

bayes2_multilevel

Quarto enables you to weave together content and executable code into a finished document.

1. Load Required Packages

```
#####
# 1. LOAD REQUIRED PACKAGES
#####
library(readxl)      # Read Excel files
library(dplyr)        # Data manipulation
```

Attaching package: 'dplyr'

The following objects are masked from 'package:stats':

filter, lag

The following objects are masked from 'package:base':

intersect, setdiff, setequal, union

```
library(tidyr)        # Data reshaping
library(glmnet)        # LASSO regression (for comparison if needed)
```

Loading required package: Matrix

Attaching package: 'Matrix'

The following objects are masked from 'package:tidyr':

expand, pack, unpack

Loaded glmnet 4.1-8

```
library(kableExtra)    # Nicely formatted tables
```

Attaching package: 'kableExtra'

The following object is masked from 'package:dplyr':

group_rows

```
library(rstanarm) # For Bayesian multilevel LASSO (stan_glmer)
```

Loading required package: Rcpp

This is rstanarm version 2.32.1

- See <https://mc-stan.org/rstanarm/articles/priors> for changes to default priors!
- Default priors may change, so it's safest to specify priors, even if equivalent to the defaults.
- For execution on a local, multicore CPU with excess RAM we recommend calling

```
options(mc.cores = parallel::detectCores())
```

```
library(broom.mixed) # For tidying Bayesian model output
library(ggplot2)     # For plotting
library(bayesplot)   # Advanced Bayesian plotting utilities
```

This is bayesplot version 1.12.0

- Online documentation and vignettes at mc-stan.org/bayesplot
- bayesplot theme set to `bayesplot::theme_default()`
 - * Does `_not_` affect other ggplot2 plots
 - * See `?bayesplot_theme_set` for details on theme setting

```
library(bayestestR) # Probability of Direction (PD) and ROPE
library(posterior) # for as_draws_df
```

This is posterior version 1.6.1

Attaching package: 'posterior'

The following object is masked from 'package:bayesplot':

`rhat`

The following objects are masked from 'package:stats':

`mad, sd, var`

The following objects are masked from 'package:base':

`%in%, match`

2. Read Data

Load the PIRLS 2021 Turkey dataset. Replace the path with your own location. The data should include the plausible values ASRREA01–ASRREA05 and the school identifier `IDSCH00L`.

```
#####
# 2. READ DATA
#####
pirls_path <- "~/Downloads/TUR_R.xlsx"
TUR_R <- read_excel(pirls_path)
```

3. Define Variables

Specify the outcome (plausible values) and predictor variables. Set the grouping variable to `IDSCH00L` for the random intercept.

```
#####
# 3. DEFINE VARIABLES
#####
plausible_vars <- c("ASRREA01", "ASRREA02", "ASRREA03", "ASRREA04", "ASRREA05")
predictor_vars <- c(
  "ASBG01", "ACBG03A", "ACBG03B", "ASDGHRL",
  "ASDHSES", "ASDHPLR", "ASDHEDUP", "ASDGSLR",
  "ASDG05S", "ASBH12", "ASBH13", "ATBR16"
)
group_var_name <- "IDSCH00L" # school identifier for random intercept
```

4. Check Missing Values Before Cleaning

```
#####
# 4. CHECK MISSING VALUES BEFORE CLEANING
#####
cat("Checking missing values before filtering:\n")
```

Checking missing values before filtering:

```
print(colSums(is.na(TUR_R[c(plausible_vars, predictor_vars)]))) # [cite: 13]
```

ASRREA01	ASRREA02	ASRREA03	ASRREA04	ASRREA05	ASBG01	ACBG03A	ACBG03B
0	0	0	0	0	1	0	0
ASDGHRL	ASDHSES	ASDHPLR	ASDHEDUP	ASDGSLR	ASDG05S	ASBH12	ASBH13
6	408	408	408	14	14	408	408
ATBR16							
98							

5. Data Cleaning & Factor Recoding

Convert coded numeric variables into factors with descriptive labels and drop rows with missing values on outcomes, predictors or the grouping variable.

```
#####
# 5. DATA CLEANING & FACTOR RECODING
#####
TUR_R2_clean <- TUR_R %>%
  mutate(
    ASBG01 = factor(ASBG01, levels = c(1, 2), labels = c("Girl", "Boy")),
    ACBG03A = factor(ACBG03A, levels = c(1, 2, 3, 4),
      labels = c("0-10%", "11-25%", "26-50%", "More than 50%")),
    ACBG03B = factor(ACBG03B, levels = c(1, 2, 3, 4),
      labels = c("0-10%", "11-25%", "26-50%", "More than 50%")),
    ASDGHRL = factor(ASDGHRL, levels = c(3, 2, 1),
      labels = c("Many resources", "Some resources", "Few resources")),
    ASDHSES = factor(ASDHSES, levels = c(3, 2, 1),
      labels = c("Upper", "Middle", "Lower")),
    ASDHPLR = factor(ASDHPLR, levels = c(1, 2, 3),
      labels = c("Very much like", "Somewhat like", "Do not like")),
    ASDHEDUP = factor(ASDHEDUP, levels = c(1, 2, 3, 4, 5),
      labels = c("University or higher", "Post-secondary not university",
        "Upper secondary", "Lower secondary",
        "Some primary/lower secondary or no school")),
    ASDGSLR = factor(ASDGSLR, levels = c(1, 2, 3),
      labels = c("Very much like reading", "Somewhat like reading", "Do not
    ASBH12 = factor(ASBH12, levels = c(5, 1, 2, 3, 4),
      labels = c(">200", "0-10", "11-25", "26-100", "101-200")),
    ASBH13 = factor(ASBH13, levels = c(5, 1, 2, 3, 4),
      labels = c(">200", "0-10", "11-25", "26-50", "51-100")),
    ATBR16 = factor(ATBR16, levels = c(4, 1, 2, 3),
      labels = c(">60 minutes", "≤15 minutes", "16-30 minutes", "31-60 minu
  ) %>%
  drop_na(any_of(c(plausible_vars, predictor_vars, group_var_name)))

cat("Rows after drop_na() and factor recoding:", nrow(TUR_R2_clean), "\n")
```

Rows after drop_na() and factor recoding: 5069

6. Helper Function for Bayesian Multilevel LASSO

Define a helper function that fits a hierarchical LASSO model using `stan_glmr()` with a random intercept for schools. Fixed effects are regularised with Laplace priors.

```
#####
# 6. CREATE A HELPER FUNCTION TO RUN BAYESIAN MULTILEVEL LASSO
#####
```

```

run_bayesian_lasso_pipeline <- function(df, outcome_var, predictor_vars,
                                       mcmc_chains = 2, mcmc_iter = 2000,
                                       mcmc_warmup = 1000, mcmc_seed = 123,
                                       prior_scale = 1, autoscale_prior = TRUE,
                                       group_var = group_var_name) {
  df_sub <- df %>% dplyr::filter(!is.na(.data[[outcome_var]]))
  y_check <- df_sub[[outcome_var]]
  if (length(unique(y_check)) < 2 || var(y_check, na.rm = TRUE) == 0) {
    message("Skipping '", outcome_var, "' because it is constant or has insufficient vari
    return(NULL)
  }
  if(nrow(df_sub) < (length(predictor_vars) + 10)){
    message("Skipping '", outcome_var, "' due to insufficient observations (", nrow(df_
    return(NULL)
  }
  formula_str <- paste(outcome_var, "~", paste(predictor_vars, collapse = " + "),
                       "+ (1 |", group_var, ")")
  model_formula <- as.formula(formula_str)
  message(paste("Fitting multilevel Bayesian LASSO for", outcome_var))
  bayesian_lasso_fit <- tryCatch({
    stan_glmer(
      formula = model_formula,
      data     = df_sub,
      family   = gaussian(),
      prior    = laplace(location = 0, scale = prior_scale, autoscale = autoscale_prior),
      chains   = mcmc_chains, iter = mcmc_iter, warmup = mcmc_warmup,
      seed     = mcmc_seed, refresh = 0
    )
  }, error = function(e) {
    message("Error fitting stan_glmer for '", outcome_var, "': ", e$message)
    return(NULL)
  })
  if (is.null(bayesian_lasso_fit)) return(NULL)
  tidy_results <- broom.mixed::tidy(bayesian_lasso_fit, effects = "fixed", conf.int = TRU
  tidy_results <- tidy_results[tidy_results$term != "(Intercept)", ]
  factor_vars <- predictor_vars[sapply(df_sub[predictor_vars], is.factor)]
  numeric_vars <- setdiff(predictor_vars, factor_vars)
  table_rows <- list()
  for (fv in factor_vars) {
    if(!(fv %in% names(df_sub))) next
    ref_level <- levels(df_sub[[fv]])[1]
    table_rows[[length(table_rows) + 1]] <- data.frame(
      Variable = fv, Category = paste("Ref:", ref_level), Estimate = 0,
      CI_Low = NA, CI_High = NA, Std_Error = NA, stringsAsFactors = FALSE
    )
  }
  other_levels <- levels(df_sub[[fv]])[-1]
  for (lvl in other_levels) {
    expected_term_name_R <- paste0(fv, make.names(lvl))
    expected_term_name_asis <- paste0(fv, lvl)
    matched_row <- tidy_results[tidy_results$term == expected_term_name_R | tidy_result
    if (nrow(matched_row) == 1) {

```

```

table_rows[[length(table_rows) + 1]] <- data.frame(
  Variable = fv, Category = lvl,
  Estimate = round(matched_row$estimate, 3),
  CI_Low = round(matched_row$conf.low, 3),
  CI_High = round(matched_row$conf.high, 3),
  Std_Error = round(matched_row$std.error, 3),
  stringsAsFactors = FALSE
)
} else {
  cat("Warning: Could not precisely match term for factor '", fv, "' level '", lvl,
  table_rows[[length(table_rows) + 1]] <- data.frame(
    Variable = fv, Category = lvl,
    Estimate = NA, CI_Low = NA, CI_High = NA, Std_Error = NA,
    stringsAsFactors = FALSE
  )
}
}
}
for (nv in numeric_vars) {
  matched_row <- tidy_results[tidy_results$term == nv, ]
  if (nrow(matched_row) == 1) {
    table_rows[[length(table_rows) + 1]] <- data.frame(
      Variable = nv, Category = "Numeric",
      Estimate = round(matched_row$estimate, 3),
      CI_Low = round(matched_row$conf.low, 3),
      CI_High = round(matched_row$conf.high, 3),
      Std_Error = round(matched_row$std.error, 3),
      stringsAsFactors = FALSE
    )
  } else {
    cat("Warning: Could not find numeric predictor '", nv, "' in model results.\n", sep
    table_rows[[length(table_rows) + 1]] <- data.frame(
      Variable = nv, Category = "(Not in model output)",
      Estimate = NA, CI_Low = NA, CI_High = NA, Std_Error = NA,
      stringsAsFactors = FALSE
    )
  }
}
}
if (length(table_rows) == 0) {
  final_table <- data.frame(Variable=character(), Category=character(), Estimate=numeric())
} else {
  final_table <- do.call(rbind, table_rows)
}
list(outcome_var = outcome_var,
     bayesian_lasso_fit = bayesian_lasso_fit,
     tidy_results = tidy_results,
     final_table = final_table)
}

```

7. Loop Over Plausible Values and Print Results

Loop through each plausible value, fit the multilevel Bayesian LASSO model, and store results.

```
#####
# 7. LOOP OVER MULTIPLE OUTCOMES & PRINT RESULTS (Using Bayesian LASSO)
#####
bayesian_results_list <- list()
bayesian_plots_list <- list()

MCMC_ITER    <- 3000
MCMC_WARMUP  <- 1500
MCMC_CHAINS  <- 3

SELECTED_PRIOR_SCALE <- 1
AUTOSCALE_PRIOR_SETTING <- TRUE

for (yvar in plausible_vars) {
  cat("\n-----\n")
  cat("Running Bayesian multilevel LASSO pipeline for outcome:", yvar, "\n")

  pipeline_res_bayesian <- run_bayesian_lasso_pipeline(
    df                = TUR_R2_clean,
    outcome_var       = yvar,
    predictor_vars    = predictor_vars,
    mcmc_chains       = MCMC_CHAINS,
    mcmc_iter         = MCMC_ITER,
    mcmc_warmup       = MCMC_WARMUP,
    mcmc_seed         = 123,
    prior_scale       = SELECTED_PRIOR_SCALE,
    autoscale_prior   = AUTOSCALE_PRIOR_SETTING,
    group_var         = group_var_name
  )

  if (!is.null(pipeline_res_bayesian)) {
    bayesian_results_list[[yvar]] <- pipeline_res_bayesian
    cat("Bayesian multilevel LASSO model fitted for", yvar, "\n")
    cat("Summary of coefficients (from broom.mixed::tidy):\n")
    print(head(pipeline_res_bayesian$tidy_results))
    cat("\nFinal Table for Bayesian LASSO, Outcome:", yvar, ":\n")
    if (nrow(pipeline_res_bayesian$final_table) > 0) {
      kbl(pipeline_res_bayesian$final_table,
        caption = paste("Bayesian LASSO Results for", yvar),
        col.names = c("Variable", "Category", "Estimate", "95% CI Low", "95% CI High",
          booktabs = TRUE, format = "html") %>%
        kable_styling(full_width = FALSE) %>% print()
    } else {
      cat("No results to display in the final table for", yvar, ":\n")
    }
    cat("\nGenerating plots for Bayesian LASSO, Outcome:", yvar, ":\n")
  }
}
```

```

current_fit <- pipeline_res_bayesian$bayesian_lasso_fit
current_tidy_results <- pipeline_res_bayesian$tidy_results
if(nrow(current_tidy_results) > 0) {
  coef_plot <- plot(current_fit, plotfun = "areas", pars = current_tidy_results$term,
                    prob = 0.95, prob_outer = 1) +
    ggtitle(paste("Posterior Medians & 95% Credible Intervals for", yvar)) +
    theme_minimal(base_size = 10) +
    theme(axis.text.y = element_text(size = rel(0.8)))
  print(coef_plot)
  bayesian_plots_list[[paste0(yvar, "_coef_plot")]] <- coef_plot
} else {
  cat("No coefficients (excluding intercept) to plot for", yvar, "\n")
}
} else {
  cat("Skipped Bayesian LASSO for", yvar, "due to issues mentioned above.\n")
}
}

```

Running Bayesian multilevel LASSO pipeline for outcome: ASRREA01

Fitting multilevel Bayesian LASSO for ASRREA01

Bayesian multilevel LASSO model fitted for ASRREA01

Summary of coefficients (from broom.mixed::tidy):

A tibble: 6 × 5

term <chr>	estimate <dbl>	std.error <dbl>	conf.low <dbl>	conf.high <dbl>
1 ASBG01Boy	-12.1	2.01	-15.2	-8.83
2 ACBG03A11-25%	-4.16	7.33	-16.6	8.48
3 ACBG03A26-50%	-7.11	8.44	-20.8	6.52
4 ACBG03AMore than 50%	-22.2	8.86	-36.9	-7.85
5 ACBG03B11-25%	3.79	6.35	-6.34	14.3
6 ACBG03B26-50%	10.4	6.91	-0.632	21.7

Final Table for Bayesian LASSO, Outcome: ASRREA01 :

<table class="table" style="width: auto !important; margin-left: auto; margin-right: auto;">

<caption>Bayesian LASSO Results for ASRREA01</caption>

<thead>

<tr>

<th style="text-align:left;"> Variable </th>

<th style="text-align:left;"> Category </th>

<th style="text-align:right;"> Estimate </th>

<th style="text-align:right;"> 95% CI Low </th>

<th style="text-align:right;"> 95% CI High </th>

<th style="text-align:right;"> Std. Error (Posterior SD) </th>

</tr>

</thead>


```

<tbody>
  <tr>
    <td style="text-align:left;"> ASBG01 </td>
    <td style="text-align:left;"> Ref: Girl </td>
    <td style="text-align:right;"> 0.000 </td>
    <td style="text-align:right;"> NA </td>
    <td style="text-align:right;"> NA </td>
    <td style="text-align:right;"> NA </td>
  </tr>
  <tr>
    <td style="text-align:left;"> ASBG01 </td>
    <td style="text-align:left;"> Boy </td>
    <td style="text-align:right;"> -12.068 </td>
    <td style="text-align:right;"> -15.244 </td>
    <td style="text-align:right;"> -8.827 </td>
    <td style="text-align:right;"> 2.009 </td>
  </tr>
  <tr>
    <td style="text-align:left;"> ACBG03A </td>
    <td style="text-align:left;"> Ref: 0-10% </td>
    <td style="text-align:right;"> 0.000 </td>
    <td style="text-align:right;"> NA </td>
    <td style="text-align:right;"> NA </td>
    <td style="text-align:right;"> NA </td>
  </tr>
  <tr>
    <td style="text-align:left;"> ACBG03A </td>
    <td style="text-align:left;"> 11-25% </td>
    <td style="text-align:right;"> -4.156 </td>
    <td style="text-align:right;"> -16.552 </td>
    <td style="text-align:right;"> 8.477 </td>
    <td style="text-align:right;"> 7.335 </td>
  </tr>
  <tr>
    <td style="text-align:left;"> ACBG03A </td>
    <td style="text-align:left;"> 26-50% </td>
    <td style="text-align:right;"> -7.109 </td>
    <td style="text-align:right;"> -20.752 </td>
    <td style="text-align:right;"> 6.520 </td>
    <td style="text-align:right;"> 8.436 </td>
  </tr>
  <tr>
    <td style="text-align:left;"> ACBG03A </td>
    <td style="text-align:left;"> More than 50% </td>
    <td style="text-align:right;"> -22.178 </td>
    <td style="text-align:right;"> -36.912 </td>
    <td style="text-align:right;"> -7.847 </td>
    <td style="text-align:right;"> 8.862 </td>
  </tr>
  <tr>
    <td style="text-align:left;"> ACBG03B </td>

```

Ref: 0–10%	0.000	NA	NA	NA
------------	-------	----	----	----

ACBG03B	11–25%	3.786	–6.337	14.254	6.353
---------	--------	-------	--------	--------	-------

ACBG03B	26–50%	10.414	–0.632	21.684	6.909
---------	--------	--------	--------	--------	-------

ACBG03B	More than 50%	8.072	–5.279	22.206	8.586
---------	---------------	-------	--------	--------	-------

ASDGHRL	Ref: Many resources	0.000	NA	NA	NA
---------	---------------------	-------	----	----	----

ASDGHRL	Some resources	9.100	2.346	15.973	4.189
---------	----------------	-------	-------	--------	-------

ASDGHRL	Few resources	22.024	11.205
---------	---------------	--------	--------

```
<td style="text-align:right;"> 32.956 </td>
<td style="text-align:right;"> 6.856 </td>
</tr>
<tr>
<td style="text-align:left;"> ASDHSES </td>
<td style="text-align:left;"> Ref: Upper </td>
<td style="text-align:right;"> 0.000 </td>
<td style="text-align:right;"> NA </td>
<td style="text-align:right;"> NA </td>
<td style="text-align:right;"> NA </td>
</tr>
<tr>
<td style="text-align:left;"> ASDHSES </td>
<td style="text-align:left;"> Middle </td>
<td style="text-align:right;"> 1.734 </td>
<td style="text-align:right;"> -4.595 </td>
<td style="text-align:right;"> 7.702 </td>
<td style="text-align:right;"> 3.838 </td>
</tr>
<tr>
<td style="text-align:left;"> ASDHSES </td>
<td style="text-align:left;"> Lower </td>
<td style="text-align:right;"> 2.320 </td>
<td style="text-align:right;"> -8.568 </td>
<td style="text-align:right;"> 13.061 </td>
<td style="text-align:right;"> 6.580 </td>
</tr>
<tr>
<td style="text-align:left;"> ASDHPLR </td>
<td style="text-align:left;"> Ref: Very much like </td>
<td style="text-align:right;"> 0.000 </td>
<td style="text-align:right;"> NA </td>
<td style="text-align:right;"> NA </td>
<td style="text-align:right;"> NA </td>
</tr>
<tr>
<td style="text-align:left;"> ASDHPLR </td>
<td style="text-align:left;"> Somewhat like </td>
<td style="text-align:right;"> -10.436 </td>
<td style="text-align:right;"> -14.333 </td>
<td style="text-align:right;"> -6.641 </td>
<td style="text-align:right;"> 2.346 </td>
</tr>
<tr>
<td style="text-align:left;"> ASDHPLR </td>
<td style="text-align:left;"> Do not like </td>
<td style="text-align:right;"> -18.272 </td>
<td style="text-align:right;"> -23.790 </td>
<td style="text-align:right;"> -12.596 </td>
<td style="text-align:right;"> 3.479 </td>
</tr>
```

```

<tr>
  <td style="text-align:left;"> ASDHEDUP </td>
  <td style="text-align:left;"> Ref: University or higher </td>
  <td style="text-align:right;"> 0.000 </td>
  <td style="text-align:right;"> NA </td>
  <td style="text-align:right;"> NA </td>
  <td style="text-align:right;"> NA </td>
</tr>
<tr>
  <td style="text-align:left;"> ASDHEDUP </td>
  <td style="text-align:left;"> Post-secondary not university </td>
  <td style="text-align:right;"> -13.070 </td>
  <td style="text-align:right;"> -19.711 </td>
  <td style="text-align:right;"> -6.203 </td>
  <td style="text-align:right;"> 4.103 </td>
</tr>
<tr>
  <td style="text-align:left;"> ASDHEDUP </td>
  <td style="text-align:left;"> Upper secondary </td>
  <td style="text-align:right;"> -22.399 </td>
  <td style="text-align:right;"> -28.497 </td>
  <td style="text-align:right;"> -16.178 </td>
  <td style="text-align:right;"> 3.784 </td>
</tr>
<tr>
  <td style="text-align:left;"> ASDHEDUP </td>
  <td style="text-align:left;"> Lower secondary </td>
  <td style="text-align:right;"> -36.750 </td>
  <td style="text-align:right;"> -43.965 </td>
  <td style="text-align:right;"> -29.637 </td>
  <td style="text-align:right;"> 4.513 </td>
</tr>
<tr>
  <td style="text-align:left;"> ASDHEDUP </td>
  <td style="text-align:left;"> Some primary/lower secondary or no school </td>
  <td style="text-align:right;"> -44.567 </td>
  <td style="text-align:right;"> -52.580 </td>
  <td style="text-align:right;"> -36.758 </td>
  <td style="text-align:right;"> 4.714 </td>
</tr>
<tr>
  <td style="text-align:left;"> ASDGSLR </td>
  <td style="text-align:left;"> Ref: Very much like reading </td>
  <td style="text-align:right;"> 0.000 </td>
  <td style="text-align:right;"> NA </td>
  <td style="text-align:right;"> NA </td>
  <td style="text-align:right;"> NA </td>
</tr>
<tr>
  <td style="text-align:left;"> ASDGSLR </td>
  <td style="text-align:left;"> Somewhat like reading </td>

