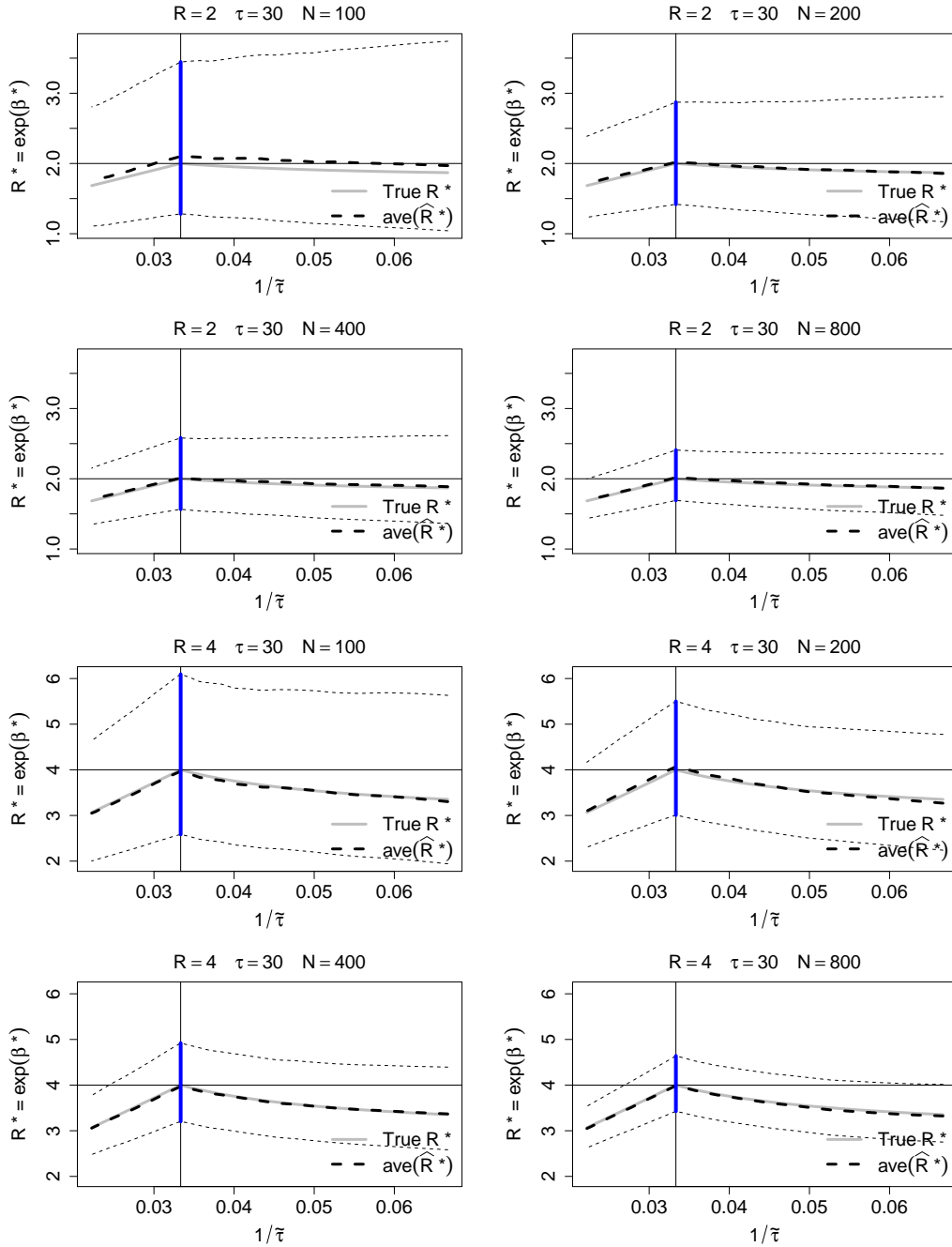


Figure 15: **Multiple Uniformly distributed exposures with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages ($\text{ave}(\hat{R}^*)$) over 200 simulated datasets. The true risk length is $\tau = 30$. $R = 2$ and 4 displayed in the top and bottom panels, respectively.

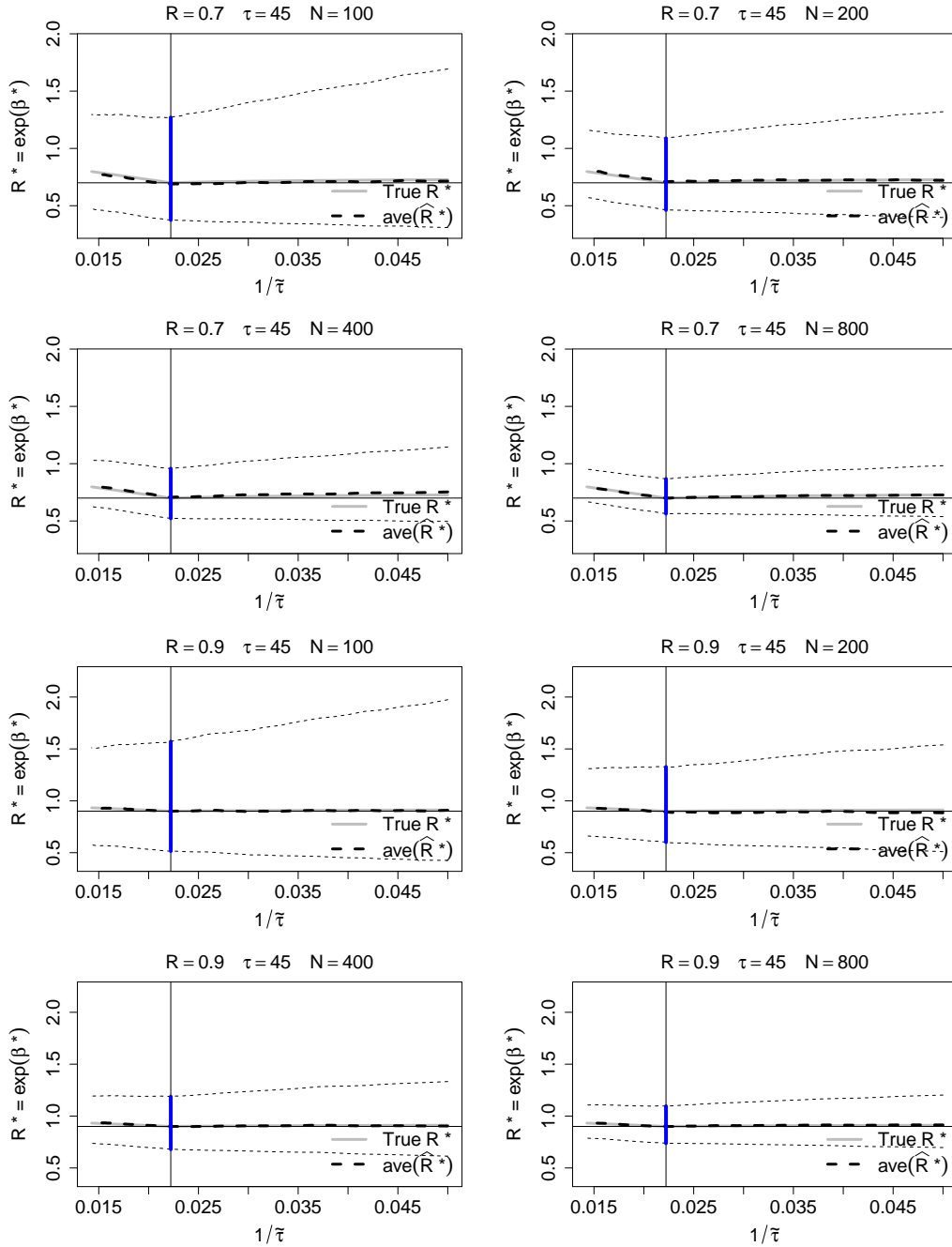


Figure 16: **Multiple Uniformly distributed exposures with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages ($\text{ave}(\hat{R}^*)$) over 200 simulated datasets. The true risk length is $\tau = 45$; $R = 0.7$ and 0.9 displayed in the top and bottom panels, respectively.

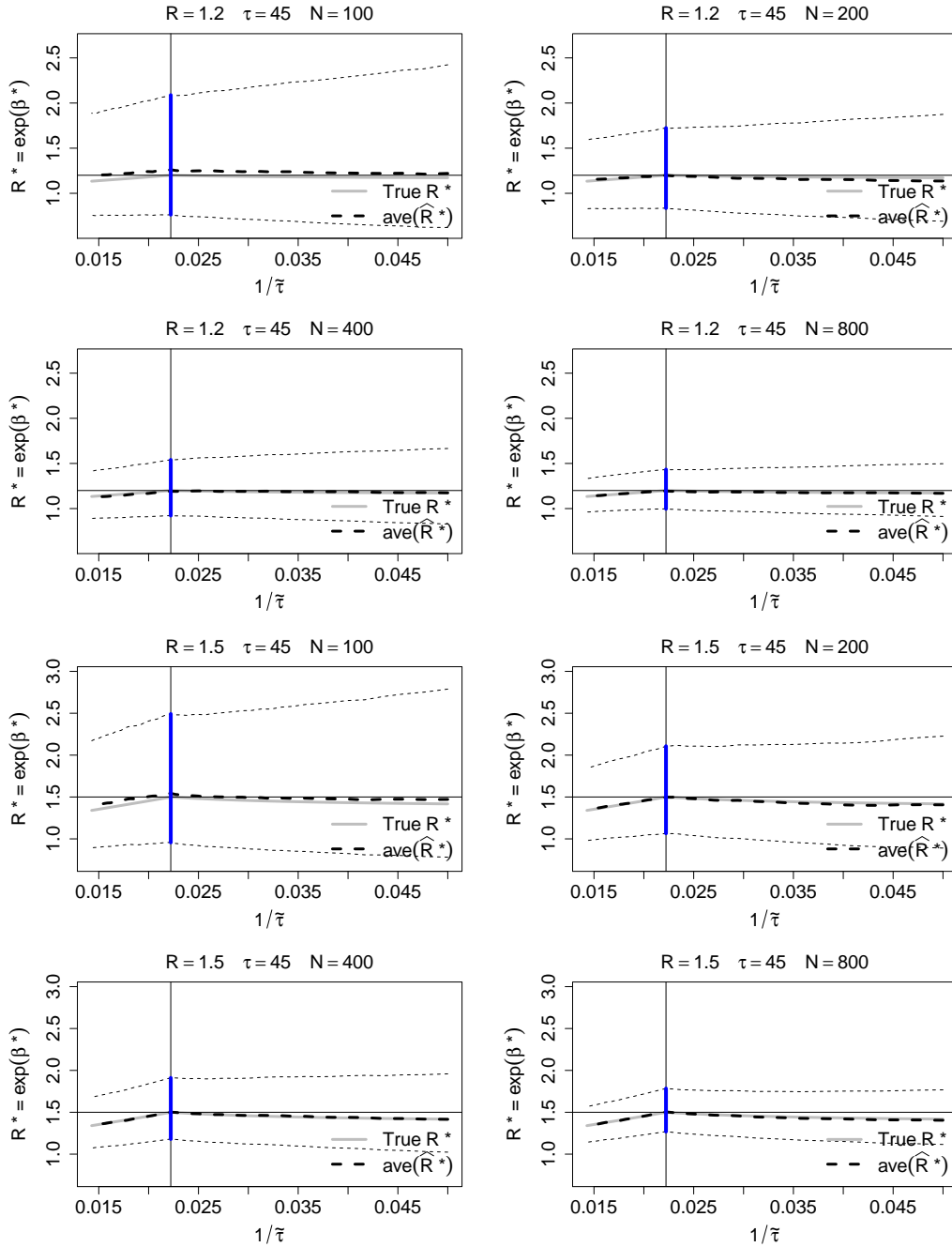


Figure 17: **Multiple Uniformly distributed exposures with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages (ave(\hat{R}^*)) over 200 simulated datasets. The true risk length is $\tau = 45$. $R = 1.2$ and 1.5 displayed in the top and bottom panels, respectively.

