

Simulation Result 1: $C \sim \text{Exp}(0.2)$

Y_i

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Table 1: Summary of the estimated SAUC for Biomarker1 when the true censoring is distributed as $Exp(0.2)$.

| Patients | N | Method | $p = 0.7$ | $p = 0.5$ | $p = 0.3$ |
|----------|-----|-----------------|---------------------|----------------------|----------------------|
| | | | Median (Q1, Q3) | Median (Q1, Q3) | Median (Q1, Q3) |
| 50-150 | 20 | HZ _P | 0.00 (73.32, 76.39) | 0.00 (73.57, 75.97) | 0.00 (73.67, 75.65) |
| | | HZ _O | 1.11 (74.27, 78.11) | 1.70 (74.53, 78.27) | 3.72 (75.47, 80.57) |
| | | Proposed | 0.62 (73.35, 77.91) | -0.13 (72.35, 76.97) | -1.54 (70.04, 76.82) |
| | | Succuess | 99.6 | 99.1 | 96.6 |
| | 30 | HZ _P | 0.00 (73.56, 75.96) | 0.00 (73.60, 75.73) | 0.00 (73.84, 75.42) |
| | | HZ _O | 1.14 (74.40, 77.38) | 1.72 (74.84, 77.92) | 3.06 (75.42, 79.64) |
| | | Proposed | 0.37 (73.56, 77.10) | 0.03 (72.77, 76.60) | -1.61 (70.38, 75.78) |
| | | Succuess | 100 | 99.8 | 98.6 |
| | 50 | HZ _P | 0.00 (73.66, 75.57) | 0.00 (73.74, 75.33) | 0.00 (73.86, 75.17) |
| | | HZ _O | 1.10 (74.52, 76.90) | 1.51 (74.89, 77.23) | 3.10 (75.97, 78.95) |
| | | Proposed | 0.45 (73.55, 76.48) | -0.19 (72.87, 76.06) | -1.19 (71.29, 75.60) |
| | | Succuess | 99.9 | 100 | 99.1 |
| | 100 | HZ _P | 0.00 (73.81, 75.23) | 0.00 (73.94, 75.02) | 0.00 (73.99, 74.81) |
| | | HZ _O | 1.04 (74.74, 76.43) | 1.59 (75.33, 76.96) | 2.87 (76.19, 78.22) |
| | | Proposed | 0.50 (73.95, 76.19) | 0.09 (73.40, 75.80) | -0.86 (71.66, 75.08) |
| | | Succuess | 100 | 99.9 | 100 |
| | 20 | HZ _P | 0.00 (74.78, 77.07) | 0.00 (74.91, 76.94) | 0.00 (75.04, 76.59) |
| | | HZ _O | 0.92 (75.30, 78.29) | 1.55 (75.76, 78.97) | 3.15 (77.01, 80.92) |
| | | Proposed | 0.18 (73.65, 78.14) | -0.46 (72.87, 77.73) | -2.10 (69.96, 76.58) |
| | | Succuess | 99.5 | 99.2 | 58.5 |
| | 30 | HZ _P | 0.00 (75.01, 76.87) | 0.00 (75.00, 76.59) | 0.00 (75.07, 76.28) |
| | | HZ _O | 0.74 (75.58, 78.00) | 1.31 (75.79, 78.46) | 2.86 (76.73, 80.25) |
| | | Proposed | 0.08 (74.36, 77.60) | -0.12 (73.71, 77.36) | -2.08 (70.00, 76.12) |
| | | Succuess | 99.8 | 99.3 | 56.6 |
| | 50 | HZ _P | 0.00 (74.93, 76.40) | 0.00 (74.98, 76.19) | 0.00 (75.15, 76.18) |
| | | HZ _O | 0.78 (75.52, 77.38) | 1.14 (75.76, 77.79) | 2.59 (76.82, 79.75) |
| | | Proposed | 0.38 (74.82, 77.28) | 0.02 (74.24, 76.86) | -1.36 (71.77, 76.43) |
| | | Succuess | 100 | 99.9 | 54.8 |
| | 100 | HZ _P | 0.00 (73.81, 75.23) | 0.00 (73.94, 75.02) | 0.00 (73.99, 74.81) |
| | | HZ _O | 1.04 (74.74, 76.43) | 1.59 (75.33, 76.96) | 2.87 (76.19, 78.22) |
| | | Proposed | 0.50 (73.95, 76.19) | 0.09 (73.40, 75.80) | -0.86 (71.66, 75.08) |
| | | Succuess | 100 | 99.9 | 100 |

