

Simulation Result 1: C~Exp(0.2)

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2023-02-08

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)	CR	Median (Q1, Q3)	CR	Median (Q1, Q3)	CR
50-150	20	HZ _P	75.01 (73.32, 76.39)	99.6	74.82 (73.57, 75.97)	99.1	74.66 (73.67, 75.65)	96.6
		HZ _O	76.12 (74.27, 78.11)	99.6	76.52 (74.53, 78.27)	99.1	78.37 (75.47, 80.57)	96.3
		Prop	75.48 (73.10, 77.71)	63.9	74.96 (72.28, 77.38)	59.9	73.78 (70.19, 77.74)	46.8
	30	HZ _P	74.82 (73.56, 75.96)	100.0	74.78 (73.60, 75.73)	99.8	74.56 (73.84, 75.42)	98.6
		HZ _O	75.96 (74.40, 77.38)	100.0	76.50 (74.84, 77.92)	99.8	77.62 (75.45, 79.64)	98.4
		Prop	75.29 (73.30, 77.14)	73.2	75.11 (72.89, 77.01)	67.8	73.96 (71.13, 76.75)	58.8
	50	HZ _P	74.61 (73.66, 75.57)	99.9	74.59 (73.74, 75.33)	100.0	74.46 (73.86, 75.17)	99.1
		HZ _O	75.71 (74.52, 76.90)	99.9	76.10 (74.89, 77.23)	100.0	77.56 (75.97, 78.95)	99.0
		Prop	75.09 (73.57, 76.51)	82.9	74.60 (72.95, 76.38)	77.0	74.11 (71.92, 76.30)	66.5
	100	HZ _P	74.54 (73.81, 75.23)	100.0	74.50 (73.94, 75.02)	99.9	74.40 (73.99, 74.81)	100.0
		HZ _O	75.57 (74.74, 76.43)	100.0	76.08 (75.33, 76.96)	99.9	77.27 (76.19, 78.22)	100.0
		Prop	75.02 (73.96, 76.26)	91.2	74.64 (73.51, 75.90)	87.8	73.94 (72.31, 75.44)	77.1
50-300	20	HZ _P	75.87 (74.78, 77.07)	99.5	75.96 (74.91, 76.94)	99.2	75.82 (75.04, 76.59)	58.5
		HZ _O	76.79 (75.30, 78.29)	99.5	77.51 (75.76, 78.97)	99.2	78.98 (77.01, 80.92)	58.5
		Prop	75.73 (72.97, 77.61)	61.7	75.34 (71.77, 77.40)	56.8	75.24 (67.89, 77.83)	19.3
	30	HZ _P	75.97 (75.01, 76.87)	99.8	75.81 (75.00, 76.59)	99.3	75.64 (75.07, 76.28)	56.6
		HZ _O	76.71 (75.58, 78.00)	99.8	77.12 (75.79, 78.46)	99.3	78.51 (76.73, 80.25)	56.6
		Prop	75.88 (74.15, 77.50)	70.5	75.71 (73.62, 77.28)	67.0	75.61 (72.77, 78.26)	20.8
	50	HZ _P	75.67 (74.93, 76.40)	100.0	75.59 (74.98, 76.19)	99.9	75.65 (75.15, 76.18)	54.8
		HZ _O	76.45 (75.52, 77.38)	100.0	76.73 (75.76, 77.79)	99.9	78.25 (76.82, 79.75)	54.8
		Prop	75.97 (74.82, 77.24)	79.7	75.65 (74.35, 76.89)	74.5	75.70 (73.83, 77.44)	26.1
	100	HZ _P	75.58 (75.07, 76.14)	100.0	75.52 (75.10, 76.00)	100.0	75.51 (75.13, 75.88)	51.3
		HZ _O	76.28 (75.59, 76.94)	100.0	76.64 (75.92, 77.29)	100.0	77.74 (76.71, 78.77)	51.3
		Prop	75.88 (75.09, 76.70)	86.4	75.70 (74.85, 76.59)	73.7	75.53 (74.23, 76.64)	28.4