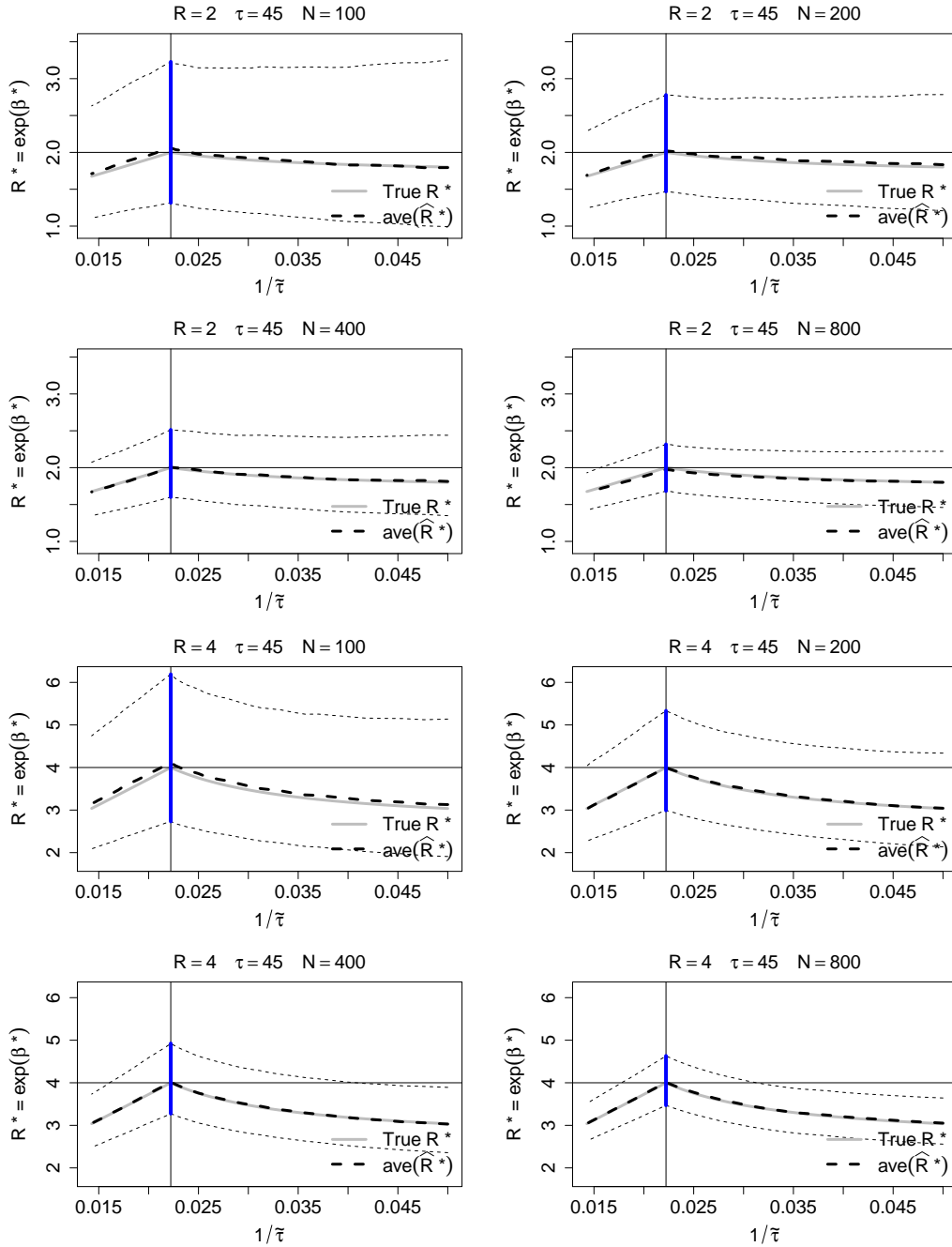


Figure 18: **Multiple Uniformly distributed exposures with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages ($\text{ave}(\hat{R}^*)$) over 200 simulated datasets. The true risk length is $\tau = 45$. $R = 2$ and 4 displayed in the top and bottom panels, respectively.

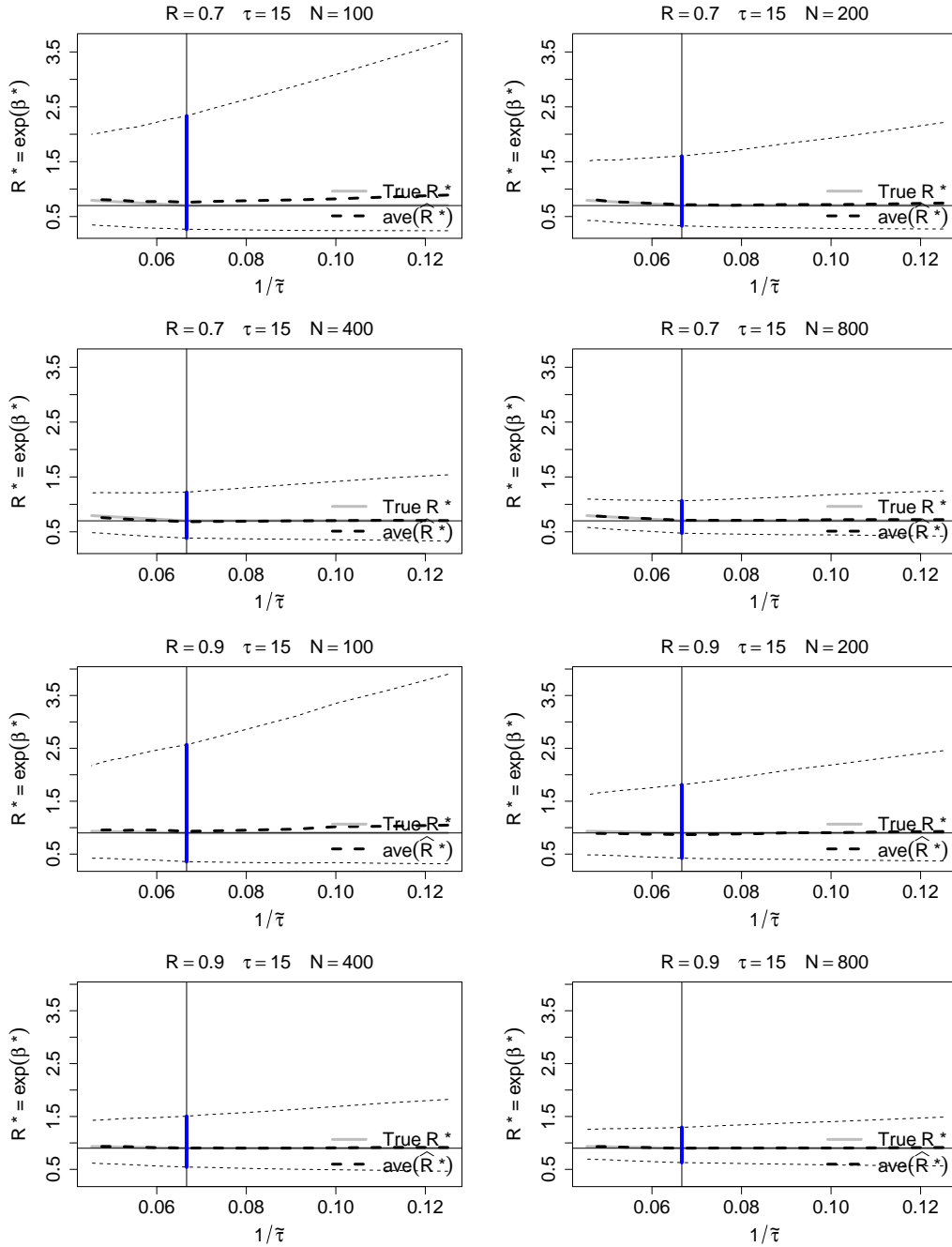


Figure 19: **Single Normally distributed exposure with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages ($\text{ave}(\hat{R}^*)$) over 200 simulated datasets. The true risk length is $\tau = 15$; $R = 0.7$ and 0.9 displayed in the top and bottom panels, respectively.

