

# ABCD ADHD menarche analysis: Output for cross-sectional models

## Model 1 output

```
    Estimate   Est.Error     Q2.5     Q97.5
R2 0.7203643 0.002968573 0.7144555 0.7261356

Family: poisson
Links: mu = log
Formula: cbcl_scr_syn_attention_r ~ menarche_status_p + age_years_c + ethnicity + inr_c + (1 | Data: imp_df (Number of observations: 20703)
Draws: 2 chains, each with iter = 8000; warmup = 4000; thin = 1;
       total post-warmup draws = 8000

Multilevel Hyperparameters:
~family_id (Number of levels: 4922)
    Estimate   Est.Error l-95% CI u-95% CI     Rhat Bulk_ESS Tail_ESS
sd(Intercept)  0.8757     0.0397   0.7941   0.9497 1.0051      774     1272

~site_id (Number of levels: 22)
    Estimate   Est.Error l-95% CI u-95% CI     Rhat Bulk_ESS Tail_ESS
sd(Intercept)  0.1866     0.0407   0.1198   0.2802 1.0001      5279     5509

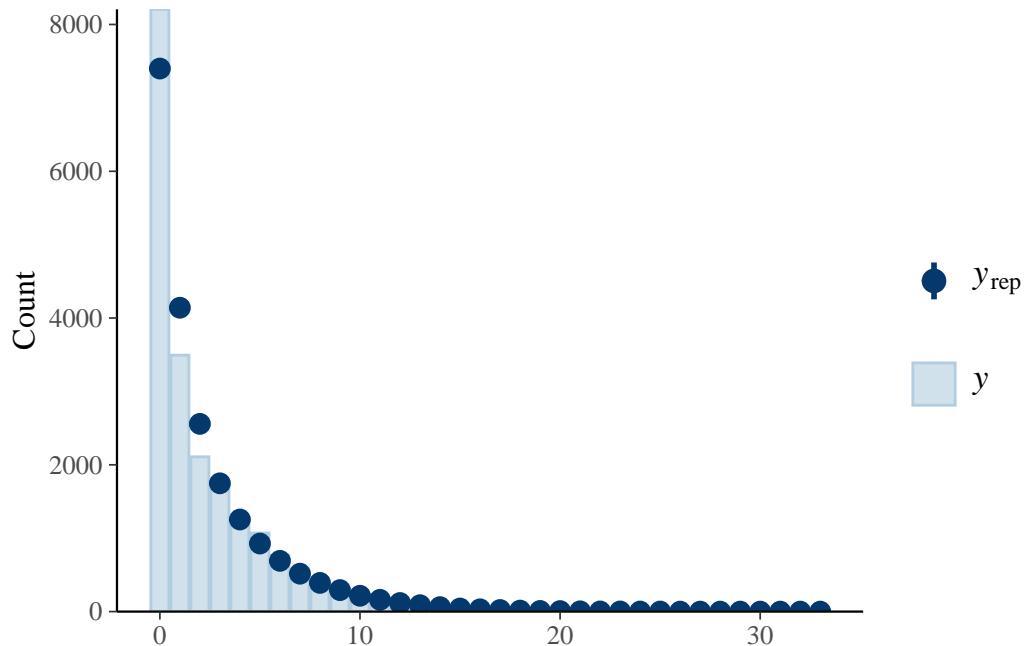
~src_subject_id (Number of levels: 5658)
    Estimate   Est.Error l-95% CI u-95% CI     Rhat Bulk_ESS Tail_ESS
sd(Intercept)  1.0065     0.0330   0.9439   1.0735 1.0043      745     1559

Regression Coefficients:
    Estimate   Est.Error l-95% CI u-95% CI     Rhat Bulk_ESS
Intercept          0.1148     0.0515   0.0142   0.2174 1.0002      5110
menarche_status_pY  0.0328     0.0169   -0.0002   0.0667 1.0001     12583
```

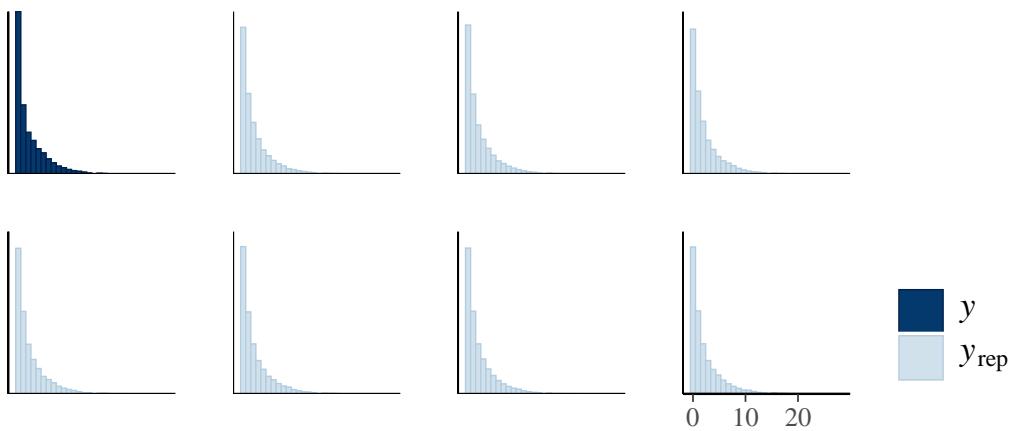
age_years_c	-0.0177	0.0057	-0.0287	-0.0068	1.0000	13482
ethnicity2	0.0487	0.0619	-0.0731	0.1691	1.0000	8107
ethnicity3	-0.0505	0.0594	-0.1669	0.0653	1.0000	7627
ethnicity4	-0.5078	0.1426	-0.7852	-0.2291	1.0000	7791
ethnicity5	0.1986	0.0668	0.0683	0.3301	1.0008	7447
inr_c	-0.0131	0.0035	-0.0199	-0.0061	1.0004	17540
Tail_ESS						
Intercept	5202					
menarche_status_pY	5877					
age_years_c	6327					
ethnicity2	6014					
ethnicity3	6146					
ethnicity4	6444					
ethnicity5	6059					
inr_c	6628					

Draws were sampled using sampling(NUTS). For each parameter, Bulk\_ESS and Tail\_ESS are effective sample size measures, and Rhat is the potential scale reduction factor on split chains (at convergence, Rhat = 1).

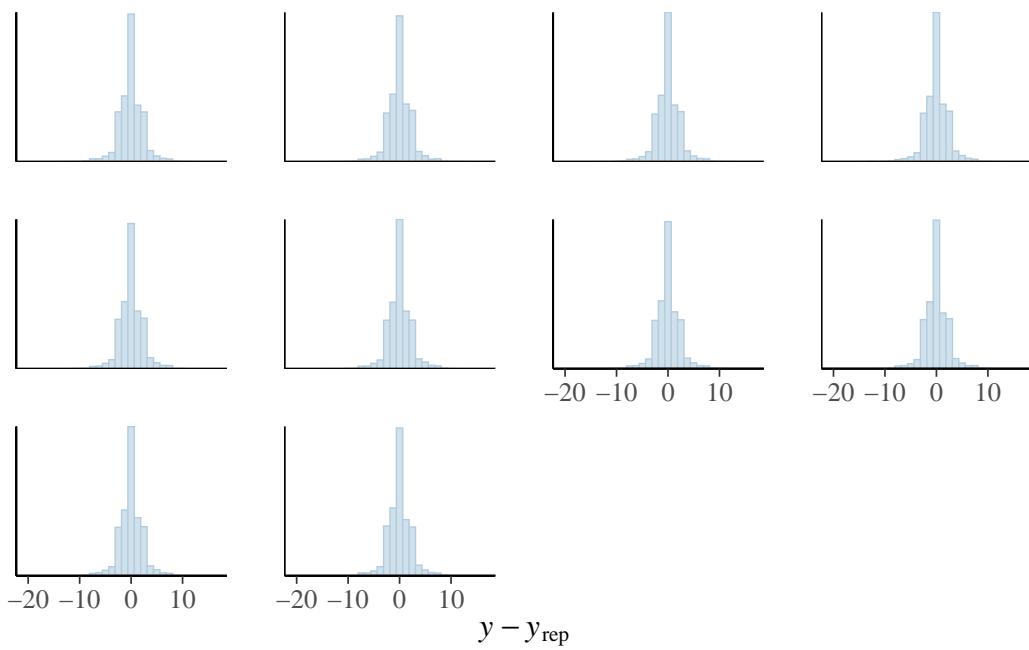
## Model 1 posterior predictive diagnostics