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. Prop 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 only the observed (published) studies. CR denotes the proportion of successfully converged estimates 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)	CR	Median (Q1, Q3)	CR	Median (Q1, Q3)	CR
50-150	20	HZ _P	57.65 (56.67, 58.73)	99.1	57.76 (56.85, 58.57)	99.5	57.75 (57.08, 58.37)	98.6
		HZ _O	58.26 (57.05, 59.51)	99.2	59.27 (57.88, 60.58)	98.9	61.32 (59.29, 62.95)	97.9
		Prop	57.63 (56.11, 59.03)	78.7	56.92 (55.27, 58.88)	75.1	57.37 (54.85, 61.24)	70.0
	30	HZ _P	57.67 (56.93, 58.46)	99.5	57.72 (57.07, 58.44)	99.8	57.73 (57.19, 58.24)	100.0
		HZ _O	58.32 (57.28, 59.33)	99.1	59.23 (58.24, 60.24)	99.2	61.43 (59.81, 62.90)	98.8
		Prop	57.47 (56.22, 58.64)	83.5	56.53 (55.19, 58.08)	83.3	56.16 (54.30, 60.57)	76.7
	50	HZ _P	57.75 (57.12, 58.36)	99.9	57.71 (57.16, 58.24)	100.0	57.75 (57.34, 58.14)	99.9
		HZ _O	58.48 (57.67, 59.17)	99.7	59.19 (58.36, 59.94)	99.6	61.21 (60.08, 62.34)	99.1
		Prop	57.45 (56.52, 58.32)	88.1	56.15 (55.22, 57.10)	89.2	55.17 (54.12, 56.73)	82.5
	100	HZ _P	57.73 (57.25, 58.18)	99.9	57.73 (57.36, 58.09)	100.0	57.75 (57.46, 58.03)	99.9
		HZ _O	58.40 (57.89, 58.93)	99.9	59.10 (58.57, 59.67)	100.0	61.26 (60.45, 62.06)	99.8
		Prop	57.23 (56.59, 57.88)	94.2	56.02 (55.43, 56.65)	96.2	54.80 (54.05, 55.66)	93.6
50-300	20	HZ _P	57.91 (57.15, 58.63)	98.9	57.92 (57.29, 58.56)	99.4	57.88 (57.44, 58.43)	98.0
		HZ _O	58.68 (57.71, 59.59)	99.0	59.46 (58.37, 60.38)	99.2	61.20 (59.86, 62.55)	97.3
		Prop	57.81 (56.88, 58.79)	64.7	57.56 (56.07, 59.15)	66.0	59.62 (55.91, 62.10)	65.3
	30	HZ _P	57.90 (57.30, 58.55)	98.9	57.89 (57.38, 58.45)	99.5	57.87 (57.49, 58.27)	97.8
		HZ _O	58.67 (57.93, 59.43)	98.7	59.39 (58.60, 60.15)	99.2	61.10 (59.95, 62.16)	97.4
		Prop	57.74 (56.89, 58.60)	71.4	57.14 (56.04, 58.34)	73.4	57.57 (55.30, 61.31)	71.8
	50	HZ _P	57.84 (57.38, 58.37)	99.2	57.93 (57.51, 58.33)	99.4	57.93 (57.60, 58.21)	98.4
		HZ _O	58.58 (58.00, 59.13)	99.2	59.42 (58.83, 60.01)	99.4	61.16 (60.30, 61.93)	98.4
		Prop	57.54 (56.85, 58.21)	79.2	56.94 (56.15, 57.78)	81.7	56.37 (54.94, 60.64)	78.7
	100	HZ _P	57.93 (57.60, 58.28)	99.6	57.92 (57.61, 58.20)	99.9	57.89 (57.69, 58.11)	98.2
		HZ _O	58.64 (58.23, 59.08)	99.6	59.35 (58.93, 59.77)	99.9	61.06 (60.51, 61.65)	98.2
		Prop	57.47 (57.04, 57.98)	84.4	56.78 (56.28, 57.29)	83.7	55.57 (54.59, 57.40)	78.8