```

```

<td style="text-align:right;"> -13.031 </td>
<td style="text-align:right;"> -16.638 </td>
<td style="text-align:right;"> -9.383 </td>
<td style="text-align:right;"> 2.266 </td>
</tr>
<tr>
<td style="text-align:left;"> ASDGSLR </td>
<td style="text-align:left;"> Do not like reading </td>
<td style="text-align:right;"> -22.236 </td>
<td style="text-align:right;"> -29.204 </td>
<td style="text-align:right;"> -15.275 </td>
<td style="text-align:right;"> 4.168 </td>
</tr>
<tr>
<td style="text-align:left;"> ASBH12 </td>
<td style="text-align:left;"> Ref: &gt;200 </td>
<td style="text-align:right;"> 0.000 </td>
<td style="text-align:right;"> NA </td>
<td style="text-align:right;"> NA </td>
<td style="text-align:right;"> NA </td>
</tr>
<tr>
<td style="text-align:left;"> ASBH12 </td>
<td style="text-align:left;"> 0-10 </td>
<td style="text-align:right;"> -6.511 </td>
<td style="text-align:right;"> -16.024 </td>
<td style="text-align:right;"> 2.641 </td>
<td style="text-align:right;"> 5.558 </td>
</tr>
<tr>
<td style="text-align:left;"> ASBH12 </td>
<td style="text-align:left;"> 11-25 </td>
<td style="text-align:right;"> -1.605 </td>
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<td style="text-align:right;"> 0.304 </td>
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<tr>
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```

```

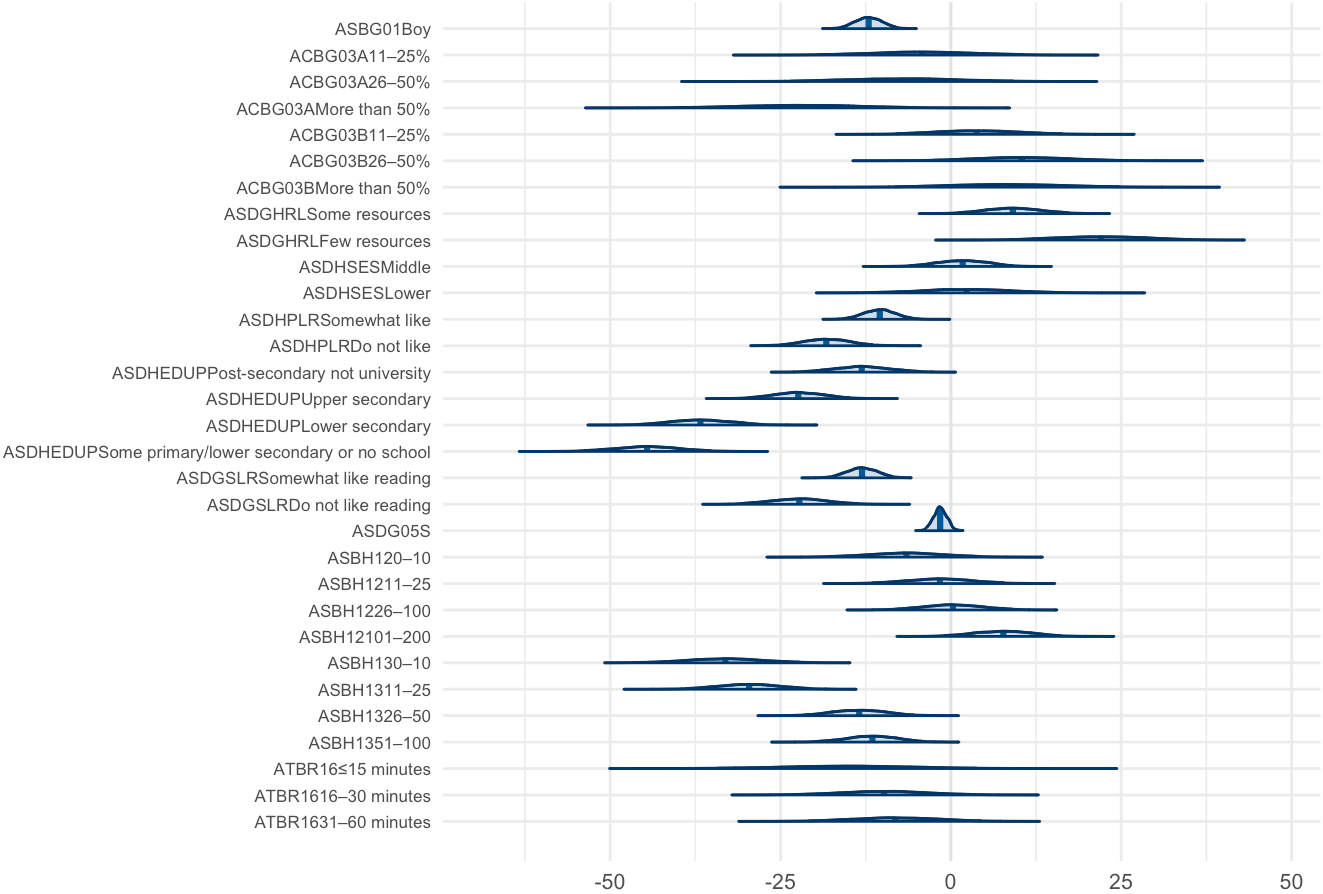
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  </tr>
  <tr>
    <td style="text-align:left;"> ASBH13 </td>
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    <td style="text-align:right;"> -33.086 </td>
    <td style="text-align:right;"> -42.435 </td>
    <td style="text-align:right;"> -23.917 </td>
    <td style="text-align:right;"> 5.603 </td>
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    <td style="text-align:right;"> -37.270 </td>
    <td style="text-align:right;"> -21.986 </td>
    <td style="text-align:right;"> 4.611 </td>
  </tr>
  <tr>
    <td style="text-align:left;"> ASBH13 </td>
    <td style="text-align:left;"> 26-50 </td>
    <td style="text-align:right;"> -13.441 </td>
    <td style="text-align:right;"> -20.080 </td>
    <td style="text-align:right;"> -6.937 </td>
    <td style="text-align:right;"> 4.110 </td>
  </tr>
  <tr>
    <td style="text-align:left;"> ASBH13 </td>
    <td style="text-align:left;"> 51-100 </td>
    <td style="text-align:right;"> -11.518 </td>
    <td style="text-align:right;"> -17.938 </td>
    <td style="text-align:right;"> -5.495 </td>
    <td style="text-align:right;"> 3.806 </td>
  </tr>
  <tr>
    <td style="text-align:left;"> ATBR16 </td>
    <td style="text-align:left;"> Ref: &gt;60 minutes </td>
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    <td style="text-align:right;"> NA </td>
    <td style="text-align:right;"> NA </td>
  </tr>
  <tr>

```

ATBR16	≤15 minutes	-15.122	-31.175	0.429	9.525
ATBR16	16–30 minutes	-9.796	-20.560	0.744	6.320
ATBR16	31–60 minutes	-8.187	-18.634	2.368	6.388
ASDG05S	Numeric	-1.570	-3.197	0.015	0.971

Generating plots for Bayesian LASSO, Outcome: ASRREA01 :

Posterior Medians & 95% Credible Intervals for ASRREA01



Running Bayesian multilevel LASSO pipeline for outcome: ASRREA02

Fitting multilevel Bayesian LASSO for ASRREA02

Bayesian multilevel LASSO model fitted for ASRREA02

Summary of coefficients (from broom.mixed::tidy):

A tibble: 6 × 5

term	estimate	std.error	conf.low	conf.high
<chr>	<dbl>	<dbl>	<dbl>	<dbl>
1 ASBG01Boy	-14.8	1.99	-18.0	-11.5
2 ACBG03A11-25%	-3.98	7.39	-16.2	8.51
3 ACBG03A26-50%	-7.24	8.30	-21.3	7.43
4 ACBG03AMore than 50%	-20.7	8.89	-35.6	-6.61
5 ACBG03B11-25%	6.42	6.36	-3.81	16.8
6 ACBG03B26-50%	11.6	6.82	0.612	23.3

Final Table for Bayesian LASSO, Outcome: ASRREA02 :

<table class="table" style="width: auto !important; margin-left: auto; margin-right: auto;">

<caption>Bayesian LASSO Results for ASRREA02</caption>

<thead>

<tr>

<th style="text-align:left;"> Variable </th>


```

<th style="text-align:left;"> Category </th>
<th style="text-align:right;"> Estimate </th>
<th style="text-align:right;"> 95% CI Low </th>
<th style="text-align:right;"> 95% CI High </th>
<th style="text-align:right;"> Std. Error (Posterior SD) </th>
</tr>
</thead>
<tbody>
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<td style="text-align:right;"> NA </td>
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<td style="text-align:right;"> -11.501 </td>
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<td style="text-align:left;"> Ref: 0-10% </td>
<td style="text-align:right;"> 0.000 </td>
<td style="text-align:right;"> NA </td>
<td style="text-align:right;"> NA </td>
<td style="text-align:right;"> NA </td>
</tr>
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<td style="text-align:right;"> -16.242 </td>
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<tr>
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<td style="text-align:right;"> -7.236 </td>
<td style="text-align:right;"> -21.305 </td>
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<tr>
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<td style="text-align:left;"> More than 50% </td>

```

-20.698					
-35.606					
-6.611					
8.886					

ACBG03B	Ref: 0-10%	0.000	NA	NA	NA
---------	------------	-------	----	----	----

ACBG03B	11-25%	6.422	-3.810	16.791	6.359
---------	--------	-------	--------	--------	-------

ACBG03B	26-50%	11.557	0.612	23.310	6.824
---------	--------	--------	-------	--------	-------

ACBG03B	More than 50%	12.060	-1.513	26.338	8.289
---------	---------------	--------	--------	--------	-------

ASDGHRL	Ref: Many resources	0.000	NA	NA	NA
---------	---------------------	-------	----	----	----

ASDGHRL	Some resources	7.169	0.321	14.143	
---------	----------------	-------	-------	--------	--

```
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  <td style="text-align:right;"> NA </td>
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  <td style="text-align:right;"> NA </td>
  <td style="text-align:right;"> NA </td>
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<tr>
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ASDHPLR	Do not like	-20.475	-26.219	-14.561	3.463
ASDHEDUP	Ref: University or higher	0.000	NA	NA	NA
ASDHEDUP	Post-secondary not university	-12.256	-19.112	-5.379	4.138
ASDHEDUP	Upper secondary	-20.846	-27.054	-14.478	3.810
ASDHEDUP	Lower secondary	-38.335	-45.614	-30.974	4.398
ASDHEDUP	Some primary/lower secondary or no school	-47.547	-55.152	-39.700	4.702
ASDGSLR	Ref: Very much like reading	0.000			

```
 NA | NA | NA || ASDGSLR | Somewhat like reading | -12.354 | -16.007 | -8.601 | 2.349 |
| ASDGSLR | Do not like reading | -15.654 | -22.622 | -8.682 | 4.342 |
| ASBH12 | Ref: &gt;200 | 0.000 | NA | NA | NA |
| ASBH12 | 0-10 | -8.936 | -18.040 | 0.191 | 5.656 |
| ASBH12 | 11-25 | -1.795 | -9.731 | 6.073 | 4.819 |
| ASBH12 | 26-100 | 1.573 | -5.803 | 8.777 | 4.498 |

```

```
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  <td style="text-align:left;"> 101-200 </td>
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  <td style="text-align:right;"> NA </td>
  <td style="text-align:right;"> NA </td>
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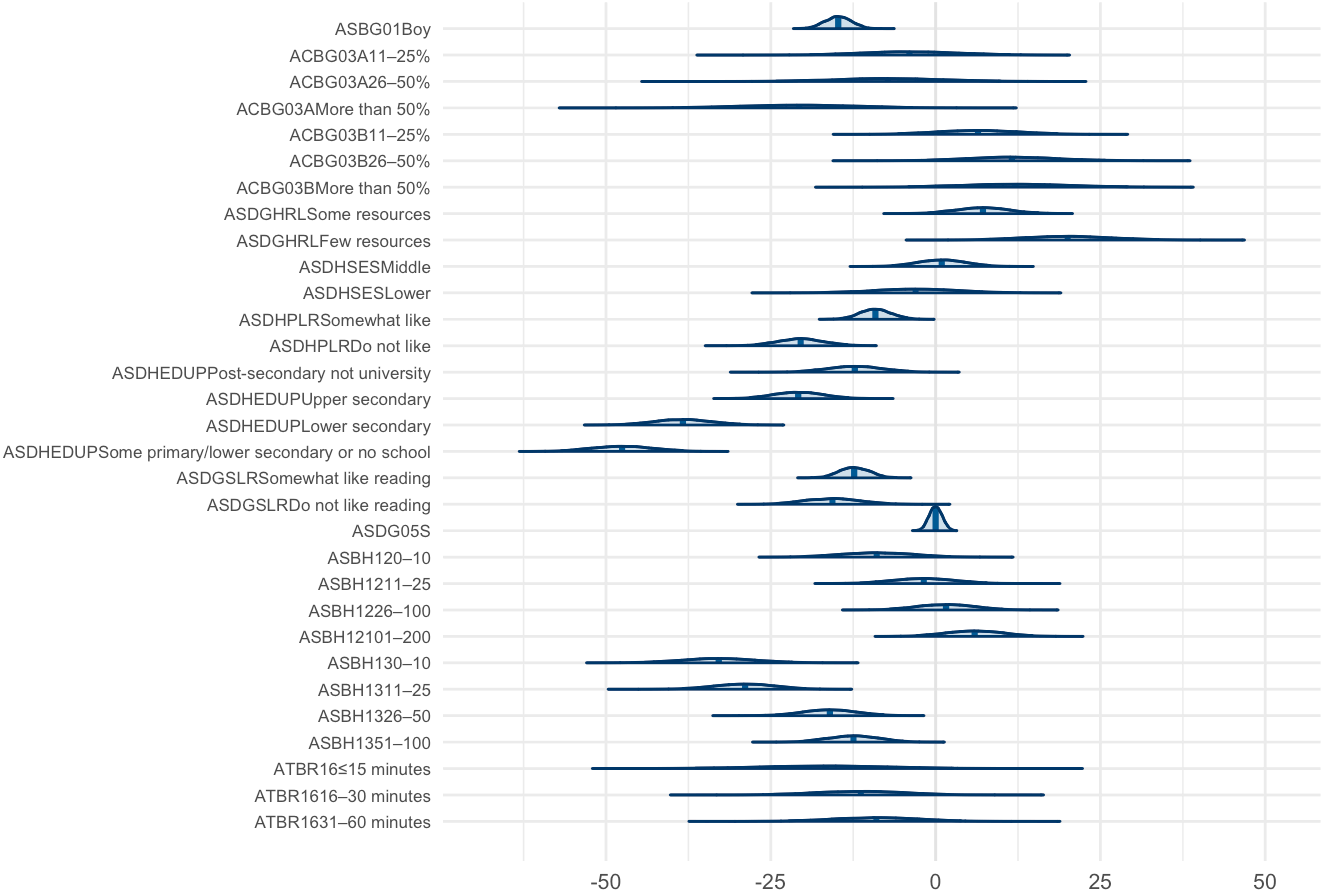
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</tr>
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</tbody>
</table>

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Generating plots for Bayesian LASSO, Outcome: ASRREA02 :

Posterior Medians & 95% Credible Intervals for ASRREA02



Running Bayesian multilevel LASSO pipeline for outcome: ASRREA03

Fitting multilevel Bayesian LASSO for ASRREA03

Bayesian multilevel LASSO model fitted for ASRREA03

Summary of coefficients (from broom.mixed::tidy):

A tibble: 6 × 5

term	estimate	std.error	conf.low	conf.high
<chr>	<dbl>	<dbl>	<dbl>	<dbl>
1 ASBG01Boy	-13.1	1.97	-16.5	-9.88
2 ACBG03A11-25%	-4.24	7.30	-16.4	8.49
3 ACBG03A26-50%	-5.26	8.76	-19.3	9.33
4 ACBG03AMore than 50%	-20.3	8.88	-35.1	-4.99
5 ACBG03B11-25%	6.51	6.32	-3.53	16.7
6 ACBG03B26-50%	10.9	6.98	-0.422	22.7

Final Table for Bayesian LASSO, Outcome: ASRREA03 :

<table class="table" style="width: auto !important; margin-left: auto; margin-right: auto;">

<caption>Bayesian LASSO Results for ASRREA03</caption>

<thead>

<tr>

<th style="text-align:left;"> Variable </th>


```

<th style="text-align:left;"> Category </th>
<th style="text-align:right;"> Estimate </th>
<th style="text-align:right;"> 95% CI Low </th>
<th style="text-align:right;"> 95% CI High </th>
<th style="text-align:right;"> Std. Error (Posterior SD) </th>
</tr>
</thead>
<tbody>
<tr>
<td style="text-align:left;"> ASBG01 </td>
<td style="text-align:left;"> Ref: Girl </td>
<td style="text-align:right;"> 0.000 </td>
<td style="text-align:right;"> NA </td>
<td style="text-align:right;"> NA </td>
<td style="text-align:right;"> NA </td>
</tr>
<tr>
<td style="text-align:left;"> ASBG01 </td>
<td style="text-align:left;"> Boy </td>
<td style="text-align:right;"> -13.107 </td>
<td style="text-align:right;"> -16.458 </td>
<td style="text-align:right;"> -9.880 </td>
<td style="text-align:right;"> 1.965 </td>
</tr>
<tr>
<td style="text-align:left;"> ACBG03A </td>
<td style="text-align:left;"> Ref: 0-10% </td>
<td style="text-align:right;"> 0.000 </td>
<td style="text-align:right;"> NA </td>
<td style="text-align:right;"> NA </td>
<td style="text-align:right;"> NA </td>
</tr>
<tr>
<td style="text-align:left;"> ACBG03A </td>
<td style="text-align:left;"> 11-25% </td>
<td style="text-align:right;"> -4.239 </td>
<td style="text-align:right;"> -16.384 </td>
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<td style="text-align:right;"> -19.300 </td>
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</tr>
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<td style="text-align:left;"> More than 50% </td>

```

-20.264					
-35.114					
-4.988					
8.884					

ACBG03B	Ref: 0-10%	0.000	NA	NA	NA
---------	------------	-------	----	----	----

ACBG03B	11-25%	6.512	-3.530	16.651	6.323
---------	--------	-------	--------	--------	-------

ACBG03B	26-50%	10.903	-0.422	22.690	6.980
---------	--------	--------	--------	--------	-------

ACBG03B	More than 50%	12.067	-2.157	26.811	8.652
---------	---------------	--------	--------	--------	-------

ASDGHRL	Ref: Many resources	0.000	NA	NA	NA
---------	---------------------	-------	----	----	----

ASDGHRL	Some resources	7.325	0.690	14.175	
---------	----------------	-------	-------	--------	--

```

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    <td style="text-align:right;"> NA </td>
    <td style="text-align:right;"> NA </td>
  </tr>
  <tr>
    <td style="text-align:left;"> ASDHSES </td>
    <td style="text-align:left;"> Middle </td>
    <td style="text-align:right;"> 1.079 </td>
    <td style="text-align:right;"> -5.236 </td>
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    <td style="text-align:right;"> 3.856 </td>
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    <td style="text-align:left;"> Lower </td>
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    <td style="text-align:right;"> -16.149 </td>
    <td style="text-align:right;"> 5.649 </td>
    <td style="text-align:right;"> 6.902 </td>
  </tr>
  <tr>
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    <td style="text-align:right;"> NA </td>
    <td style="text-align:right;"> NA </td>
  </tr>
  <tr>
    <td style="text-align:left;"> ASDHPLR </td>
    <td style="text-align:left;"> Somewhat like </td>
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    <td style="text-align:right;"> 2.344 </td>
  </tr>
  <tr>

```

ASDHPLR	Do not like	-18.440	-24.293	-12.609	3.461
ASDHEDUP	Ref: University or higher	0.000	NA	NA	NA
ASDHEDUP	Post-secondary not university	-12.471	-19.649	-5.675	4.178
ASDHEDUP	Upper secondary	-24.380	-30.592	-18.174	3.817
ASDHEDUP	Lower secondary	-41.285	-48.415	-33.961	4.458
ASDHEDUP	Some primary/lower secondary or no school	-48.817	-56.570	-40.863	4.756
ASDGSLR	Ref: Very much like reading	0.000			

```
 NA </td>  NA </td>  NA </td> </tr> <tr>  ASDGSLR </td>  Somewhat like reading </td>  -10.848 </td>  -14.593 </td>  -7.133 </td>  2.199 </td> </tr> <tr>  ASDGSLR </td>  Do not like reading </td>  -14.752 </td>  -22.159 </td>  -7.874 </td>  4.348 </td> </tr> <tr>  ASBH12 </td>  Ref: &gt;200 </td>  0.000 </td>  NA </td>  NA </td>  NA </td> </tr> <tr>  ASBH12 </td>  0-10 </td>  -12.386 </td>  -22.124 </td>  -3.106 </td>  5.567 </td> </tr> <tr>  ASBH12 </td>  11-25 </td>  -3.248 </td>  -11.706 </td>  5.011 </td>  5.227 </td> </tr> <tr>  ASBH12 </td>  26-100 </td>  -0.303 </td>  -7.530 </td>  7.290 </td>  4.609 </td> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
```

