

Cox PH model

on coronary heart disease
(response)

as functions of
gender, diastolic blood pressure (d**dp**),
age, BMI, serum cholesterol.

$$dbp_{ij} = \begin{cases} 1: & \text{if the } i^{\text{th}} \text{ patient is in DBP Group } j \\ 0: & \text{otherwise.} \end{cases}$$

Then a simple proportional hazards model for estimating the relative risks associated with these blood pressures is

$$\lambda_i[t] = \lambda_0[t] \exp[\beta_2 \times dbp_{i2} + \beta_3 \times dbp_{i3} + \beta_4 \times dbp_{i4} + \beta_5 \times dbp_{i5} + \beta_6 \times dbp_{i6} + \beta_7 \times dbp_{i7}]. \quad (7.4)$$

$$\lambda_i[t] = \lambda_0[t] \exp \left[\sum_{h=2}^7 \beta_h \times dbp_{ih} + \gamma \times male_i \right]. \quad (7.7)$$

$$\lambda_i[t] = \lambda_0[t] \exp \left[\sum_{h=2}^7 \beta_h \times dbp_{ih} + \gamma \times male_i + \sum_{h=2}^7 \delta_h \times dbp_{ih} \times male_i \right]. \quad (7.8)$$

$$\lambda_i[t] = \lambda_0[t] \exp \left[\sum_{h=2}^7 \beta_h \times dbp_{ih} + \gamma \times male_i + \sum_{h=2}^7 \delta_h \times dbp_{ih} \times male_i + \theta_1 \times age_i \right], \quad (7.9)$$

$$\lambda_i[t] = \lambda_0[t] \exp \left[\sum_{h=2}^7 \beta_h \times dbp_{ih} + \gamma \times male_i + \sum_{h=2}^7 \delta_h \times dbp_{ih} \times male_i + \theta_1 \times age_i + \theta_2 \times bmi_i \right], \text{ and} \quad (7.10)$$

$$\lambda_i[t] = \lambda_0[t] \exp \left[\sum_{h=2}^7 \beta_h \times dbp_{ih} + \gamma \times male_i + \sum_{h=2}^7 \delta_h \times dbp_{ih} \times male_i + \theta_1 \times age_i + \theta_2 \times bmi_i + \theta_3 \times scl_i \right]. \quad (7.11)$$

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Table 7.1. Effect of baseline diastolic blood pressure on coronary heart disease. The Framingham Heart Study data were analyzed using model (7.4).

Baseline diastolic blood pressure	Number of subjects	Cases of coronary heart disease		β_j	Relative risk	95% confidence interval
		Number of subjects	Relative risk			
≤60 mm Hg	150	18	1.0*			
61–70 mm Hg	774	182	0.677	1.97	(1.2–3.2)	
71–80 mm Hg	1467	419	0.939	2.56	(1.6–4.1)	
81–90 mm Hg	1267	404	1.117	3.06	(1.9–4.9)	
91–100 mm Hg	701	284	1.512	4.54	(2.8–7.3)	
101–110 mm Hg	235	110	1.839	6.29	(3.8–10)	
>110 mm Hg	105	56	2.247	9.46	(5.6–16)	
Total	4699	1473				

*Denominator of relative risk

Table 7.3. Effect of gender and baseline diastolic blood pressure on coronary heart disease. The Framingham Heart Study data are analyzed using model (7.8), which includes interaction terms for the joint effects of gender and blood pressure.

Baseline diastolic blood pressure	Relative risk	Gender		Relative risk	95% confidence interval
		Women	Men		
≤60 mm Hg	1.0*			2.37	(0.94–6.0)
61–70 mm Hg	1.83	(0.92–3.6)		4.59	(2.3–9.1)
71–80 mm Hg	2.43	(1.2–4.7)		5.55	(2.9–11)
81–90 mm Hg	3.52	(1.8–6.9)		5.28	(2.7–10)
91–100 mm Hg	4.69	(2.4–9.3)		8.28	(4.2–16)
101–110 mm Hg	7.64	(3.8–15)		10.9	(5.4–22)
>110 mm Hg	13.6	(6.6–28)		13.0	(5.9–29)

*Denominator of relative risk

Table 7.2. Effect of gender and baseline diastolic blood pressure on coronary heart disease. The Framingham Heart Study data are analyzed using the multiplicative model (7.7).

Baseline diastolic blood pressure	Relative risk	Gender		Relative risk	95% confidence interval
		Women	Men		
≤60 mm Hg	1.0*			1.83	(1.7–2.0)
61–70 mm Hg	1.91	(1.2–3.1)		3.51	(2.1–5.7)
71–80 mm Hg	2.43	(1.5–3.9)		4.46	(2.8–7.2)
81–90 mm Hg	2.78	(1.7–4.5)		5.09	(3.2–8.2)
91–100 mm Hg	4.06	(2.5–6.5)		7.45	(4.6–12)
101–110 mm Hg	5.96	(3.6–9.8)		10.9	(6.6–18)
>110 mm Hg	9.18	(5.4–15)		16.8	(9.8–29)

*Denominator of relative risk

Table 7.4. Effect of gender and baseline diastolic blood pressure (DBP) on coronary heart disease. The Framingham Heart Study data are analyzed using model (7.11). This model includes gender–DBP interaction terms and adjusts for age, body mass index and serum cholesterol.

Baseline diastolic blood pressure	Relative risk	Gender		Relative risk	95% confidence interval
		Women	Men		
≤60 mm Hg	1.0*			1.98	(0.79–5.0)
61–70 mm Hg	1.51	(0.76–3.0)		3.53	(1.8–7.0)
71–80 mm Hg	1.65	(0.85–3.2)		3.88	(2.0–7.6)
81–90 mm Hg	1.91	(0.98–3.7)		3.33	(1.7–6.5)
91–100 mm Hg	1.94	(0.97–3.9)		4.86	(2.5–9.5)
101–110 mm Hg	3.10	(1.5–6.3)		6.29	(3.1–13)
>110 mm Hg	5.27	(2.5–11)		6.40	(2.9–14)

*Denominator of relative risk

†Adjusted for age, body mass index, and serum cholesterol.