Median with 25th and 75th empirical quartiles (Q1, Q3) of the SAUC at $t = 2$ are reported. N denotes the number of the published studies. Proposed denotes the proposed sensitivity analysis method; HZ_P denotes the HZ model using the population (published and unpublished) studies; HZ_O denotes the HZ model using the observed (published) studies. CR denotes the proportion of convergence among 1000 repetition All the entries are multiplied by 100.

Table 2: Summary of the estimated SAUC for Biomarker2 when the true censoring is distributed as $Exp(0.2)$.

| Patients | N | Method | $p = 0.7$ | $p = 0.5$ | $p = 0.3$ |
|----------|--------|-----------------|----------------------|----------------------|----------------------|
| | | | Median (Q1, Q3) | Median (Q1, Q3) | Median (Q1, Q3) |
| 50-150 | 20 | HZ _P | 0.00 (56.68, 58.72) | 0.00 (56.85, 58.57) | 0.00 (57.08, 58.37) |
| | | HZ _O | 0.61 (57.05, 59.51) | 1.53 (57.88, 60.58) | 3.57 (59.27, 62.95) |
| | | Proposed | -0.16 (55.95, 58.91) | -1.01 (55.02, 58.45) | -1.30 (54.27, 60.13) |
| | | Success | 99.8 | 99.8 | 98.9 |
| | 30 | HZ _P | 0.00 (56.93, 58.46) | 0.00 (57.07, 58.44) | 0.00 (57.19, 58.24) |
| | | HZ _O | 0.65 (57.28, 59.32) | 1.51 (58.24, 60.22) | 3.70 (59.81, 62.91) |
| | | Proposed | -0.29 (56.21, 58.53) | -1.33 (55.09, 57.86) | -1.99 (54.00, 58.77) |
| | | Success | 99.8 | 100 | 100 |
| | 50 | HZ _P | 0.00 (57.12, 58.36) | 0.00 (57.16, 58.24) | 0.00 (57.34, 58.14) |
| | | HZ _O | 0.73 (57.65, 59.17) | 1.49 (58.35, 59.94) | 3.46 (60.09, 62.34) |
| | | Proposed | -0.32 (56.48, 58.28) | -1.59 (55.19, 57.03) | -2.65 (53.94, 56.40) |
| | | Success | 100 | 100 | 99.9 |
| | 100 | HZ _P | 0.00 (57.25, 58.18) | 0.00 (57.36, 58.09) | 0.00 (57.46, 58.03) |
| | | HZ _O | 0.67 (57.89, 58.93) | 1.38 (58.57, 59.67) | 3.51 (60.45, 62.05) |
| | | Proposed | -0.52 (56.57, 57.88) | -1.72 (55.42, 56.64) | -2.96 (54.01, 55.65) |
| | | Success | 99.9 | 100 | 99.9 |
| | 50-300 | HZ _P | 0.00 (57.15, 58.63) | 0.00 (57.29, 58.56) | 0.00 (57.44, 58.43) |
| | | HZ _O | 0.79 (57.71, 59.59) | 1.54 (58.38, 60.38) | 3.34 (59.87, 62.56) |
| | | Proposed | -0.14 (56.76, 58.76) | -0.58 (55.90, 58.75) | -0.02 (55.35, 61.22) |
| | | Success | 99.3 | 99.5 | 98 |
| | | HZ _P | 0.00 (57.30, 58.55) | 0.00 (57.38, 58.45) | 0.00 (57.49, 58.27) |
| | | HZ _O | 0.77 (57.92, 59.43) | 1.50 (58.59, 60.15) | 3.22 (59.94, 62.16) |
| | | Proposed | -0.23 (56.78, 58.51) | -0.79 (55.93, 58.20) | -1.12 (55.09, 60.62) |
| | | Success | 98.9 | 99.5 | 97.8 |
| | | HZ _P | 0.00 (57.38, 58.37) | 0.00 (57.51, 58.33) | 0.00 (57.60, 58.21) |
| | | HZ _O | 0.74 (58.00, 59.13) | 1.49 (58.83, 60.01) | 3.23 (60.30, 61.93) |
| | | Proposed | -0.35 (56.80, 58.18) | -0.99 (56.16, 57.76) | -1.78 (54.82, 58.83) |
| | | Success | 99.2 | 99.4 | 98.4 |
| | 100 | HZ _P | 0.00 (57.25, 58.18) | 0.00 (57.36, 58.09) | 0.00 (57.46, 58.03) |
| | | HZ _O | 0.67 (57.89, 58.93) | 1.38 (58.57, 59.67) | 3.51 (60.45, 62.05) |
| | | Proposed | -0.52 (56.57, 57.88) | -1.72 (55.42, 56.64) | -2.96 (54.01, 55.65) |
| | | Success | 99.9 | 100 | 99.9 |