```
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  <td style="text-align:right;"> 18.380 </td>
  <td style="text-align:right;"> 4.532 </td>
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  <td style="text-align:right;"> NA </td>
  <td style="text-align:right;"> NA </td>
  <td style="text-align:right;"> NA </td>
</tr>
<tr>
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  <td style="text-align:left;"> 0-10 </td>
  <td style="text-align:right;"> -34.105 </td>
  <td style="text-align:right;"> -43.659 </td>
  <td style="text-align:right;"> -24.708 </td>
  <td style="text-align:right;"> 5.629 </td>
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<tr>
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  <td style="text-align:left;"> 11-25 </td>
  <td style="text-align:right;"> -30.105 </td>
  <td style="text-align:right;"> -37.807 </td>
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  <td style="text-align:right;"> 4.734 </td>
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<tr>
  <td style="text-align:left;"> ATBR16 </td>
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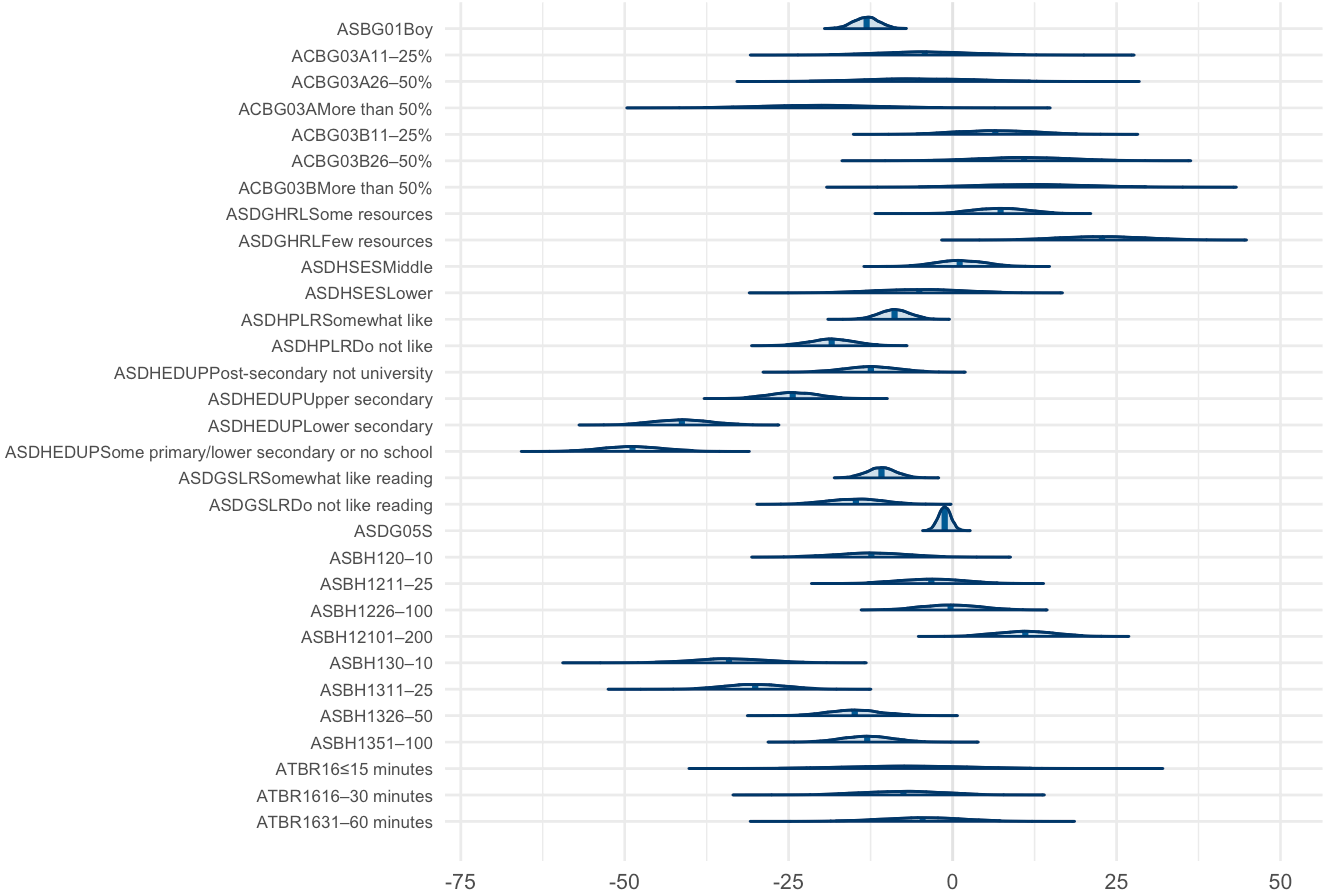
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<td style="text-align:right;"> -23.101 </td>
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<tr>
<td style="text-align:left;"> ATBR16 </td>
<td style="text-align:left;"> 16–30 minutes </td>
<td style="text-align:right;"> -7.505 </td>
<td style="text-align:right;"> -18.326 </td>
<td style="text-align:right;"> 2.235 </td>
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<tr>
<td style="text-align:left;"> ATBR16 </td>
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<td style="text-align:right;"> -4.583 </td>
<td style="text-align:right;"> -15.459 </td>
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</tbody>
</table>

```

Generating plots for Bayesian LASSO, Outcome: ASRREA03 :

Posterior Medians & 95% Credible Intervals for ASRREA03



Running Bayesian multilevel LASSO pipeline for outcome: ASRREA04

Fitting multilevel Bayesian LASSO for ASRREA04

Bayesian multilevel LASSO model fitted for ASRREA04

Summary of coefficients (from broom.mixed::tidy):

A tibble: 6 × 5

term	estimate	std.error	conf.low	conf.high
<chr>	<dbl>	<dbl>	<dbl>	<dbl>
1 ASBG01Boy	-14.9	1.95	-18.1	-11.7
2 ACBG03A11-25%	-4.70	7.23	-16.5	7.23
3 ACBG03A26-50%	-9.07	8.21	-22.8	4.23
4 ACBG03AMore than 50%	-21.8	8.68	-36.2	-8.08
5 ACBG03B11-25%	5.20	5.93	-4.73	15.2
6 ACBG03B26-50%	10.8	6.77	-0.198	21.8

Final Table for Bayesian LASSO, Outcome: ASRREA04 :

<table class="table" style="width: auto !important; margin-left: auto; margin-right: auto;">

<caption>Bayesian LASSO Results for ASRREA04</caption>

<thead>

<tr>

<th style="text-align:left;"> Variable </th>


```

<th style="text-align:left;"> Category </th>
<th style="text-align:right;"> Estimate </th>
<th style="text-align:right;"> 95% CI Low </th>
<th style="text-align:right;"> 95% CI High </th>
<th style="text-align:right;"> Std. Error (Posterior SD) </th>
</tr>
</thead>
<tbody>
<tr>
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<td style="text-align:right;"> NA </td>
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<td style="text-align:right;"> NA </td>
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<td style="text-align:left;"> 11-25% </td>
<td style="text-align:right;"> -4.701 </td>
<td style="text-align:right;"> -16.468 </td>
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<td style="text-align:right;"> 7.233 </td>
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<tr>
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<td style="text-align:left;"> 26-50% </td>
<td style="text-align:right;"> -9.072 </td>
<td style="text-align:right;"> -22.772 </td>
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<tr>
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<td style="text-align:left;"> More than 50% </td>

```

-21.777					
-36.185					
-8.080					
8.679					

ACBG03B	Ref: 0-10%	0.000	NA	NA	NA
---------	------------	-------	----	----	----

ACBG03B	11-25%	5.195	-4.729	15.205	5.930
---------	--------	-------	--------	--------	-------

ACBG03B	26-50%	10.847	-0.198	21.783	6.768
---------	--------	--------	--------	--------	-------

ACBG03B	More than 50%	9.738	-3.793	23.269	8.414
---------	---------------	-------	--------	--------	-------

ASDGHRL	Ref: Many resources	0.000	NA	NA	NA
---------	---------------------	-------	----	----	----

ASDGHRL	Some resources	8.892	2.150	15.527	
---------	----------------	-------	-------	--------	--

```

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    <td style="text-align:right;"> NA </td>
    <td style="text-align:right;"> NA </td>
  </tr>
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    <td style="text-align:right;"> NA </td>
    <td style="text-align:right;"> NA </td>
  </tr>
  <tr>
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ASDHPLR	Do not like	-19.167	-24.847	-13.743	3.467
ASDHEDUP	Ref: University or higher	0.000	NA	NA	NA
ASDHEDUP	Post-secondary not university	-11.557	-18.538	-4.627	4.176
ASDHEDUP	Upper secondary	-20.561	-26.724	-14.366	3.815
ASDHEDUP	Lower secondary	-35.951	-42.931	-28.635	4.297
ASDHEDUP	Some primary/lower secondary or no school	-43.219	-50.979	-35.602	4.520
ASDGSLR	Ref: Very much like reading	0.000			

```
 NA | NA | NA || ASDGSLR | Somewhat like reading | -12.046 | -15.570 | -8.428 | 2.132 |
| ASDGSLR | Do not like reading | -17.243 | -24.217 | -10.446 | 4.177 |
| ASBH12 | Ref: &gt;200 | 0.000 | NA | NA | NA |
| ASBH12 | 0-10 | -5.826 | -14.667 | 3.233 | 5.418 |
| ASBH12 | 11-25 | -0.328 | -8.494 | 7.711 | 4.884 |
| ASBH12 | 26-100 | 2.847 | -4.430 | 10.001 | 4.383 |

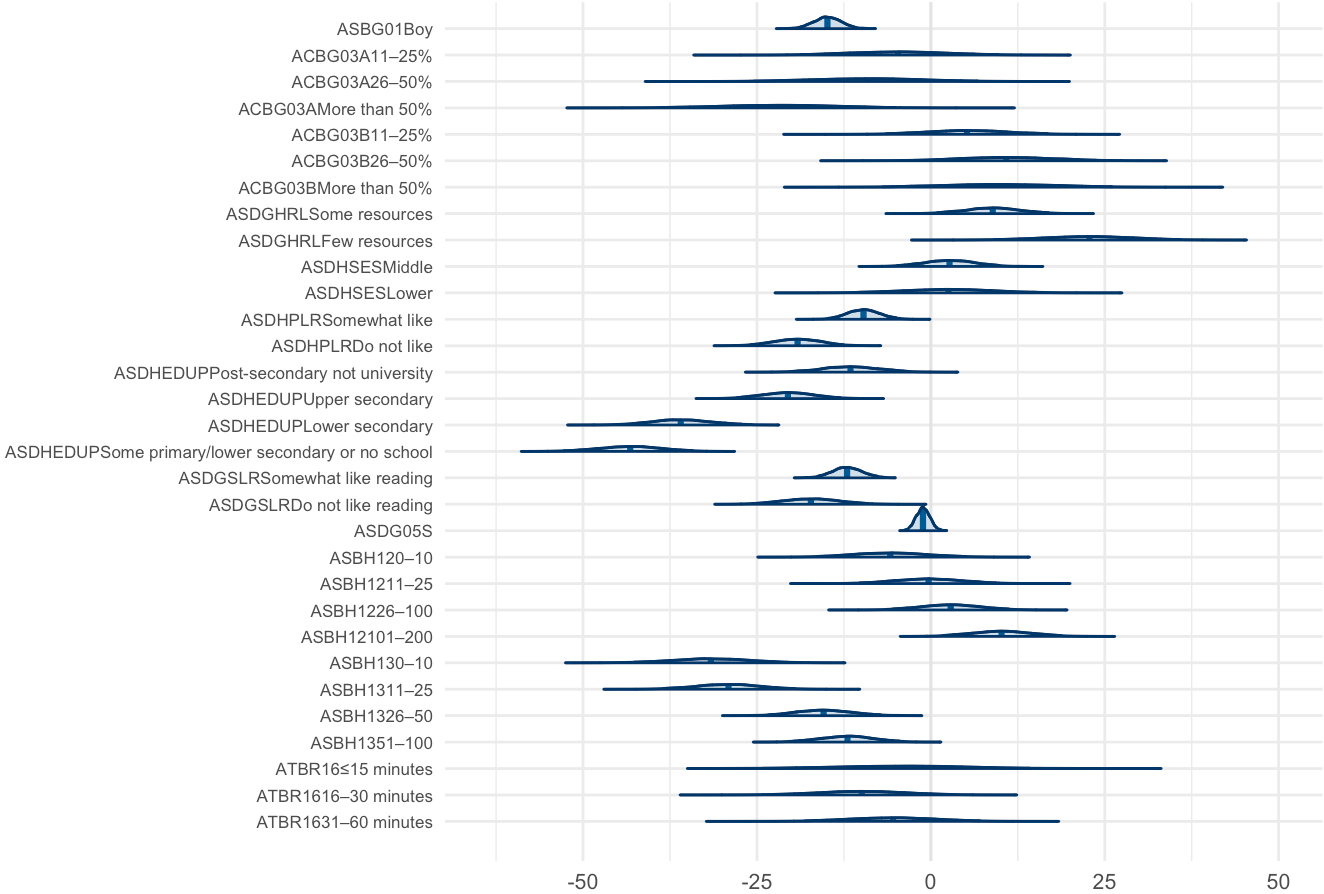
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  <td style="text-align:right;"> NA </td>
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<tr>
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Ref: >60 minutes	0.000	NA	NA	NA
ATBR16	≤15 minutes	-4.080	-20.277	11.052
ATBR16	16-30 minutes	-9.923	-20.566	0.544
ATBR16	31-60 minutes	-5.425	-16.045	4.903
ASDG05S	Numeric	-1.132	-2.703	0.475
		0.985		

Generating plots for Bayesian LASSO, Outcome: ASRREA04 :

Posterior Medians & 95% Credible Intervals for ASRREA04



Running Bayesian multilevel LASSO pipeline for outcome: ASRREA05

Fitting multilevel Bayesian LASSO for ASRREA05

Bayesian multilevel LASSO model fitted for ASRREA05

Summary of coefficients (from broom.mixed::tidy):

A tibble: 6 × 5

term	estimate	std.error	conf.low	conf.high
<chr>	<dbl>	<dbl>	<dbl>	<dbl>
1 ASBG01Boy	-15.0	2.00	-18.4	-11.7
2 ACBG03A11-25%	-1.67	7.44	-14.2	10.5
3 ACBG03A26-50%	-2.80	8.46	-17.2	10.6
4 ACBG03AMore than 50%	-17.2	9.10	-32.8	-2.82
5 ACBG03B11-25%	6.84	6.40	-3.46	17.5
6 ACBG03B26-50%	12.3	6.76	0.924	23.8

Final Table for Bayesian LASSO, Outcome: ASRREA05 :

<table class="table" style="width: auto !important; margin-left: auto; margin-right: auto;">

<caption>Bayesian LASSO Results for ASRREA05</caption>

<thead>

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<th style="text-align:left;"> Variable </th>


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<th style="text-align:left;"> Category </th>
<th style="text-align:right;"> Estimate </th>
<th style="text-align:right;"> 95% CI Low </th>
<th style="text-align:right;"> 95% CI High </th>
<th style="text-align:right;"> Std. Error (Posterior SD) </th>
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<td style="text-align:left;"> Boy </td>
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<td style="text-align:left;"> ACBG03A </td>
<td style="text-align:left;"> Ref: 0-10% </td>
<td style="text-align:right;"> 0.000 </td>
<td style="text-align:right;"> NA </td>
<td style="text-align:right;"> NA </td>
<td style="text-align:right;"> NA </td>
</tr>
<tr>
<td style="text-align:left;"> ACBG03A </td>
<td style="text-align:left;"> 11-25% </td>
<td style="text-align:right;"> -1.670 </td>
<td style="text-align:right;"> -14.223 </td>
<td style="text-align:right;"> 10.524 </td>
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</tr>
<tr>
<td style="text-align:left;"> ACBG03A </td>
<td style="text-align:left;"> More than 50% </td>

```

-17.220					
-32.765					
-2.820					
9.096					

ACBG03B	Ref: 0-10%	0.000	NA	NA	NA
---------	------------	-------	----	----	----

ACBG03B	11-25%	6.835	-3.465	17.491	6.398
---------	--------	-------	--------	--------	-------

ACBG03B	26-50%	12.300	0.924	23.778	6.760
---------	--------	--------	-------	--------	-------

ACBG03B	More than 50%	16.173	1.156	30.106	8.968
---------	---------------	--------	-------	--------	-------

ASDGHRL	Ref: Many resources	0.000	NA	NA	NA
---------	---------------------	-------	----	----	----

ASDGHRL	Some resources	8.759	1.964	15.684	
---------	----------------	-------	-------	--------	--

```

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    <td style="text-align:right;"> NA </td>
    <td style="text-align:right;"> NA </td>
</tr>
<tr>
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    <td style="text-align:left;"> Middle </td>
    <td style="text-align:right;"> 1.142 </td>
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    <td style="text-align:right;"> 3.768 </td>
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    <td style="text-align:right;"> NA </td>
    <td style="text-align:right;"> NA </td>
</tr>
<tr>
    <td style="text-align:left;"> ASDHPLR </td>
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</tr>
<tr>

```

ASDHPLR	Do not like	-19.452	-25.094	-13.882	3.440
ASDHEDUP	Ref: University or higher	0.000	NA	NA	NA
ASDHEDUP	Post-secondary not university	-17.374	-24.397	-10.360	4.300
ASDHEDUP	Upper secondary	-24.101	-30.440	-18.082	3.603
ASDHEDUP	Lower secondary	-42.557	-49.853	-35.256	4.501
ASDHEDUP	Some primary/lower secondary or no school	-47.192	-55.060	-39.573	4.715
ASDGSLR	Ref: Very much like reading	0.000			

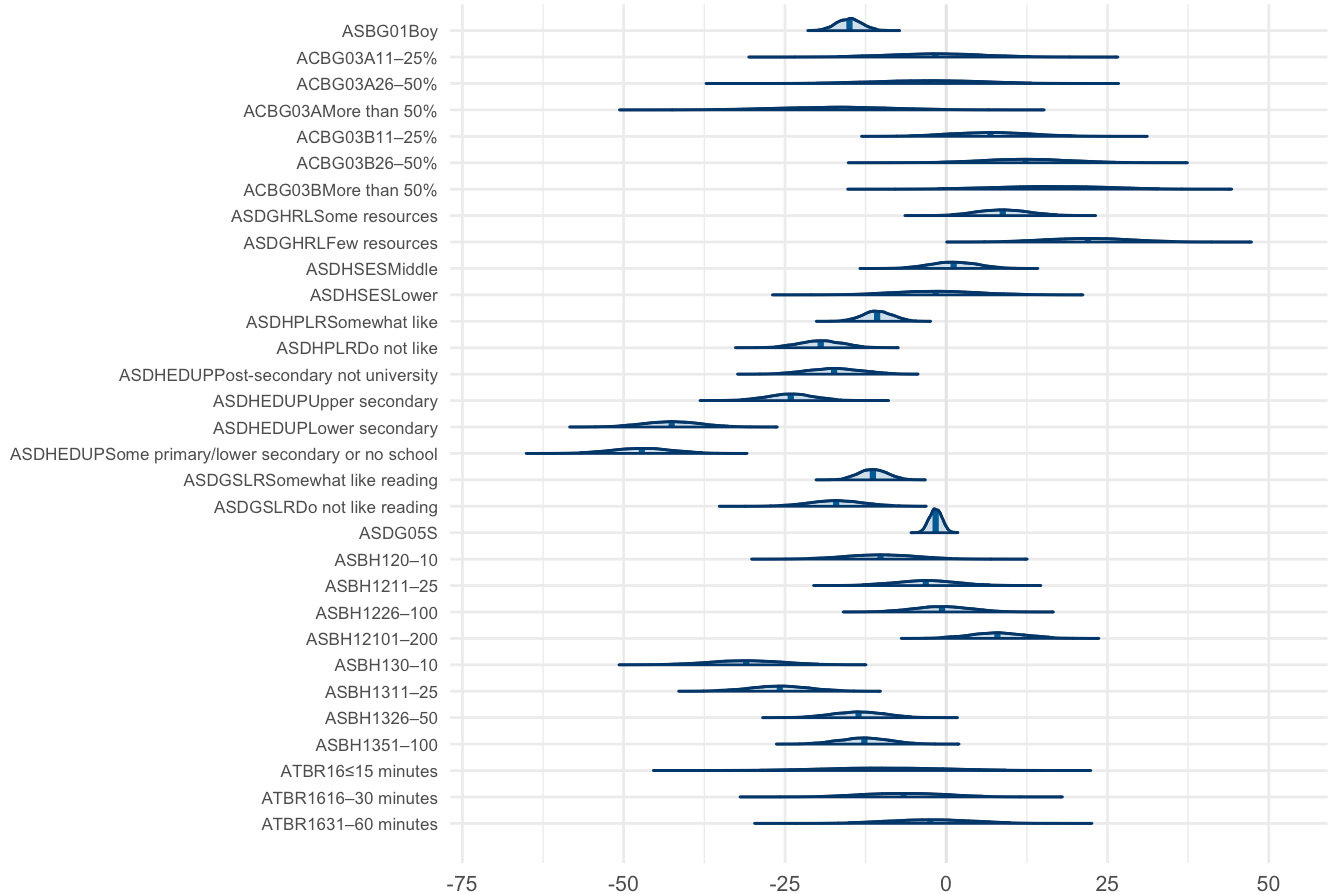
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 NA </td>  NA </td>  NA </td> </tr> <tr>  ASDGSLR </td>  Somewhat like reading </td>  -11.365 </td>  -14.969 </td>  -7.605 </td>  2.279 </td> </tr> <tr>  ASDGSLR </td>  Do not like reading </td>  -17.072 </td>  -24.377 </td>  -9.845 </td>  4.220 </td> </tr> <tr>  ASBH12 </td>  Ref: &gt;200 </td>  0.000 </td>  NA </td>  NA </td>  NA </td> </tr> <tr>  ASBH12 </td>  0-10 </td>  -10.190 </td>  -19.446 </td>  -1.093 </td>  5.549 </td> </tr> <tr>  ASBH12 </td>  11-25 </td>  -3.164 </td>  -11.390 </td>  4.813 </td>  4.791 </td> </tr> <tr>  ASBH12 </td>  26-100 </td>  -0.651 </td>  -8.113 </td>  6.565 </td>  4.405 </td> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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```
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  <td style="text-align:right;"> NA </td>
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  <td style="text-align:left;"> ASBH13 </td>
  <td style="text-align:left;"> 0-10 </td>
  <td style="text-align:right;"> -31.012 </td>
  <td style="text-align:right;"> -40.768 </td>
  <td style="text-align:right;"> -21.544 </td>
  <td style="text-align:right;"> 5.804 </td>
</tr>
<tr>
  <td style="text-align:left;"> ASBH13 </td>
  <td style="text-align:left;"> 11-25 </td>
  <td style="text-align:right;"> -25.797 </td>
  <td style="text-align:right;"> -33.768 </td>
  <td style="text-align:right;"> -17.954 </td>
  <td style="text-align:right;"> 4.655 </td>
</tr>
<tr>
  <td style="text-align:left;"> ASBH13 </td>
  <td style="text-align:left;"> 26-50 </td>
  <td style="text-align:right;"> -13.594 </td>
  <td style="text-align:right;"> -20.479 </td>
  <td style="text-align:right;"> -6.852 </td>
  <td style="text-align:right;"> 4.227 </td>
</tr>
<tr>
  <td style="text-align:left;"> ASBH13 </td>
  <td style="text-align:left;"> 51-100 </td>
  <td style="text-align:right;"> -12.690 </td>
  <td style="text-align:right;"> -19.239 </td>
  <td style="text-align:right;"> -6.280 </td>
  <td style="text-align:right;"> 3.916 </td>
</tr>
<tr>
  <td style="text-align:left;"> ATBR16 </td>
```

Ref: >60 minutes	0.000	NA	NA	NA
ATBR16	≤15 minutes	-9.574	-25.429	6.276
ATBR16	16-30 minutes	-6.591	-17.111	4.064
ATBR16	31-60 minutes	-2.462	-13.250	7.985
ASDG05S	Numeric	-1.641	-3.239	-0.055
		1.000		

Generating plots for Bayesian LASSO, Outcome: ASRREA05 :

Posterior Medians & 95% Credible Intervals for ASRREA05



```
cat("\nAll Bayesian LASSO analyses done! Check 'bayesian_results_list' for stored models
```

All Bayesian LASSO analyses done! Check 'bayesian_results_list' for stored models and tables, and 'bayesian_plots_list' for stored plots.

8. Detailed Model Inspection for One Outcome

Inspect diagnostics, trace plots, posterior predictive checks and probability of direction for the first successfully fitted model.