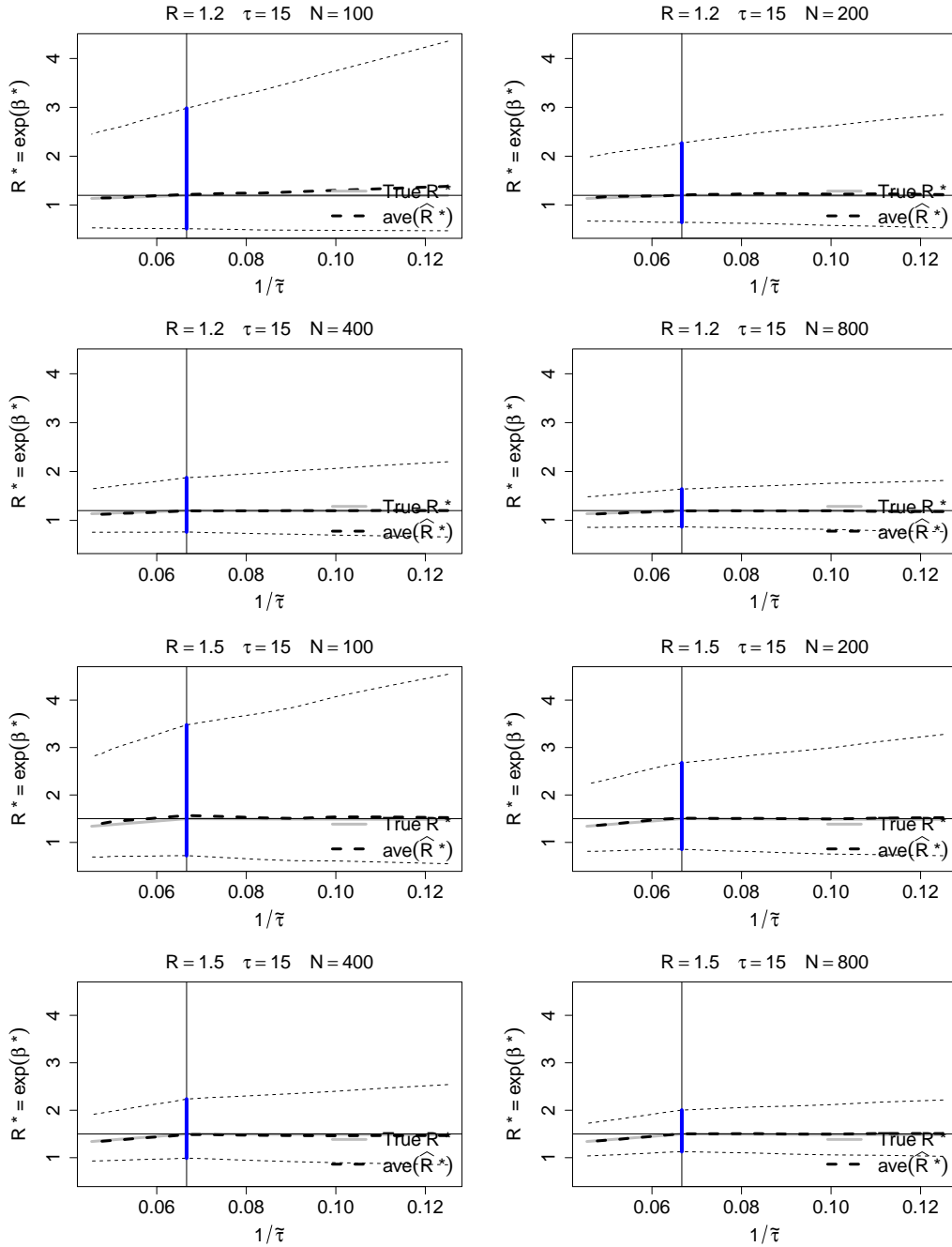


Figure 20: **Single Normally distributed exposure with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages ($\text{ave}(\hat{R}^*)$) over 200 simulated datasets. The true risk length is $\tau = 15$. $R = 1.2$ and 1.5 displayed in the top and bottom panels, respectively.

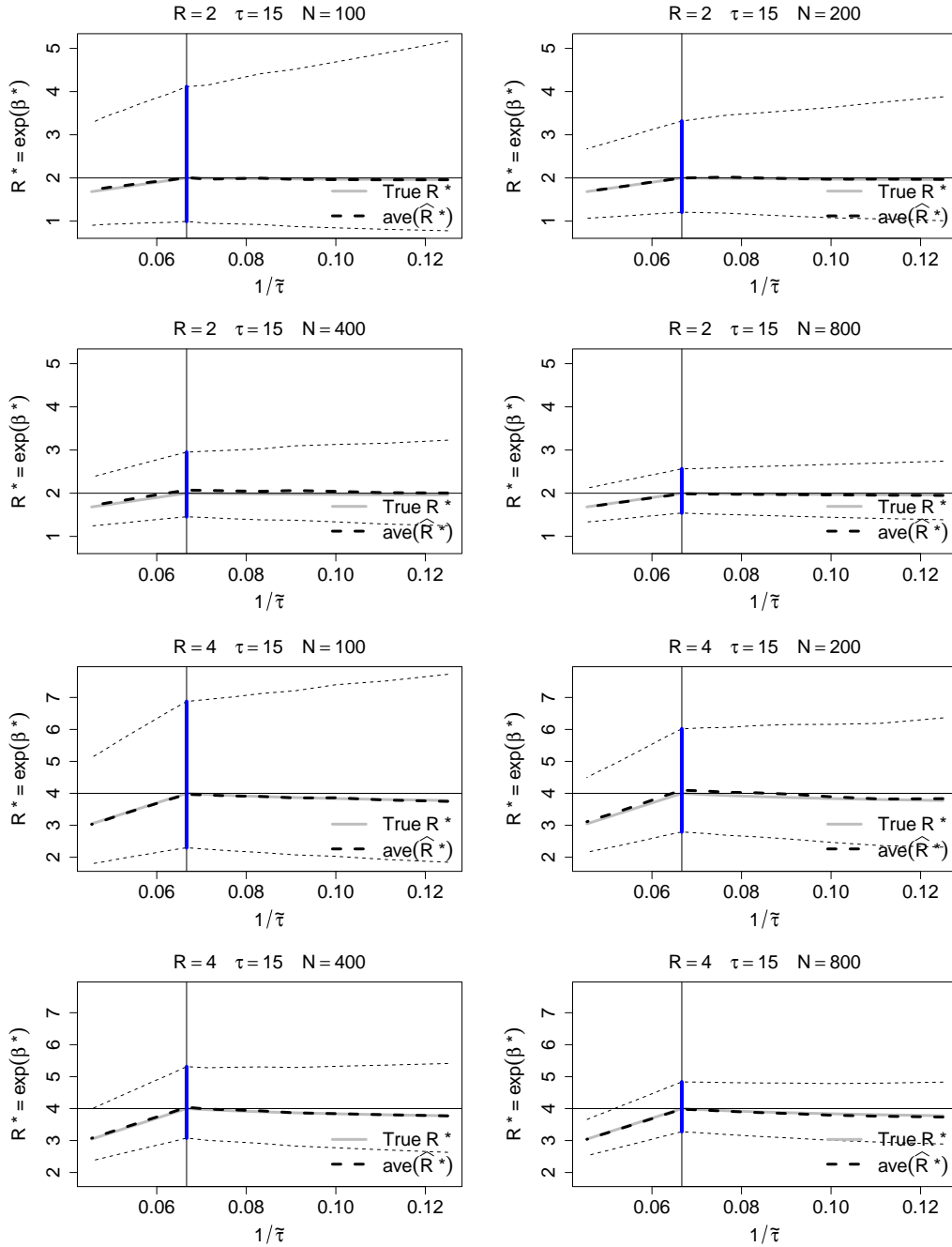


Figure 21: **Single Normally distributed exposure with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages ($\text{ave}(\hat{R}^*)$) over 200 simulated datasets. The true risk length is $\tau = 15$. $R = 2$ and 4 displayed in the top and bottom panels, respectively.

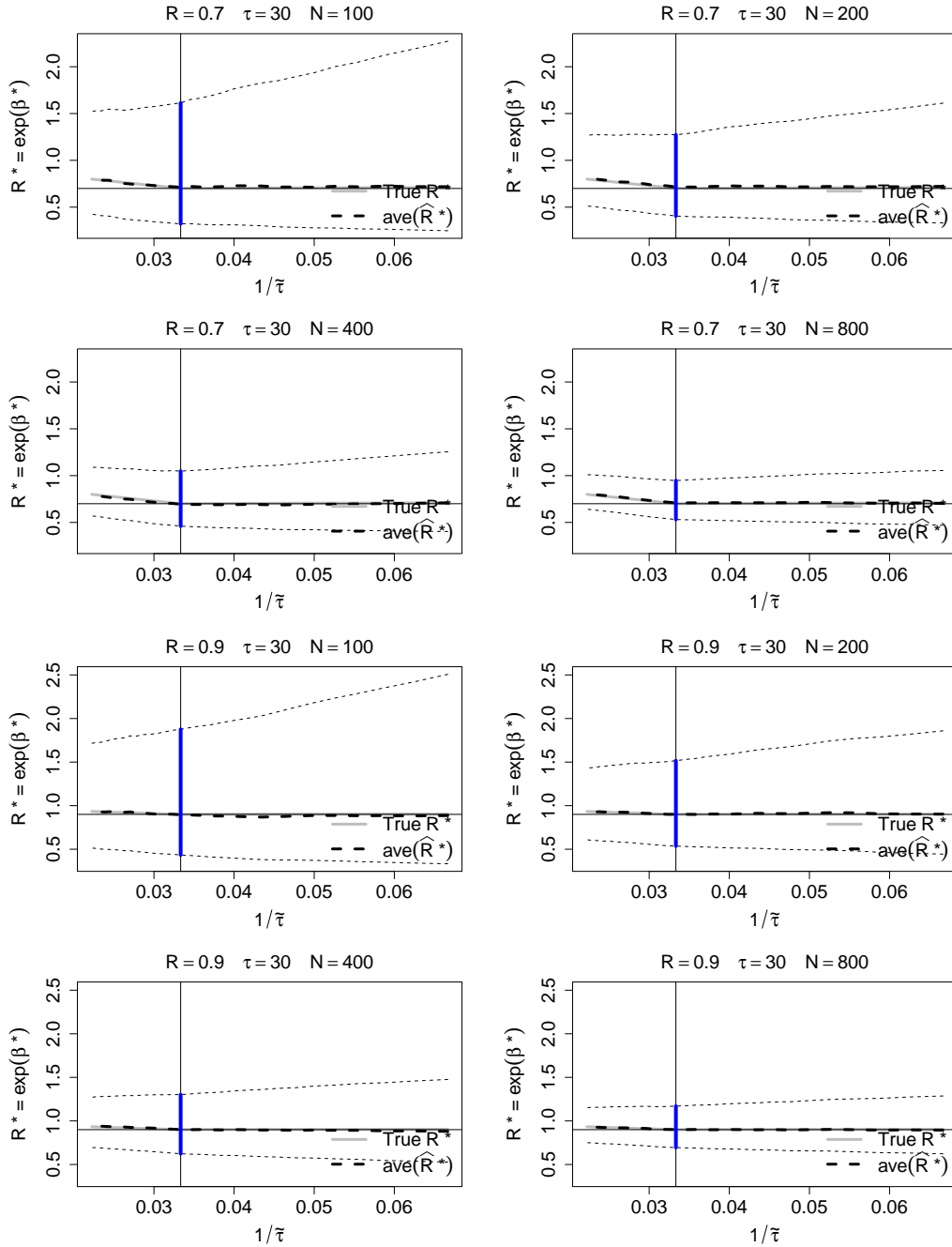


Figure 22: **Single Normally distributed exposure with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages ($\text{ave}(\hat{R}^*)$) over 200 simulated datasets. The true risk length is $\tau = 30$; $R = 0.7$ and 0.9 displayed in the top and bottom panels, respectively.