Median with 25th and 75th empirical quartiles (Q1, Q3) of the SAUC at $t = 2$ are reported. N denotes the number of the published studies. Proposed denotes the proposed sensitivity analysis method; HZ_P denotes the HZ model using the population (published and unpublished) studies; HZ_O denotes the HZ model using the observed (published) studies. CR denotes the proportion of convergence among 1000 repetition All the entries are multiplied by 100.

Table 3: Summary of the estimated SAUC for Biomarker1 when the true censoring is distributed as $U(1, 4)$, but a misspecified exponential distribution is fitted.

| Patients | N | Method | $p = 0.7$ | $p = 0.5$ | $p = 0.3$ |
|----------|--------|-----------------|---------------------|----------------------|----------------------|
| | | | Median (Q1, Q3) | Median (Q1, Q3) | Median (Q1, Q3) |
| 50-150 | 20 | HZ _P | 0.00 (73.89, 76.74) | 0.00 (73.80, 76.42) | 0.00 (73.99, 75.85) |
| | | HZ _O | 1.01 (74.44, 78.03) | 1.76 (74.98, 78.94) | 3.55 (76.12, 80.89) |
| | | Proposed | 0.91 (74.04, 78.41) | 0.44 (73.05, 77.97) | -1.61 (70.22, 76.79) |
| | | Succuess | 100 | 99.1 | 98.4 |
| | 30 | HZ _P | 0.00 (73.86, 76.22) | 0.00 (73.95, 75.90) | 0.00 (74.13, 75.57) |
| | | HZ _O | 1.24 (74.75, 77.70) | 1.73 (75.20, 78.06) | 3.25 (76.14, 80.12) |
| | | Proposed | 1.11 (74.37, 78.31) | 0.08 (73.04, 77.31) | -1.76 (70.41, 76.01) |
| | | Succuess | 100 | 99.3 | 99.1 |
| | 50 | HZ _P | 0.00 (73.99, 75.83) | 0.00 (74.08, 75.52) | 0.00 (74.15, 75.29) |
| | | HZ _O | 0.98 (74.90, 77.10) | 1.54 (75.33, 77.50) | 2.84 (76.20, 79.14) |
| | | Proposed | 0.91 (74.43, 77.49) | 0.19 (73.37, 76.86) | -1.83 (70.76, 75.07) |
| | | Succuess | 99.9 | 99.7 | 99.6 |
| | 100 | HZ _P | 0.00 (74.16, 75.42) | 0.00 (74.24, 75.26) | 0.00 (74.34, 75.14) |
| | | HZ _O | 1.01 (75.01, 76.61) | 1.55 (75.47, 77.11) | 2.76 (76.42, 78.50) |