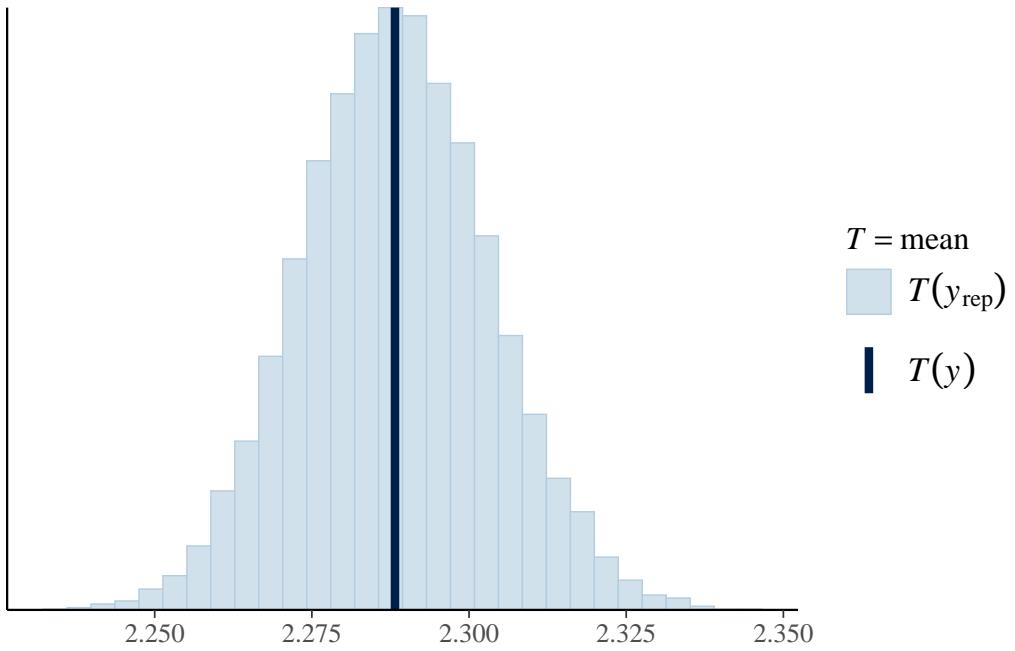
`stat\_bin()` using `bins = 30`. Pick better value with `binwidth`.



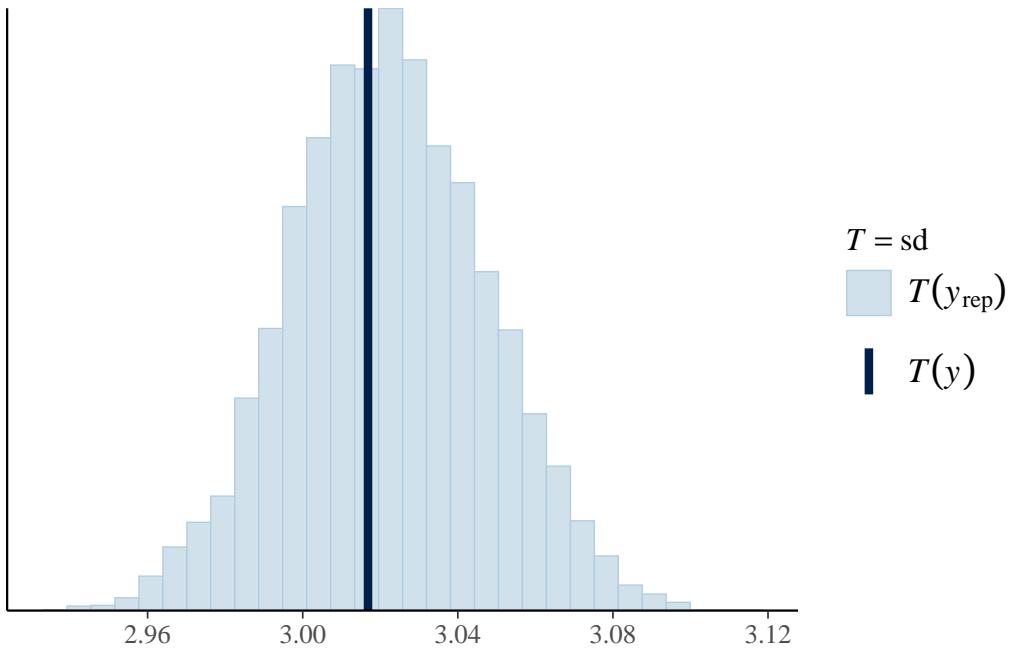
``stat_bin()` using `bins = 30`.` Pick better value with ``binwidth``.

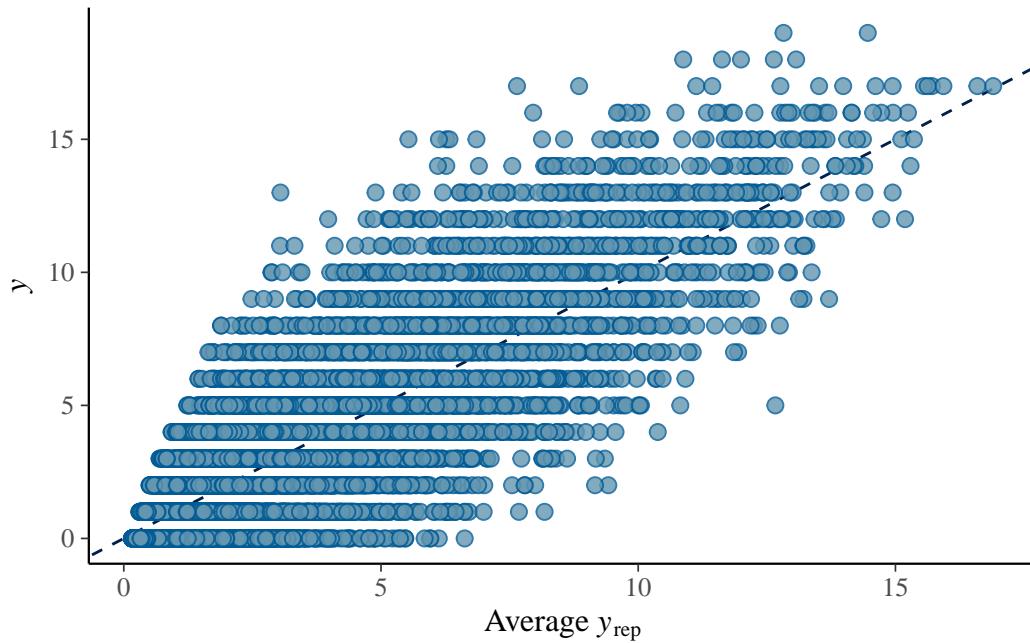


``stat_bin()` using `bins = 30`.` Pick better value with ``binwidth``.



```
`stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```





## Model 1b output

	Estimate	Est.Error	Q2.5	Q97.5
R2	0.713695	0.002930041	0.7077849	0.7193777