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. Prop 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 only the observed (published) studies. CR denotes the proportion of successfully converged estimates 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)	CR	Median (Q1, Q3)	CR	Median (Q1, Q3)	CR
50-150	20	HZ _P	75.34 (73.89, 76.74)	100.0	75.06 (73.80, 76.42)	99.1	74.97 (73.99, 75.85)	98.4
		HZ _O	76.36 (74.45, 78.03)	99.9	76.82 (74.98, 78.94)	99.1	78.51 (76.11, 80.88)	98.3
		Prop	75.59 (73.37, 78.12)	41.5	75.41 (72.80, 78.08)	39.6	73.31 (69.64, 77.41)	32.2
	30	HZ _P	75.04 (73.86, 76.22)	100.0	74.92 (73.95, 75.90)	99.3	74.83 (74.13, 75.57)	99.1
		HZ _O	76.28 (74.75, 77.70)	100.0	76.65 (75.20, 78.06)	99.3	78.08 (76.14, 80.12)	99.1
		Prop	75.72 (73.74, 78.05)	49.2	74.70 (72.69, 77.04)	42.2	73.74 (71.08, 76.80)	38.4
	50	HZ _P	75.00 (73.99, 75.83)	99.9	74.84 (74.08, 75.52)	99.7	74.77 (74.15, 75.29)	99.6
		HZ _O	75.98 (74.90, 77.10)	99.9	76.39 (75.33, 77.50)	99.7	77.61 (76.20, 79.14)	99.6
		Prop	75.72 (74.08, 77.21)	58.9	74.84 (73.26, 76.52)	52.5	73.68 (71.51, 75.56)	46.2
	100	HZ _P	74.75 (74.16, 75.42)	100.0	74.77 (74.24, 75.26)	100.0	74.76 (74.34, 75.14)	99.8
		HZ _O	75.76 (75.01, 76.61)	100.0	76.32 (75.47, 77.11)	100.0	77.52 (76.42, 78.50)	99.8
		Prop	75.59 (74.50, 76.67)	72.5	75.14 (73.92, 76.38)	64.0	73.66 (72.13, 75.32)	55.2
50-300	20	HZ _P	76.22 (75.03, 77.25)	99.8	76.14 (75.15, 77.16)	98.0	76.03 (75.20, 76.68)	54.2
		HZ _O	77.07 (75.59, 78.53)	99.8	77.72 (76.01, 79.29)	98.0	79.01 (77.06, 80.85)	54.2
		Prop	75.76 (73.61, 78.01)	31.2	75.07 (67.19, 77.43)	30.4	69.64 (34.05, 75.87)	4.7
	30	HZ _P	76.08 (75.07, 77.03)	100.0	75.98 (75.18, 76.74)	98.3	75.84 (75.21, 76.42)	55.1
		HZ _O	76.93 (75.77, 78.13)	100.0	77.42 (76.05, 78.70)	98.3	78.96 (77.29, 80.30)	55.0
		Prop	76.09 (74.48, 77.57)	35.5	75.85 (73.99, 77.17)	30.7	74.32 (35.72, 77.07)	4.3
	50	HZ _P	75.84 (75.17, 76.62)	100.0	75.86 (75.27, 76.49)	99.5	75.79 (75.34, 76.26)	51.0
		HZ _O	76.63 (75.74, 77.66)	100.0	77.14 (76.16, 78.07)	99.5	78.49 (77.04, 79.91)	51.0
		Prop	76.14 (75.04, 77.23)	41.1	75.74 (74.60, 76.89)	34.7	74.26 (72.28, 76.58)	5.6
	100	HZ _P	75.85 (75.32, 76.33)	100.0	75.77 (75.36, 76.23)	99.4	75.74 (75.42, 76.08)	44.9
		HZ _O	76.53 (75.86, 77.13)	100.0	76.90 (76.18, 77.62)	99.4	78.16 (76.91, 79.35)	44.9
		Prop	76.12 (75.35, 76.90)	49.6	75.92 (75.10, 76.75)	42.2	74.62 (73.67, 76.71)	3.5

