WS #16 - Cox PH: linear in variables

Math 150, Jo Hardin

Monday, April 7, 2025

Your Name: _____

Names of people you worked with: _____

What is your favorite movie?

Task: Consider the handout on hazard ratios for CHD (from the Framingham Study, Mahmood et al 2014, tables from Dupont 2009). Note that Dupont (throughout the text) refers to HR as instantaneous relative risk (which is why the tables say RR).

1. Table 7.1: why is there no CI for the HR (RR) for $\leq$ 60 mm HG?
2. Table 7.2: from the coefficient estimates, does it still seem like dbp is linear in $\ln(HR)$? Justify your response numerically.

Solution:

1. Table 7.1: why is there no CI for the HR (RR) for ≤ 60 mm HG?

We can only measure the *ratio*, not the hazard rate or the actual risk. To measure / estimate the HR for various covariates, there must be a baseline value. "≤ 60" was chosen as the baseline. That means that the HR for "≤ 60" versus "≤ 60" is 1, and there is no error bound on that quantity.

2. Table 7.2: from the coefficient estimates, does it still seem like dbp is linear in $\ln(HR)$? Justify your response numerically.

If the $\ln(HR_{\Delta_{10}})$ is the same for every 10 unit increase in mm HG (**regardless** of the baseline HG), then we know the effect is constant, i.e., linear.

Note that most of the HRs which describe a 10 mm HG increase are around 1.9. So we know that men have higher risk than women, but the change in dbp seems reasonably linear in $\ln(HR_{\Delta_{10}})$ for both men and women (each increase is roughly 0.3).

dbp	HR(w)	$\ln(HR_{\Delta_0})$ (w)	$\ln(HR_{\Delta_{10}})$ (w)	HR (m)	$\ln(HR_{\Delta_0})$ (m)	$\ln(HR_{\Delta_{10}})$ (m)
61-70	1.91	0.65		3.51	1.26	
71-80	2.43	0.89	0.24	4.46	1.49	0.24
81-90	2.78	1.02	0.13	5.09	1.63	0.13
91-100	4.06	1.40	0.38	7.45	2.01	0.38
101-110	5.96	1.79	0.39	10.9	2.39	0.39
> 110	9.18	2.22	0.43	16.8	2.82	0.43