```

Family: poisson
Links: mu = log
Formula: cbcl_scr_syn_attention_r ~ pds_f4_p_c + age_years_c + ethnicity + inr_c + (1 | src_s
Data: imp_df (Number of observations: 21152)
Draws: 2 chains, each with iter = 8000; warmup = 4000; thin = 1;
       total post-warmup draws = 8000

Multilevel Hyperparameters:
~family_id (Number of levels: 4939)
  Estimate   Est.Error  l-95% CI  u-95% CI    Rhat Bulk_ESS Tail_ESS
sd(Intercept)  0.8635     0.0407   0.7791   0.9423 1.0012      804     1605

~site_id (Number of levels: 22)
  Estimate   Est.Error  l-95% CI  u-95% CI    Rhat Bulk_ESS Tail_ESS
sd(Intercept)  0.1838     0.0406   0.1174   0.2750 0.9998      6473     5860

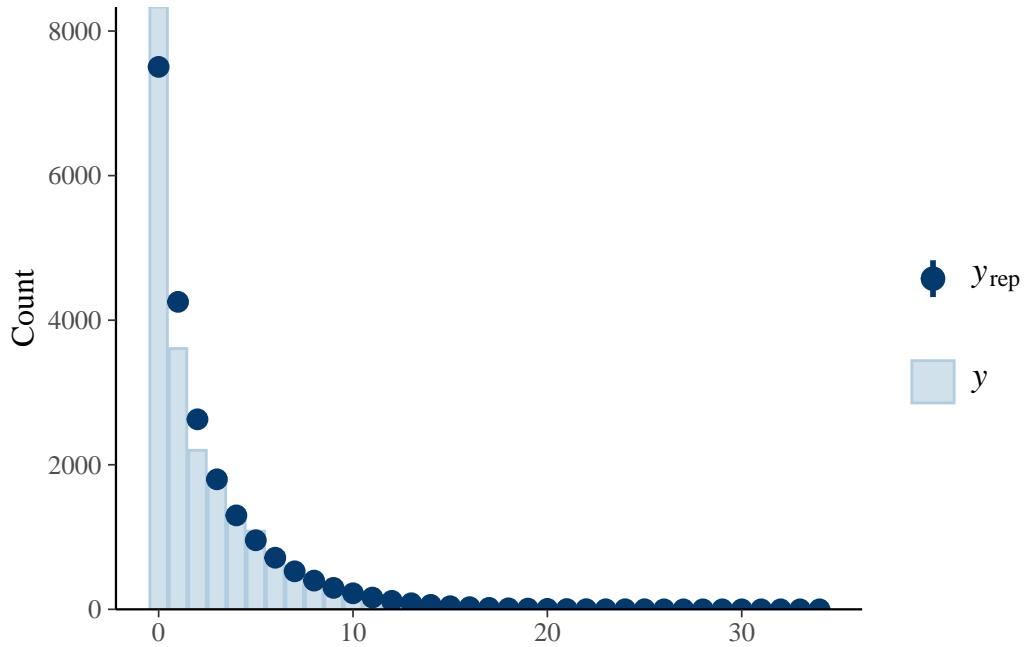
~src_subject_id (Number of levels: 5677)

```

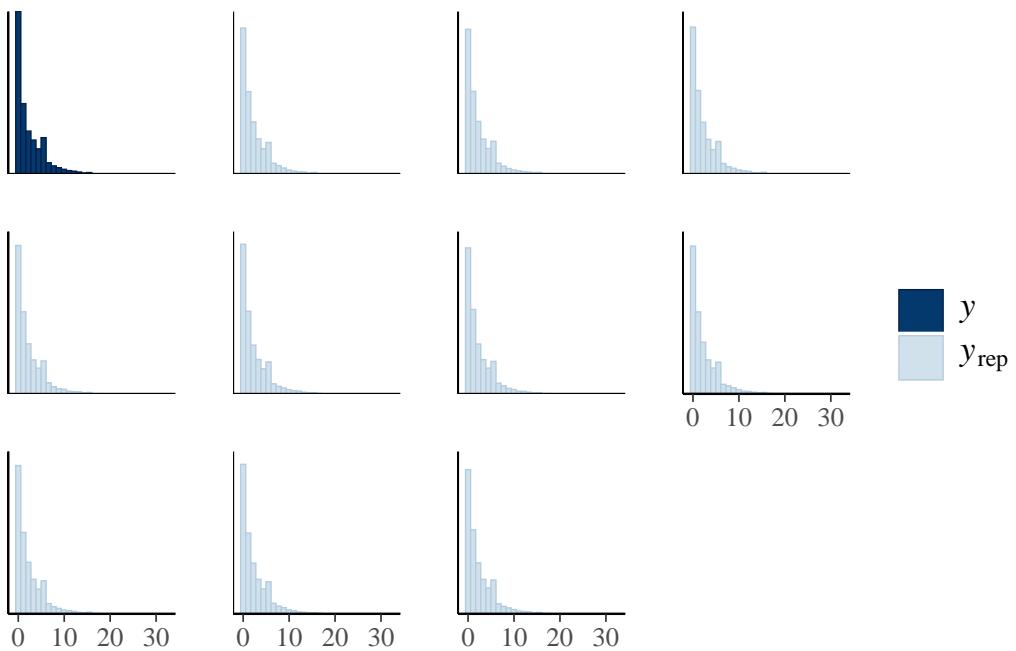
	Estimate	Est.Error	1-95% CI	u-95% CI	Rhat	Bulk_ESS	Tail_ESS
sd(Intercept)	0.9965	0.0338	0.9303	1.0632	1.0017	1002	2116
Regression Coefficients:							
	Estimate	Est.Error	1-95% CI	u-95% CI	Rhat	Bulk_ESS	Tail_ESS
Intercept	0.1320	0.0514	0.0308	0.2324	1.0007	5891	5913