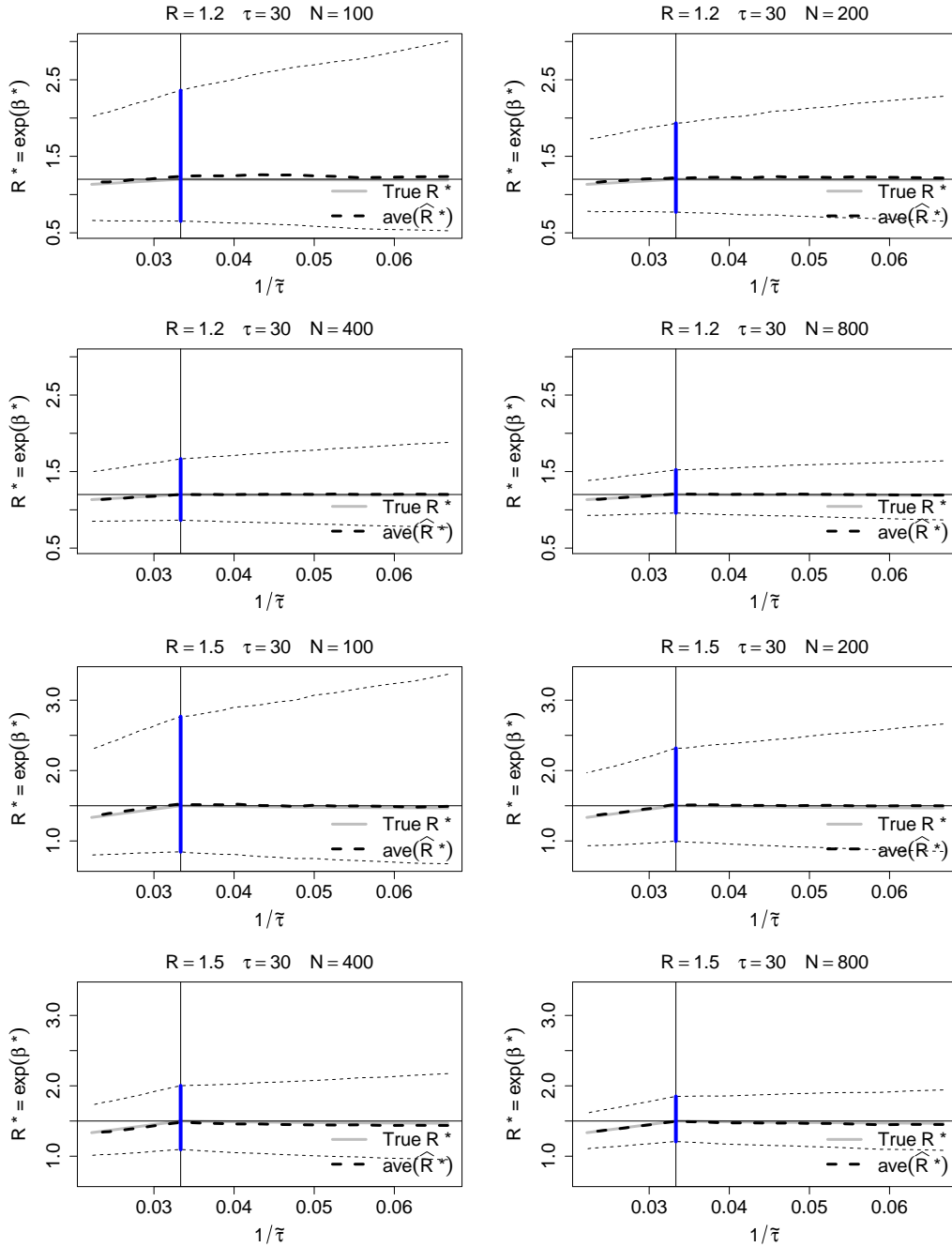


Figure 23: **Single Normally distributed exposure with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages (ave(\hat{R}^*)) over 200 simulated datasets. The true risk length is $\tau = 30$. $R = 1.2$ and 1.5 displayed in the top and bottom panels, respectively.

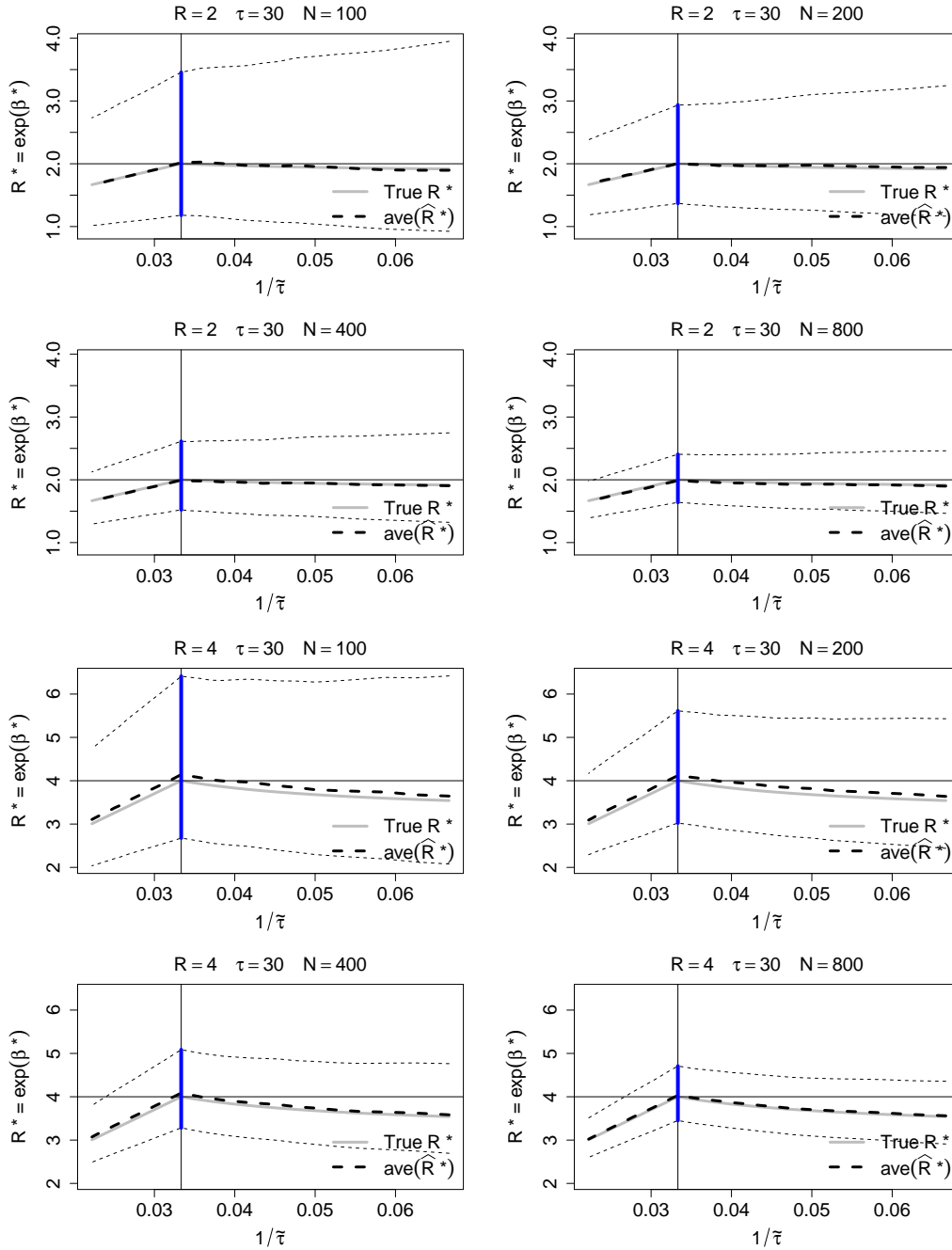


Figure 24: **Single Normally distributed exposure with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages (ave(\hat{R}^*)) over 200 simulated datasets. The true risk length is $\tau = 30$. $R = 2$ and 4 displayed in the top and bottom panels, respectively.

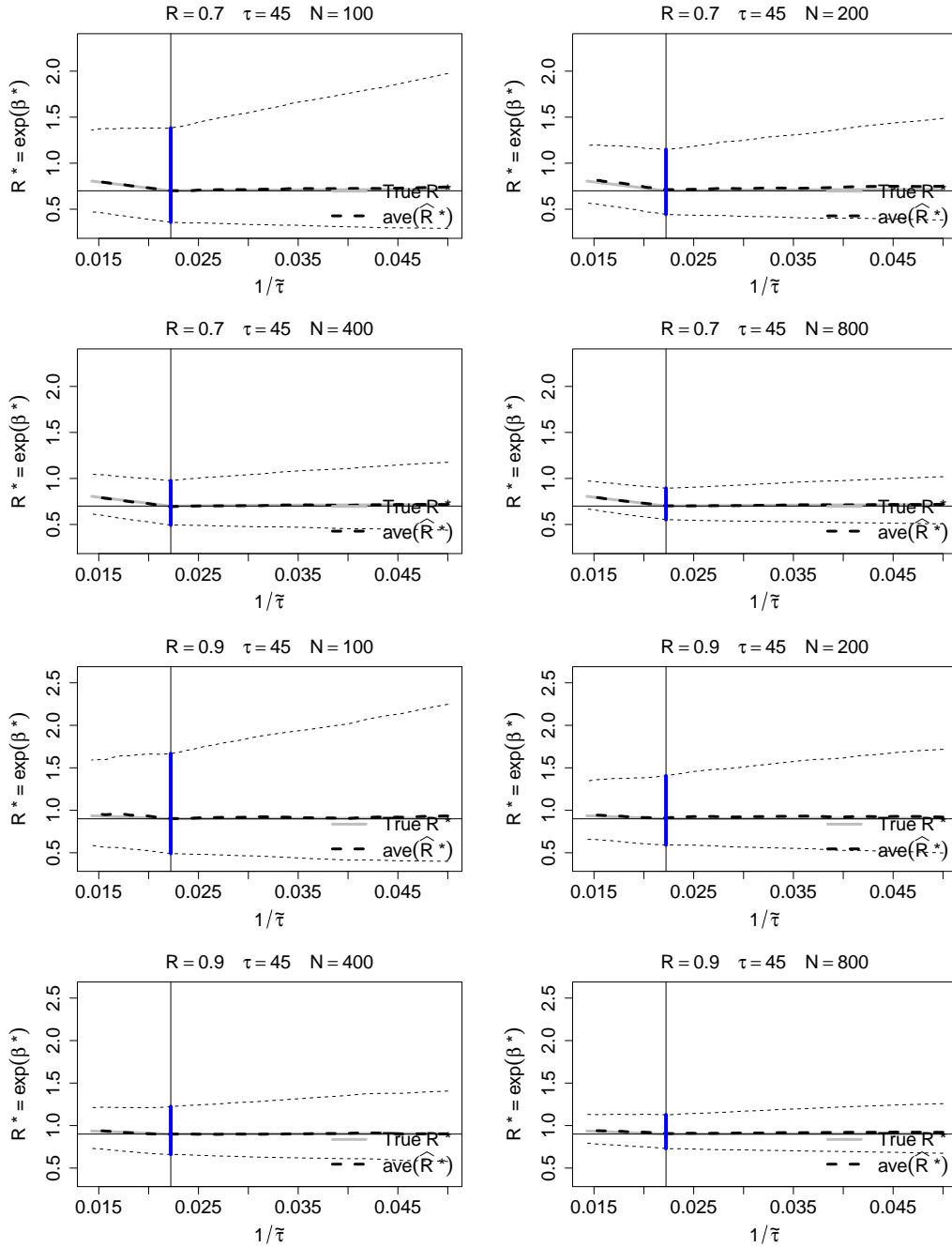


Figure 25: **Single Normally distributed exposure with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages ($\text{ave}(\hat{R}^*)$) over 200 simulated datasets. The true risk length is $\tau = 45$; $R = 0.7$ and 0.9 displayed in the top and bottom panels, respectively.

