# How rho will affect the value of $S_{km}, S_{p1}, S_{p2}$

*2019-07-31*

To generate examples with the $\rho_i$ value we want, we may use the piecewise example in Slud's paper, whose joint distribution is:

$$f(t,s) = \begin{cases} f_1(t)f_C(s) & (t \le s) \\ f_C(s)\dfrac{S_1(s)}{S_2(s)}f_2(t) & (t > s) \end{cases}$$

Let

- $f_1(t) = exp(-t)$, $S_1(s) = exp(-x)$
- $f_C(s) = exp(-s)$, $S_C(s) = exp(-s)$
- $f_2(t) = \rho exp(-\rho t)$ , $S_2(s) = exp(-\rho t)$
- $\rho(t) = \frac{h_2(t)}{h_1(t)} = \rho$, which is a constant.

Then

$$f(t,s) = \begin{cases} exp(-t-s) & (t \le s) \\ \rho exp(-\rho t + (\rho-2)s) & (t > s) \end{cases}$$

And

$$f(t) = \frac{2\rho-2}{\rho-2}exp(-2t) - \frac{\rho}{\rho-2}exp(-10t)$$

$$S(t) = \frac{2\rho-2}{2\rho-4}exp(-2t) - \frac{1}{\rho-2}exp(-\rho t)$$

$$\psi(t) = exp(-2t),\ S_x(t) = exp(-2t)$$

## Set $\rho$ values

Let's $\rho = 0, 0.1, 0.9, 1, 1.1, 1.01, 10, 100$

Simulate 200 paired data points from the associated joint distribution $f(t,s)$.

## The censor percentage

| | 0 | 0.1 | 0.9 | 1 | 1.1 | 1.01 | 10 | 100 |
|---|---|---|---|---|---|---|---|---|
| Censor percent | 0.005 | 0.299 | 0.476 | 0.5 | 0.503 | 0.516 | 0.484 | 0.489 |

When $\rho$ is close to 0, there is less censoring. Otherwise, the censor percentage is around 50 %.

## The differences between true values

Differences between all times points:

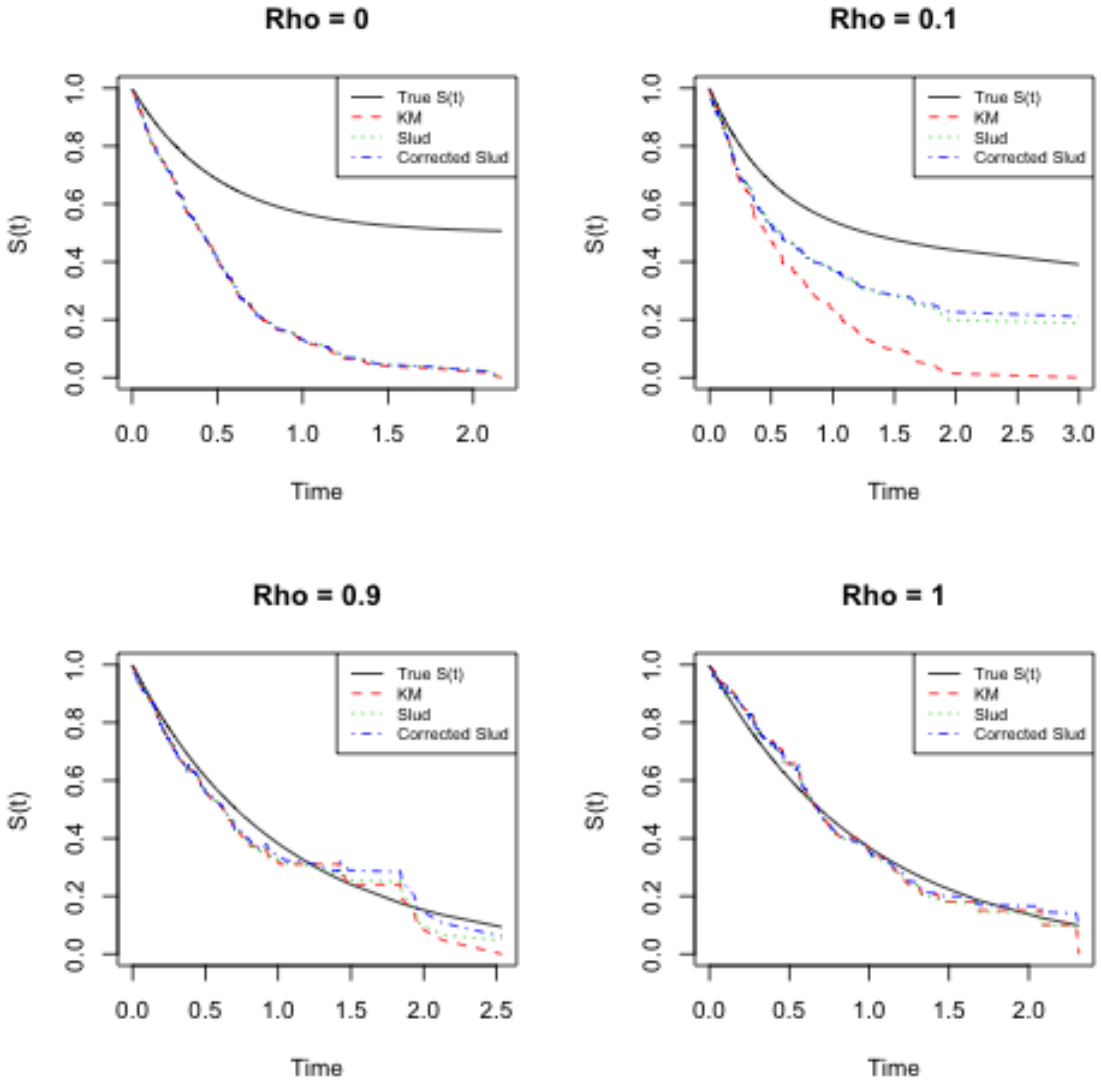
| | 0 | 0.1 | 0.9 | 1 | 1.1 | 1.01 | 10 | 100 |
|---|---|---|---|---|---|---|---|---|
| KM | 0.2380 | 0.1557 | 0.0372 | 0.0344 | 0.0223 | 0.0132 | 0.1402 | 0.1737 |

