HW 9

Herschel & Pilgrim

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Research Question

> Does Self-rated health (SRH) at baseline predict dementia risk measured by a latent dementia index at the conclusion of the study?

Variables

- `base_srh` : self-rated health at baseline measured on a 1-3 Likert scale in response to the question: “How do you rate your overall health?” 1 = “good,” 2 = “reasonable,” 3 = “bad.”
- `LDI_HARM` : Continuous latent factor that accounts for common variance in memory, cognitive ability and functional ability measures. Ranges from 1-11 in the sample, lower scores indicate poorer performance on dementia-indicative measures.

Variable Summary

	N	Mean	SD	Min	Max	Histogram
srh2	548	1.37	0.36	1.00	2.71	
LDI_HARM	548	7.30	1.51	1.12	10.90	

Model

Model:

$$
\begin{aligned}
LDI_i &\sim N(\mu_i, \sigma) \\
\mu_i &= \eta_i \\
\eta_i &= \beta_0 + \beta_1 srh_i
\end{aligned}
$$

Prior:

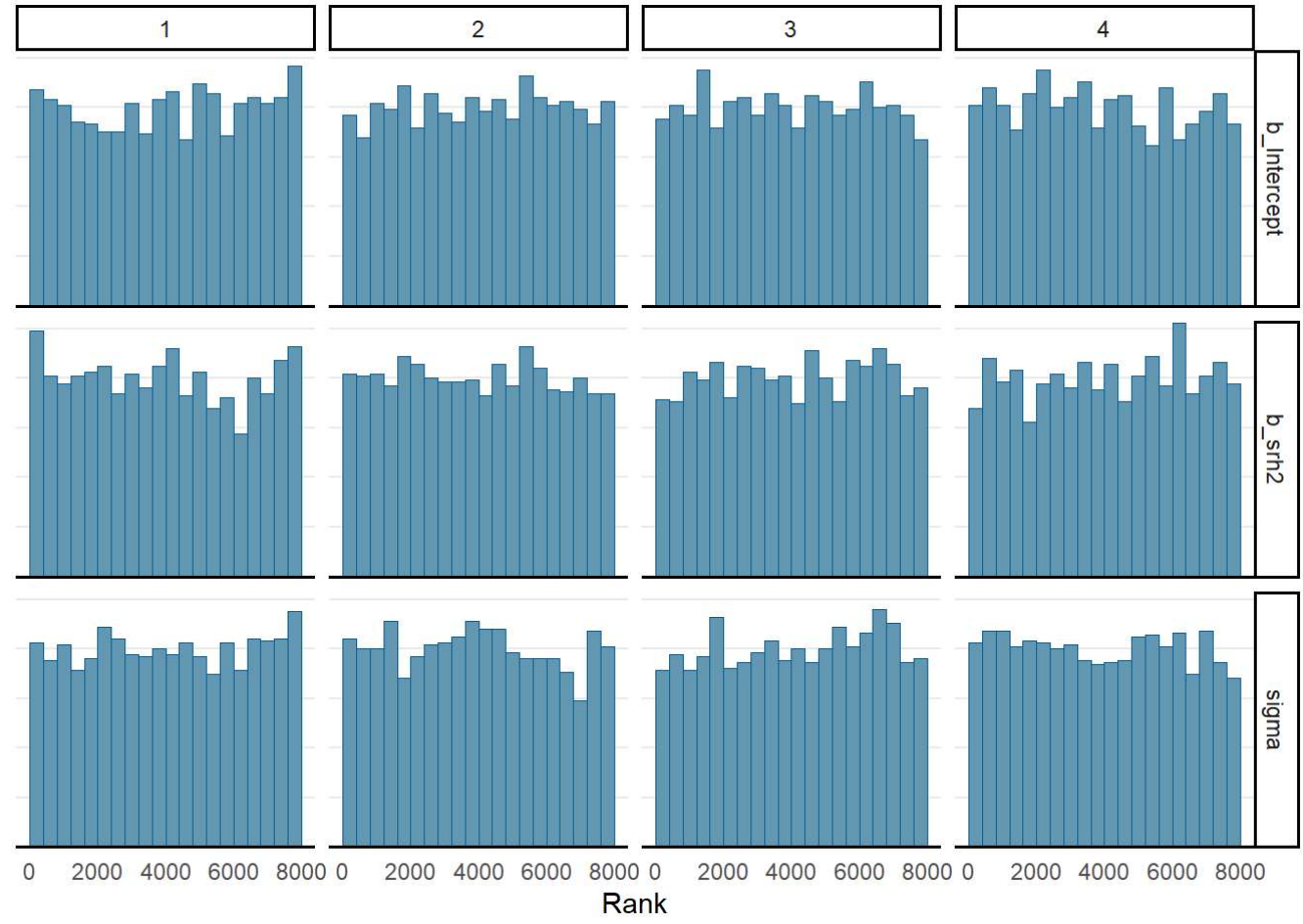
$$
\begin{aligned}
\beta_0 &\sim N(7, 3) \\
\beta_1 &\sim N(0, 2) \\
\sigma &\sim t_4^+(0, 3)
\end{aligned}
$$