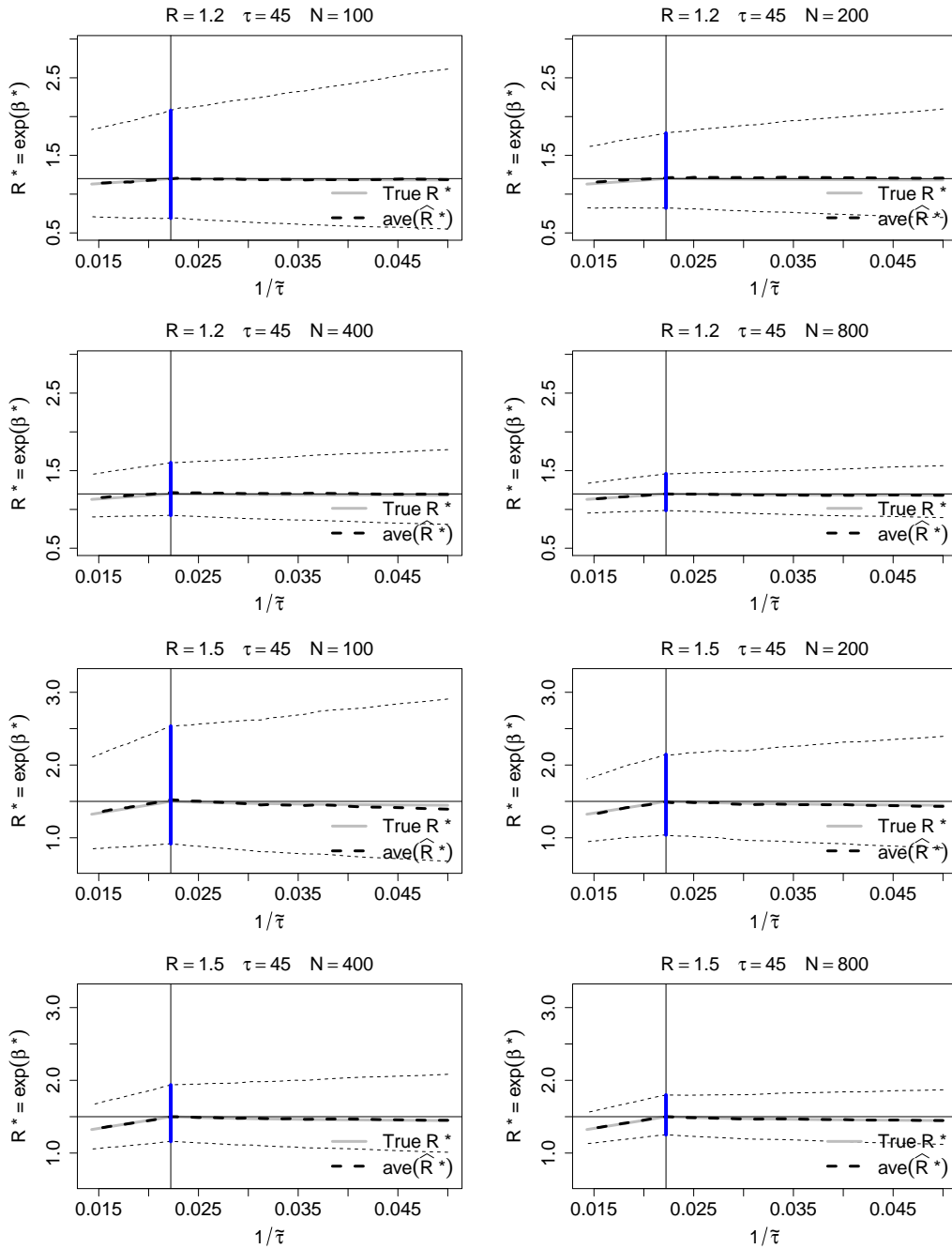


Figure 26: **Single Normally distributed exposure with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages ($\text{ave}(\hat{R}^*)$) over 200 simulated datasets. The true risk length is $\tau = 45$. $R = 1.2$ and 1.5 displayed in the top and bottom panels, respectively.

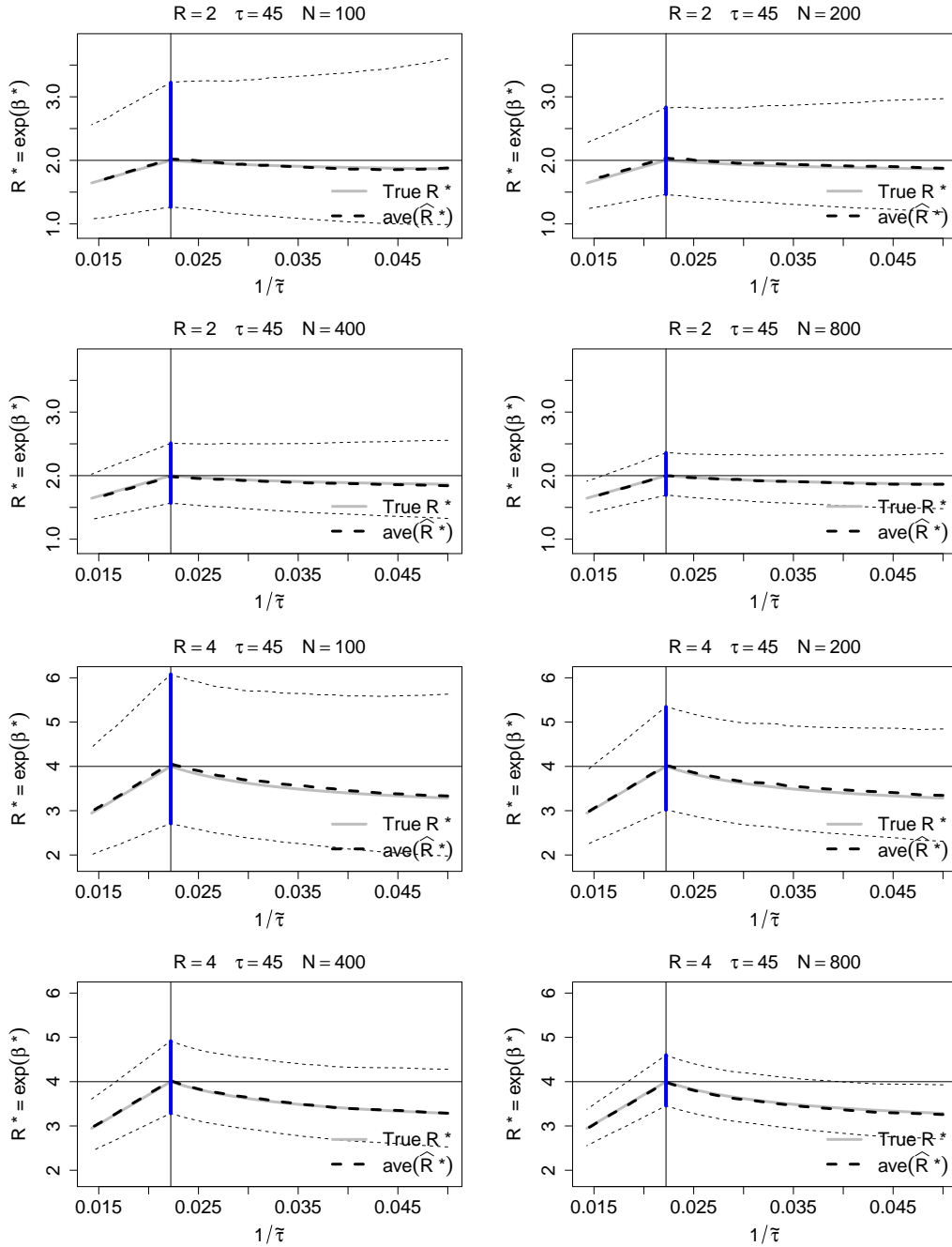


Figure 27: **Single Normally distributed exposure with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages ($\text{ave}(\hat{R}^*)$) over 200 simulated datasets. The true risk length is $\tau = 45$. $R = 2$ and 4 displayed in the top and bottom panels, respectively.

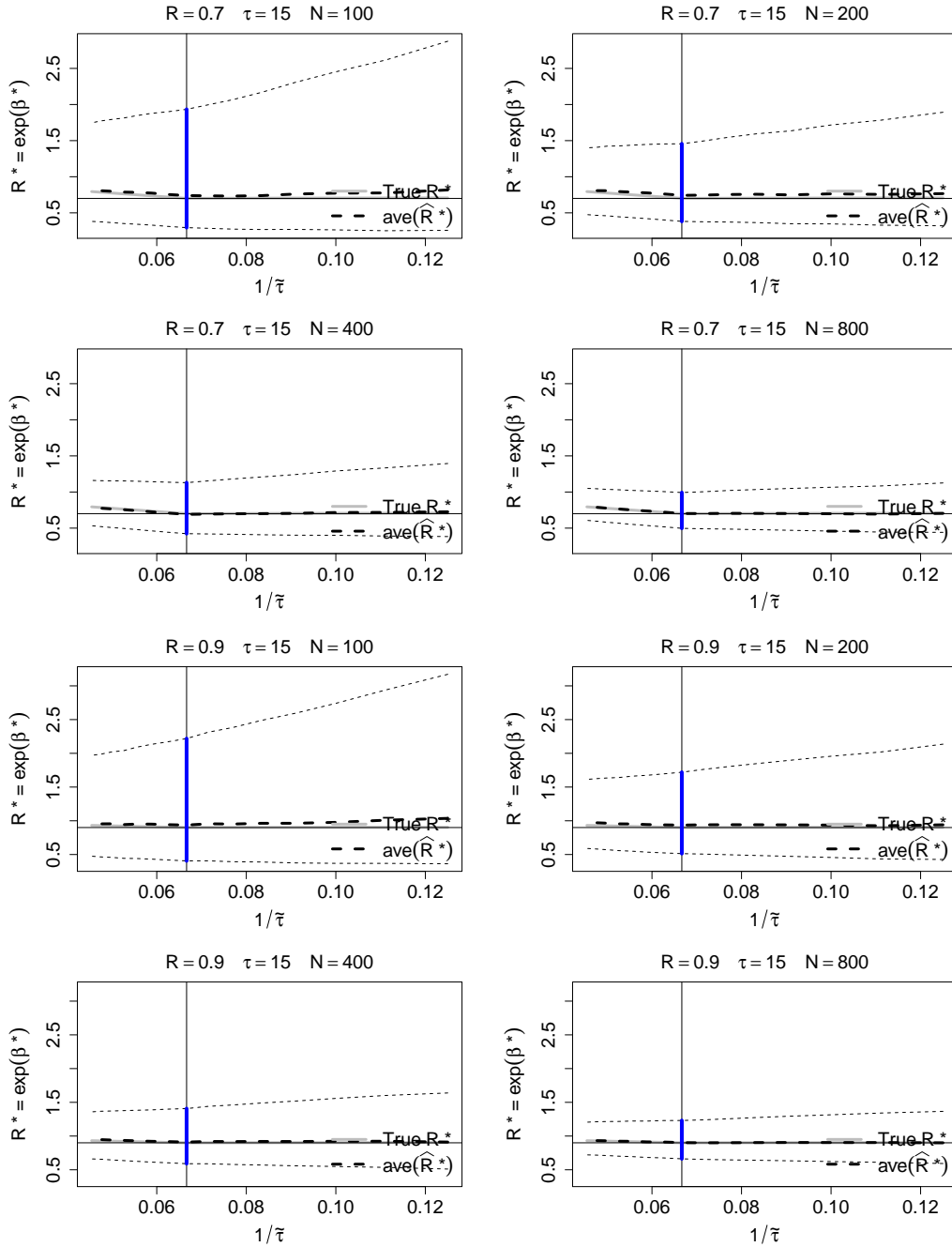


Figure 28: **Multiple Normally distributed exposures with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages ($\text{ave}(\hat{R}^*)$) over 200 simulated datasets. The true risk length is $\tau = 15$; $R = 0.7$ and 0.9 displayed in the top and bottom panels, respectively.

