

# HW 9

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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:

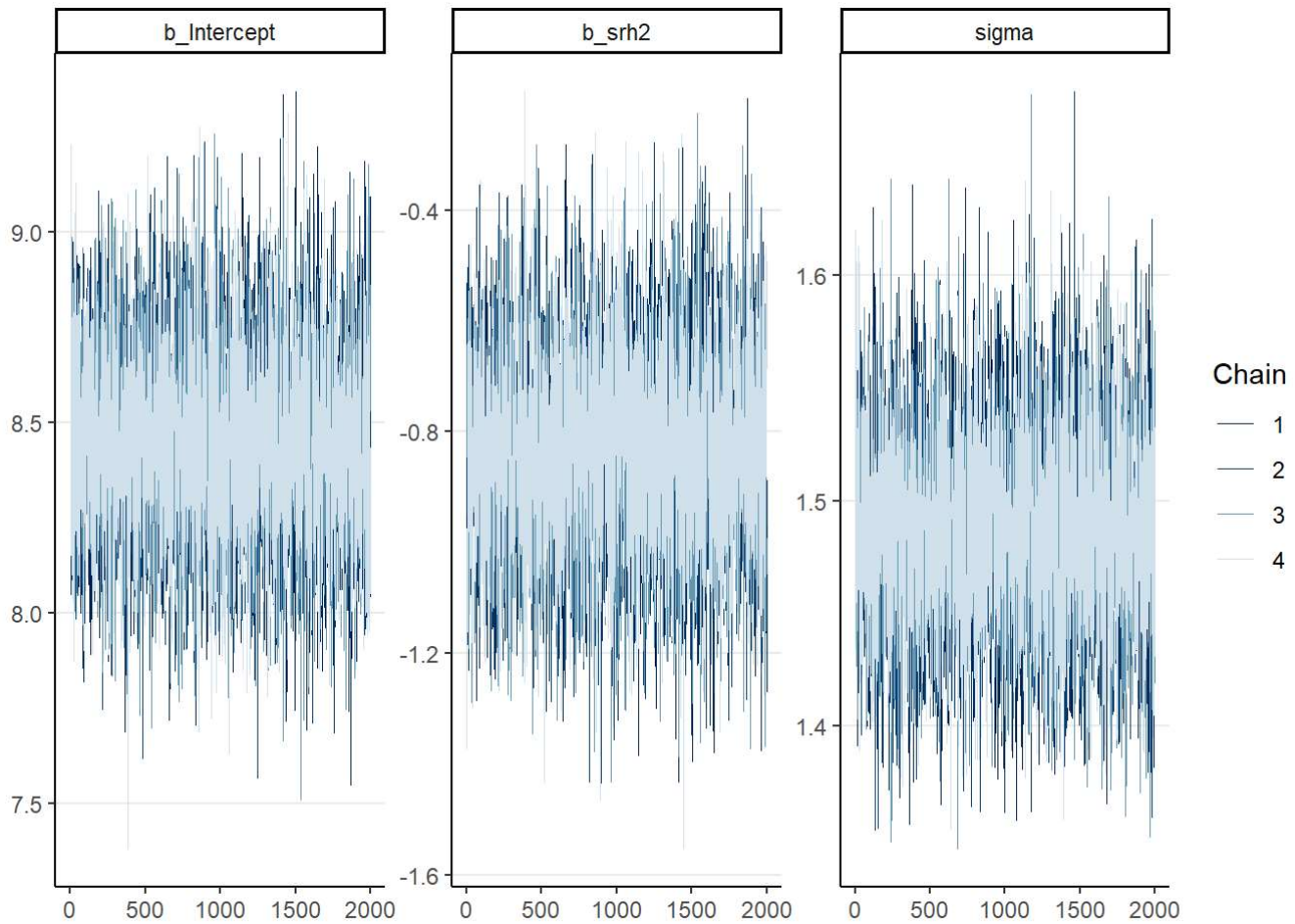