pds_f4_p_c	0.0452	0.0105	0.0250	0.0656	1.0006	14816	5591
age_years_c	-0.0301	0.0054	-0.0409	-0.0198	1.0009	13779	6066
ethnicity2	0.0287	0.0615	-0.0918	0.1472	1.0000	9195	6114
ethnicity3	-0.0483	0.0595	-0.1627	0.0684	1.0004	9486	6333
ethnicity4	-0.4775	0.1412	-0.7542	-0.2017	1.0004	10755	6267
ethnicity5	0.1953	0.0670	0.0651	0.3269	1.0006	9251	6142
inr_c	-0.0144	0.0035	-0.0212	-0.0076	1.0002	16323	5587

Draws were sampled using sampling(NUTS). For each parameter, Bulk\_ESS and Tail\_ESS are effective sample size measures, and Rhat is the potential scale reduction factor on split chains (at convergence, Rhat = 1).

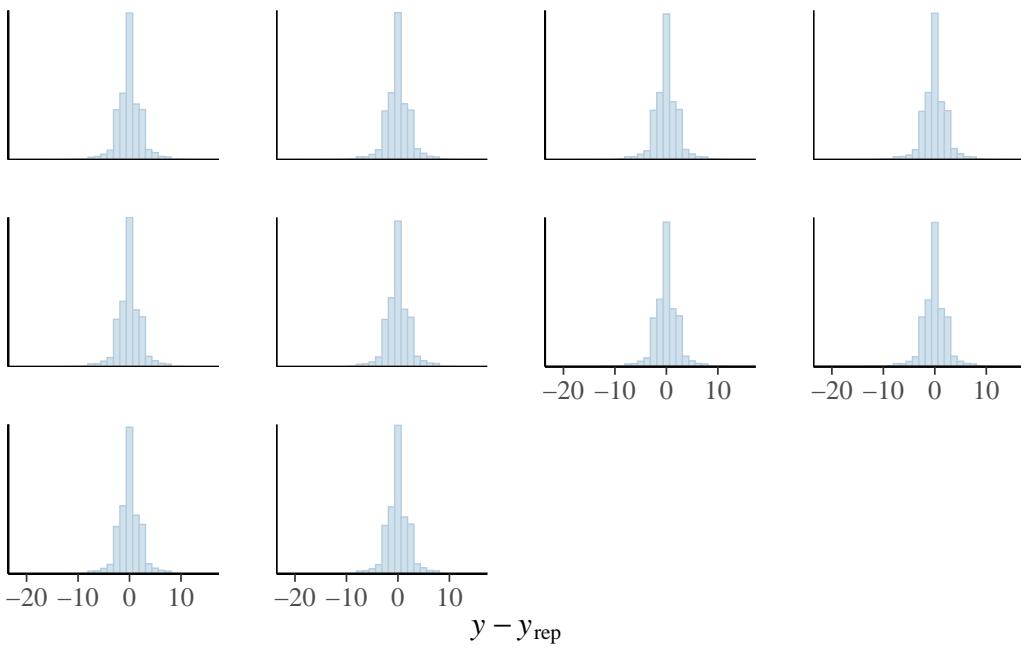
## Model 1b posterior predictive diagnostics



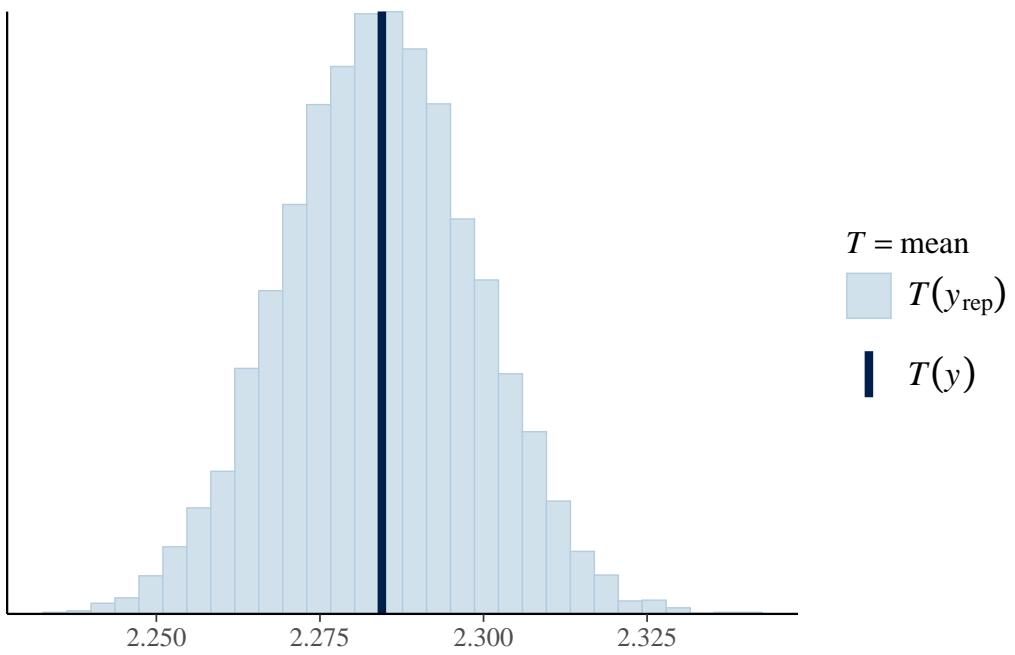
`stat\_bin()` using `bins = 30`. Pick better value with `binwidth`.



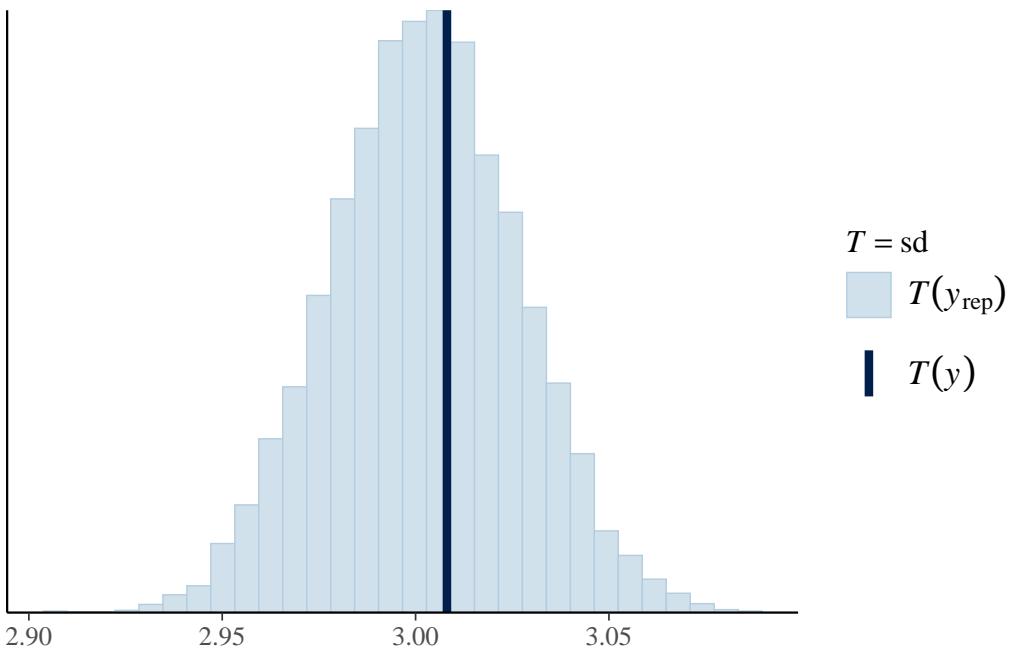
``stat_bin()` using `bins = 30`.` Pick better value with ``binwidth``.

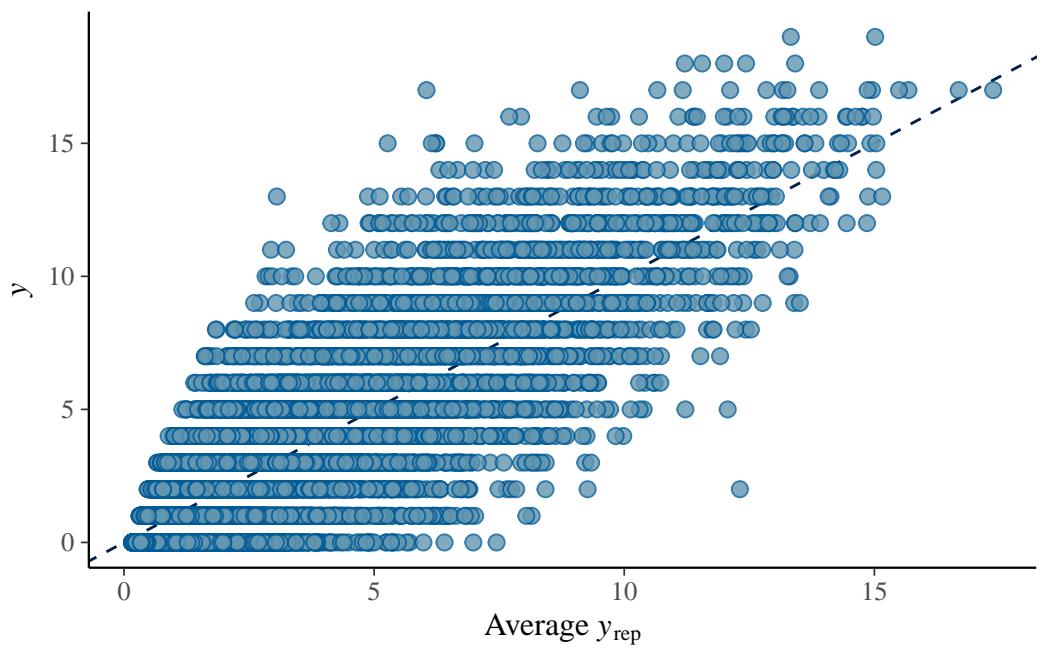


``stat_bin()` using `bins = 30`.` Pick better value with ``binwidth``.