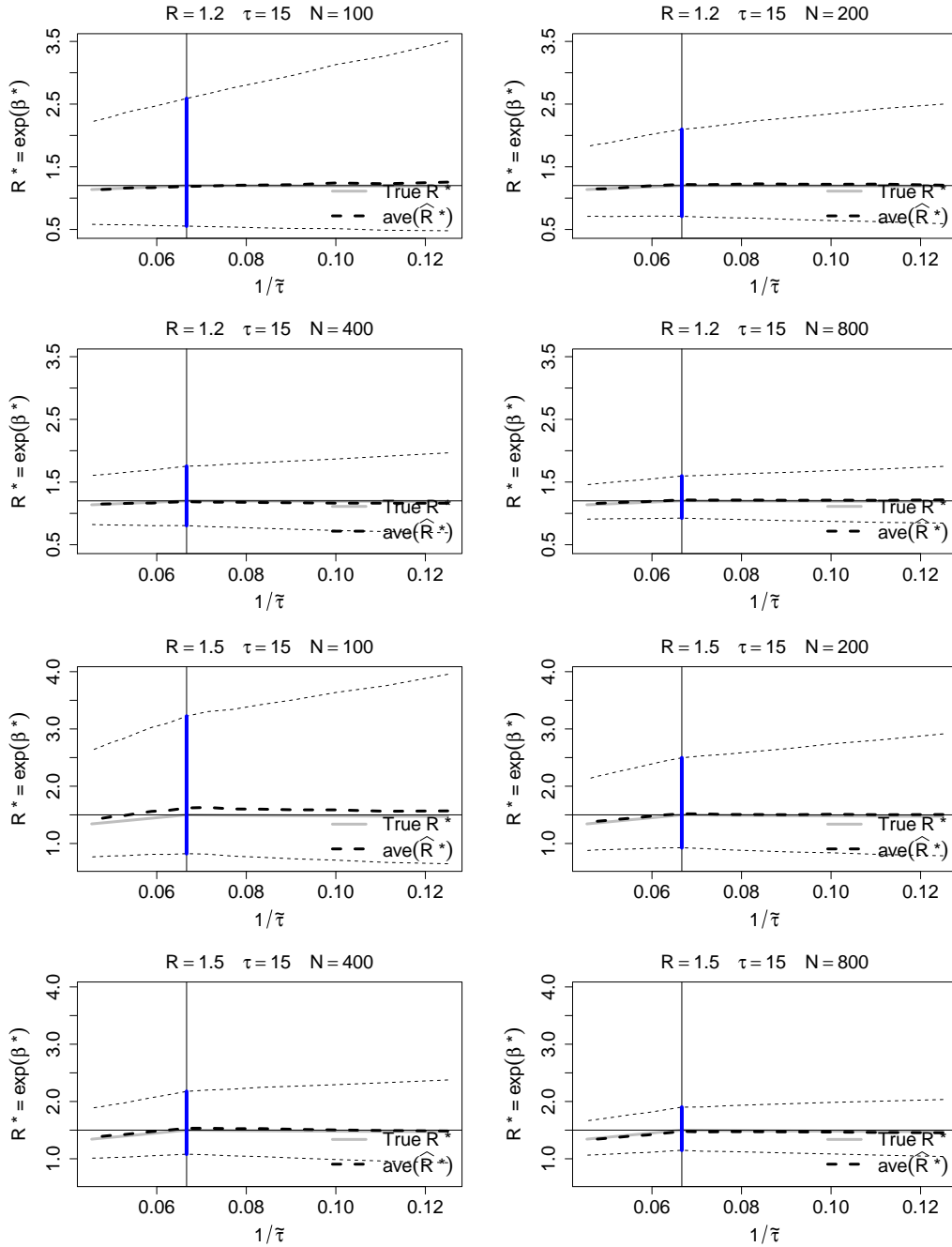


Figure 29: **Multiple Normally distributed exposures with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages ($\text{ave}(\hat{R}^*)$) over 200 simulated datasets. The true risk length is $\tau = 15$. $R = 1.2$ and 1.5 displayed in the top and bottom panels, respectively.

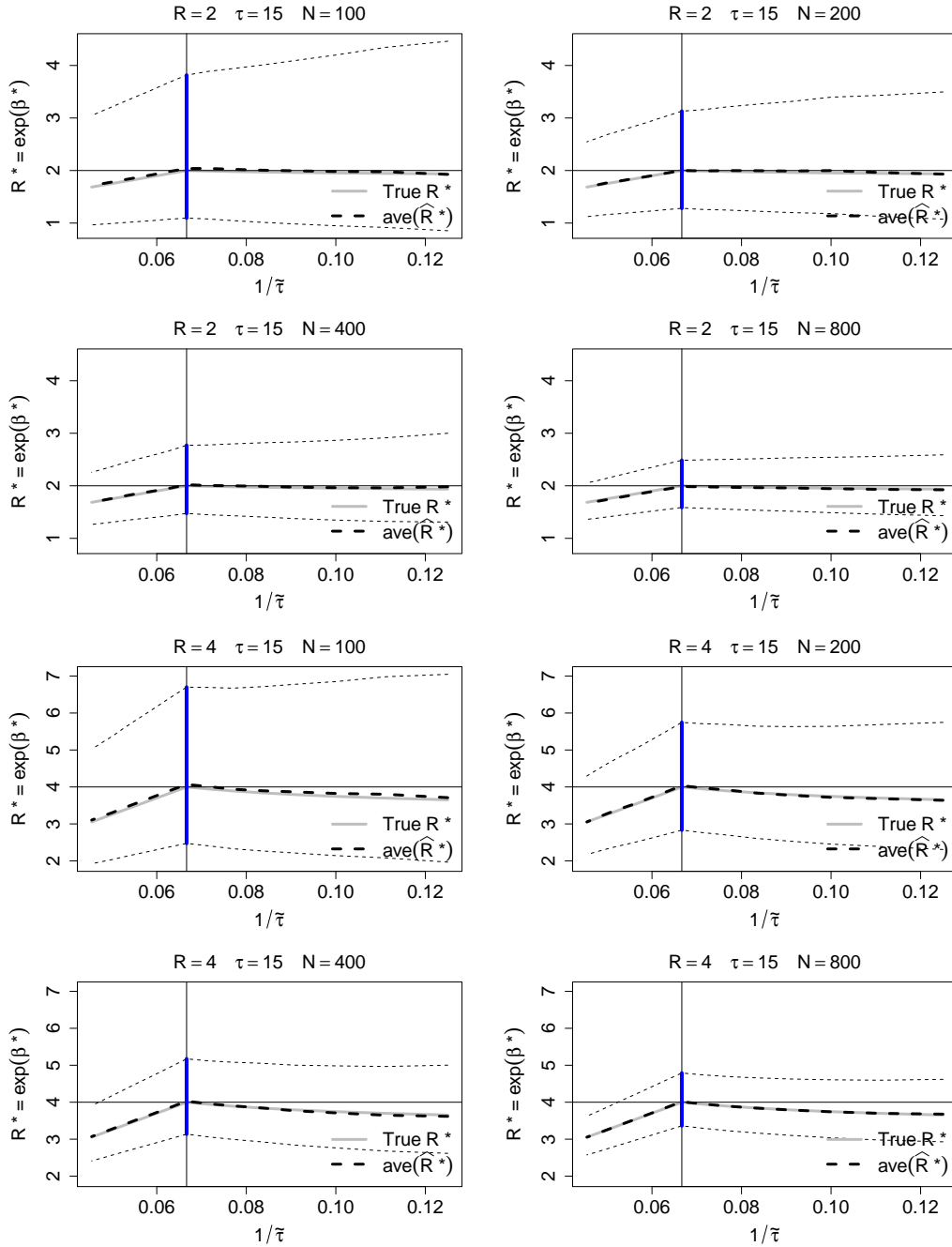


Figure 30: **Multiple Normally distributed exposures with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages ($\text{ave}(\hat{R}^*)$) over 200 simulated datasets. The true risk length is $\tau = 15$. $R = 2$ and 4 displayed in the top and bottom panels, respectively.