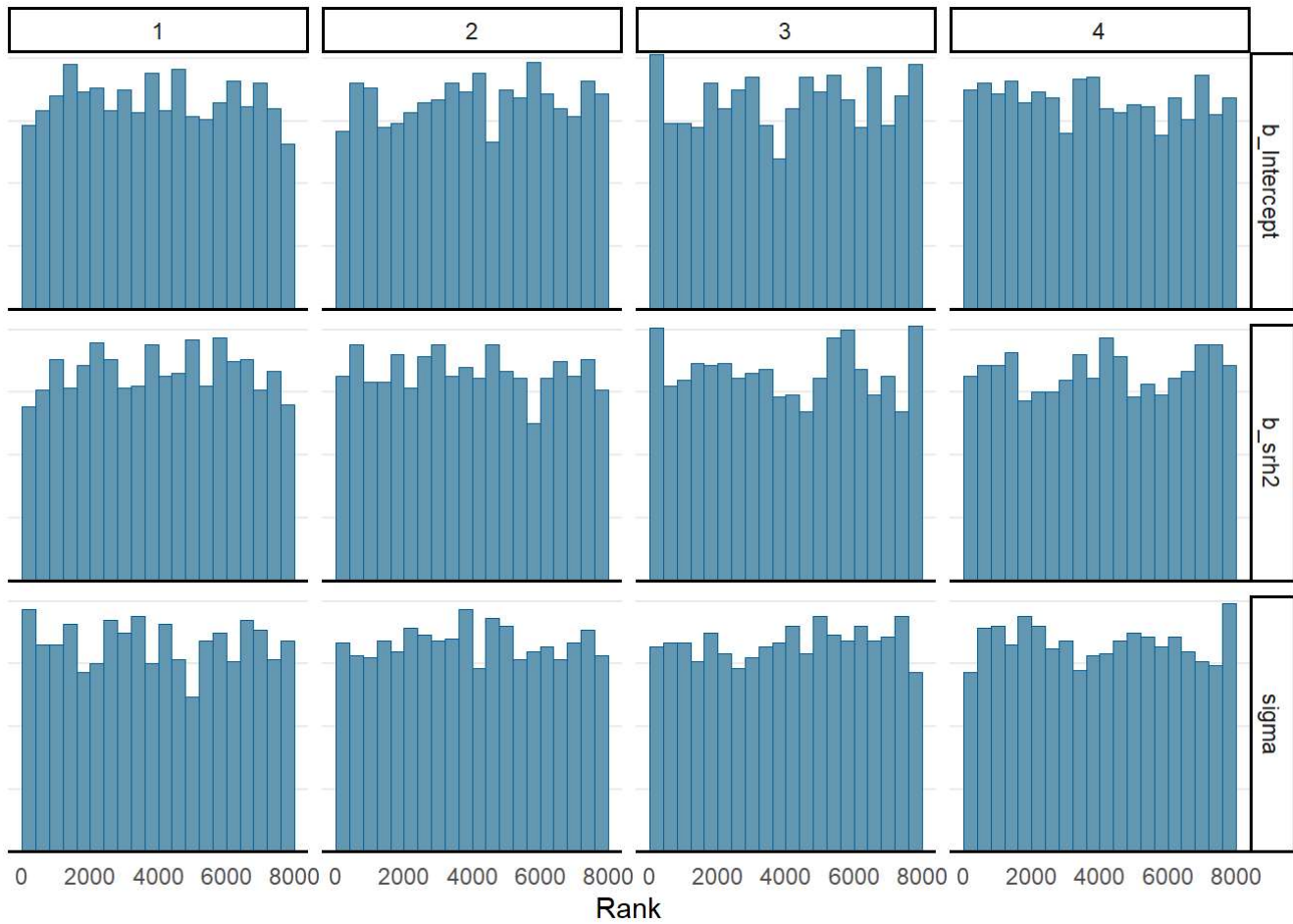
$$\begin{aligned}
 \beta_0 &\sim N(7, 3) \\
 \beta_1 &\sim N(0, 2) \\
 \sigma &\sim t_4^+(0, 3)
 \end{aligned}$$