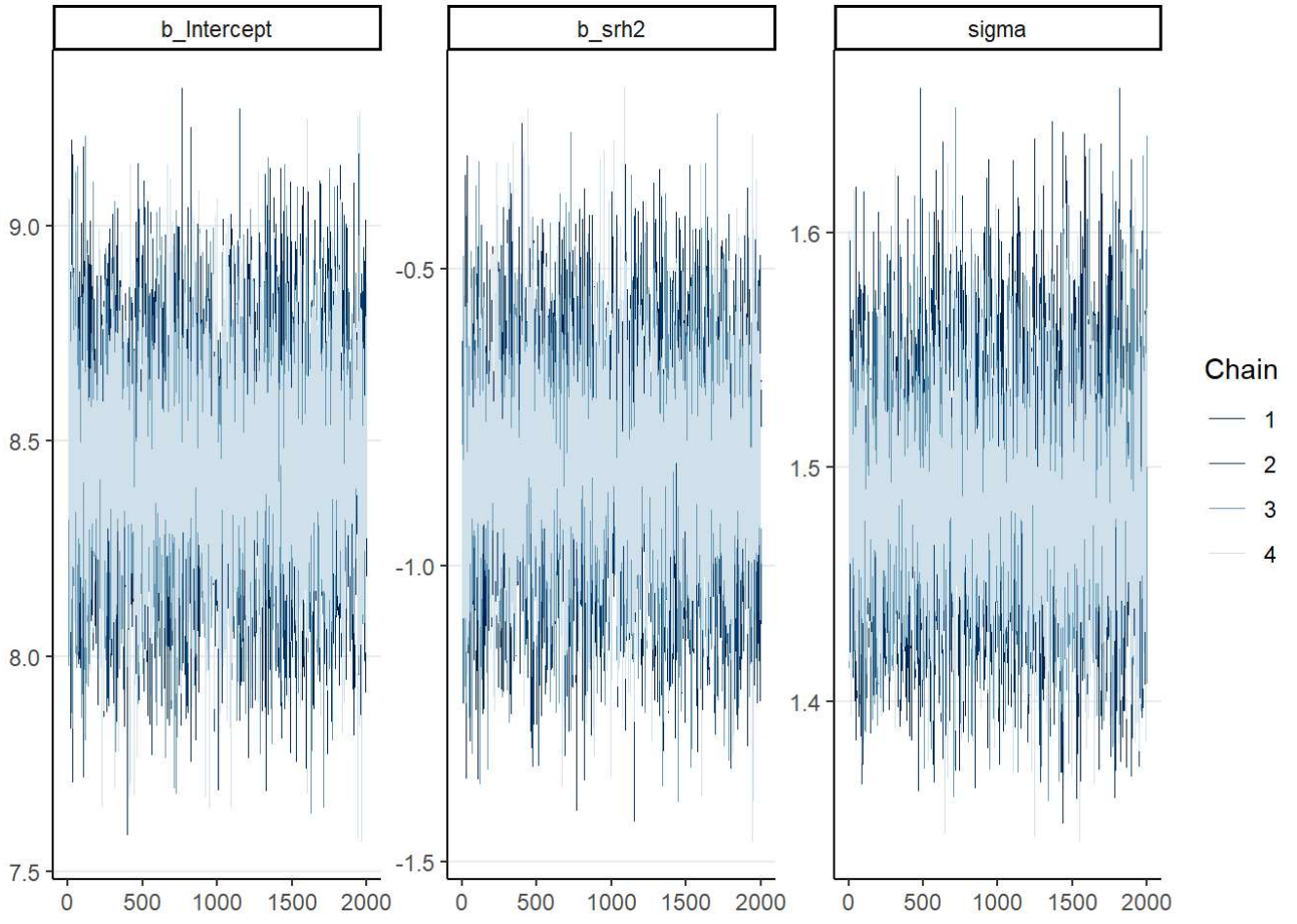
Run Model

We used 4 chains, each with 4,000 iterations (first 2,000 as warm-ups).