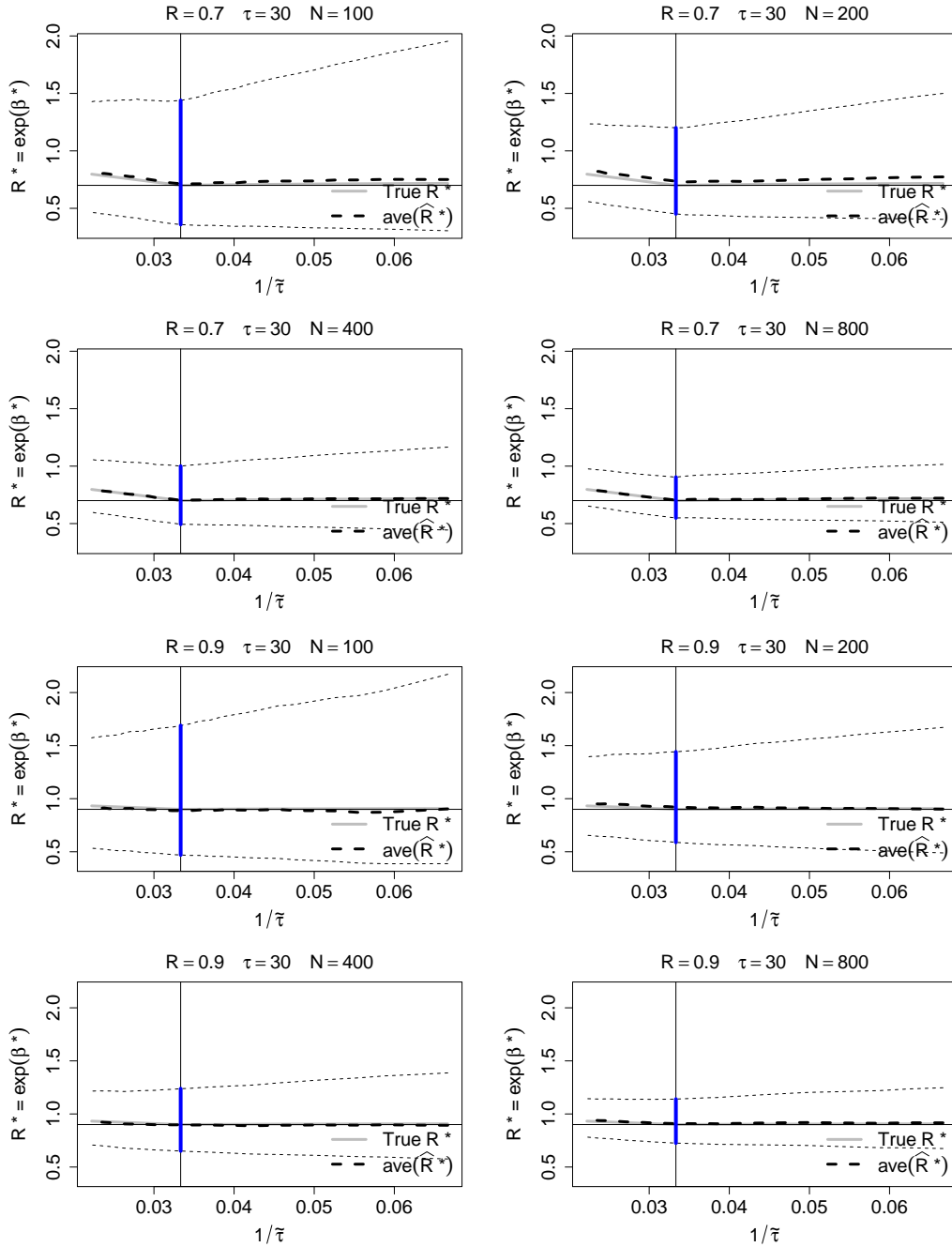


Figure 31: **Multiple Normally distributed exposures with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages ($\text{ave}(\hat{R}^*)$) over 200 simulated datasets. The true risk length is $\tau = 30$; $R = 0.7$ and 0.9 displayed in the top and bottom panels, respectively.

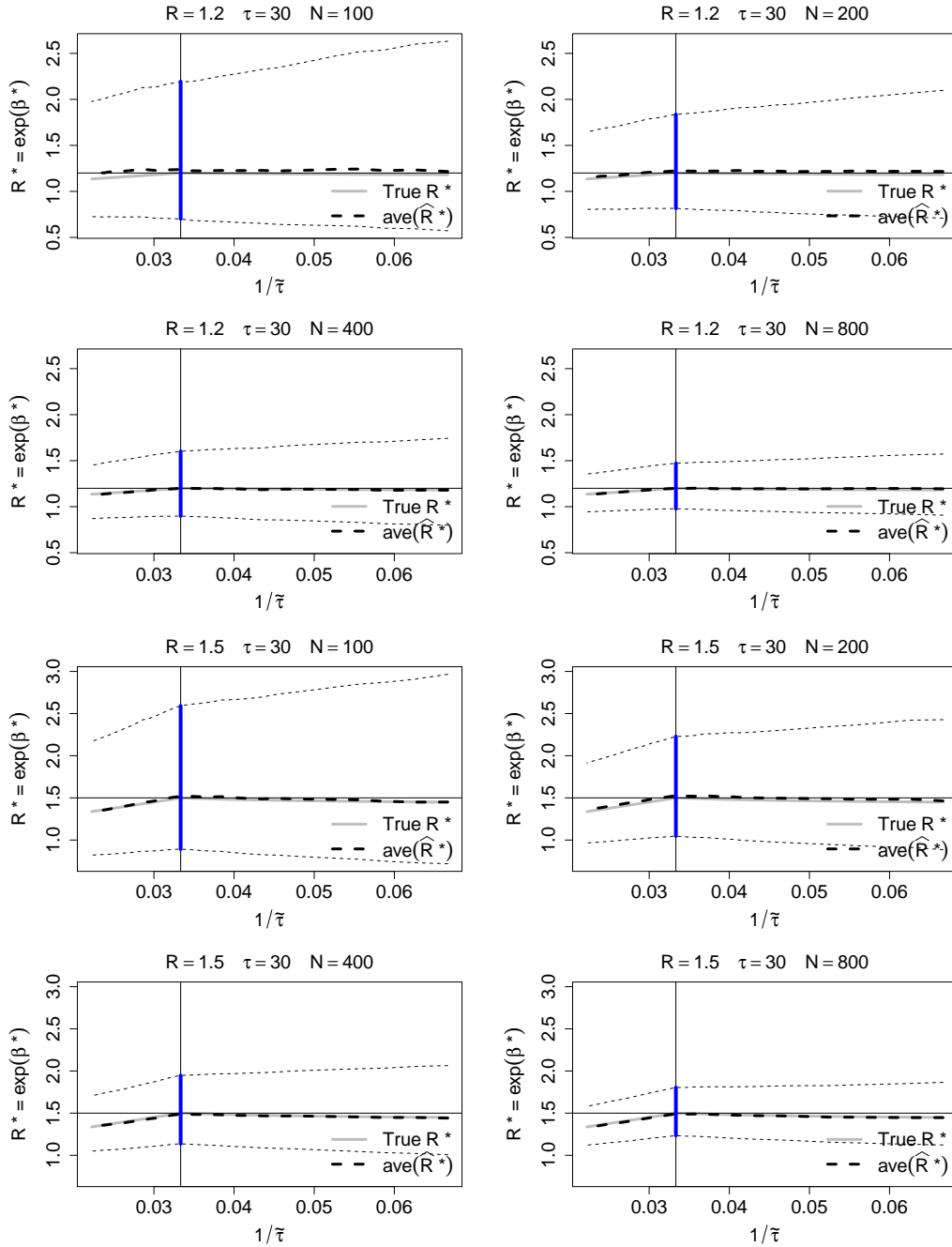


Figure 32: **Multiple Normally distributed exposures with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages ($\text{ave}(\hat{R}^*)$) over 200 simulated datasets. The true risk length is $\tau = 30$. $R = 1.2$ and 1.5 displayed in the top and bottom panels, respectively.

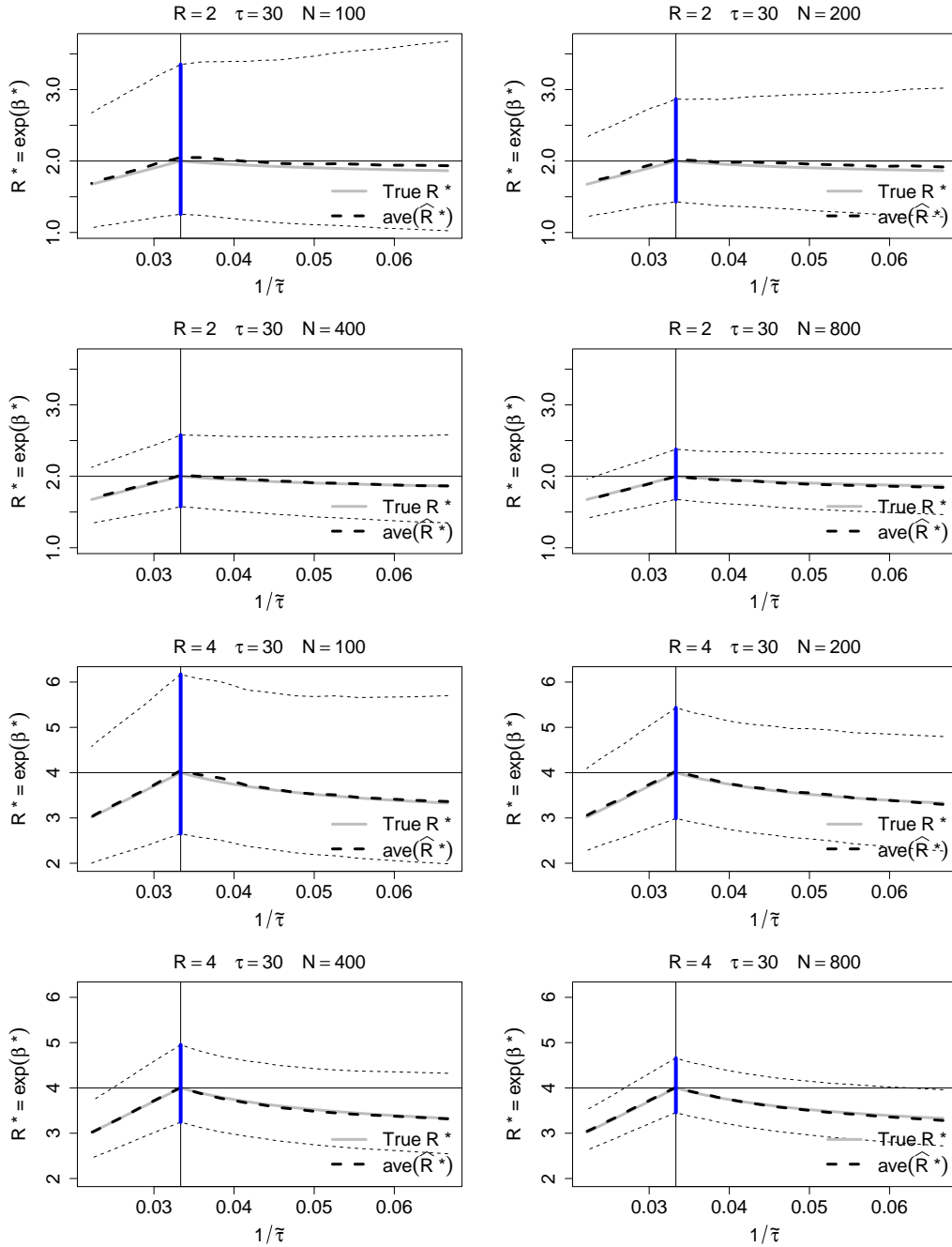


Figure 33: **Multiple Normally distributed exposures with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages ($\text{ave}(\hat{R}^*)$) over 200 simulated datasets. The true risk length is $\tau = 30$. $R = 2$ and 4 displayed in the top and bottom panels, respectively.