| | | Proposed | 0.99 (74.64, 76.92) | 0.29 (73.78, 76.40) | -1.67 (71.53, 74.93) |
| | | Succuess | 100 | 100 | 99.8 |
| | 50-300 | HZ _P | 0.00 (75.03, 77.25) | 0.00 (75.15, 77.16) | 0.00 (75.20, 76.68) |
| | | HZ _O | 0.85 (75.59, 78.53) | 1.59 (76.01, 79.29) | 2.98 (77.06, 80.85) |
| | | Proposed | 0.76 (74.10, 79.77) | 0.57 (73.32, 79.56) | -2.11 (70.47, 75.98) |
| | | Succuess | 99.8 | 98 | 54.2 |
| | 30 | HZ _P | 0.00 (75.07, 77.03) | 0.00 (75.18, 76.74) | 0.00 (75.21, 76.42) |
| | | HZ _O | 0.85 (75.77, 78.13) | 1.44 (76.05, 78.70) | 3.12 (77.29, 80.30) |
| | | Proposed | 0.74 (74.41, 79.30) | 0.30 (73.67, 78.43) | -2.05 (70.18, 75.64) |
| | | Succuess | 100 | 98.3 | 55.1 |
| | 50 | HZ _P | 0.00 (75.17, 76.62) | 0.00 (75.27, 76.49) | 0.00 (75.34, 76.26) |
| | | HZ _O | 0.79 (75.74, 77.66) | 1.28 (76.16, 78.07) | 2.70 (77.04, 79.91) |
| | | Proposed | 0.72 (74.97, 78.46) | -0.18 (73.84, 77.53) | -2.46 (70.14, 75.32) |
| | | Succuess | 100 | 99.5 | 51 |
| | 100 | HZ _P | 0.00 (74.16, 75.42) | 0.00 (74.24, 75.26) | 0.00 (74.34, 75.14) |
| | | HZ _O | 1.01 (75.01, 76.61) | 1.55 (75.47, 77.11) | 2.76 (76.42, 78.50) |
| | | Proposed | 0.99 (74.64, 76.92) | 0.29 (73.78, 76.40) | -1.67 (71.53, 74.93) |
| | | Succuess | 100 | 100 | 99.8 |

Median with 25th and 75th empirical quartiles (Q1, Q3) of the SAUC at $t = 2$ are reported. N denotes the number of the published studies. Proposed denotes the proposed sensitivity analysis method; HZ_P denotes the HZ model using the population (published and unpublished) studies; HZ_O denotes the HZ model using the observed (published) studies. CR denotes the proportion of convergence among 1000 repetition All the entries are multiplied by 100.

Table 4: Summary of the estimated SAUC for Biomarker2 when the true censoring is distributed as $U(1, 4)$, but a misspecified exponential distribution is fitted.