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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)	CR	Median (Q1, Q3)	CR	Median (Q1, Q3)	CR
50-150	20	HZ _P	57.85 (56.85, 58.76)	99.4	57.80 (57.01, 58.60)	99.4	57.93 (57.26, 58.42)	99.4
		HZ _O	58.80 (57.68, 59.94)	98.2	59.67 (58.42, 60.98)	98.9	62.42 (60.53, 64.08)	98.1
		Prop	57.98 (56.50, 59.30)	55.5	57.40 (55.49, 59.64)	52.7	60.68 (55.19, 63.38)	54.5
	30	HZ _P	57.81 (57.02, 58.60)	99.4	57.78 (57.10, 58.34)	99.8	57.78 (57.31, 58.27)	99.9
		HZ _O	58.86 (57.89, 59.71)	99.6	59.79 (58.82, 60.84)	99.4	62.35 (60.88, 63.76)	98.7
		Prop	57.92 (56.68, 58.95)	61.2	56.86 (55.49, 58.71)	58.0	56.93 (54.49, 62.82)	56.9
	50	HZ _P	57.73 (57.19, 58.34)	100.0	57.81 (57.31, 58.33)	99.9	57.79 (57.46, 58.20)	99.9
		HZ _O	58.74 (58.02, 59.47)	99.9	59.79 (59.02, 60.53)	99.4	62.30 (61.26, 63.30)	99.6
		Prop	57.57 (56.55, 58.37)	66.0	56.51 (55.50, 57.62)	63.1	55.41 (53.93, 61.43)	64.4
	100	HZ _P	57.83 (57.40, 58.22)	100.0	57.82 (57.47, 58.14)	100.0	57.80 (57.54, 58.07)	99.7
		HZ _O	58.81 (58.31, 59.32)	100.0	59.83 (59.28, 60.33)	100.0	62.19 (61.42, 62.95)	99.6
		Prop	57.43 (56.83, 57.95)	64.8	56.37 (55.75, 57.05)	69.6	54.66 (53.53, 55.92)	69.7
50-300	20	HZ _P	57.92 (57.16, 58.66)	99.4	57.89 (57.31, 58.51)	99.3	57.94 (57.45, 58.45)	98.3
		HZ _O	58.91 (58.00, 59.81)	99.5	59.83 (58.91, 60.77)	98.9	61.73 (60.49, 62.83)	96.8
		Prop	57.98 (56.80, 59.20)	41.6	58.15 (56.38, 60.25)	42.8	60.87 (57.56, 62.40)	51.9
	30	HZ _P	57.98 (57.39, 58.57)	99.9	58.02 (57.48, 58.45)	99.5	57.98 (57.59, 58.33)	99.5
		HZ _O	58.93 (58.28, 59.67)	99.8	59.90 (59.12, 60.63)	99.3	61.80 (60.82, 62.68)	99.3
		Prop	57.76 (56.93, 58.84)	46.5	57.53 (56.38, 59.09)	46.1	60.64 (56.10, 62.44)	55.1
	50	HZ _P	57.90 (57.48, 58.39)	99.9	57.93 (57.55, 58.30)	99.9	57.94 (57.64, 58.23)	99.3
		HZ _O	58.91 (58.36, 59.51)	99.9	59.86 (59.30, 60.35)	99.9	61.75 (60.98, 62.47)	99.1
		Prop	57.63 (56.95, 58.35)	49.5	57.14 (56.32, 58.02)	49.4	57.64 (55.66, 61.83)	60.2
	100	HZ _P	57.92 (57.61, 58.25)	100.0	57.94 (57.69, 58.21)	99.9	57.94 (57.73, 58.15)	99.7
		HZ _O	58.89 (58.53, 59.28)	100.0	59.87 (59.47, 60.27)	99.9	61.65 (61.17, 62.18)	99.7
		Prop	57.47 (57.05, 57.90)	54.2	56.97 (56.44, 57.56)	48.7	56.61 (55.25, 61.51)	62.1

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