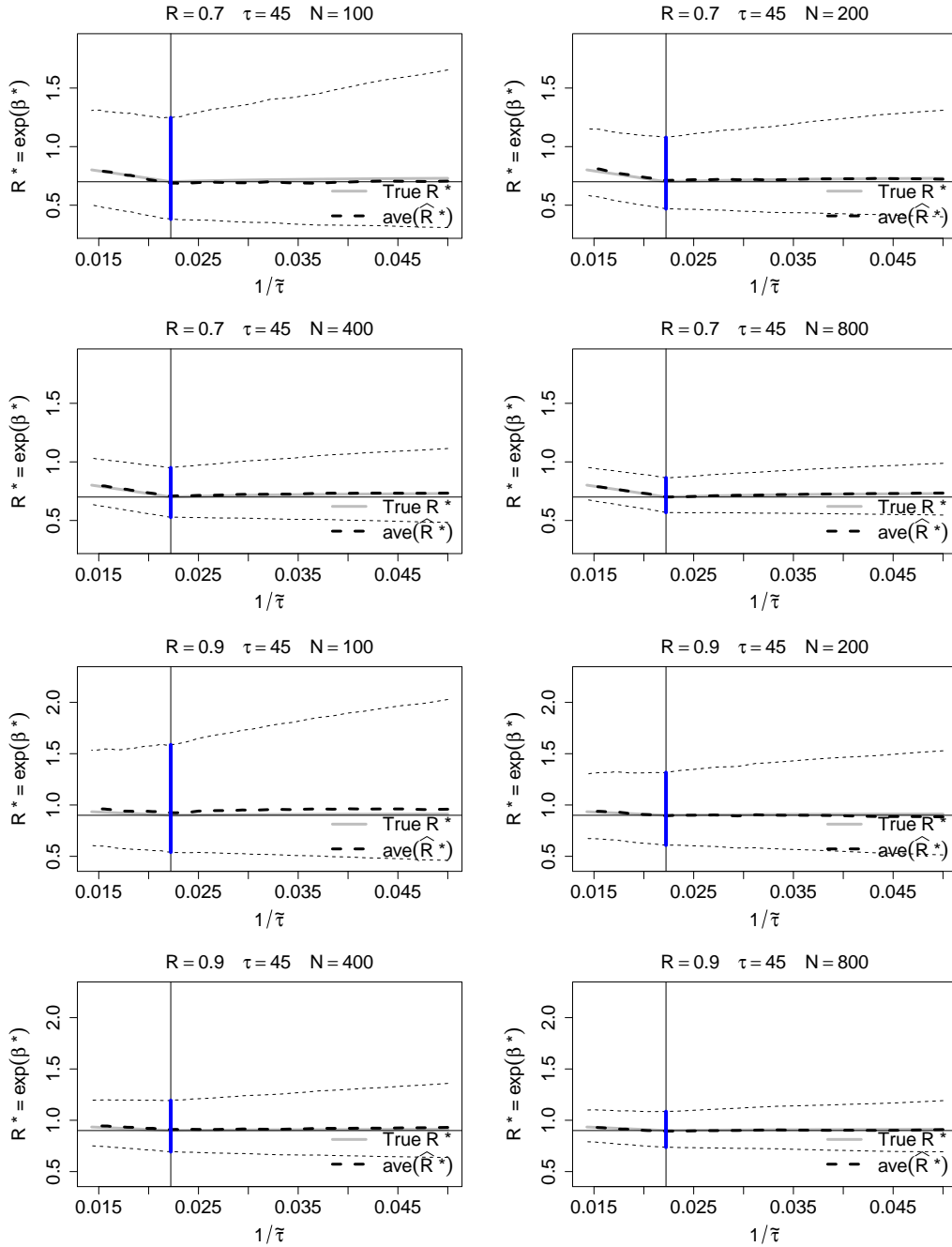


Figure 34: **Multiple Normally distributed exposures with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages ($\text{ave}(\hat{R}^*)$) over 200 simulated datasets. The true risk length is $\tau = 45$; $R = 0.7$ and 0.9 displayed in the top and bottom panels, respectively.

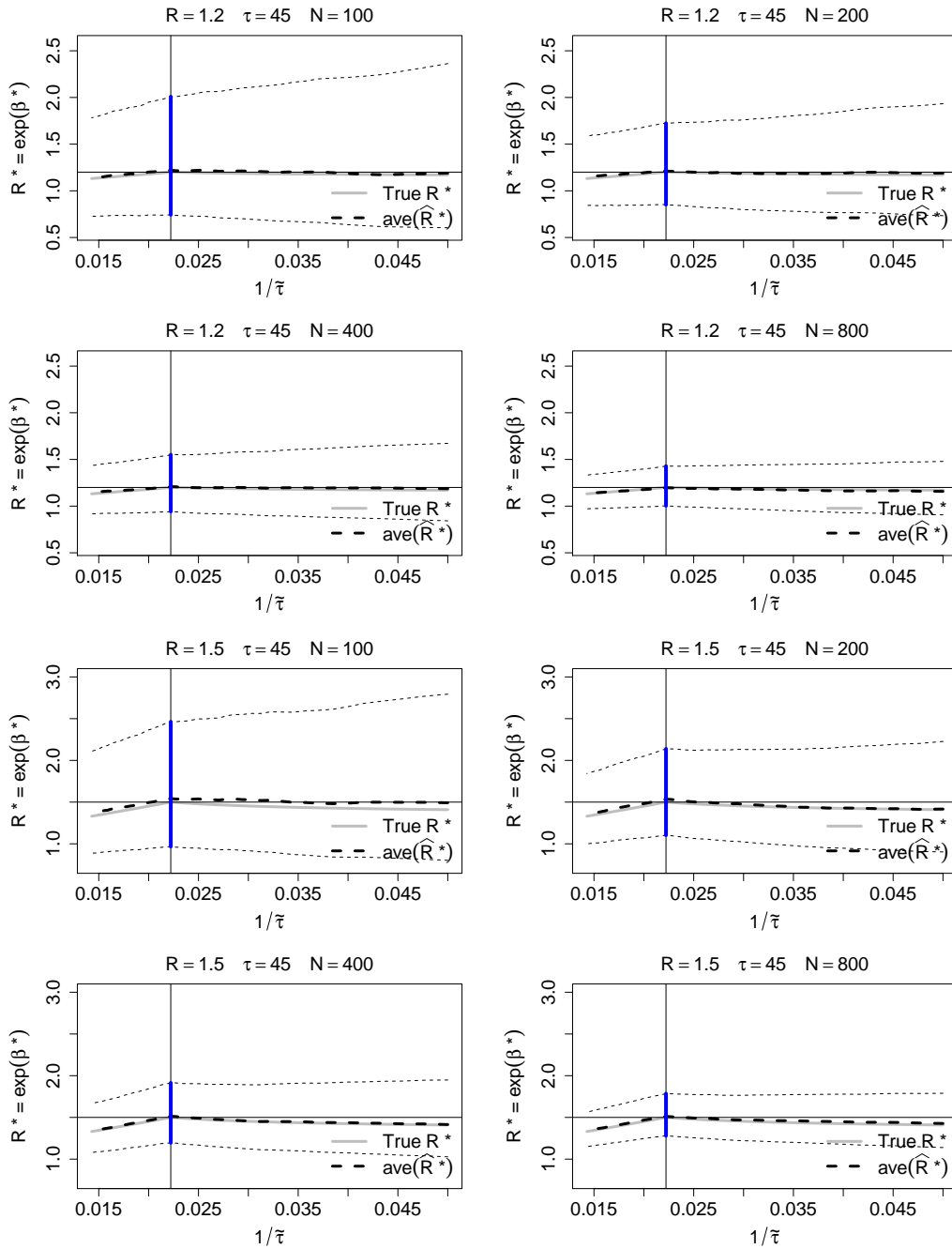


Figure 35: **Multiple Normally distributed exposures with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages ($\text{ave}(\hat{R}^*)$) over 200 simulated datasets. The true risk length is $\tau = 45$. $R = 1.2$ and 1.5 displayed in the top and bottom panels, respectively.

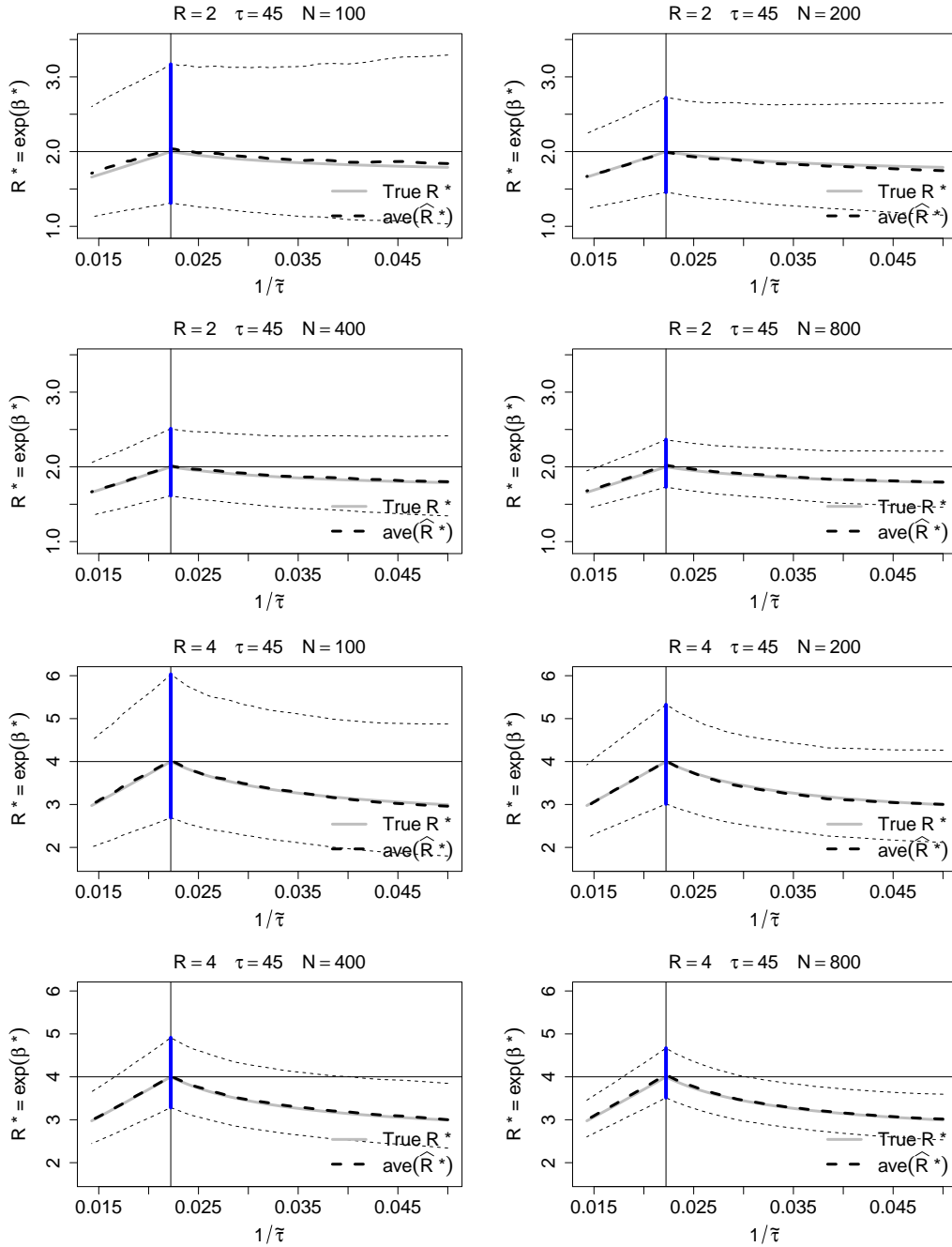


Figure 36: **Multiple Normally distributed exposures with no age effects.** Theoretical characterization of bias (solid gray) in the relative incidence estimate for varying (mis)specified risk period length, $\tilde{\tau}$. Dashed black curve denotes the naive SCCS estimate for a given risk period length along with 95% confidence interval; given are averages ($\text{ave}(\hat{R}^*)$) over 200 simulated datasets. The true risk length is $\tau = 45$. $R = 2$ and 4 displayed in the top and bottom panels, respectively.