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Week 4 Quiz

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1. Person 1 has hazard $h_1(t) = 1$, and Person 2 has hazard $h_2(t) = 2$. What is the probability of dying within the first year for each patient? **1 / 1 point**

Hint:

The survival function $S(t)$ in terms of the hazard function is:

$$S(t) = e^{-\int_0^t h(s)ds}$$

- (•) 0.63, 0.86
- ( ) 0.6, 0.6
- ( ) 0.37, 0.14

Correct

Note that since the hazards are constant,

$S_1(1) = e^{(-h_1(0))} = e^{(-1)}$.

$S_2(1) = e^{(-h_2(0))} = e^{(-2)}$.

Since we want the probability of death, we take $1 - S(t)$.

This gives us for person 1: $1 - e^{(-1)} = 0.63$.

For person 2, $1 - e^{(-2)} = 0.86$.

2. Let $T > 0$. **1 / 1 point**

For patient 1, let the survival function be $S_1(t)$ and the hazard function be $h_1(t)$.

For patient 2, let the survival function be $S_2(t)$ and the hazard function be $h_2(t)$

You see that $S_1(T) > S_2(T)$. The survival probability of patient 1 at time T is higher than the survival probability of patient 2 at time T.

Which of the following is true about the hazard of patient 1 and 2 at time T?

Hint:

$$S(t) = e^{-\int_0^t h(s)ds}$$

- ( ) h_1(T) > h_2(T)
- ( ) h_1(T) < h_2(T)
- ( ) h_1(T) = h_2(T)
- (•) None of the above

Correct

The answer is none of the above.

Recall that $S(t)$ decays exponentially in the integral of the hazard (it's e raised to the power of negative 1 times the integral of the hazard).

So just because you know $S(T)$ at one point does not say anything about $h(T)$ at that point, since $S(T)$ also depends on what happened from time $t = 0$ up to time $t = T$.

3. Now assume that the hazards for patient 1, h_1 and for patient 2, h_2 are proportional to each other. Also assume that $S_1(T) > S_2(T)$ for some T > 0. **1 / 1 point**

Then which of the following is true about the hazards?

- ( ) h_1(T) = h_2(T)
- ( ) h_1(T) > h_2(T)
- (•) h_1(T) < h_2(T)

Correct

Since the hazards are proportional, we know that they cannot cross each other when we vary the time T.

Therefore if the survival function of Person 1 is above the survival function of Person 2 at any point, it must be above the person 2 survival function everywhere.

Since the survival function decays exponentially with the hazards (it is e raised to the power of negative 1 times the integral of the hazard) it means that the hazard of Person 1 is LESS than the hazard of Person 2.

Since the hazards are proportional, this must be true for any time T.