Results

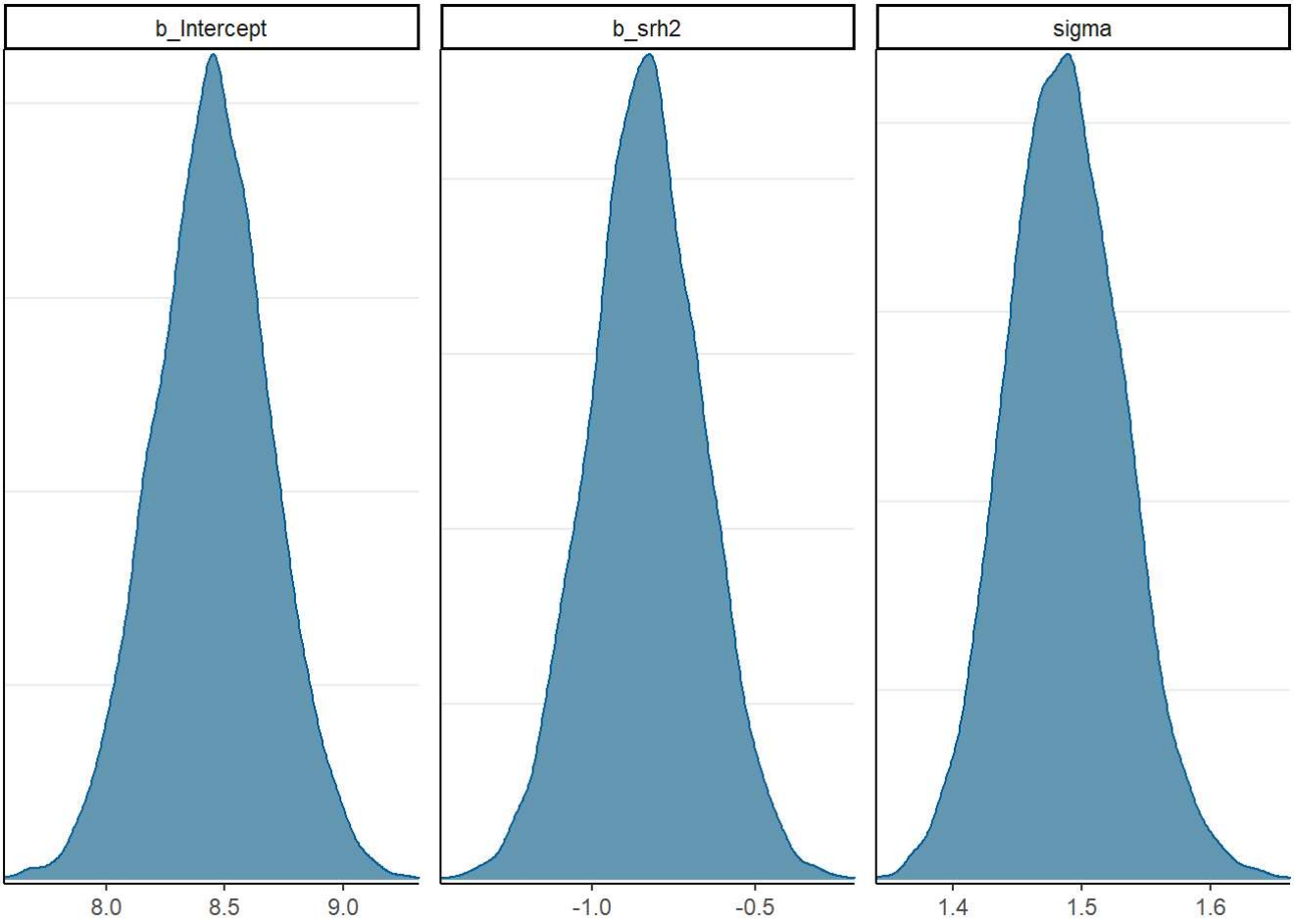
As shown in the graphs below, the chains mixed well.


1
2
3
4
b_Intercept
b_srh2
sigma
0
2000
4000
6000
8000
Rank


b_Intercept
b_srh2
sigma
9.0
8.5
8.0
7.5
-0.5
-1.0
-1.5
1.6
1.5
1.4
0
500
1000
1500
2000
Chain
1
2
3
4

The following graph shows the posterior distributions of β_0, β_1, and σ.

```
##  Family: gaussian
##   Links: mu = identity; sigma = identity
## Formula: LDI_HARM ~ srh2
##    Data: health (Number of observations: 548)
##   Draws: 4 chains, each with iter = 4000; warmup = 2000; thin = 1;
##          total post-warmup draws = 8000
##
## Population-Level Effects:
##           Estimate Est.Error l-95% CI u-95% CI Rhat Bulk_ESS Tail_ESS
## Intercept     8.45      0.25     7.96     8.94 1.00     8233     6109
## srh2         -0.83      0.17    -1.17    -0.49 1.00     8033     6264
##
## Family Specific Parameters:
##       Estimate Est.Error l-95% CI u-95% CI Rhat Bulk_ESS Tail_ESS
## sigma     1.49      0.05     1.40     1.58 1.00     8096     6028
##
## Draws were sampled using sampling(NUTS). For each parameter, Bulk_ESS
## and Tail_ESS are effective sample size measures, and Rhat is the potential
## scale reduction factor on split chains (at convergence, Rhat = 1).
```



Our results indicate that higher SRH scores predict lower LDI with the posterior mean of the regression parameter as -0.84 and a 90% CI of [-1.20,-0.49]. In other words, those with poorer self-rated health had worse dementia outcomes.