```
`stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```





## Model 2 output

```
Estimate   Est.Error    Q2.5    Q97.5
R2 0.8495708 0.002253478 0.8451188 0.8539552
```

```
Family: poisson
Links: mu = log
Formula: cbcl_scr_syn_internal_r ~ menarche_status_p * adhd_diagnosis + age_years_c + ethnic
Data: imp_df (Number of observations: 20697)
Draws: 2 chains, each with iter = 8000; warmup = 4000; thin = 1;
      total post-warmup draws = 8000

Multilevel Hyperparameters:
~family_id (Number of levels: 4916)
Estimate   Est.Error    l-95% CI   u-95% CI    Rhat Bulk_ESS Tail_ESS
sd(Intercept) 0.7660     0.0175    0.7312    0.8003 1.0010      1332     2782

~obs_id (Number of levels: 20697)
Estimate   Est.Error    l-95% CI   u-95% CI    Rhat Bulk_ESS Tail_ESS
sd(Intercept) 0.4434     0.0059    0.4318    0.4553 1.0005      3568     5271

~site_id (Number of levels: 22)
Estimate   Est.Error    l-95% CI   u-95% CI    Rhat Bulk_ESS Tail_ESS
sd(Intercept) 0.1329     0.0293    0.0848    0.1991 1.0003      5033     5693

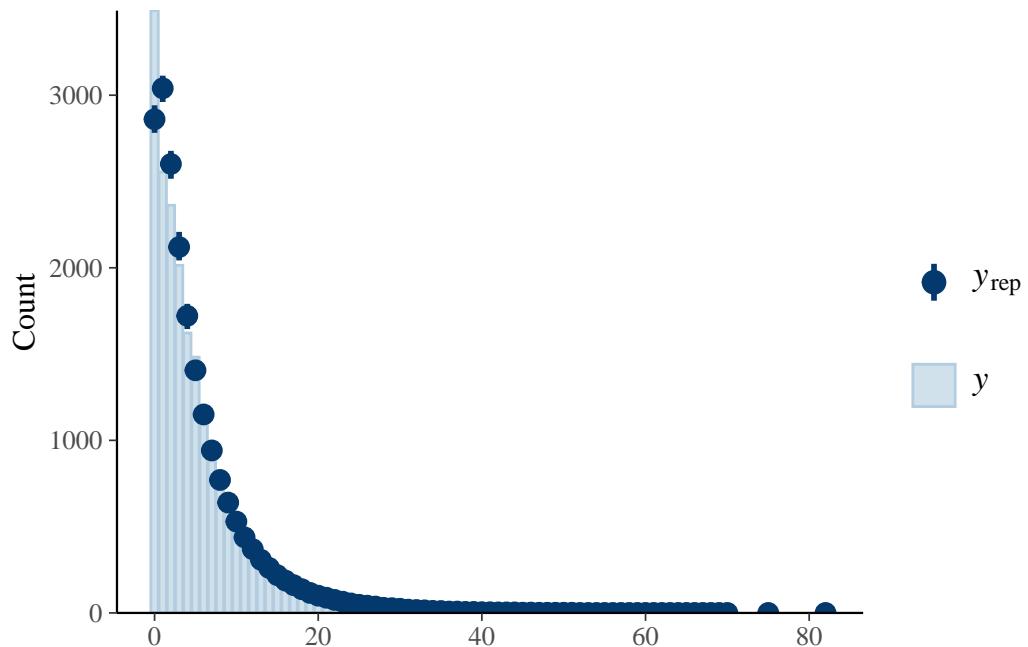
~src_subject_id (Number of levels: 5652)
Estimate   Est.Error    l-95% CI   u-95% CI    Rhat Bulk_ESS Tail_ESS
sd(Intercept) 0.4597     0.0211    0.4191    0.5015 1.0011      814      1844

Regression Coefficients:
Estimate   Est.Error    l-95% CI   u-95% CI    Rhat
Intercept          1.0982     0.0376    1.0245    1.1726 1.0001
menarche_status_pY 0.0941     0.0182    0.0586    0.1298 1.0002
adhd_diagnosis1    0.7014     0.0331    0.6370    0.7667 1.0000
age_years_c         0.0184     0.0057    0.0073    0.0297 1.0000
ethnicity2        -0.4001     0.0444   -0.4876   -0.3137 1.0002
ethnicity3        -0.0536     0.0412   -0.1342    0.0262 1.0011
ethnicity4        -0.3495     0.0943   -0.5378   -0.1608 1.0002
ethnicity5         0.0593     0.0465   -0.0314    0.1511 1.0005
inr_c              -0.0061     0.0032   -0.0124    0.0002 0.9998
menarche_status_pY:adhd_diagnosis1 -0.0735     0.0290   -0.1293   -0.0157 0.9999
                                         Bulk_ESS Tail_ESS
```

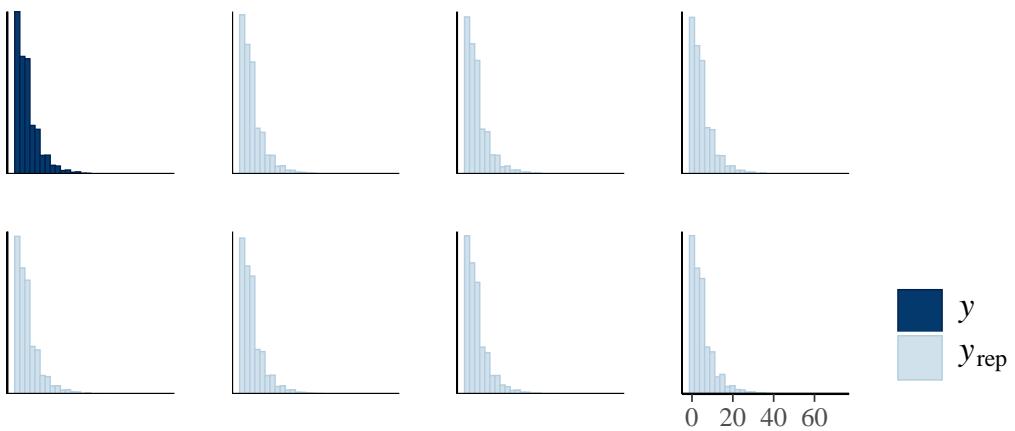
Intercept	5263	5193
menarche_status_pY	9331	6539
adhd_diagnosis1	5678	6007
age_years_c	9318	6149
ethnicity2	7388	5924
ethnicity3	6367	5439
ethnicity4	7666	5816
ethnicity5	6594	6448
inr_c	10288	6300
menarche_status_pY:adhd_diagnosis1	9852	6073

Draws were sampled using `sampling(NUTS)`. For each parameter, Bulk\_ESS and Tail\_ESS are effective sample size measures, and Rhat is the potential scale reduction factor on split chains (at convergence, Rhat = 1).