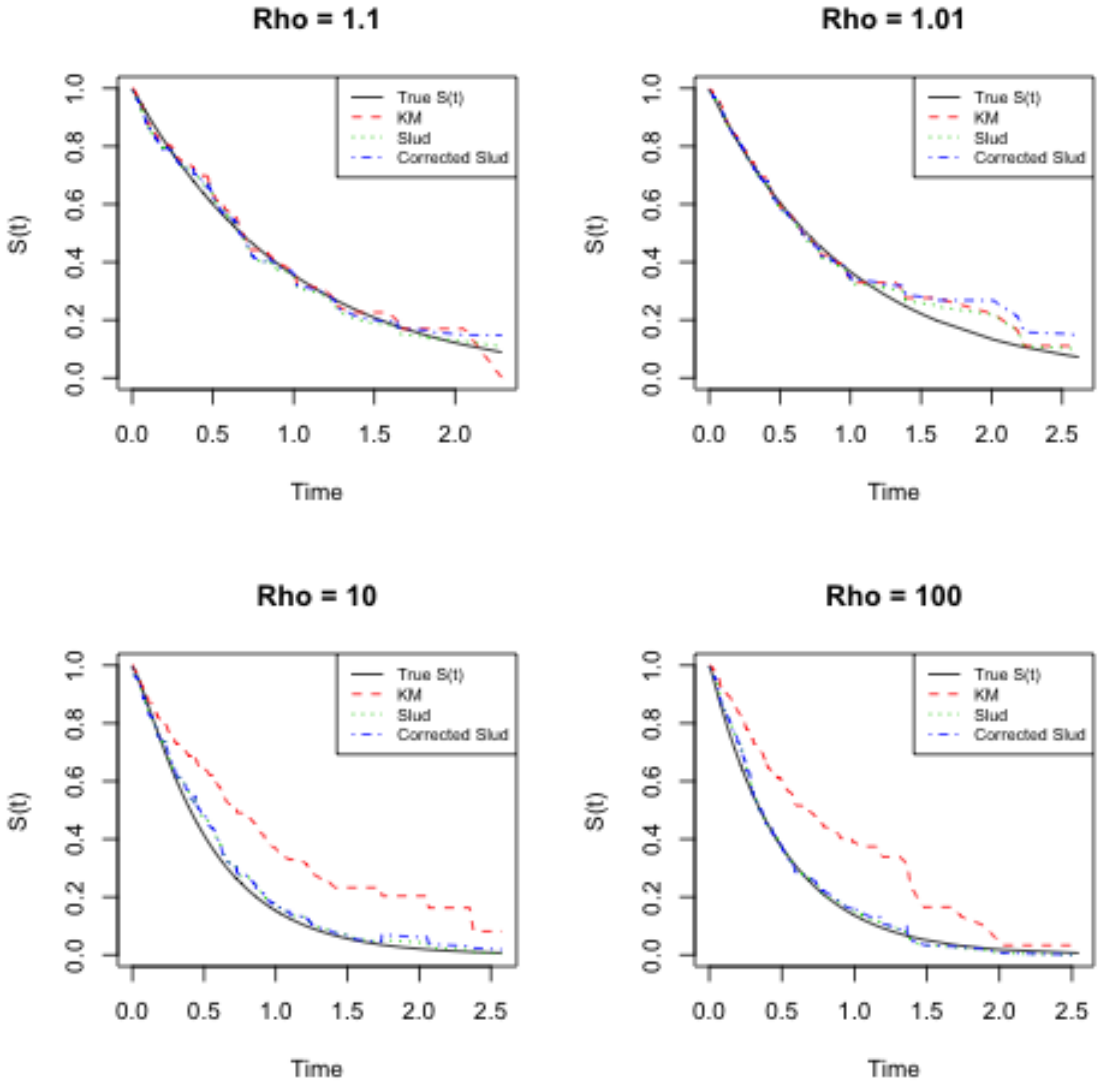
| | 0 | 0.1 | 0.9 | 1 | 1.1 | 1.01 | 10 | 100 |
|---|---|---|---|---|---|---|---|---|
| Sp1 | 0.2362 | 0.1058 | 0.0370 | 0.0312 | 0.0203 | 0.0124 | 0.0262 | 0.0193 |
| Sp2 | 0.2362 | 0.1048 | 0.0357 | 0.0306 | 0.0200 | 0.0132 | 0.0272 | 0.0207 |

Differences between the first 100 subjects' times points:

| | 0 | 0.1 | 0.9 | 1 | 1.1 | 1.01 | 10 | 100 |
|---|---|---|---|---|---|---|---|---|
| KM | 0.1160 | 0.0637 | 0.0250 | 0.0357 | 0.0198 | 0.0103 | 0.0756 | 0.1383 |
| Sp1 | 0.1157 | 0.0573 | 0.0281 | 0.0307 | 0.0199 | 0.0054 | 0.0198 | 0.0279 |
| Sp2 | 0.1157 | 0.0572 | 0.0274 | 0.0317 | 0.0201 | 0.0056 | 0.0200 | 0.0283 |

## The Plot




Rho = 1.1
Rho = 1.01
Rho = 10
Rho = 100
True S(t)
KM
Slud
Corrected Slud
S(t)
Time
0.0
0.2
0.4
0.6
0.8
1.0
0.5
1.5
2.0
2.5