```
#####
# 8. DETAILED MODEL INSPECTION (MULTILEVEL)
#####
first_successful_outcome <- names(bayesian_results_list)[1]

if (!is.null(first_successful_outcome) && !is.null(bayesian_results_list[[first_successful_outcome]])) {
  cat("\n--- Detailed analysis for outcome:", first_successful_outcome, "---\n")
  model_to_inspect <- bayesian_results_list[[first_successful_outcome]]$bayesian_lasso_fit
  tidy_results_inspect <- bayesian_results_list[[first_successful_outcome]]$tidy_results
  # 1. Full summary including MCMC diagnostics
  cat("\n1. Model Summary (check Rhat ~ 1, n_eff adequate):\n")
}
```



```

print(summary(model_to_inspect))
# 2. Trace plots for a few parameters
if (nrow(tidy_results_inspect) > 0) {
  params_to_trace <- head(tidy_results_inspect$term, min(3, nrow(tidy_results_inspect)))
  if (length(params_to_trace) > 0) {
    cat("\n2. Trace plots for parameters:", paste(params_to_trace, collapse=" "), "\n")
    trace_plot <- mcmc_trace(model_to_inspect, pars = params_to_trace) +
      ggtitle(paste("Trace Plots for", first_successful_outcome, "(Selected Predictors)"))
    print(trace_plot)
    bayesian_plots_list[[paste0(first_successful_outcome, "_trace_plot")]] <- trace_plot
  }
}
# 3. Posterior density plots for a few parameters
if (nrow(tidy_results_inspect) > 0) {
  params_to_plot_density <- head(tidy_results_inspect$term, min(3, nrow(tidy_results_inspect)))
  if (length(params_to_plot_density) > 0) {
    cat("\n3. Posterior density plots for parameters:", paste(params_to_plot_density, collapse=" "), "\n")
    density_plot <- mcmc_dens_overlay(model_to_inspect, pars = params_to_plot_density)
    ggtitle(paste("Posterior Densities for", first_successful_outcome, "(Selected Predictors)"))
    print(density_plot)
    bayesian_plots_list[[paste0(first_successful_outcome, "_density_plot")]] <- density_plot
  }
}
# 4. Posterior predictive check (density overlay)
cat("\n4. Posterior predictive check (density overlay):\n")
y_actual <- model_to_inspect$y
y_pred_posterior <- posterior_predict(model_to_inspect)
ppc_plot <- ppc_dens_overlay(y_actual, y_pred_posterior[1:min(50, nrow(y_pred_posterior))])
ggtitle(paste("Posterior Predictive Check for", first_successful_outcome))
print(ppc_plot)
bayesian_plots_list[[paste0(first_successful_outcome, "_ppc_dens_plot")]] <- ppc_plot
# 5. Probability of Direction (PD)
cat("\n5. Probability of direction (PD) for coefficients:\n")
pd_results <- p_direction(model_to_inspect)
print(pd_results)
# 6. Scatter plot of posterior means vs SD
if (nrow(tidy_results_inspect) > 0) {
  cat("\n6. Scatter plot of posterior means vs SD:\n")
  scatter_plot_custom <- ggplot(tidy_results_inspect, aes(x = estimate, y = std.error))
  geom_point() +
  geom_text(aes(label = term), vjust = -0.5, size = 3, check_overlap = TRUE) +
  labs(title = paste("Posterior Mean vs SD for", first_successful_outcome),
       x = "Posterior Mean (Estimate)", y = "Posterior Standard Deviation") +
  theme_bw()
  print(scatter_plot_custom)
  bayesian_plots_list[[paste0(first_successful_outcome, "_mean_vs_sd_plot")]] <- scatter_plot_custom
} else {
  cat("\nNo successful models to generate detailed plots.\n")
}

```

--- Detailed analysis for outcome: ASRREA01 ---

1. Model Summary (check Rhat ~ 1, n_eff adequate):

Model Info:

```
function:      stan_glmer
family:        gaussian [identity]
formula:       ASRREA01 ~ ASBG01 + ACBG03A + ACBG03B + ASDGHRL + ASDHSES + ASDHPLR +
               ASDHEDUP + ASDGSLR + ASDG05S + ASBH12 + ASBH13 + ATBR16 +
               (1 | IDSCH00L)
algorithm:     sampling
sample:        4500 (posterior sample size)
priors:        see help('prior_summary')
observations:  5069
groups:        IDSCH00L (180)
```

Estimates:

	mean	sd	10%	50%
(Intercept)	578.8	13.9	560.9	579.0
ASBG01Boy	-12.1	2.0	-14.6	-12.1
ACBG03A11-25%	-4.2	7.6	-13.8	-4.2
ACBG03A26-50%	-7.2	8.4	-17.9	-7.1
ACBG03AMore than 50%	-22.2	8.8	-33.5	-22.2
ACBG03B11-25%	3.8	6.3	-4.2	3.8
ACBG03B26-50%	10.4	6.9	1.7	10.4
ACBG03BMore than 50%	8.2	8.4	-2.5	8.1
ASDGHRLSome resources	9.1	4.1	3.9	9.1
ASDGHRLFew resources	22.0	6.7	13.5	22.0
ASDHSESMiddle	1.7	3.8	-3.2	1.7
ASDHSESLower	2.3	6.6	-6.1	2.3
ASDHPLRSomewhat like	-10.5	2.3	-13.5	-10.4
ASDHPLRDo not like	-18.2	3.4	-22.6	-18.3
ASDHEDUPPost-secondary not university	-13.0	4.1	-18.3	-13.1
ASDHEDUPUpper secondary	-22.3	3.8	-27.1	-22.4
ASDHEDUPLower secondary	-36.7	4.4	-42.3	-36.8
ASDHEDUPSome primary/lower secondary or no school	-44.6	4.7	-50.7	-44.6
ASDGSLRSomewhat like reading	-13.0	2.2	-15.9	-13.0
ASDGSLRDo not like reading	-22.3	4.2	-27.7	-22.2
ASDG05S	-1.6	1.0	-2.8	-1.6
ASBH120-10	-6.6	5.6	-13.9	-6.5
ASBH1211-25	-1.7	4.9	-8.0	-1.6
ASBH1226-100	0.3	4.4	-5.4	0.3
ASBH12101-200	7.7	4.4	2.1	7.7
ASBH130-10	-33.1	5.6	-40.3	-33.1
ASBH1311-25	-29.6	4.6	-35.6	-29.6
ASBH1326-50	-13.5	4.1	-18.5	-13.4
ASBH1351-100	-11.6	3.8	-16.5	-11.5
ATBR16≤15 minutes	-15.1	9.6	-27.4	-15.1
ATBR1616-30 minutes	-9.9	6.4	-18.1	-9.8

ATBR1631-60 minutes	-8.1	6.4	-16.3	-8.2
b[(Intercept) IDSCH00L:5001]	30.9	10.6	17.5	30.7
b[(Intercept) IDSCH00L:5002]	35.1	15.1	15.9	35.1
b[(Intercept) IDSCH00L:5003]	6.1	13.3	-10.7	6.0
b[(Intercept) IDSCH00L:5004]	-50.7	14.5	-69.1	-50.7
b[(Intercept) IDSCH00L:5005]	1.3	14.0	-17.1	1.3
b[(Intercept) IDSCH00L:5006]	-11.5	14.5	-29.6	-11.5
b[(Intercept) IDSCH00L:5007]	14.3	12.8	-2.2	14.3
b[(Intercept) IDSCH00L:5008]	3.0	17.6	-20.4	3.1
b[(Intercept) IDSCH00L:5009]	-8.1	13.5	-25.6	-8.3
b[(Intercept) IDSCH00L:5010]	19.1	12.4	3.5	18.7
b[(Intercept) IDSCH00L:5011]	-9.8	13.8	-27.1	-9.9
b[(Intercept) IDSCH00L:5012]	-8.9	13.2	-25.8	-9.0
b[(Intercept) IDSCH00L:5013]	29.3	16.2	8.8	29.2
b[(Intercept) IDSCH00L:5014]	1.9	10.8	-11.8	2.0
b[(Intercept) IDSCH00L:5015]	2.5	10.8	-11.6	2.3
b[(Intercept) IDSCH00L:5016]	-6.1	16.8	-27.3	-6.2
b[(Intercept) IDSCH00L:5017]	13.4	14.5	-5.2	13.5
b[(Intercept) IDSCH00L:5018]	-6.2	9.2	-18.0	-6.2
b[(Intercept) IDSCH00L:5019]	-20.9	16.4	-41.9	-20.7
b[(Intercept) IDSCH00L:5020]	28.6	9.8	16.0	28.7
b[(Intercept) IDSCH00L:5021]	-8.2	15.4	-28.0	-8.1
b[(Intercept) IDSCH00L:5022]	19.6	10.0	6.8	19.9
b[(Intercept) IDSCH00L:5023]	-8.9	14.1	-27.0	-9.2
b[(Intercept) IDSCH00L:5024]	26.0	18.8	2.0	25.7
b[(Intercept) IDSCH00L:5026]	39.6	12.5	23.3	39.7
b[(Intercept) IDSCH00L:5027]	-38.3	13.3	-55.7	-38.1
b[(Intercept) IDSCH00L:5028]	0.2	16.3	-20.8	0.2
b[(Intercept) IDSCH00L:5029]	20.0	14.3	1.9	20.1
b[(Intercept) IDSCH00L:5030]	-29.5	15.1	-48.4	-29.3
b[(Intercept) IDSCH00L:5031]	4.6	10.9	-9.6	4.8
b[(Intercept) IDSCH00L:5032]	-41.1	11.8	-56.0	-41.1
b[(Intercept) IDSCH00L:5033]	-32.1	10.7	-45.8	-32.1
b[(Intercept) IDSCH00L:5034]	13.9	15.4	-5.9	13.9
b[(Intercept) IDSCH00L:5035]	6.7	13.3	-10.5	6.8
b[(Intercept) IDSCH00L:5036]	18.6	12.8	2.4	18.5
b[(Intercept) IDSCH00L:5037]	-20.9	11.6	-35.8	-20.9
b[(Intercept) IDSCH00L:5038]	-26.8	11.6	-41.6	-26.7
b[(Intercept) IDSCH00L:5039]	-12.4	14.0	-30.1	-12.4
b[(Intercept) IDSCH00L:5040]	22.3	12.1	6.9	22.3
b[(Intercept) IDSCH00L:5041]	37.0	10.5	23.8	36.9
b[(Intercept) IDSCH00L:5042]	-46.0	11.9	-61.6	-45.8
b[(Intercept) IDSCH00L:5043]	4.4	19.6	-20.6	4.7
b[(Intercept) IDSCH00L:5044]	27.7	13.1	11.0	27.5
b[(Intercept) IDSCH00L:5045]	11.8	11.2	-2.7	11.6
b[(Intercept) IDSCH00L:5046]	22.7	10.7	8.8	22.8
b[(Intercept) IDSCH00L:5047]	20.0	15.3	-0.3	19.8
b[(Intercept) IDSCH00L:5048]	16.0	12.0	0.3	16.0
b[(Intercept) IDSCH00L:5049]	-55.0	13.4	-72.4	-54.6
b[(Intercept) IDSCH00L:5050]	-43.4	13.8	-61.1	-43.3
b[(Intercept) IDSCH00L:5051]	-2.7	9.0	-14.1	-2.8

b[(Intercept) IDSCH00L:5052]	11.7	10.4	-1.4	11.6
b[(Intercept) IDSCH00L:5053]	2.0	11.9	-13.1	1.9
b[(Intercept) IDSCH00L:5054]	22.8	14.0	4.4	23.0
b[(Intercept) IDSCH00L:5055]	-27.9	10.6	-41.5	-28.0
b[(Intercept) IDSCH00L:5056]	7.3	15.3	-12.0	7.4
b[(Intercept) IDSCH00L:5057]	16.1	14.0	-1.9	16.3
b[(Intercept) IDSCH00L:5058]	-0.8	15.1	-20.5	-0.6
b[(Intercept) IDSCH00L:5059]	-7.4	19.4	-32.7	-7.5
b[(Intercept) IDSCH00L:5060]	42.4	14.9	23.3	42.5
b[(Intercept) IDSCH00L:5061]	-19.3	11.5	-34.1	-19.4
b[(Intercept) IDSCH00L:5062]	-14.8	14.7	-33.4	-14.6
b[(Intercept) IDSCH00L:5063]	-18.3	14.7	-37.0	-18.4
b[(Intercept) IDSCH00L:5064]	-2.7	14.7	-21.8	-2.7
b[(Intercept) IDSCH00L:5065]	30.7	9.2	19.2	30.6
b[(Intercept) IDSCH00L:5066]	2.6	12.9	-13.8	2.7
b[(Intercept) IDSCH00L:5067]	-22.9	15.0	-42.1	-23.1
b[(Intercept) IDSCH00L:5068]	14.9	10.7	1.3	14.8
b[(Intercept) IDSCH00L:5069]	-15.5	14.9	-34.6	-15.6
b[(Intercept) IDSCH00L:5070]	-20.0	12.4	-35.9	-19.7
b[(Intercept) IDSCH00L:5071]	3.8	14.7	-14.7	3.8
b[(Intercept) IDSCH00L:5072]	15.6	13.1	-1.5	15.7
b[(Intercept) IDSCH00L:5073]	7.8	10.8	-6.1	7.6
b[(Intercept) IDSCH00L:5074]	31.5	9.7	19.0	31.4
b[(Intercept) IDSCH00L:5075]	-47.0	17.4	-69.3	-47.2
b[(Intercept) IDSCH00L:5076]	-23.0	19.5	-48.3	-22.9
b[(Intercept) IDSCH00L:5078]	-15.5	13.5	-32.6	-15.6
b[(Intercept) IDSCH00L:5079]	-4.9	14.5	-23.3	-4.9
b[(Intercept) IDSCH00L:5080]	-15.2	10.0	-28.0	-15.1
b[(Intercept) IDSCH00L:5081]	8.4	15.6	-11.8	8.6
b[(Intercept) IDSCH00L:5082]	9.1	12.6	-7.0	9.0
b[(Intercept) IDSCH00L:5083]	7.0	12.4	-9.0	6.8
b[(Intercept) IDSCH00L:5084]	2.2	9.2	-9.3	2.2
b[(Intercept) IDSCH00L:5085]	-26.8	10.3	-39.9	-26.8
b[(Intercept) IDSCH00L:5086]	27.3	14.7	8.1	27.2
b[(Intercept) IDSCH00L:5087]	27.9	13.4	10.6	27.9
b[(Intercept) IDSCH00L:5088]	1.2	10.2	-11.9	1.3
b[(Intercept) IDSCH00L:5090]	-11.1	17.2	-32.9	-10.9
b[(Intercept) IDSCH00L:5091]	-2.7	12.3	-18.4	-2.5
b[(Intercept) IDSCH00L:5092]	25.2	11.4	10.8	25.2
b[(Intercept) IDSCH00L:5093]	4.8	11.2	-9.4	4.4
b[(Intercept) IDSCH00L:5094]	-11.8	13.4	-29.0	-11.7
b[(Intercept) IDSCH00L:5095]	16.4	15.3	-3.2	16.7
b[(Intercept) IDSCH00L:5096]	13.7	10.8	0.2	13.7
b[(Intercept) IDSCH00L:5097]	-22.3	12.9	-38.7	-22.3
b[(Intercept) IDSCH00L:5098]	-79.2	14.2	-97.7	-79.1
b[(Intercept) IDSCH00L:5099]	6.9	14.5	-11.3	6.6
b[(Intercept) IDSCH00L:5100]	7.9	11.1	-6.2	7.8
b[(Intercept) IDSCH00L:5102]	-9.4	9.5	-21.6	-9.4
b[(Intercept) IDSCH00L:5103]	-12.7	16.8	-34.1	-12.8
b[(Intercept) IDSCH00L:5105]	26.8	13.5	10.0	26.7
b[(Intercept) IDSCH00L:5106]	26.6	10.6	13.2	26.3

b[(Intercept) IDSCH00L:5107]	34.4	14.3	16.3	34.3
b[(Intercept) IDSCH00L:5109]	5.9	14.3	-12.2	5.6
b[(Intercept) IDSCH00L:5110]	-7.3	10.3	-20.2	-7.6
b[(Intercept) IDSCH00L:5111]	20.0	11.2	5.4	19.9
b[(Intercept) IDSCH00L:5113]	7.5	13.9	-10.1	7.5
b[(Intercept) IDSCH00L:5114]	27.5	13.2	10.5	27.4
b[(Intercept) IDSCH00L:5115]	-20.1	17.5	-42.8	-20.1
b[(Intercept) IDSCH00L:5116]	2.8	9.4	-9.5	2.9
b[(Intercept) IDSCH00L:5117]	20.2	13.3	3.0	20.1
b[(Intercept) IDSCH00L:5118]	-12.4	14.3	-30.9	-12.5
b[(Intercept) IDSCH00L:5119]	-7.6	11.2	-22.3	-7.4
b[(Intercept) IDSCH00L:5120]	-4.7	10.3	-18.0	-4.7
b[(Intercept) IDSCH00L:5121]	-27.7	15.4	-47.4	-28.0
b[(Intercept) IDSCH00L:5122]	-23.1	11.9	-38.6	-22.8
b[(Intercept) IDSCH00L:5123]	-1.4	12.0	-16.6	-1.4
b[(Intercept) IDSCH00L:5124]	17.2	11.6	1.8	17.3
b[(Intercept) IDSCH00L:5125]	8.3	10.4	-5.0	8.4
b[(Intercept) IDSCH00L:5126]	1.5	16.1	-19.1	1.4
b[(Intercept) IDSCH00L:5127]	-17.3	13.0	-34.0	-17.3
b[(Intercept) IDSCH00L:5128]	10.7	13.2	-5.6	10.4
b[(Intercept) IDSCH00L:5129]	7.4	13.9	-10.5	7.3
b[(Intercept) IDSCH00L:5130]	2.6	19.3	-22.2	2.7
b[(Intercept) IDSCH00L:5131]	-6.4	12.3	-22.1	-6.4
b[(Intercept) IDSCH00L:5132]	26.5	13.9	8.6	26.7
b[(Intercept) IDSCH00L:5133]	7.4	11.5	-7.7	7.6
b[(Intercept) IDSCH00L:5134]	0.4	16.0	-20.0	0.1
b[(Intercept) IDSCH00L:5135]	8.2	12.1	-7.2	8.2
b[(Intercept) IDSCH00L:5136]	21.7	12.2	6.2	21.8
b[(Intercept) IDSCH00L:5137]	7.3	11.8	-8.1	7.3
b[(Intercept) IDSCH00L:5138]	5.9	11.0	-8.2	5.9
b[(Intercept) IDSCH00L:5139]	5.5	10.9	-8.8	5.5
b[(Intercept) IDSCH00L:5140]	-5.0	14.2	-23.2	-5.1
b[(Intercept) IDSCH00L:5141]	-3.8	13.9	-22.1	-3.7
b[(Intercept) IDSCH00L:5142]	21.8	17.5	-0.9	21.7
b[(Intercept) IDSCH00L:5143]	3.7	11.2	-10.4	3.6
b[(Intercept) IDSCH00L:5144]	11.1	19.3	-13.4	11.1
b[(Intercept) IDSCH00L:5146]	-21.7	14.6	-40.5	-21.8
b[(Intercept) IDSCH00L:5147]	-6.7	12.5	-22.5	-7.0
b[(Intercept) IDSCH00L:5148]	-48.0	15.0	-67.2	-48.0
b[(Intercept) IDSCH00L:5149]	18.5	12.3	2.2	18.7
b[(Intercept) IDSCH00L:5150]	1.2	10.8	-12.8	1.4
b[(Intercept) IDSCH00L:5151]	-15.5	13.5	-32.8	-15.7
b[(Intercept) IDSCH00L:5152]	-27.9	17.6	-50.6	-28.0
b[(Intercept) IDSCH00L:5153]	40.1	10.4	26.4	40.0
b[(Intercept) IDSCH00L:5154]	-7.3	14.8	-25.6	-7.4
b[(Intercept) IDSCH00L:5155]	14.2	11.1	-0.2	14.3
b[(Intercept) IDSCH00L:5156]	-8.1	14.6	-26.8	-8.0
b[(Intercept) IDSCH00L:5157]	-12.0	12.9	-28.6	-12.0
b[(Intercept) IDSCH00L:5158]	-1.0	11.1	-15.3	-0.8
b[(Intercept) IDSCH00L:5160]	24.8	11.8	9.6	24.8
b[(Intercept) IDSCH00L:5161]	10.5	10.5	-2.9	10.5

b[(Intercept) IDSCH00L:5162]	-0.3	11.6	-15.0	-0.5
b[(Intercept) IDSCH00L:5163]	-17.5	9.9	-30.1	-17.4
b[(Intercept) IDSCH00L:5164]	-0.1	10.6	-13.5	-0.2
b[(Intercept) IDSCH00L:5165]	-32.7	16.5	-53.7	-33.0
b[(Intercept) IDSCH00L:5167]	-17.5	8.7	-28.6	-17.4
b[(Intercept) IDSCH00L:5168]	4.5	15.1	-15.1	4.4
b[(Intercept) IDSCH00L:5169]	-3.4	15.8	-24.0	-3.4
b[(Intercept) IDSCH00L:5170]	5.0	14.9	-14.3	5.0
b[(Intercept) IDSCH00L:5171]	-10.4	14.1	-28.1	-10.4
b[(Intercept) IDSCH00L:5172]	-63.6	9.6	-75.9	-63.5
b[(Intercept) IDSCH00L:5173]	-24.2	12.2	-39.8	-24.0
b[(Intercept) IDSCH00L:5174]	3.6	14.2	-14.5	3.6
b[(Intercept) IDSCH00L:5175]	-8.2	9.3	-20.3	-8.1
b[(Intercept) IDSCH00L:5177]	-4.5	15.1	-23.5	-4.2
b[(Intercept) IDSCH00L:5178]	11.2	11.7	-3.8	11.0
b[(Intercept) IDSCH00L:5179]	1.9	12.5	-14.0	2.0
b[(Intercept) IDSCH00L:5180]	3.8	17.2	-17.9	3.9
b[(Intercept) IDSCH00L:5181]	6.2	11.9	-9.0	6.4
b[(Intercept) IDSCH00L:5182]	16.9	12.1	1.6	16.6
b[(Intercept) IDSCH00L:5183]	-20.6	14.8	-38.9	-20.6
b[(Intercept) IDSCH00L:5184]	10.1	13.5	-7.2	10.0
b[(Intercept) IDSCH00L:5185]	11.5	13.8	-6.2	11.6
b[(Intercept) IDSCH00L:5186]	14.3	10.6	0.6	14.6
b[(Intercept) IDSCH00L:5188]	-18.3	16.8	-40.1	-18.1
b[(Intercept) IDSCH00L:5189]	15.4	16.1	-5.3	15.6
b[(Intercept) IDSCH00L:5190]	20.7	17.4	-1.8	20.8
b[(Intercept) IDSCH00L:5191]	2.8	13.5	-14.5	3.1
b[(Intercept) IDSCH00L:5192]	-18.6	16.5	-40.2	-18.5
sigma	68.3	0.7	67.4	68.3
Sigma[IDSCH00L:(Intercept),(Intercept)]	618.3	93.4	504.0	610.0
90%				
(Intercept)	596.2			
ASBG01Boy	-9.5			
ACBG03A11-25%	5.6			
ACBG03A26-50%	3.7			
ACBG03AMore than 50%	-11.1			
ACBG03B11-25%	12.0			
ACBG03B26-50%	19.2			
ACBG03BMore than 50%	19.0			
ASDGHRLSome resources	14.5			
ASDGHRLFew resources	30.7			
ASDHSESMiddle	6.4			
ASDHSESLower	10.7			
ASDHPLRSomewhat like	-7.5			
ASDHPLRDo not like	-13.9			
ASDHEDUPPost-secondary not university	-7.7			
ASDHEDUPUpper secondary	-17.5			
ASDHEDUPLower secondary	-31.0			
ASDHEDUPSome primary/lower secondary or no school	-38.6			
ASDGLSLSomewhat like reading	-10.2			
ASDGLSLRDo not like reading	-16.9			

ASDG05S	-0.3
ASBH120-10	0.6
ASBH1211-25	4.6
ASBH1226-100	6.1
ASBH12101-200	13.2
ASBH130-10	-25.9
ASBH1311-25	-23.6
ASBH1326-50	-8.4
ASBH1351-100	-6.8
ATBR16≤15 minutes	-3.1
ATBR1616-30 minutes	-1.7
ATBR1631-60 minutes	0.1
b[(Intercept) IDSCH00L:5001]	44.3
b[(Intercept) IDSCH00L:5002]	54.4
b[(Intercept) IDSCH00L:5003]	23.4
b[(Intercept) IDSCH00L:5004]	-32.2
b[(Intercept) IDSCH00L:5005]	19.3
b[(Intercept) IDSCH00L:5006]	7.2
b[(Intercept) IDSCH00L:5007]	30.8
b[(Intercept) IDSCH00L:5008]	25.6
b[(Intercept) IDSCH00L:5009]	9.1
b[(Intercept) IDSCH00L:5010]	35.0
b[(Intercept) IDSCH00L:5011]	8.1
b[(Intercept) IDSCH00L:5012]	7.9
b[(Intercept) IDSCH00L:5013]	50.3
b[(Intercept) IDSCH00L:5014]	15.9
b[(Intercept) IDSCH00L:5015]	16.7
b[(Intercept) IDSCH00L:5016]	15.2
b[(Intercept) IDSCH00L:5017]	32.0
b[(Intercept) IDSCH00L:5018]	5.6
b[(Intercept) IDSCH00L:5019]	-0.3
b[(Intercept) IDSCH00L:5020]	41.1
b[(Intercept) IDSCH00L:5021]	11.4
b[(Intercept) IDSCH00L:5022]	32.1
b[(Intercept) IDSCH00L:5023]	9.3
b[(Intercept) IDSCH00L:5024]	49.9
b[(Intercept) IDSCH00L:5026]	55.8
b[(Intercept) IDSCH00L:5027]	-21.0
b[(Intercept) IDSCH00L:5028]	20.8
b[(Intercept) IDSCH00L:5029]	38.1
b[(Intercept) IDSCH00L:5030]	-10.3
b[(Intercept) IDSCH00L:5031]	18.6
b[(Intercept) IDSCH00L:5032]	-26.0
b[(Intercept) IDSCH00L:5033]	-18.5
b[(Intercept) IDSCH00L:5034]	33.7
b[(Intercept) IDSCH00L:5035]	23.4
b[(Intercept) IDSCH00L:5036]	35.0
b[(Intercept) IDSCH00L:5037]	-6.2
b[(Intercept) IDSCH00L:5038]	-12.1
b[(Intercept) IDSCH00L:5039]	5.6
b[(Intercept) IDSCH00L:5040]	37.6

b[(Intercept) IDSCH00L:5041]	50.5
b[(Intercept) IDSCH00L:5042]	-30.6
b[(Intercept) IDSCH00L:5043]	29.4
b[(Intercept) IDSCH00L:5044]	44.4
b[(Intercept) IDSCH00L:5045]	26.4
b[(Intercept) IDSCH00L:5046]	36.1
b[(Intercept) IDSCH00L:5047]	40.1
b[(Intercept) IDSCH00L:5048]	31.4
b[(Intercept) IDSCH00L:5049]	-38.0
b[(Intercept) IDSCH00L:5050]	-26.1
b[(Intercept) IDSCH00L:5051]	9.0
b[(Intercept) IDSCH00L:5052]	25.0
b[(Intercept) IDSCH00L:5053]	17.3
b[(Intercept) IDSCH00L:5054]	40.5
b[(Intercept) IDSCH00L:5055]	-14.6
b[(Intercept) IDSCH00L:5056]	26.6
b[(Intercept) IDSCH00L:5057]	33.9
b[(Intercept) IDSCH00L:5058]	18.9
b[(Intercept) IDSCH00L:5059]	17.8
b[(Intercept) IDSCH00L:5060]	61.4
b[(Intercept) IDSCH00L:5061]	-4.5
b[(Intercept) IDSCH00L:5062]	4.2
b[(Intercept) IDSCH00L:5063]	0.3
b[(Intercept) IDSCH00L:5064]	16.0
b[(Intercept) IDSCH00L:5065]	42.3
b[(Intercept) IDSCH00L:5066]	19.1
b[(Intercept) IDSCH00L:5067]	-3.7
b[(Intercept) IDSCH00L:5068]	28.9
b[(Intercept) IDSCH00L:5069]	3.4
b[(Intercept) IDSCH00L:5070]	-4.3
b[(Intercept) IDSCH00L:5071]	22.8
b[(Intercept) IDSCH00L:5072]	32.2
b[(Intercept) IDSCH00L:5073]	21.8
b[(Intercept) IDSCH00L:5074]	43.9
b[(Intercept) IDSCH00L:5075]	-24.4
b[(Intercept) IDSCH00L:5076]	2.0
b[(Intercept) IDSCH00L:5078]	1.9
b[(Intercept) IDSCH00L:5079]	13.6
b[(Intercept) IDSCH00L:5080]	-2.6
b[(Intercept) IDSCH00L:5081]	28.3
b[(Intercept) IDSCH00L:5082]	25.2
b[(Intercept) IDSCH00L:5083]	22.9