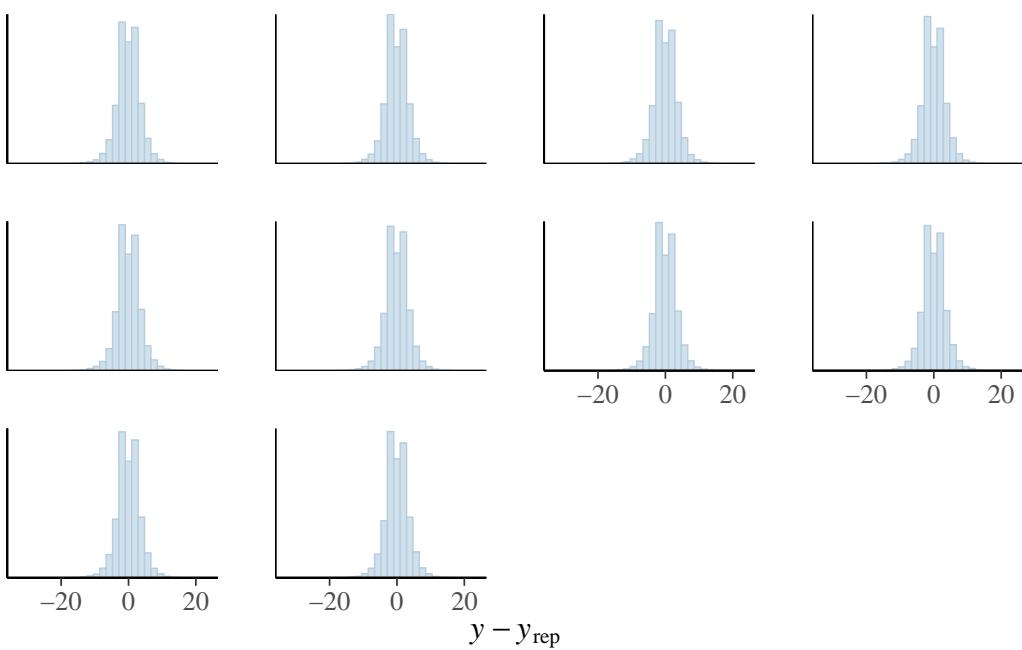
## Model 2 posterior predictive diagnostics



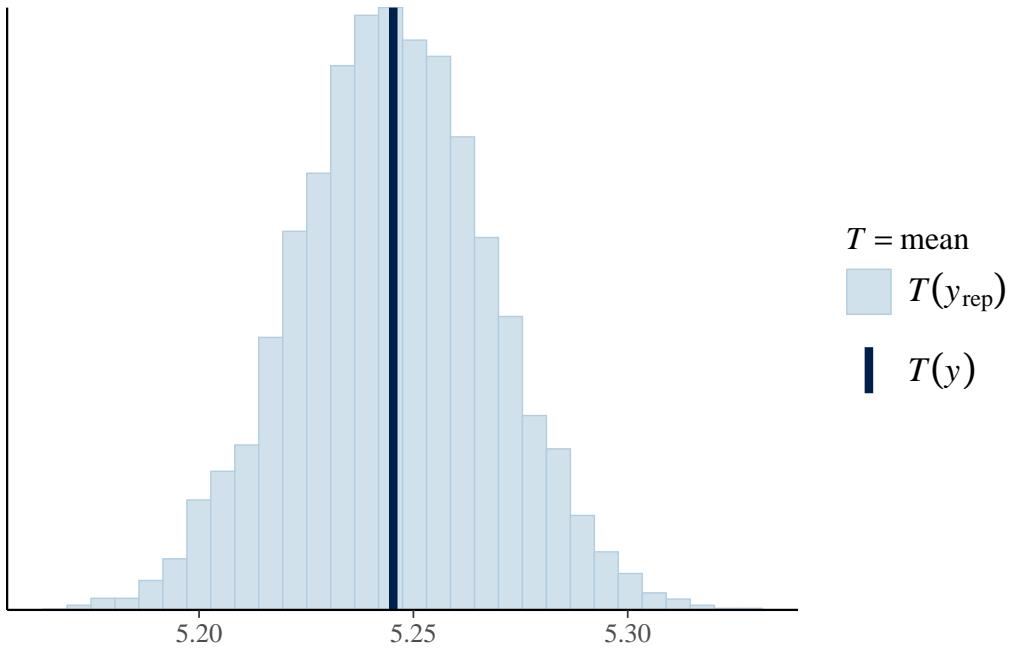
``stat_bin()`` using ``bins = 30``. Pick better value with ``binwidth``.



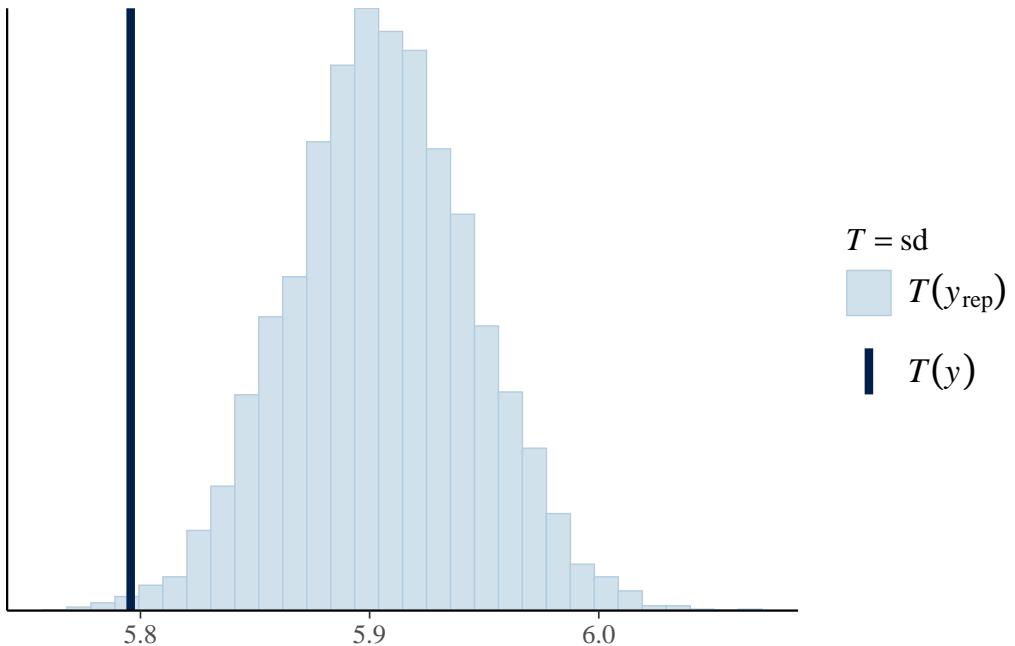
``stat_bin()` using `bins = 30`.` Pick better value with ``binwidth``.