# Run Model

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

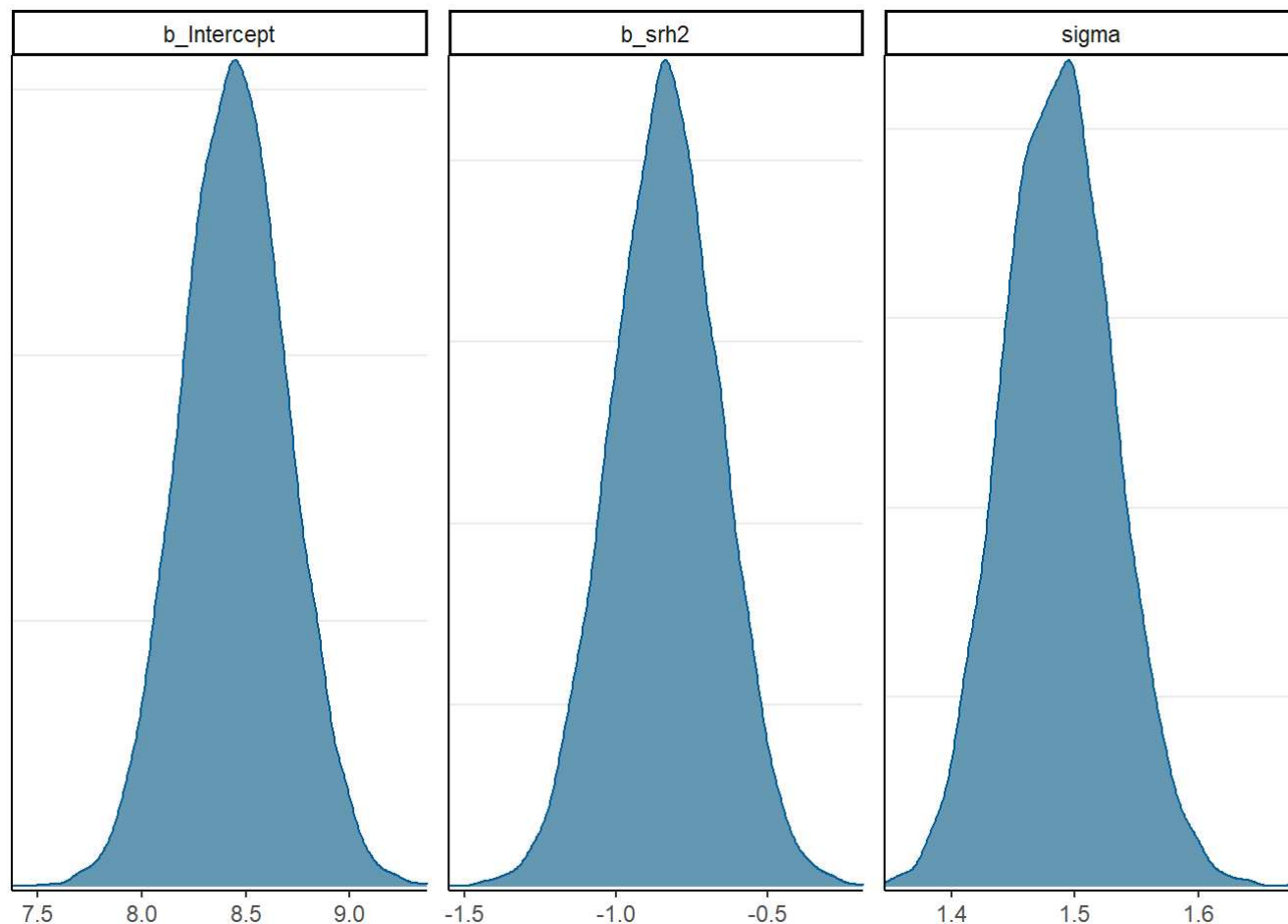
# Results

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



The following graph shows the posterior distributions of  $\beta_0$ ,  $\beta_1$ , and  $\sigma$ .

```
## 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   7.95   8.95 1.00   7491   5879
## srh2          -0.84      0.18  -1.18  -0.49 1.00   7567   5972
##
## Family Specific Parameters:
##      Estimate Est.Error l-95% CI u-95% CI Rhat Bulk_ESS Tail_ESS
## sigma       1.49      0.04   1.40   1.58 1.00   7551   5854
##
## 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).
```



The results show 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]. This tells us that individuals who report a lower self-rated health score at baseline had higher dementia scores (worse dementia outcomes) at the end of the study.