b[(Intercept) IDSCH00L:5084]	14.0
b[(Intercept) IDSCH00L:5085]	-13.5
b[(Intercept) IDSCH00L:5086]	46.1
b[(Intercept) IDSCH00L:5087]	45.4
b[(Intercept) IDSCH00L:5088]	14.3
b[(Intercept) IDSCH00L:5090]	10.6
b[(Intercept) IDSCH00L:5091]	13.1
b[(Intercept) IDSCH00L:5092]	39.9
b[(Intercept) IDSCH00L:5093]	19.5

b[(Intercept) IDSCH00L:5094]	5.2
b[(Intercept) IDSCH00L:5095]	35.6
b[(Intercept) IDSCH00L:5096]	27.4
b[(Intercept) IDSCH00L:5097]	-5.9
b[(Intercept) IDSCH00L:5098]	-60.9
b[(Intercept) IDSCH00L:5099]	25.2
b[(Intercept) IDSCH00L:5100]	22.0
b[(Intercept) IDSCH00L:5102]	2.7
b[(Intercept) IDSCH00L:5103]	8.5
b[(Intercept) IDSCH00L:5105]	43.9
b[(Intercept) IDSCH00L:5106]	40.2
b[(Intercept) IDSCH00L:5107]	52.7
b[(Intercept) IDSCH00L:5109]	24.3
b[(Intercept) IDSCH00L:5110]	5.9
b[(Intercept) IDSCH00L:5111]	34.4
b[(Intercept) IDSCH00L:5113]	25.2
b[(Intercept) IDSCH00L:5114]	44.5
b[(Intercept) IDSCH00L:5115]	2.7
b[(Intercept) IDSCH00L:5116]	14.6
b[(Intercept) IDSCH00L:5117]	37.3
b[(Intercept) IDSCH00L:5118]	5.8
b[(Intercept) IDSCH00L:5119]	6.7
b[(Intercept) IDSCH00L:5120]	8.7
b[(Intercept) IDSCH00L:5121]	-8.2
b[(Intercept) IDSCH00L:5122]	-8.3
b[(Intercept) IDSCH00L:5123]	13.9
b[(Intercept) IDSCH00L:5124]	32.2
b[(Intercept) IDSCH00L:5125]	21.7
b[(Intercept) IDSCH00L:5126]	22.8
b[(Intercept) IDSCH00L:5127]	-0.8
b[(Intercept) IDSCH00L:5128]	27.6
b[(Intercept) IDSCH00L:5129]	25.5
b[(Intercept) IDSCH00L:5130]	27.8
b[(Intercept) IDSCH00L:5131]	9.5
b[(Intercept) IDSCH00L:5132]	44.3
b[(Intercept) IDSCH00L:5133]	21.6
b[(Intercept) IDSCH00L:5134]	20.8
b[(Intercept) IDSCH00L:5135]	23.4
b[(Intercept) IDSCH00L:5136]	37.4
b[(Intercept) IDSCH00L:5137]	22.7
b[(Intercept) IDSCH00L:5138]	20.2
b[(Intercept) IDSCH00L:5139]	19.5
b[(Intercept) IDSCH00L:5140]	13.6
b[(Intercept) IDSCH00L:5141]	14.2
b[(Intercept) IDSCH00L:5142]	44.0
b[(Intercept) IDSCH00L:5143]	18.1
b[(Intercept) IDSCH00L:5144]	35.9
b[(Intercept) IDSCH00L:5146]	-3.2
b[(Intercept) IDSCH00L:5147]	9.5
b[(Intercept) IDSCH00L:5148]	-29.2
b[(Intercept) IDSCH00L:5149]	34.0

b[(Intercept) IDSCH00L:5150]	15.0
b[(Intercept) IDSCH00L:5151]	2.0
b[(Intercept) IDSCH00L:5152]	-5.0
b[(Intercept) IDSCH00L:5153]	53.3
b[(Intercept) IDSCH00L:5154]	11.6
b[(Intercept) IDSCH00L:5155]	28.1
b[(Intercept) IDSCH00L:5156]	10.8
b[(Intercept) IDSCH00L:5157]	4.3
b[(Intercept) IDSCH00L:5158]	13.0
b[(Intercept) IDSCH00L:5160]	40.1
b[(Intercept) IDSCH00L:5161]	24.3
b[(Intercept) IDSCH00L:5162]	14.7
b[(Intercept) IDSCH00L:5163]	-5.0
b[(Intercept) IDSCH00L:5164]	13.4
b[(Intercept) IDSCH00L:5165]	-11.3
b[(Intercept) IDSCH00L:5167]	-6.3
b[(Intercept) IDSCH00L:5168]	23.9
b[(Intercept) IDSCH00L:5169]	16.8
b[(Intercept) IDSCH00L:5170]	23.7
b[(Intercept) IDSCH00L:5171]	7.4
b[(Intercept) IDSCH00L:5172]	-51.4
b[(Intercept) IDSCH00L:5173]	-8.5
b[(Intercept) IDSCH00L:5174]	21.3
b[(Intercept) IDSCH00L:5175]	3.7
b[(Intercept) IDSCH00L:5177]	14.6
b[(Intercept) IDSCH00L:5178]	26.2
b[(Intercept) IDSCH00L:5179]	18.0
b[(Intercept) IDSCH00L:5180]	25.4
b[(Intercept) IDSCH00L:5181]	21.5
b[(Intercept) IDSCH00L:5182]	32.5
b[(Intercept) IDSCH00L:5183]	-1.9
b[(Intercept) IDSCH00L:5184]	27.7
b[(Intercept) IDSCH00L:5185]	29.2
b[(Intercept) IDSCH00L:5186]	27.6
b[(Intercept) IDSCH00L:5188]	3.1
b[(Intercept) IDSCH00L:5189]	35.6
b[(Intercept) IDSCH00L:5190]	42.5
b[(Intercept) IDSCH00L:5191]	20.4
b[(Intercept) IDSCH00L:5192]	2.8
sigma	69.2
Sigma[IDSCH00L:(Intercept),(Intercept)]	743.0

Fit Diagnostics:

	mean	sd	10%	50%	90%
mean_PPD	507.2	1.3	505.5	507.2	508.9

The mean_ppd is the sample average posterior predictive distribution of the outcome variable (for details see `help('summary.stanreg')`).

MCMC diagnostics

mcse Rhat n_eff

(Intercept)	0.4	1.0	1372
ASBG01Boy	0.0	1.0	4141
ACBG03A11–25%	0.2	1.0	1075
ACBG03A26–50%	0.2	1.0	1216
ACBG03AMore than 50%	0.3	1.0	1088
ACBG03B11–25%	0.2	1.0	995
ACBG03B26–50%	0.2	1.0	1264
ACBG03BMore than 50%	0.3	1.0	1094
ASDGHRLSome resources	0.1	1.0	4478
ASDGHRLFew resources	0.1	1.0	4224
ASDHSESMiddle	0.1	1.0	928
ASDHSESLower	0.1	1.0	1956
ASDHPLRSomewhat like	0.0	1.0	4338
ASDHPLRDo not like	0.0	1.0	4679
ASDHEDUPPost–secondary not university	0.1	1.0	4144
ASDHEDUPUpper secondary	0.1	1.0	4670
ASDHEDUPLower secondary	0.1	1.0	3313
ASDHEDUPSome primary/lower secondary or no school	0.1	1.0	3483
ASDGLRSomewhat like reading	0.0	1.0	4635
ASDGLRDo not like reading	0.1	1.0	4786
ASDG05S	0.0	1.0	3577
ASBH120–10	0.1	1.0	2066
ASBH1211–25	0.1	1.0	2079
ASBH1226–100	0.1	1.0	2278
ASBH12101–200	0.1	1.0	2962
ASBH130–10	0.1	1.0	4986
ASBH1311–25	0.1	1.0	4698
ASBH1326–50	0.1	1.0	4858
ASBH1351–100	0.1	1.0	4305
ATBR16≤15 minutes	0.2	1.0	2966
ATBR1616–30 minutes	0.1	1.0	2879
ATBR1631–60 minutes	0.1	1.0	3046
b[(Intercept) IDSCH00L:5001]	0.2	1.0	2071
b[(Intercept) IDSCH00L:5002]	0.2	1.0	4519
b[(Intercept) IDSCH00L:5003]	0.2	1.0	3918
b[(Intercept) IDSCH00L:5004]	0.2	1.0	3571
b[(Intercept) IDSCH00L:5005]	0.2	1.0	5245
b[(Intercept) IDSCH00L:5006]	0.2	1.0	6128
b[(Intercept) IDSCH00L:5007]	0.2	1.0	3140
b[(Intercept) IDSCH00L:5008]	0.2	1.0	5673
b[(Intercept) IDSCH00L:5009]	0.2	1.0	3756
b[(Intercept) IDSCH00L:5010]	0.2	1.0	5432
b[(Intercept) IDSCH00L:5011]	0.2	1.0	4388
b[(Intercept) IDSCH00L:5012]	0.2	1.0	4641
b[(Intercept) IDSCH00L:5013]	0.2	1.0	4295
b[(Intercept) IDSCH00L:5014]	0.2	1.0	3912
b[(Intercept) IDSCH00L:5015]	0.2	1.0	2758
b[(Intercept) IDSCH00L:5016]	0.2	1.0	5564
b[(Intercept) IDSCH00L:5017]	0.2	1.0	4210
b[(Intercept) IDSCH00L:5018]	0.2	1.0	2346
b[(Intercept) IDSCH00L:5019]	0.3	1.0	3999

b[(Intercept) IDSCH00L:5020]	0.2	1.0	4223
b[(Intercept) IDSCH00L:5021]	0.2	1.0	4462
b[(Intercept) IDSCH00L:5022]	0.2	1.0	3050
b[(Intercept) IDSCH00L:5023]	0.2	1.0	4460
b[(Intercept) IDSCH00L:5024]	0.3	1.0	5387
b[(Intercept) IDSCH00L:5026]	0.2	1.0	4188
b[(Intercept) IDSCH00L:5027]	0.2	1.0	3194
b[(Intercept) IDSCH00L:5028]	0.2	1.0	4705
b[(Intercept) IDSCH00L:5029]	0.2	1.0	5408
b[(Intercept) IDSCH00L:5030]	0.2	1.0	4865
b[(Intercept) IDSCH00L:5031]	0.2	1.0	2459
b[(Intercept) IDSCH00L:5032]	0.2	1.0	3962
b[(Intercept) IDSCH00L:5033]	0.2	1.0	2393
b[(Intercept) IDSCH00L:5034]	0.2	1.0	5604
b[(Intercept) IDSCH00L:5035]	0.2	1.0	4774
b[(Intercept) IDSCH00L:5036]	0.2	1.0	4045
b[(Intercept) IDSCH00L:5037]	0.2	1.0	2458
b[(Intercept) IDSCH00L:5038]	0.2	1.0	4668
b[(Intercept) IDSCH00L:5039]	0.2	1.0	3868
b[(Intercept) IDSCH00L:5040]	0.2	1.0	4309
b[(Intercept) IDSCH00L:5041]	0.2	1.0	2772
b[(Intercept) IDSCH00L:5042]	0.2	1.0	3759
b[(Intercept) IDSCH00L:5043]	0.2	1.0	6408
b[(Intercept) IDSCH00L:5044]	0.2	1.0	4686
b[(Intercept) IDSCH00L:5045]	0.2	1.0	2220
b[(Intercept) IDSCH00L:5046]	0.2	1.0	3012
b[(Intercept) IDSCH00L:5047]	0.2	1.0	5129
b[(Intercept) IDSCH00L:5048]	0.2	1.0	3058
b[(Intercept) IDSCH00L:5049]	0.2	1.0	3400
b[(Intercept) IDSCH00L:5050]	0.2	1.0	4698
b[(Intercept) IDSCH00L:5051]	0.1	1.0	3895
b[(Intercept) IDSCH00L:5052]	0.2	1.0	2713
b[(Intercept) IDSCH00L:5053]	0.2	1.0	2615
b[(Intercept) IDSCH00L:5054]	0.2	1.0	5009
b[(Intercept) IDSCH00L:5055]	0.2	1.0	3042
b[(Intercept) IDSCH00L:5056]	0.2	1.0	4835
b[(Intercept) IDSCH00L:5057]	0.2	1.0	3644
b[(Intercept) IDSCH00L:5058]	0.2	1.0	4356
b[(Intercept) IDSCH00L:5059]	0.3	1.0	5864
b[(Intercept) IDSCH00L:5060]	0.2	1.0	4470
b[(Intercept) IDSCH00L:5061]	0.2	1.0	2308
b[(Intercept) IDSCH00L:5062]	0.2	1.0	5258
b[(Intercept) IDSCH00L:5063]	0.2	1.0	4251
b[(Intercept) IDSCH00L:5064]	0.2	1.0	4121
b[(Intercept) IDSCH00L:5065]	0.2	1.0	2927
b[(Intercept) IDSCH00L:5066]	0.2	1.0	3802
b[(Intercept) IDSCH00L:5067]	0.2	1.0	4260
b[(Intercept) IDSCH00L:5068]	0.2	1.0	4686
b[(Intercept) IDSCH00L:5069]	0.2	1.0	4283
b[(Intercept) IDSCH00L:5070]	0.2	1.0	3802
b[(Intercept) IDSCH00L:5071]	0.2	1.0	3750

b[(Intercept) IDSCH00L:5072]	0.2	1.0	3508
b[(Intercept) IDSCH00L:5073]	0.2	1.0	2598
b[(Intercept) IDSCH00L:5074]	0.2	1.0	3926
b[(Intercept) IDSCH00L:5075]	0.3	1.0	3849
b[(Intercept) IDSCH00L:5076]	0.3	1.0	5537
b[(Intercept) IDSCH00L:5078]	0.2	1.0	3958
b[(Intercept) IDSCH00L:5079]	0.2	1.0	5392
b[(Intercept) IDSCH00L:5080]	0.2	1.0	1854
b[(Intercept) IDSCH00L:5081]	0.3	1.0	3578
b[(Intercept) IDSCH00L:5082]	0.2	1.0	2883
b[(Intercept) IDSCH00L:5083]	0.2	1.0	5204
b[(Intercept) IDSCH00L:5084]	0.2	1.0	3298
b[(Intercept) IDSCH00L:5085]	0.2	1.0	4154
b[(Intercept) IDSCH00L:5086]	0.2	1.0	4768
b[(Intercept) IDSCH00L:5087]	0.2	1.0	4556
b[(Intercept) IDSCH00L:5088]	0.2	1.0	2603
b[(Intercept) IDSCH00L:5090]	0.3	1.0	4656
b[(Intercept) IDSCH00L:5091]	0.2	1.0	3154
b[(Intercept) IDSCH00L:5092]	0.2	1.0	2541
b[(Intercept) IDSCH00L:5093]	0.2	1.0	2433
b[(Intercept) IDSCH00L:5094]	0.2	1.0	3566
b[(Intercept) IDSCH00L:5095]	0.2	1.0	5617
b[(Intercept) IDSCH00L:5096]	0.2	1.0	3885
b[(Intercept) IDSCH00L:5097]	0.2	1.0	3484
b[(Intercept) IDSCH00L:5098]	0.2	1.0	3806
b[(Intercept) IDSCH00L:5099]	0.2	1.0	3870
b[(Intercept) IDSCH00L:5100]	0.2	1.0	2504
b[(Intercept) IDSCH00L:5102]	0.2	1.0	2881
b[(Intercept) IDSCH00L:5103]	0.2	1.0	5677
b[(Intercept) IDSCH00L:5105]	0.2	1.0	3427
b[(Intercept) IDSCH00L:5106]	0.2	1.0	4281
b[(Intercept) IDSCH00L:5107]	0.2	1.0	5303
b[(Intercept) IDSCH00L:5109]	0.2	1.0	4715
b[(Intercept) IDSCH00L:5110]	0.2	1.0	2048
b[(Intercept) IDSCH00L:5111]	0.2	1.0	3257
b[(Intercept) IDSCH00L:5113]	0.2	1.0	3247
b[(Intercept) IDSCH00L:5114]	0.2	1.0	5421
b[(Intercept) IDSCH00L:5115]	0.2	1.0	5490
b[(Intercept) IDSCH00L:5116]	0.2	1.0	2444
b[(Intercept) IDSCH00L:5117]	0.2	1.0	4555
b[(Intercept) IDSCH00L:5118]	0.2	1.0	3328
b[(Intercept) IDSCH00L:5119]	0.2	1.0	3226
b[(Intercept) IDSCH00L:5120]	0.2	1.0	2768
b[(Intercept) IDSCH00L:5121]	0.2	1.0	4501
b[(Intercept) IDSCH00L:5122]	0.3	1.0	1949
b[(Intercept) IDSCH00L:5123]	0.2	1.0	3292
b[(Intercept) IDSCH00L:5124]	0.2	1.0	3254
b[(Intercept) IDSCH00L:5125]	0.2	1.0	2786
b[(Intercept) IDSCH00L:5126]	0.2	1.0	5102
b[(Intercept) IDSCH00L:5127]	0.2	1.0	3154
b[(Intercept) IDSCH00L:5128]	0.2	1.0	3332

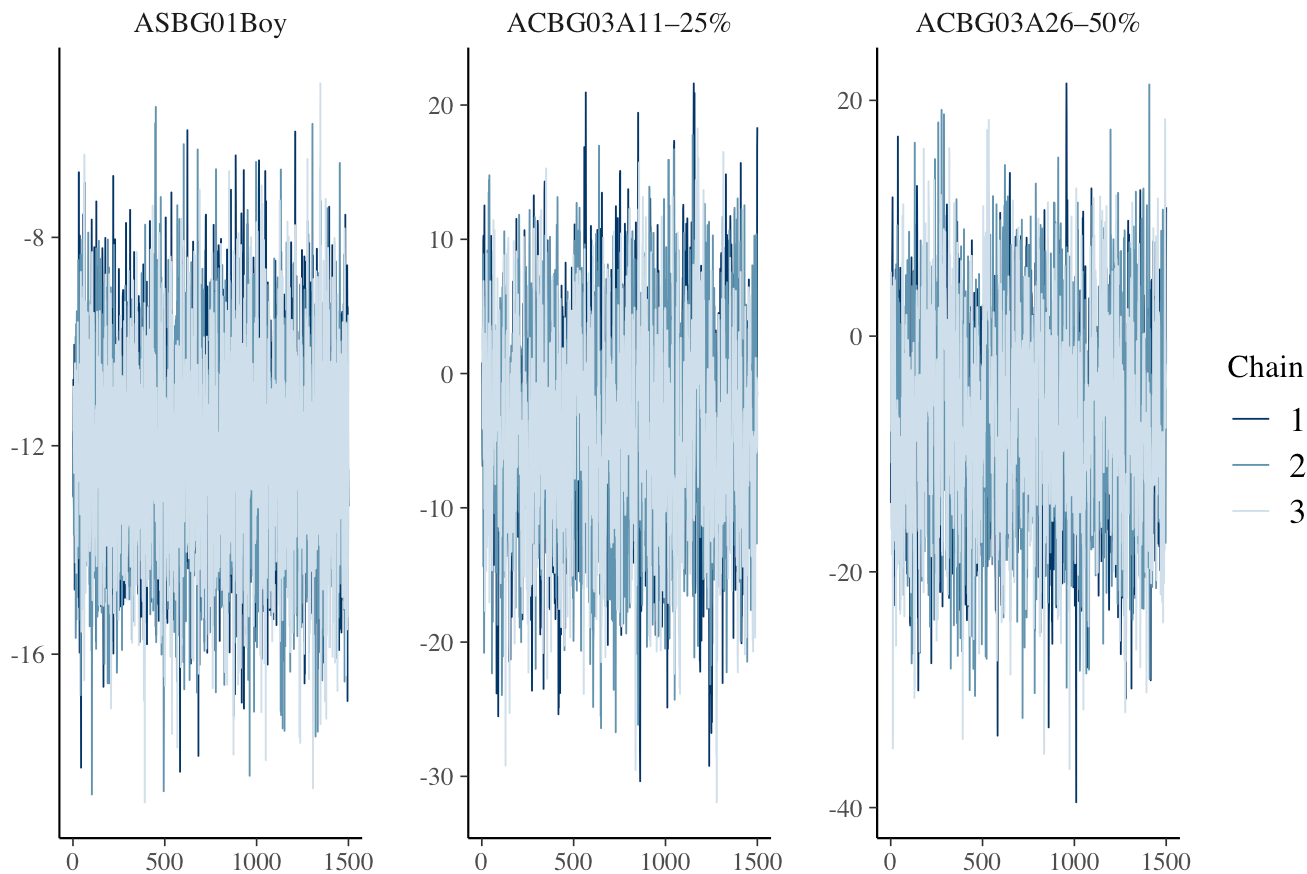
b[(Intercept) IDSCH00L:5129]	0.2	1.0	3590
b[(Intercept) IDSCH00L:5130]	0.3	1.0	5085
b[(Intercept) IDSCH00L:5131]	0.3	1.0	2151
b[(Intercept) IDSCH00L:5132]	0.2	1.0	4687
b[(Intercept) IDSCH00L:5133]	0.2	1.0	2215
b[(Intercept) IDSCH00L:5134]	0.3	1.0	3722
b[(Intercept) IDSCH00L:5135]	0.2	1.0	3982
b[(Intercept) IDSCH00L:5136]	0.2	1.0	3518
b[(Intercept) IDSCH00L:5137]	0.2	1.0	4909
b[(Intercept) IDSCH00L:5138]	0.2	1.0	2806
b[(Intercept) IDSCH00L:5139]	0.2	1.0	2832
b[(Intercept) IDSCH00L:5140]	0.2	1.0	4658
b[(Intercept) IDSCH00L:5141]	0.2	1.0	4105
b[(Intercept) IDSCH00L:5142]	0.3	1.0	4434
b[(Intercept) IDSCH00L:5143]	0.2	1.0	3437
b[(Intercept) IDSCH00L:5144]	0.3	1.0	4972
b[(Intercept) IDSCH00L:5146]	0.2	1.0	3510
b[(Intercept) IDSCH00L:5147]	0.2	1.0	5164
b[(Intercept) IDSCH00L:5148]	0.2	1.0	5410
b[(Intercept) IDSCH00L:5149]	0.2	1.0	4166
b[(Intercept) IDSCH00L:5150]	0.2	1.0	2676
b[(Intercept) IDSCH00L:5151]	0.2	1.0	3242
b[(Intercept) IDSCH00L:5152]	0.2	1.0	5018
b[(Intercept) IDSCH00L:5153]	0.2	1.0	4147
b[(Intercept) IDSCH00L:5154]	0.2	1.0	3587
b[(Intercept) IDSCH00L:5155]	0.2	1.0	4221
b[(Intercept) IDSCH00L:5156]	0.2	1.0	4054
b[(Intercept) IDSCH00L:5157]	0.2	1.0	3303
b[(Intercept) IDSCH00L:5158]	0.2	1.0	2760
b[(Intercept) IDSCH00L:5160]	0.2	1.0	4031
b[(Intercept) IDSCH00L:5161]	0.2	1.0	2829
b[(Intercept) IDSCH00L:5162]	0.3	1.0	2091
b[(Intercept) IDSCH00L:5163]	0.2	1.0	3317
b[(Intercept) IDSCH00L:5164]	0.2	1.0	4002
b[(Intercept) IDSCH00L:5165]	0.3	1.0	4045
b[(Intercept) IDSCH00L:5167]	0.1	1.0	3458
b[(Intercept) IDSCH00L:5168]	0.2	1.0	5557
b[(Intercept) IDSCH00L:5169]	0.2	1.0	4392
b[(Intercept) IDSCH00L:5170]	0.2	1.0	4804
b[(Intercept) IDSCH00L:5171]	0.2	1.0	5085
b[(Intercept) IDSCH00L:5172]	0.1	1.0	4157
b[(Intercept) IDSCH00L:5173]	0.2	1.0	4010
b[(Intercept) IDSCH00L:5174]	0.2	1.0	4899
b[(Intercept) IDSCH00L:5175]	0.2	1.0	2834
b[(Intercept) IDSCH00L:5177]	0.2	1.0	4406
b[(Intercept) IDSCH00L:5178]	0.2	1.0	2804
b[(Intercept) IDSCH00L:5179]	0.2	1.0	2903
b[(Intercept) IDSCH00L:5180]	0.3	1.0	4653
b[(Intercept) IDSCH00L:5181]	0.2	1.0	2936
b[(Intercept) IDSCH00L:5182]	0.2	1.0	2696
b[(Intercept) IDSCH00L:5183]	0.2	1.0	4261

b[(Intercept) IDSCH00L:5184]	0.2	1.0	3728
b[(Intercept) IDSCH00L:5185]	0.2	1.0	4351
b[(Intercept) IDSCH00L:5186]	0.2	1.0	4008
b[(Intercept) IDSCH00L:5188]	0.2	1.0	5289
b[(Intercept) IDSCH00L:5189]	0.2	1.0	4429
b[(Intercept) IDSCH00L:5190]	0.3	1.0	4660
b[(Intercept) IDSCH00L:5191]	0.2	1.0	3611
b[(Intercept) IDSCH00L:5192]	0.2	1.0	5089
sigma	0.0	1.0	6073
Sigma[IDSCH00L:(Intercept),(Intercept)]	2.5	1.0	1350
mean_PPD	0.0	1.0	4601
log-posterior	0.5	1.0	854

For each parameter, mcse is Monte Carlo standard error, n_eff is a crude measure of effective sample size, and Rhat is the potential scale reduction factor on split chains (at convergence Rhat=1).

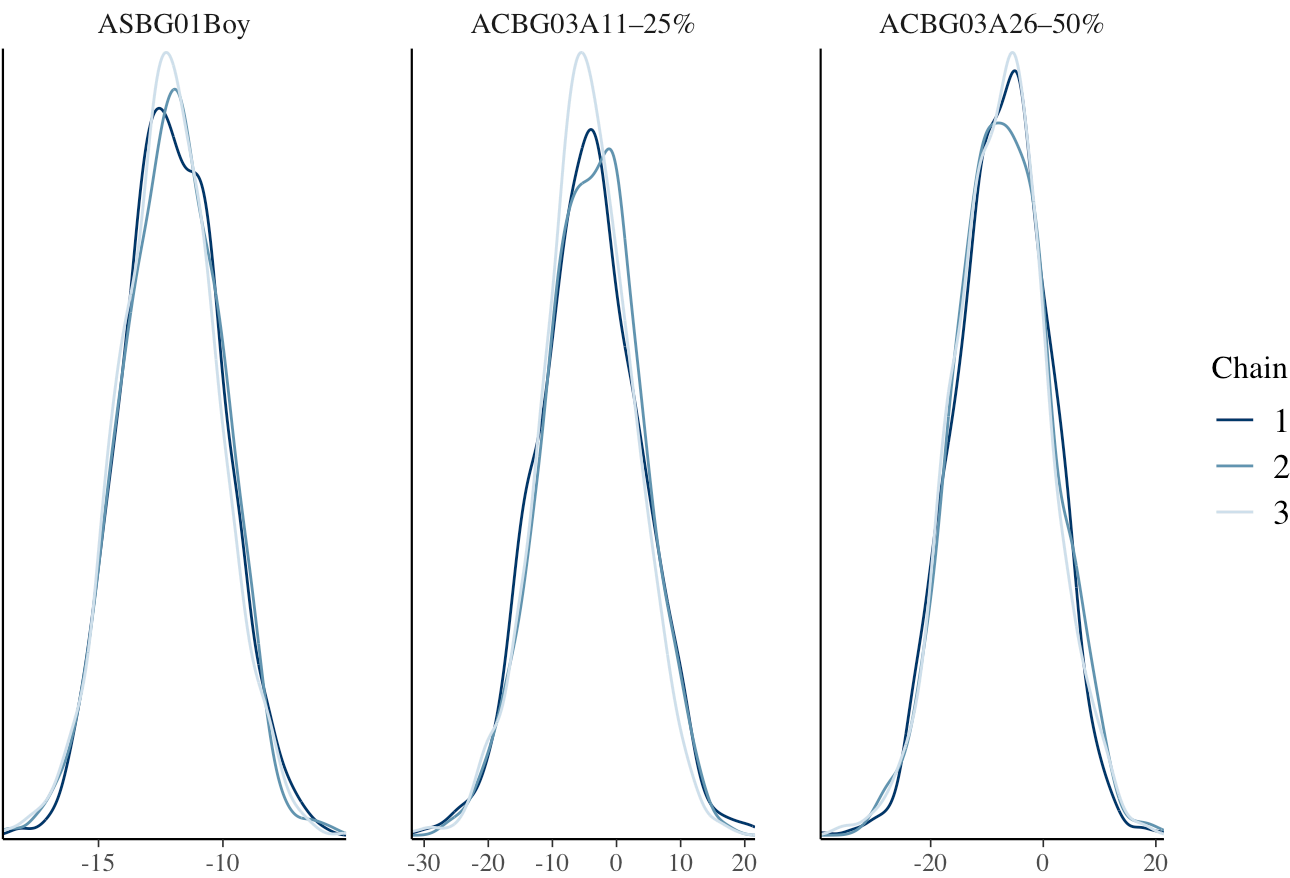
2. Trace plots for parameters: ASBG01Boy, ACBG03A11–25%, ACBG03A26–50%

Trace Plots for ASRREA01 (Selected Predictors)



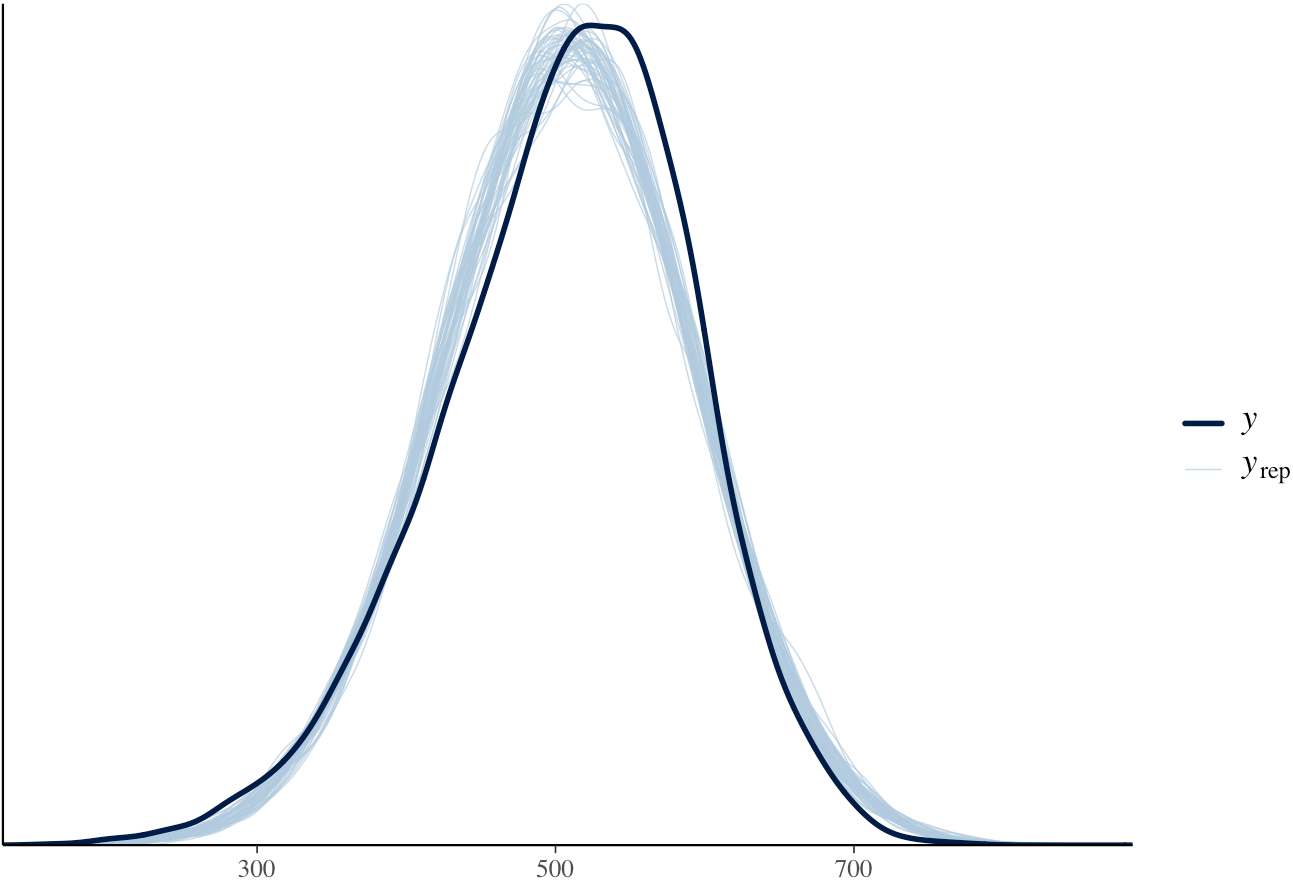
3. Posterior density plots for parameters: ASBG01Boy, ACBG03A11–25%, ACBG03A26–50%

Posterior Densities for ASRREA01 (Selected Predictors)



4. Posterior predictive check (density overlay):

Posterior Predictive Check for ASRREA01



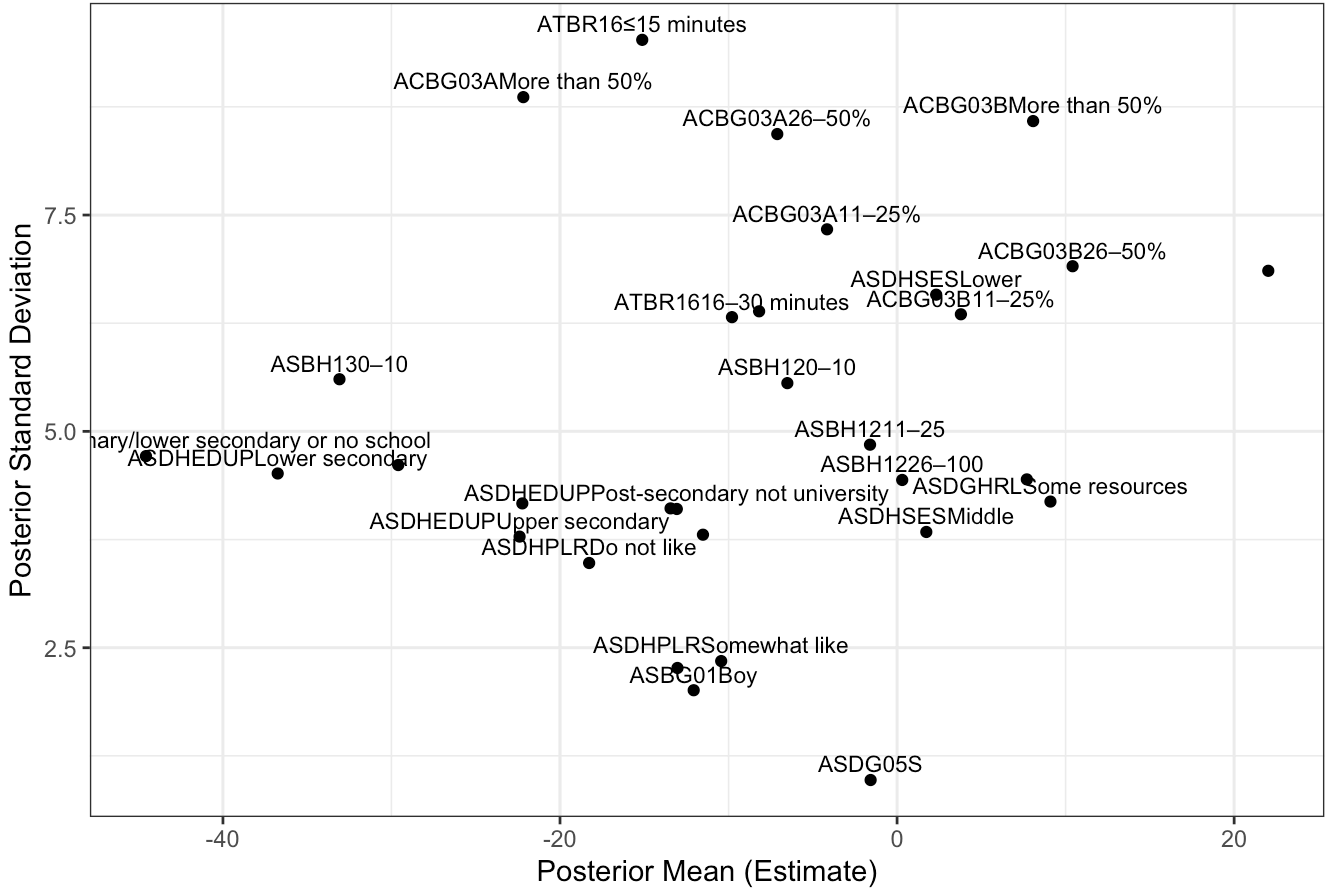
5. Probability of direction (PD) for coefficients:
Probability of Direction

Parameter	pd
(Intercept)	100%
ASBG01Boy	100%
ACBG03A11–25%	71.04%
ACBG03A26–50%	80.73%
ACBG03AMore than 50%	99.33%
ACBG03B11–25%	72.53%
ACBG03B26–50%	93.71%
ACBG03BMore than 50%	83.67%
ASDGHRLSome resources	99.04%
ASDGHRLFew resources	99.93%
ASDHSESMiddle	66.91%
ASDHSESLower	62.82%
ASDHPLRSomewhat like	100%
ASDHPLRDo not like	100%
ASDHEDUPPost–secondary not university	99.96%
ASDHEDUPUpper secondary	100%
ASDHEDUPLower secondary	100%
ASDHEDUPSome primary/lower secondary or no school	100%
ASDGSLSRSomehow like reading	100%

ASDGLRDo not like reading	100%
ASDG05S	94.78%
ASBH120-10	87.78%
ASBH1211-25	63.18%
ASBH1226-100	52.58%
ASBH12101-200	95.84%
ASBH130-10	100%
ASBH1311-25	100%
ASBH1326-50	99.96%
ASBH1351-100	99.91%
ATBR16≤15 minutes	94.29%
ATBR1616-30 minutes	93.76%
ATBR1631-60 minutes	89.89%

6. Scatter plot of posterior means vs SD:

Posterior Mean vs SD for ASRREA01



9. Model Comparison Plot Across Outcomes

Create a comparison plot for a chosen predictor across all plausible values (multilevel models).

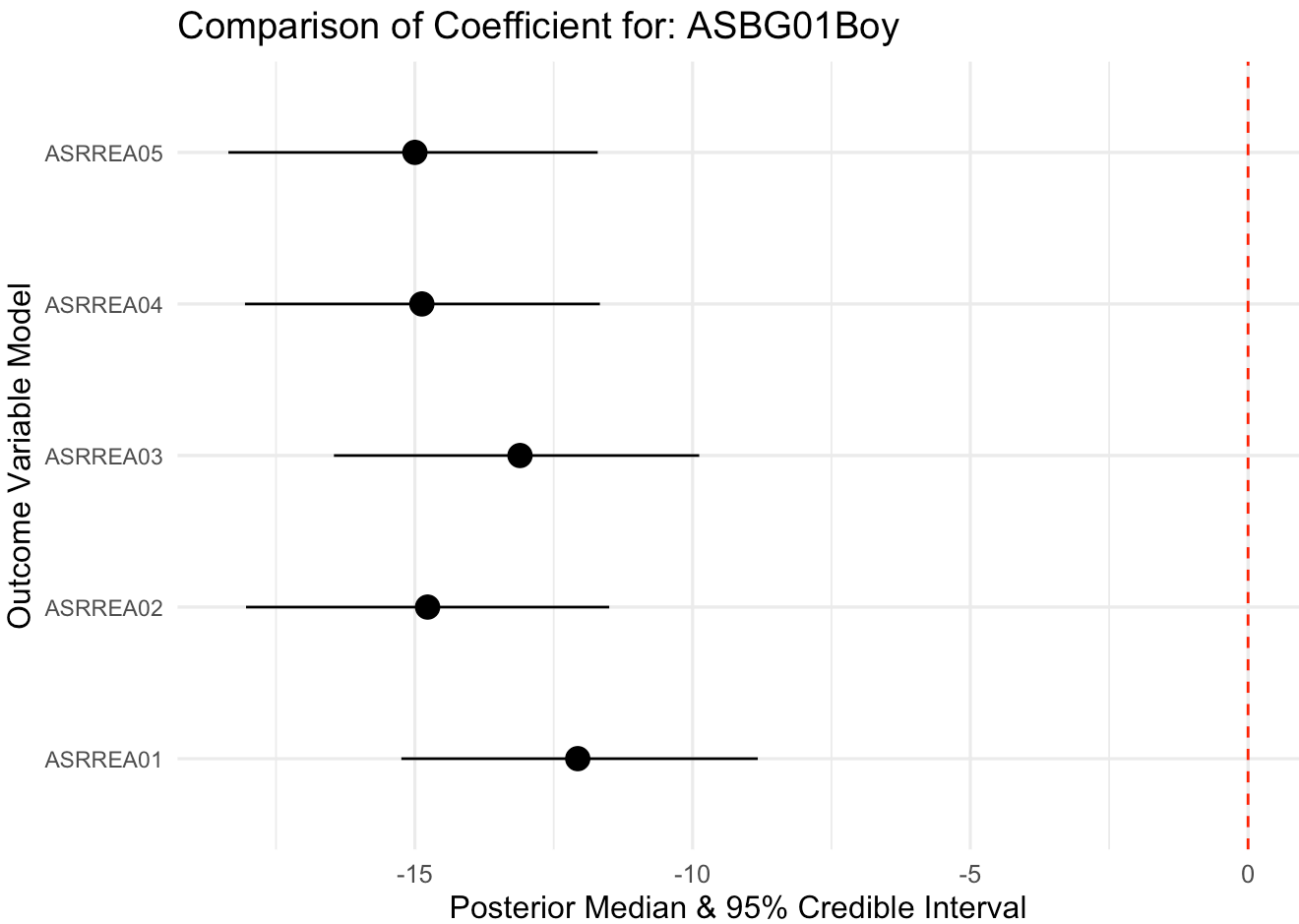
```
#####  
# 9. MODEL COMPARISON PLOT ACROSS OUTCOMES  
#####
```