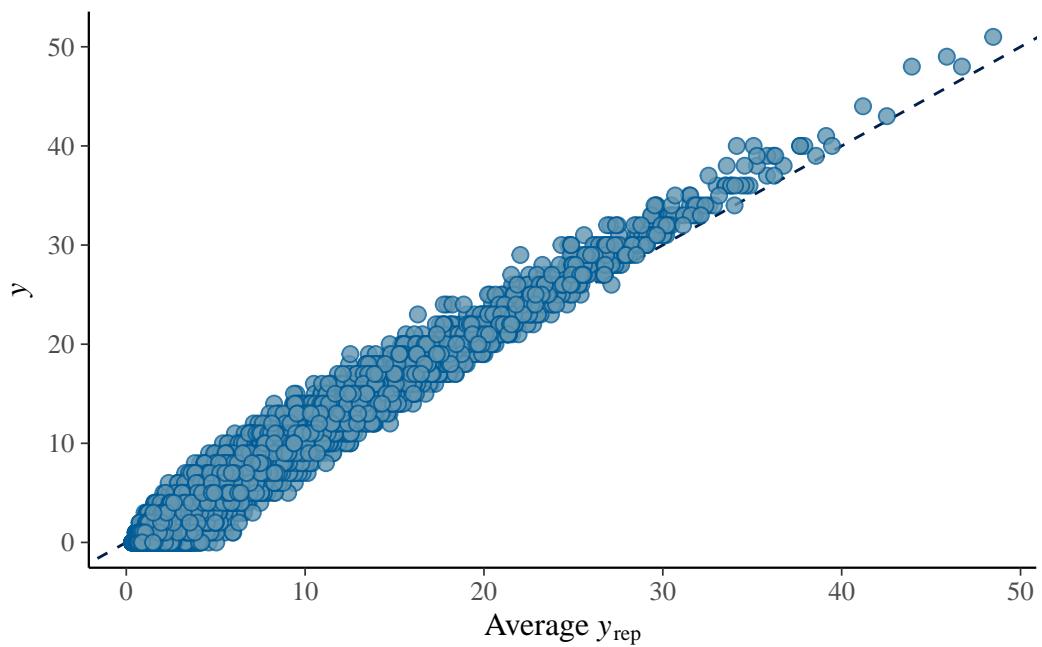


``stat_bin()` using `bins = 30`.` Pick better value with ``binwidth``.



```
`stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```





## Model 2 interaction analysis

adhd_diagnosis	menarche_status_p	emmmean	lower.HPD	upper.HPD
0	N	0.949	0.870	1.02
1	N	1.650	1.560	1.74
0	Y	1.043	0.963	1.12
1	Y	1.671	1.576	1.77

Results are averaged over the levels of: ethnicity  
 Point estimate displayed: median  
 Results are given on the log (not the response) scale.  
 HPD interval probability: 0.95

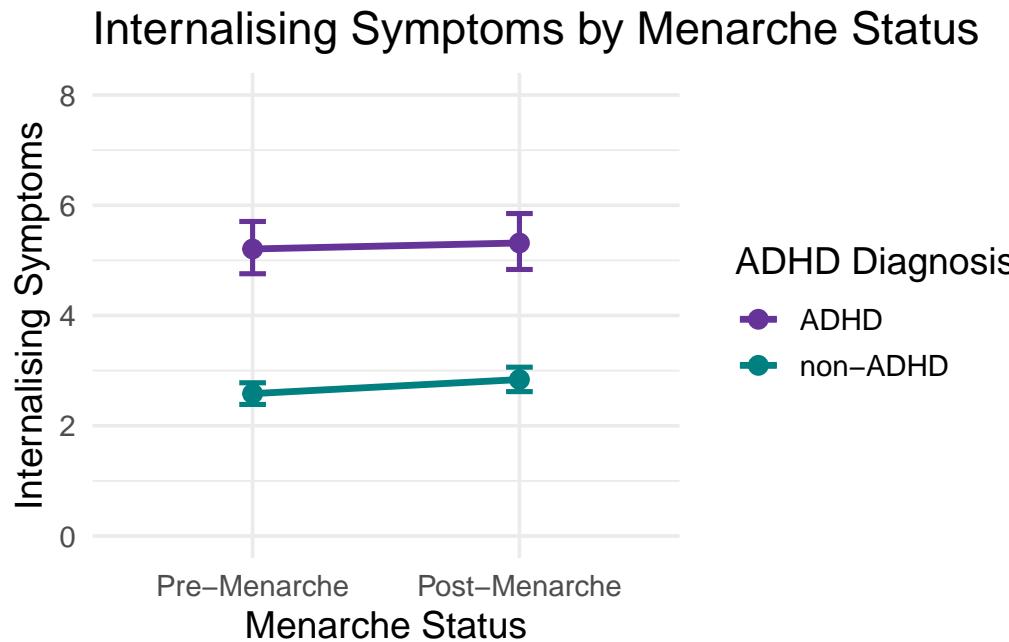
adhd\_diagnosis = 0:  
 contrast estimate lower.HPD upper.HPD  
 Y - N      0.0940      0.0597      0.1308

adhd\_diagnosis = 1:  
 contrast estimate lower.HPD upper.HPD  
 Y - N      0.0207      -0.0318      0.0765

Results are averaged over the levels of: ethnicity  
 Point estimate displayed: median

Results are given on the log (not the response) scale.  
HPD interval probability: 0.95

### Visualise interaction model 2



## Model 2b output

```
Estimate   Est.Error    Q2.5    Q97.5
R2 0.8494806 0.002238864 0.8450176 0.8537599
```