| Patients | N | Method | $p = 0.7$ | $p = 0.5$ | $p = 0.3$ |
|----------|-----|-----------------|----------------------|----------------------|----------------------|
| | | | Median (Q1, Q3) | Median (Q1, Q3) | Median (Q1, Q3) |
| 50-150 | 20 | HZ _P | 0.00 (56.84, 58.76) | 0.00 (57.00, 58.60) | 0.00 (57.26, 58.42) |
| | | HZ _O | 0.95 (57.67, 59.93) | 1.87 (58.42, 60.98) | 4.47 (60.50, 64.06) |
| | | Proposed | -0.16 (56.23, 59.05) | -1.05 (55.20, 58.49) | -0.97 (54.22, 61.60) |
| | | Success | 99.8 | 100 | 99.6 |
| | 30 | HZ _P | 0.00 (57.02, 58.60) | 0.00 (57.10, 58.34) | 0.00 (57.31, 58.27) |
| | | HZ _O | 1.05 (57.89, 59.72) | 2.00 (58.82, 60.83) | 4.56 (60.86, 63.78) |
| | | Proposed | -0.09 (56.40, 58.76) | -1.22 (55.26, 58.01) | -1.96 (54.12, 60.06) |
| | | Success | 99.9 | 99.9 | 99.9 |
| | 50 | HZ _P | 0.00 (57.19, 58.34) | 0.00 (57.31, 58.33) | 0.00 (57.46, 58.20) |
| | | HZ _O | 1.01 (58.02, 59.48) | 1.97 (59.02, 60.53) | 4.50 (61.26, 63.30) |
| | | Proposed | -0.22 (56.57, 58.26) | -1.33 (55.48, 57.43) | -2.63 (53.78, 57.21) |
| | | Success | 100 | 100 | 99.9 |
| | 100 | HZ _P | 0.00 (57.40, 58.22) | 0.00 (57.47, 58.14) | 0.00 (57.54, 58.07) |
| | | HZ _O | 0.98 (58.31, 59.32) | 2.01 (59.28, 60.33) | 4.39 (61.42, 62.95) |
| | | Proposed | -0.46 (56.78, 57.93) | -1.49 (55.73, 57.01) | -3.10 (53.64, 55.92) |
| | | Success | 100 | 100 | 99.7 |
| | 20 | HZ _P | 0.00 (57.15, 58.65) | 0.00 (57.31, 58.51) | 0.00 (57.45, 58.45) |
| | | HZ _O | 0.99 (58.00, 59.81) | 1.94 (58.90, 60.77) | 3.79 (60.47, 62.84) |
| | | Proposed | -0.10 (56.79, 59.04) | -0.28 (56.34, 59.10) | 0.41 (56.16, 61.31) |
| | | Success | 99.6 | 99.6 | 98.3 |
| | 30 | HZ _P | 0.00 (57.39, 58.57) | 0.00 (57.48, 58.45) | 0.00 (57.59, 58.33) |
| | | HZ _O | 0.95 (58.29, 59.67) | 1.89 (59.12, 60.63) | 3.83 (60.82, 62.68) |
| | | Proposed | -0.22 (56.97, 58.72) | -0.49 (56.45, 58.64) | -0.28 (55.80, 61.24) |
| | | Success | 99.9 | 99.5 | 99.5 |
| | 50 | HZ _P | 0.00 (57.48, 58.39) | 0.00 (57.55, 58.30) | 0.00 (57.64, 58.23) |
| | | HZ _O | 1.01 (58.36, 59.51) | 1.94 (59.30, 60.35) | 3.81 (60.98, 62.47) |
| | | Proposed | -0.24 (56.96, 58.35) | -0.65 (56.49, 58.09) | -0.81 (55.68, 59.81) |
| | | Success | 99.9 | 99.9 | 99.3 |
| | 100 | HZ _P | 0.00 (57.40, 58.22) | 0.00 (57.47, 58.14) | 0.00 (57.54, 58.07) |
| | | HZ _O | 0.98 (58.31, 59.32) | 2.01 (59.28, 60.33) | 4.39 (61.42, 62.95) |
| | | Proposed | -0.46 (56.78, 57.93) | -1.49 (55.73, 57.01) | -3.10 (53.64, 55.92) |
| | | Success | 100 | 100 | 99.7 |

Median with 25th and 75th empirical quartiles (Q1, Q3) of the SAUC at $t = 2$ are reported. N denotes the number of the published studies. Proposed denotes the proposed sensitivity analysis method; HZ_P denotes the HZ model using the population (published and unpublished) studies; HZ_O denotes the HZ model using the observed (published) studies. CR denotes the proportion of convergence among 1000 repetition All the entries are multiplied by 100.