```

all_coef_summary <- list()
for (y_var_name in names(bayesian_results_list)) {
  res <- bayesian_results_list[[y_var_name]]$tidy_results
  res$outcome_model <- y_var_name
  all_coef_summary[[y_var_name]] <- res
}
if (length(all_coef_summary) > 0) {
  combined_coef_df <- do.call(rbind, all_coef_summary)
  rownames(combined_coef_df) <- NULL
  predictor_to_compare <- combined_coef_df$term[1]
  cat(paste("\nComparing coefficient for predictor:", predictor_to_compare, "across outcome models.\n"))
  coef_subset_for_plot <- combined_coef_df[combined_coef_df$term == predictor_to_compare, ]
  if(nrow(coef_subset_for_plot) > 0){
    comparison_plot <- ggplot(coef_subset_for_plot,
                              aes(x = outcome_model, y = estimate, ymin = conf.low, ymax = conf.high)) +
      geom_pointrange(size = 0.8) +
      geom_hline(yintercept = 0, linetype = "dashed", color = "red") +
      coord_flip() +
      labs(title = paste("Comparison of Coefficient for:", predictor_to_compare),
           x = "Outcome Variable Model",
           y = "Posterior Median & 95% Credible Interval") +
      theme_minimal(base_size = 12) +
      theme(axis.text.y = element_text(size = rel(0.9)))
    print(comparison_plot)
    bayesian_plots_list[[paste0("comparison_", gsub("[^A-Za-z0-9]", "_", predictor_to_compare))] <- comparison_plot
  } else {
    cat("Predictor '", predictor_to_compare, "' not found in any model results for comparison.\n")
  }
} else {
  cat("No successful model results available to generate comparison plots.\n")
}

```

Comparing coefficient for predictor: ASBG01Boy across outcome models.



10. Pooling Results Across Plausible Values

Pool posterior draws across plausible values to obtain combined estimates, credible intervals and PD values for each predictor.

```
#####
# 10. POOLING RESULTS ACROSS PLAUSIBLE VALUES
#####
cat("\n-----\n")

-----

cat("SECTION 10: POOLING RESULTS ACROSS PLAUSIBLE VALUES\n")

SECTION 10: POOLING RESULTS ACROSS PLAUSIBLE VALUES

cat("-----\n")

-----
```

```

if (length(bayesian_results_list) == 0) {
  cat("No results in 'bayesian_results_list' to pool.\n")
} else {
  successful_pv_models <- names(bayesian_results_list)
  cat("Pooling results from the following PV models:", paste(successful_pv_models, collapse = ", "))
  coef_names <- names(fixef(bayesian_results_list[[successful_pv_models[1]]]$bayesian_lasso_fit))
  coef_names <- coef_names[coef_names != "(Intercept)"]
  pooled_posterior_summary_list <- list()
  for (coef_name in coef_names) {
    all_draws_for_coef <- c()
    for (pv_model_name in successful_pv_models) {
      current_model_fit <- bayesian_results_list[[pv_model_name]]$bayesian_lasso_fit
      draws_df <- as_draws_df(current_model_fit)
      if (!is.null(draws_df) && coef_name %in% names(draws_df)) {
        all_draws_for_coef <- c(all_draws_for_coef, draws_df[[coef_name]])
      }
    }
    if (length(all_draws_for_coef) > 0) {
      summary_stats <- describe_posterior(all_draws_for_coef, ci = 0.95, test = c("pd"))
      pooled_posterior_summary_list[[coef_name]] <- data.frame(
        Term = coef_name,
        Median = round(summary_stats$Median, 4),
        CI_Low = round(summary_stats$CI_low, 4),
        CI_High = round(summary_stats$CI_high, 4),
        PD = round(summary_stats$pd, 4),
        Posterior_SD = round(sd(all_draws_for_coef), 4)
      )
    }
  }
  if (length(pooled_posterior_summary_list) > 0) {
    final_pooled_summary_df <- do.call(rbind, pooled_posterior_summary_list)
    rownames(final_pooled_summary_df) <- NULL
    cat("\n--- Final Pooled Bayesian LASSO Results Across All Plausible Values ---\n")
    kbl(
      final_pooled_summary_df,
      caption = "Pooled Bayesian LASSO Results Across Plausible Values",
      col.names = c("Predictor Term", "Median Estimate", "95% CI Low", "95% CI High",
                    "Prob. of Direction (PD)", "Posterior SD"),
      booktabs = TRUE,
      format = "html" ) %>%
      kable_styling(full_width = FALSE) %>% print()
    bayesian_results_list["pooled_summary"] <- list(final_pooled_summary_df)
    pooled_plot_df <- final_pooled_summary_df %>%
      mutate(term = Term, estimate = Median,
             conf.low = CI_Low, conf.high = CI_High)
    pooled_coef_plot <- ggplot(pooled_plot_df, aes(x = estimate, y = reorder(term, estimate))) +
      geom_pointrange(aes(xmin = conf.low, xmax = conf.high), size=0.5) +
      geom_vline(xintercept = 0, linetype = "dashed", color = "red") +
      labs(title = "Pooled Posterior Medians & 95% CIs Across Plausible Values",
           x = "Coefficient Estimate (Posterior Median)",

```

```

      y = "Predictor Term") +
    theme_minimal(base_size = 10) +
    theme(axis.text.y = element_text(size=rel(0.8)))
  print(pooled_coef_plot)
  bayesian_plots_list["_pooled_coef_plot_"] <- pooled_coef_plot
} else {
  cat("Could not generate pooled summary table as no coefficients were processed.\n")
}
}

```

Pooling results from the following PV models: ASRREA01, ASRREA02, ASRREA03, ASRREA04, ASRREA05

--- Final Pooled Bayesian LASSO Results Across All Plausible Values ---

<table class="table" style="width: auto !important; margin-left: auto; margin-right: auto;">

<caption>Pooled Bayesian LASSO Results Across Plausible Values</caption>

Predictor Term	Median Estimate	95% CI Low	95% CI High	Prob. of Direction (PD)	Posterior SD
ASBG01Boy	-14.0267	-18.3768	-9.3755	1.0000	2.3071
ACBG03A11-25%	-3.7753	-18.6528	11.1920	0.6924	7.5727
ACBG03A26-50%	-6.3794	-23.3743	10.7446	0.7651	

```
<td style="text-align:right;"> 8.7541 </td>
</tr>
<tr>
<td style="text-align:left;"> ACBG03AMore than 50% </td>
<td style="text-align:right;"> -20.4649 </td>
<td style="text-align:right;"> -38.3802 </td>
<td style="text-align:right;"> -2.6312 </td>
<td style="text-align:right;"> 0.9879 </td>
<td style="text-align:right;"> 9.0667 </td>
</tr>
<tr>
<td style="text-align:left;"> ACBG03B11-25% </td>
<td style="text-align:right;"> 5.7661 </td>
<td style="text-align:right;"> -6.4192 </td>
<td style="text-align:right;"> 18.2154 </td>
<td style="text-align:right;"> 0.8197 </td>
<td style="text-align:right;"> 6.3163 </td>
</tr>
<tr>
<td style="text-align:left;"> ACBG03B26-50% </td>
<td style="text-align:right;"> 11.2254 </td>
<td style="text-align:right;"> -2.2759 </td>
<td style="text-align:right;"> 25.0084 </td>
<td style="text-align:right;"> 0.9500 </td>
<td style="text-align:right;"> 6.9353 </td>
</tr>
<tr>
<td style="text-align:left;"> ACBG03BMore than 50% </td>
<td style="text-align:right;"> 11.5577 </td>
<td style="text-align:right;"> -5.6892 </td>
<td style="text-align:right;"> 29.3987 </td>
<td style="text-align:right;"> 0.9043 </td>
<td style="text-align:right;"> 8.9751 </td>
</tr>
<tr>
<td style="text-align:left;"> ASDGHRLSome resources </td>
<td style="text-align:right;"> 8.2416 </td>
<td style="text-align:right;"> 0.0986 </td>
<td style="text-align:right;"> 16.5026 </td>
<td style="text-align:right;"> 0.9766 </td>
<td style="text-align:right;"> 4.2189 </td>
</tr>
<tr>
<td style="text-align:left;"> ASDGHRLFew resources </td>
<td style="text-align:right;"> 21.8893 </td>
<td style="text-align:right;"> 8.6157 </td>
<td style="text-align:right;"> 35.1356 </td>
<td style="text-align:right;"> 0.9995 </td>
<td style="text-align:right;"> 6.7473 </td>
</tr>
<tr>
```

ASDHSESMiddle	1.5040	-6.0562	8.9603	0.6526	3.8244
ASDHSESLower	-1.0024	-15.3379	13.2271	0.5548	7.2591
ASDHPLRSomewhat like	-9.7510	-14.6478	-4.8853	1.0000	2.4778
ASDHPLRDo not like	-19.1514	-26.0935	-12.1777	1.0000	3.5442
ASDHEDUPPost-secondary not university	-13.2143	-22.8555	-4.5234	0.9988	4.6761
ASDHEDUPUpper secondary	-22.4402	-30.4835	-14.4189	1.0000	4.1003
ASDHEDUPLower secondary	-38.9210	-49.1229			

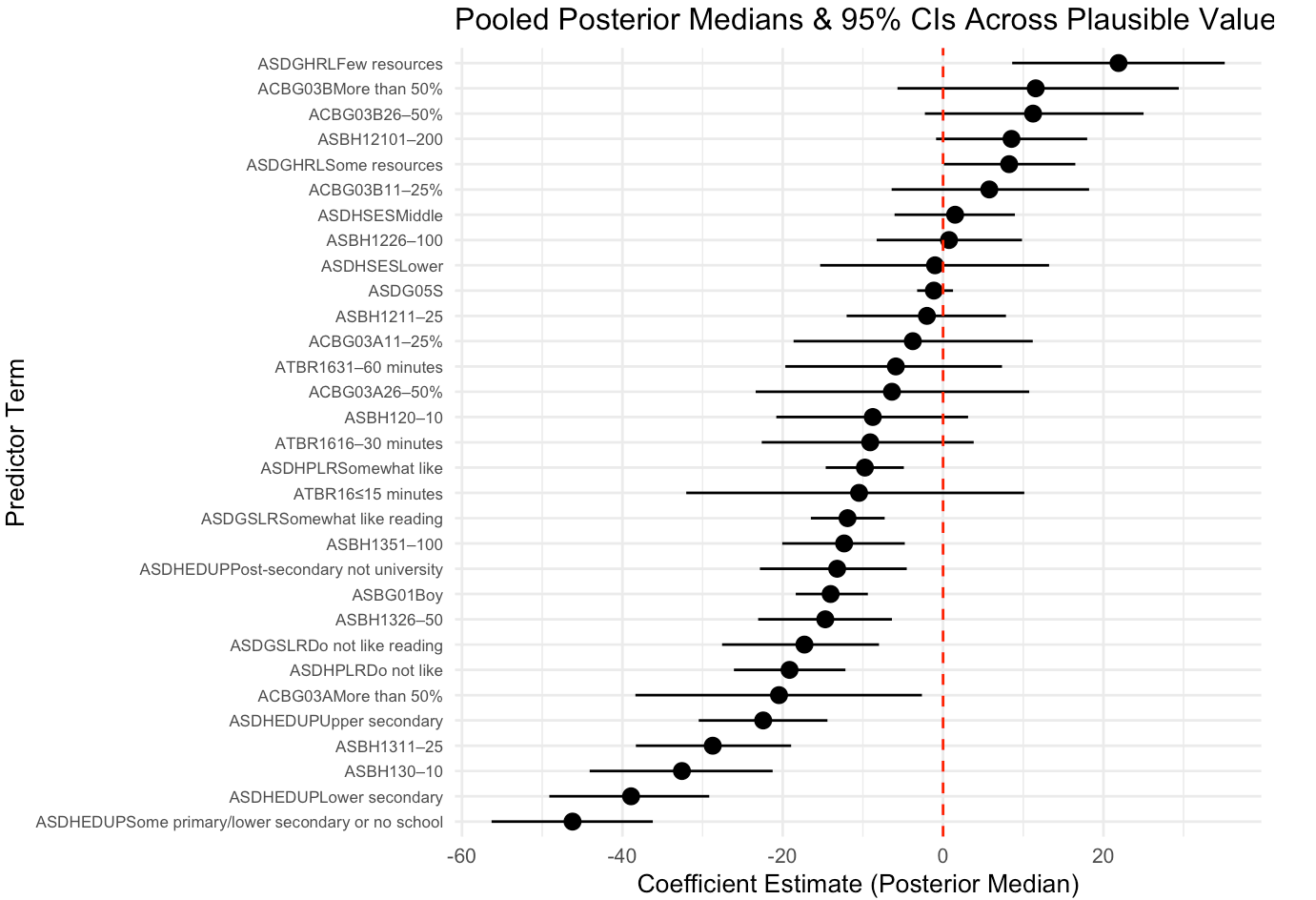

```
 -29.1636 </td>  1.0000 </td>  5.1269 </td> </tr> <tr>  ASDHEDUPSome primary/lower secondary or no school </td>  -46.2189 </td>  -56.3222 </td>  -36.2067 </td>  1.0000 </td>  5.1375 </td> </tr> <tr>  ASDGSLRSomewhat like reading </td>  -11.9190 </td>  -16.4905 </td>  -7.2782 </td>  1.0000 </td>  2.3560 </td> </tr> <tr>  ASDGSLRDo not like reading </td>  -17.2933 </td>  -27.5718 </td>  -7.9875 </td>  1.0000 </td>  4.9912 </td> </tr> <tr>  ASDG05S </td>  -1.1488 </td>  -3.2427 </td>  1.2406 </td>  0.8351 </td>  1.1403 </td> </tr> <tr>  ASBH120-10 </td>  -8.7662 </td>  -20.8077 </td>  3.1215 </td>  0.9265 </td>  6.0731 </td> </tr> <tr>  ASBH1211-25 </td>  -2.0155 </td>  -12.0378 </td>  7.8516 </td>  0.6593 </td>  5.0723 </td> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
```

```
</tr>
<tr>
  <td style="text-align:left;"> ASBH1226–100 </td>
  <td style="text-align:right;"> 0.7413 </td>
  <td style="text-align:right;"> -8.2873 </td>
  <td style="text-align:right;"> 9.8491 </td>
  <td style="text-align:right;"> 0.5634 </td>
  <td style="text-align:right;"> 4.6254 </td>
</tr>
<tr>
  <td style="text-align:left;"> ASBH12101–200 </td>
  <td style="text-align:right;"> 8.5360 </td>
  <td style="text-align:right;"> -0.8771 </td>
  <td style="text-align:right;"> 17.9781 </td>
  <td style="text-align:right;"> 0.9622 </td>
  <td style="text-align:right;"> 4.7990 </td>
</tr>
<tr>
  <td style="text-align:left;"> ASBH130–10 </td>
  <td style="text-align:right;"> -32.5755 </td>
  <td style="text-align:right;"> -44.0831 </td>
  <td style="text-align:right;"> -21.2560 </td>
  <td style="text-align:right;"> 1.0000 </td>
  <td style="text-align:right;"> 5.7939 </td>
</tr>
<tr>
  <td style="text-align:left;"> ASBH1311–25 </td>
  <td style="text-align:right;"> -28.7303 </td>
  <td style="text-align:right;"> -38.3248 </td>
  <td style="text-align:right;"> -18.9491 </td>
  <td style="text-align:right;"> 1.0000 </td>
  <td style="text-align:right;"> 4.9443 </td>
</tr>
<tr>
  <td style="text-align:left;"> ASBH1326–50 </td>
  <td style="text-align:right;"> -14.6933 </td>
  <td style="text-align:right;"> -23.0730 </td>
  <td style="text-align:right;"> -6.3789 </td>
  <td style="text-align:right;"> 0.9997 </td>
  <td style="text-align:right;"> 4.2684 </td>
</tr>
<tr>
  <td style="text-align:left;"> ASBH1351–100 </td>
  <td style="text-align:right;"> -12.3408 </td>
  <td style="text-align:right;"> -20.0671 </td>
  <td style="text-align:right;"> -4.7698 </td>
  <td style="text-align:right;"> 0.9988 </td>
  <td style="text-align:right;"> 3.9267 </td>
</tr>
<tr>
  <td style="text-align:left;"> ATBR16≤15 minutes </td>
```

-10.4793
-32.0397
10.1320
0.8342
10.7956

ATBR1616–30 minutes	-9.0907	-22.6272	3.8240	0.9139	6.7233
---------------------	---------	----------	--------	--------	--------

ATBR1631–60 minutes	-5.8909	-19.6759	7.3580	0.8077	6.9024
---------------------	---------	----------	--------	--------	--------



Warning in bayesian_plots_list["_pooled_coef_plot_"] <- pooled_coef_plot:
number of items to replace is not a multiple of replacement length

11. Plot of Probability of Direction (PD) for Pooled Coefficients

Visualise the probability of direction for each pooled coefficient.

```
#####
# 11. PLOT OF PROBABILITY OF DIRECTION (PD) FOR POOLED COEFFICIENTS
#####
cat("\n-----\n")
```

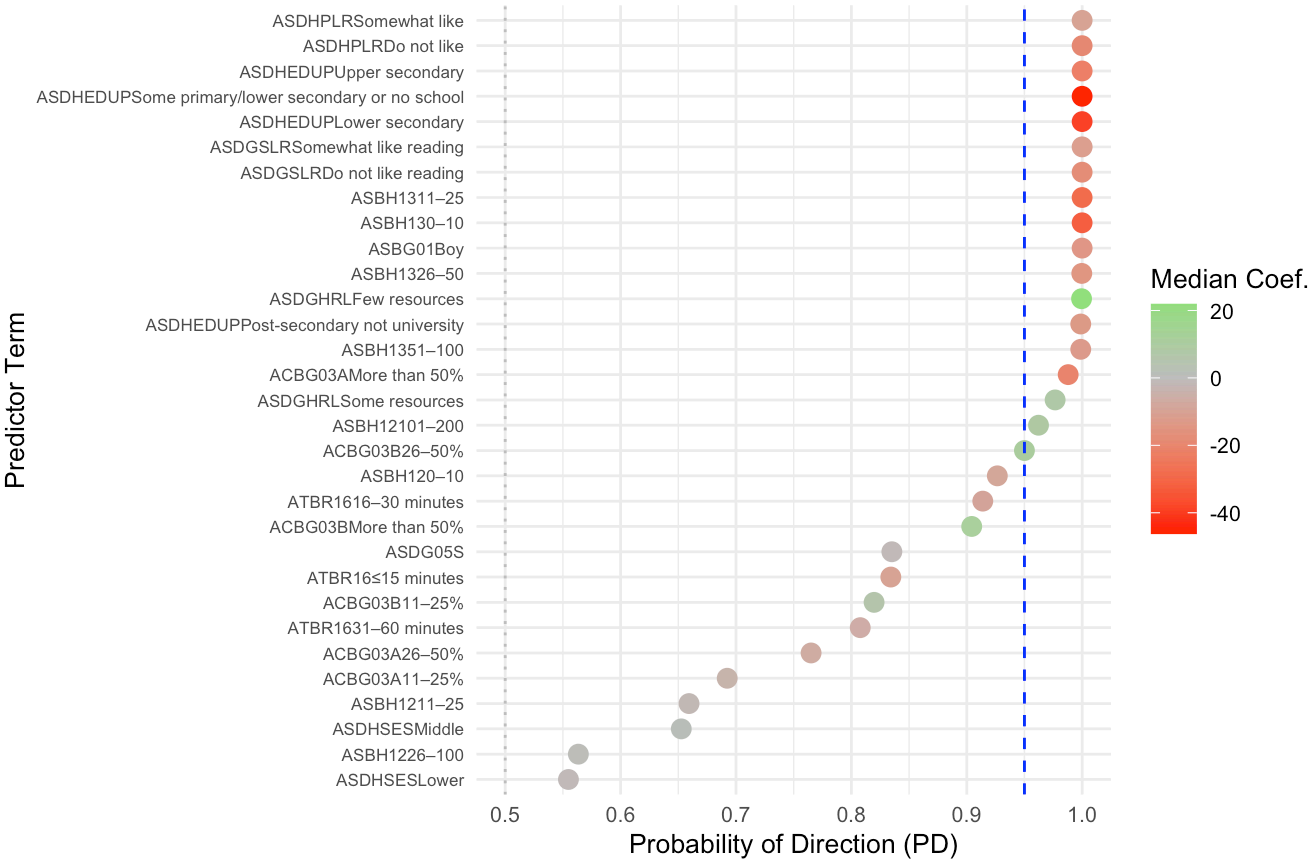
```
cat("SECTION 11: PLOT OF PROBABILITY OF DIRECTION (PD) FOR POOLED COEFFICIENTS\n")
```

SECTION 11: PLOT OF PROBABILITY OF DIRECTION (PD) FOR POOLED COEFFICIENTS

```
cat("-----\n")
```

```
if (!is.null(bayesian_results_list["_pooled_summary_"])) {
  pooled_summary_for_pd_plot <- bayesian_results_list["_pooled_summary_"]
  pd_plot <- ggplot(pooled_summary_for_pd_plot, aes(x = PD, y = reorder(Term, PD))) +
    geom_point(aes(color = Median), size = 3) +
    geom_vline(xintercept = 0.95, linetype = "dashed", color = "blue") +
    geom_vline(xintercept = 0.50, linetype = "dotted", color = "grey") +
    scale_color_gradient2(low = "red", mid = "grey", high = "green", midpoint = 0) +
    labs(title = "Probability of Direction (PD) for Pooled Coefficients",
         subtitle = "Dashed line at PD = 0.95 (strong evidence for direction)",
         x = "Probability of Direction (PD)",
         y = "Predictor Term",
         color = "Median Coef.") +
    theme_minimal(base_size = 10) +
    theme(axis.text.y = element_text(size=rel(0.8)))
  print(pd_plot)
  bayesian_plots_list["_pooled_pd_plot_"] <- pd_plot
} else {
  cat("Pooled summary results not found. Skipping PD plot.\n")
}
```

Probability of Direction (PD) for Pooled Coefficients
Dashed line at PD = 0.95 (strong evidence for direction)



12. Region of Practical Equivalence (ROPE) Analysis

Evaluate practical significance by calculating the percentage of the pooled posterior within a ROPE of ± 0.1 . Display summary and a bar plot.

```
#####  
# 12. REGION OF PRACTICAL EQUIVALENCE (ROPE) ANALYSIS  
#####  
cat("\n-----\n")  
  
-----  
  
cat("SECTION 12: REGION OF PRACTICAL EQUIVALENCE (ROPE) ANALYSIS\n")  
  
SECTION 12: REGION OF PRACTICAL EQUIVALENCE (ROPE) ANALYSIS  
  
cat("-----\n")  
  
-----
```

```

if (!is.null(bayesian_results_list[["_pooled_summary_"]])) {
  ROPE_RANGE <- c(-0.1, 0.1)
  cat(paste0("Using ROPE range: [", ROPE_RANGE[1], ", ", ROPE_RANGE[2], "]\n"))
  pooled_rope_summary_list <- list()
  coef_names_for_rope <- bayesian_results_list[["_pooled_summary_"]$Term
  for (coef_name in coef_names_for_rope) {
    all_draws_for_coef <- c()
    for (pv_model_name in names(bayesian_results_list)[!grepl("^_", names(bayesian_results_list))]) {
      current_model_fit <- bayesian_results_list[[pv_model_name]]$bayesian_lasso_fit
      draws_df <- as_draws_df(current_model_fit)
      if (!is.null(draws_df) && coef_name %in% names(draws_df)) {
        all_draws_for_coef <- c(all_draws_for_coef, draws_df[[coef_name]])
      }
    }
    if (length(all_draws_for_coef) > 0) {
      desc_post_for_rope <- describe_posterior(all_draws_for_coef, ci = 0.95, test=NULL)
      rope_obj_for_stats <- rope(all_draws_for_coef, range = ROPE_RANGE, ci = 0.95)
      current_rope_summary <- data.frame(
        Term = coef_name,
        Median = round(desc_post_for_rope$Median, 4),
        CI_Low = round(desc_post_for_rope$CI_low, 4),
        CI_High = round(desc_post_for_rope$CI_high, 4),
        ROPE_Percentage = round(rope_obj_for_stats$ROPE_Percentage * 100, 2)
      )
      pooled_rope_summary_list[[coef_name]] <- current_rope_summary
    }
  }
  if (length(pooled_rope_summary_list) > 0) {
    final_pooled_rope_df <- do.call(rbind, pooled_rope_summary_list)
    rownames(final_pooled_rope_df) <- NULL
    cat("\n--- Summary of Percentage of Posterior in ROPE for Pooled Coefficients ---\n")
    kbl(
      final_pooled_rope_df[, c("Term", "Median", "ROPE_Percentage")],
      caption = paste0("Median Estimate and Percentage of Pooled Posterior in ROPE (",
        col.names = c("Predictor Term", "Median Estimate", "% in ROPE"),
        booktabs = TRUE,
        format = "html"
      ) %>%
      kable_styling(full_width = FALSE) %>% print()
    bayesian_results_list[["_pooled_rope_summary_"]] <- final_pooled_rope_df
    rope_percentage_plot <- ggplot(final_pooled_rope_df, aes(x = ROPE_Percentage, y = reo
      geom_bar(stat="identity", fill="skyblue") +
      geom_vline(xintercept = 95, linetype = "dashed", color = "b
      labs(title = "Percentage of Pooled Posterior in ROPE",
        subtitle = paste0("ROPE range: [", ROPE_RANGE[1], ", ", "
        x = "% of Posterior in ROPE",
        y = "Predictor Term") +
      theme_minimal(base_size = 10) +
      theme(axis.text.y = element_text(size=rel(0.8)))
    print(rope_percentage_plot)
  }
}

```

```

    bayesian_plots_list[["_pooled_rope_percentage_plot_"]] <- rope_percentage_plot
  } else {
    cat("Could not generate ROPE summary table.\n")
  }
} else {
  cat("Pooled summary results not found. Skipping ROPE analysis.\n")
}

```

Using ROPE range: [-0.1, 0.1]

--- Summary of Percentage of Posterior in ROPE for Pooled Coefficients ---

<table class="table" style="width: auto !important; margin-left: auto; margin-right: auto;">

<caption>Median Estimate and Percentage of Pooled Posterior in ROPE (-0.1, 0.1)</caption>

<thead>

<tr>

<th style="text-align:left;"> Predictor Term </th>

<th style="text-align:right;"> Median Estimate </th>

<th style="text-align:right;"> % in ROPE </th>

</tr>

</thead>

<tbody>

<tr>

<td style="text-align:left;"> ASBG01Boy </td>

<td style="text-align:right;"> -14.0267 </td>

<td style="text-align:right;"> 0.00 </td>

</tr>

<tr>

<td style="text-align:left;"> ACBG03A11-25% </td>

<td style="text-align:right;"> -3.7753 </td>

<td style="text-align:right;"> 0.99 </td>

</tr>

<tr>

<td style="text-align:left;"> ACBG03A26-50% </td>

<td style="text-align:right;"> -6.3794 </td>

<td style="text-align:right;"> 0.81 </td>

</tr>

<tr>

<td style="text-align:left;"> ACBG03AMore than 50% </td>

<td style="text-align:right;"> -20.4649 </td>

<td style="text-align:right;"> 0.00 </td>

</tr>

<tr>

<td style="text-align:left;"> ACBG03B11-25% </td>

<td style="text-align:right;"> 5.7661 </td>

<td style="text-align:right;"> 0.87 </td>

</tr>

<tr>

<td style="text-align:left;"> ACBG03B26-50% </td>

<td style="text-align:right;"> 11.2254 </td>

```

    <td style="text-align:right;"> 0.36 </td>
  </tr>
  <tr>
    <td style="text-align:left;"> ACBG03BMore than 50% </td>
    <td style="text-align:right;"> 11.5577 </td>
    <td style="text-align:right;"> 0.37 </td>
  </tr>
  <tr>
    <td style="text-align:left;"> ASDGHRLSome resources </td>
    <td style="text-align:right;"> 8.2416 </td>
    <td style="text-align:right;"> 0.00 </td>
  </tr>
  <tr>
    <td style="text-align:left;"> ASDGHRLFew resources </td>
    <td style="text-align:right;"> 21.8893 </td>
    <td style="text-align:right;"> 0.00 </td>
  </tr>
  <tr>
    <td style="text-align:left;"> ASDHSESMiddle </td>
    <td style="text-align:right;"> 1.5040 </td>
    <td style="text-align:right;"> 2.01 </td>
  </tr>
  <tr>
    <td style="text-align:left;"> ASDHSESLower </td>
    <td style="text-align:right;"> -1.0024 </td>
    <td style="text-align:right;"> 1.16 </td>
  </tr>
  <tr>
    <td style="text-align:left;"> ASDHPLRSomewhat like </td>
    <td style="text-align:right;"> -9.7510 </td>
    <td style="text-align:right;"> 0.00 </td>
  </tr>
  <tr>
    <td style="text-align:left;"> ASDHPLRDo not like </td>
    <td style="text-align:right;"> -19.1514 </td>
    <td style="text-align:right;"> 0.00 </td>
  </tr>
  <tr>
    <td style="text-align:left;"> ASDHEDUPPost-secondary not university </td>
    <td style="text-align:right;"> -13.2143 </td>
    <td style="text-align:right;"> 0.00 </td>
  </tr>
  <tr>
    <td style="text-align:left;"> ASDHEDUPUpper secondary </td>
    <td style="text-align:right;"> -22.4402 </td>
    <td style="text-align:right;"> 0.00 </td>
  </tr>
  <tr>
    <td style="text-align:left;"> ASDHEDUPLower secondary </td>
    <td style="text-align:right;"> -38.9210 </td>
    <td style="text-align:right;"> 0.00 </td>
  </tr>

```

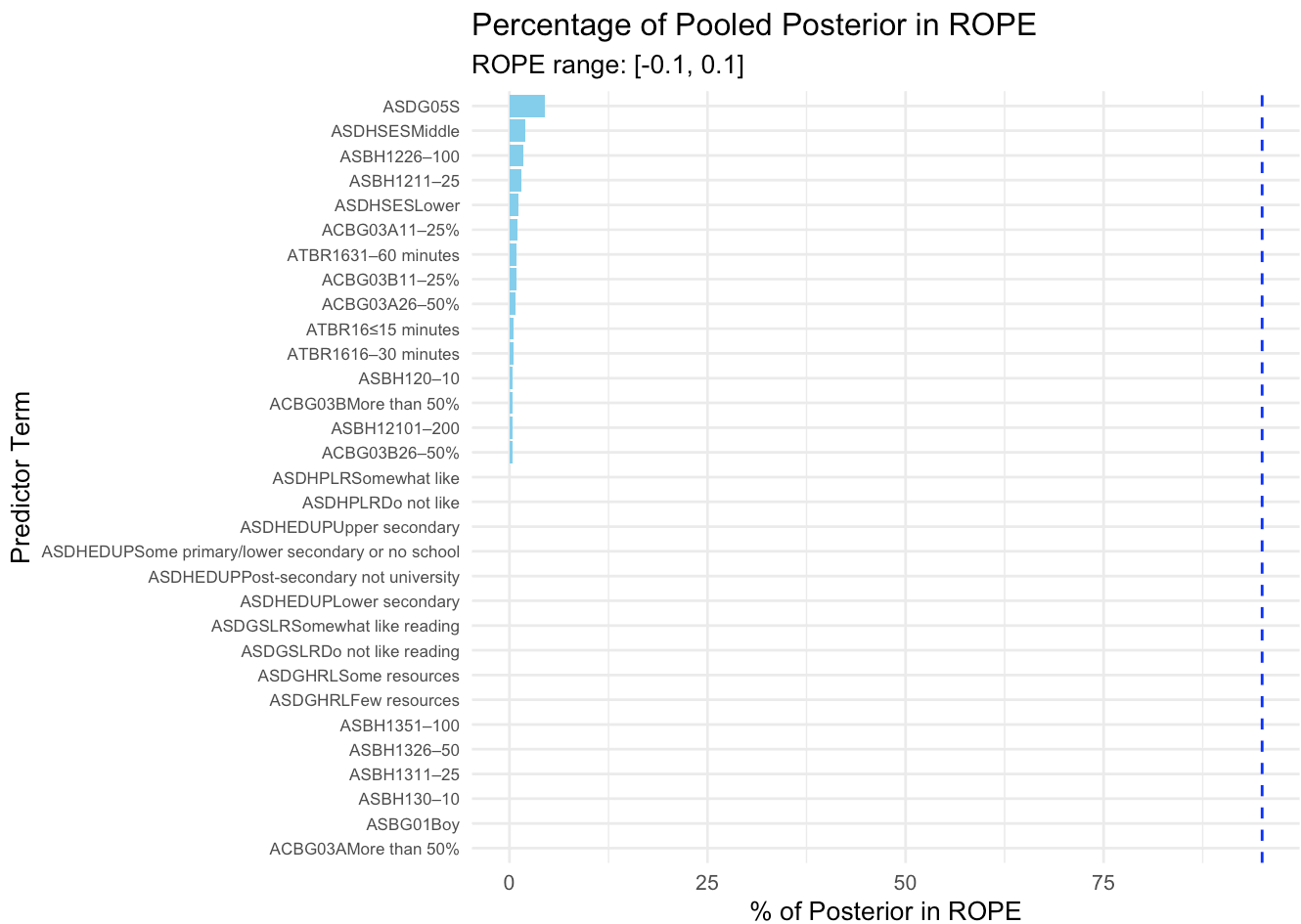


```

</tr>
<tr>
  <td style="text-align:left;"> ASDHEDUPSome primary/lower secondary or no school </td>
  <td style="text-align:right;"> -46.2189 </td>
  <td style="text-align:right;"> 0.00 </td>
</tr>
<tr>
  <td style="text-align:left;"> ASDGSLRSomewhat like reading </td>
  <td style="text-align:right;"> -11.9190 </td>
  <td style="text-align:right;"> 0.00 </td>
</tr>
<tr>
  <td style="text-align:left;"> ASDGSLRDo not like reading </td>
  <td style="text-align:right;"> -17.2933 </td>
  <td style="text-align:right;"> 0.00 </td>
</tr>
<tr>
  <td style="text-align:left;"> ASDG05S </td>
  <td style="text-align:right;"> -1.1488 </td>
  <td style="text-align:right;"> 4.41 </td>
</tr>
<tr>
  <td style="text-align:left;"> ASBH120-10 </td>
  <td style="text-align:right;"> -8.7662 </td>
  <td style="text-align:right;"> 0.39 </td>
</tr>
<tr>
  <td style="text-align:left;"> ASBH1211-25 </td>
  <td style="text-align:right;"> -2.0155 </td>
  <td style="text-align:right;"> 1.50 </td>
</tr>
<tr>
  <td style="text-align:left;"> ASBH1226-100 </td>
  <td style="text-align:right;"> 0.7413 </td>
  <td style="text-align:right;"> 1.77 </td>
</tr>
<tr>
  <td style="text-align:left;"> ASBH12101-200 </td>
  <td style="text-align:right;"> 8.5360 </td>
  <td style="text-align:right;"> 0.36 </td>
</tr>
<tr>
  <td style="text-align:left;"> ASBH130-10 </td>
  <td style="text-align:right;"> -32.5755 </td>
  <td style="text-align:right;"> 0.00 </td>
</tr>
<tr>
  <td style="text-align:left;"> ASBH1311-25 </td>
  <td style="text-align:right;"> -28.7303 </td>
  <td style="text-align:right;"> 0.00 </td>
</tr>

```

```
<tr>
  <td style="text-align:left;"> ASBH1326-50 </td>
  <td style="text-align:right;"> -14.6933 </td>
  <td style="text-align:right;"> 0.00 </td>
</tr>
<tr>
  <td style="text-align:left;"> ASBH1351-100 </td>
  <td style="text-align:right;"> -12.3408 </td>
  <td style="text-align:right;"> 0.00 </td>
</tr>
<tr>
  <td style="text-align:left;"> ATBR16≤15 minutes </td>
  <td style="text-align:right;"> -10.4793 </td>
  <td style="text-align:right;"> 0.51 </td>
</tr>
<tr>
  <td style="text-align:left;"> ATBR1616-30 minutes </td>
  <td style="text-align:right;"> -9.0907 </td>
  <td style="text-align:right;"> 0.49 </td>
</tr>
<tr>
  <td style="text-align:left;"> ATBR1631-60 minutes </td>
  <td style="text-align:right;"> -5.8909 </td>
  <td style="text-align:right;"> 0.87 </td>
</tr>
</tbody>
</table>
```



13. Shrinkage Visualisation Plot (Multilevel)

Compare the multilevel Bayesian LASSO to a non-regularised multilevel model for one plausible value.

```
#####
# 13. SHRINKAGE VISUALIZATION PLOT
#####
first_pv_name_for_shrinkage <- names(bayesian_results_list)[!grepl("^_", names(bayesian_r
if (!is.null(first_pv_name_for_shrinkage) && !is.null(TUR_R2_clean) &&
  !is.null(bayesian_results_list[[first_pv_name_for_shrinkage]])) {
  cat(paste("Fitting a non-LASSO Bayesian multilevel model for PV:", first_pv_name_for_sh
df_sub_shrinkage <- TUR_R2_clean %>%
  dplyr::filter(!is.na(.data[[first_pv_name_for_shrinkage]]))
formula_str_shrinkage <- paste(first_pv_name_for_shrinkage, "~", paste(predictor_vars,
  "+ (1 |", group_var_name, ")")
model_formula_shrinkage <- as.formula(formula_str_shrinkage)
run_non_lasso <- TRUE
if(nrow(df_sub_shrinkage) < (length(predictor_vars) + 10)) {
  message("Skipping non-LASSO model due to insufficient observations for comparison.")
  run_non_lasso <- FALSE
}
if(run_non_lasso){
```

```

non_lasso_fit <- tryCatch({
  stan_glmer(
    formula = model_formula_shrinkage,
    data     = df_sub_shrinkage,
    family   = gaussian(),
    chains   = MCMC_CHAINS, iter = MCMC_ITER, warmup = MCMC_WARMUP,
    seed     = 12345, refresh = 0
  )
}, error = function(e) { message("Error fitting non-LASSO model: ", e$message); ret
lasso_fit_for_comparison <- bayesian_results_list[[first_pv_name_for_shrinkage]]$ba
if (!is.null(non_lasso_fit) && !is.null(lasso_fit_for_comparison)) {
  tidy_non_lasso <- broom.mixed::tidy(non_lasso_fit, effects = "fixed", conf.int =
    filter(term != "(Intercept)") %>%
    select(term, estimate_non_lasso = estimate,
           conf.low_non_lasso = conf.low,
           conf.high_non_lasso = conf.high)
  tidy_lasso_comp <- broom.mixed::tidy(lasso_fit_for_comparison, effects = "fixed"
    filter(term != "(Intercept)") %>%
    select(term, estimate_lasso = estimate,
           conf.low_lasso = conf.low,
           conf.high_lasso = conf.high)
  comparison_df <- inner_join(tidy_non_lasso, tidy_lasso_comp, by = "term")
  shrinkage_plot <- ggplot(comparison_df, aes(x = estimate_non_lasso, y = estimate_
    geom_point(color = "blue") +
    geom_abline(intercept = 0, slope = 1, linetype = "dashed", color = "red") +
    geom_text(aes(label=term), hjust=0, vjust=-0.5, size=2.5, check_overlap = TRUE)
  labs(title = paste("Shrinkage Comparison for PV:", first_pv_name_for_shrinkage)
        subtitle = "Multilevel Bayesian LASSO vs Non-Regularised Bayesian Model",
        x = "Coefficient Estimate (Non-Regularised)",
        y = "Coefficient Estimate (Bayesian LASSO)") +
    theme_minimal(base_size = 10) + coord_equal()
  print(shrinkage_plot)
  bayesian_plots_list[["_shrinkage_plot_"]] <- shrinkage_plot
} else {
  cat("Could not generate shrinkage comparison plot; one or both models failed to f
}
}
} else {
  cat("Data, first PV name, or its corresponding result not available for shrinkage plot
}

```

Fitting a non-LASSO Bayesian multilevel model for PV: ASRREA01 for shrinkage comparison.

Shrinkage Comparison for PV: ASRREA01
Multilevel Bayesian LASSO vs Non-Regularised Bayesian Model