```
Family: poisson
Links: mu = log
Formula: cbcl_scr_syn_internal_r ~ pds_f4_p_c * adhd_diagnosis + age_years_c + ethnicity + inr_c
Data: imp_df (Number of observations: 21145)
Draws: 2 chains, each with iter = 8000; warmup = 4000; thin = 1;
       total post-warmup draws = 8000
```

Multilevel Hyperparameters:

~family\_id (Number of levels: 4932)

	Estimate	Est.Error	l-95% CI	u-95% CI	Rhat	Bulk_ESS	Tail_ESS
sd(Intercept)	0.7574	0.0172	0.7223	0.7900	1.0005	1576	2625

~obs\_id (Number of levels: 21145)

	Estimate	Est.Error	l-95% CI	u-95% CI	Rhat	Bulk_ESS	Tail_ESS
sd(Intercept)	0.4525	0.0059	0.4410	0.4642	1.0000	3593	5052

~site\_id (Number of levels: 22)

	Estimate	Est.Error	l-95% CI	u-95% CI	Rhat	Bulk_ESS	Tail_ESS
sd(Intercept)	0.1304	0.0291	0.0838	0.1968	1.0000	5369	5393

~src\_subject\_id (Number of levels: 5670)

	Estimate	Est.Error	l-95% CI	u-95% CI	Rhat	Bulk_ESS	Tail_ESS
sd(Intercept)	0.4547	0.0217	0.4130	0.4986	1.0006	883	1775

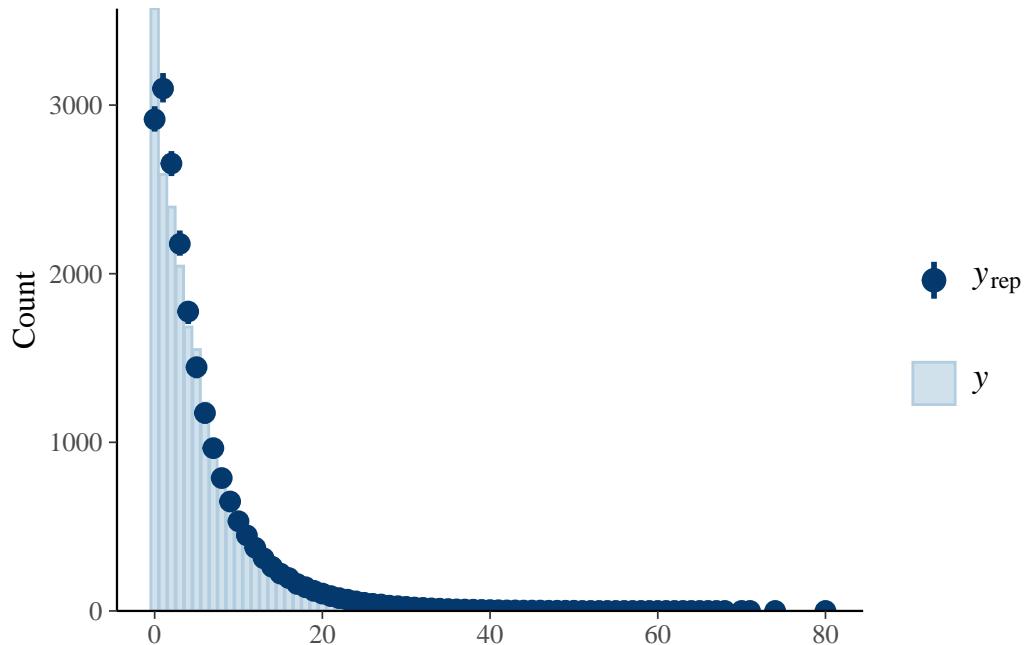
Regression Coefficients:

	Estimate	Est.Error	l-95% CI	u-95% CI	Rhat	Bulk_ESS
Intercept	1.1266	0.0362	1.0563	1.1980	1.0005	5763
pds_f4_p_c	0.0620	0.0115	0.0399	0.0847	1.0002	9288
adhd_diagnosis1	0.6735	0.0317	0.6108	0.7347	1.0004	6915
age_years_c	0.0162	0.0055	0.0053	0.0269	1.0001	9627
ethnicity2	-0.4052	0.0446	-0.4918	-0.3181	0.9999	8469
ethnicity3	-0.0453	0.0410	-0.1260	0.0349	0.9998	7689
ethnicity4	-0.3253	0.0936	-0.5051	-0.1434	1.0005	8661
ethnicity5	0.0612	0.0459	-0.0289	0.1522	1.0004	8172
inr_c	-0.0055	0.0032	-0.0118	0.0009	1.0001	11025
pds_f4_p_c:adhd_diagnosis1	-0.0413	0.0185	-0.0779	-0.0048	1.0001	10098
					Tail_ESS	

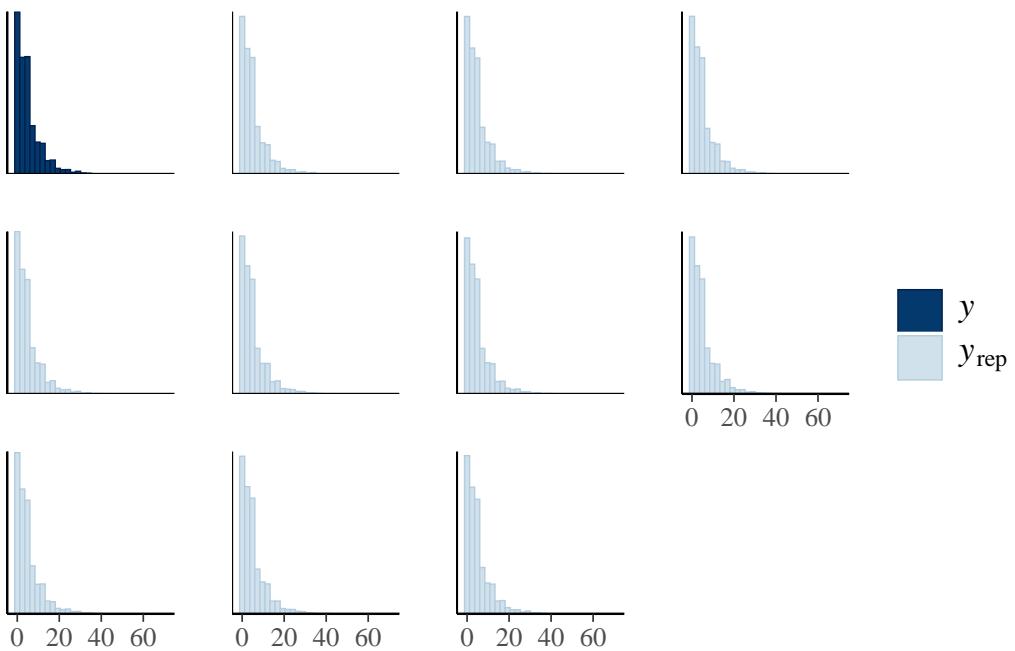
Intercept	5806
pds_f4_p_c	5353
adhd_diagnosis1	5937
age_years_c	5740
ethnicity2	5945
ethnicity3	6304
ethnicity4	5559
ethnicity5	6083
inr_c	6456
pds_f4_p_c:adhd_diagnosis1	6094

Draws were sampled using sampling(NUTS). For each parameter, Bulk\_ESS and Tail\_ESS are effective sample size measures, and Rhat is the potential scale reduction factor on split chains (at convergence, Rhat = 1).

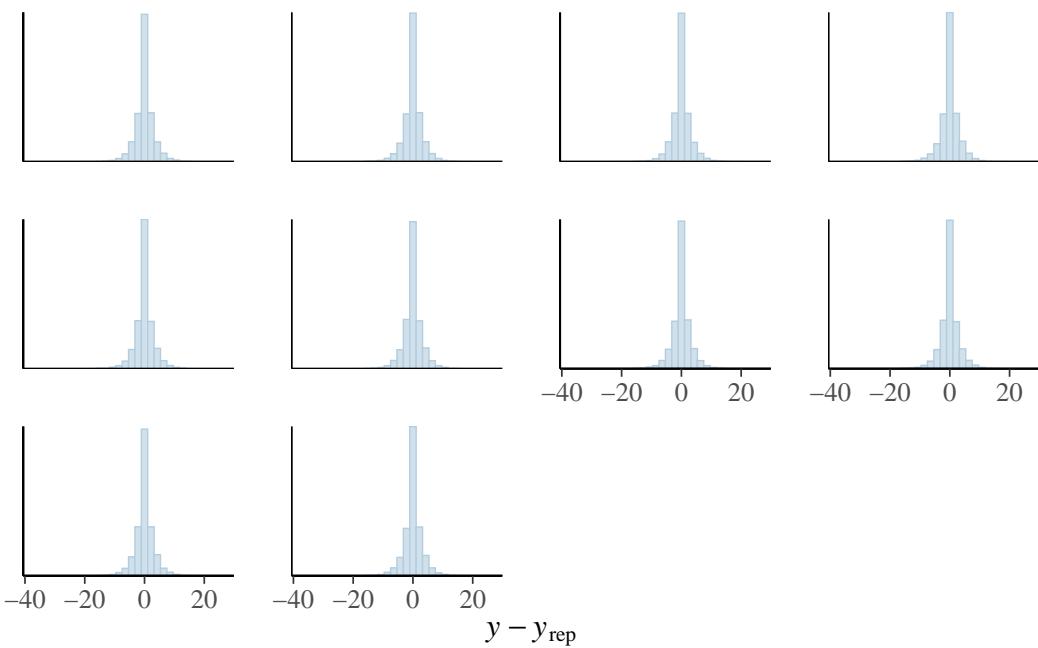
### model 2b posterior predictive diagnostics



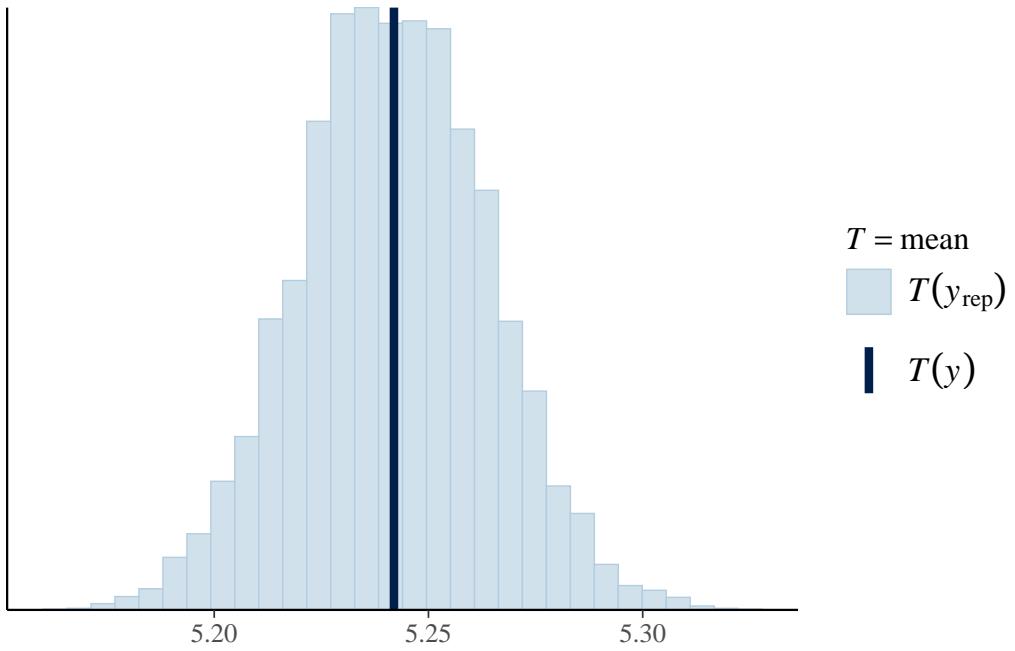
`stat\_bin()` using `bins = 30`. Pick better value with `binwidth`.



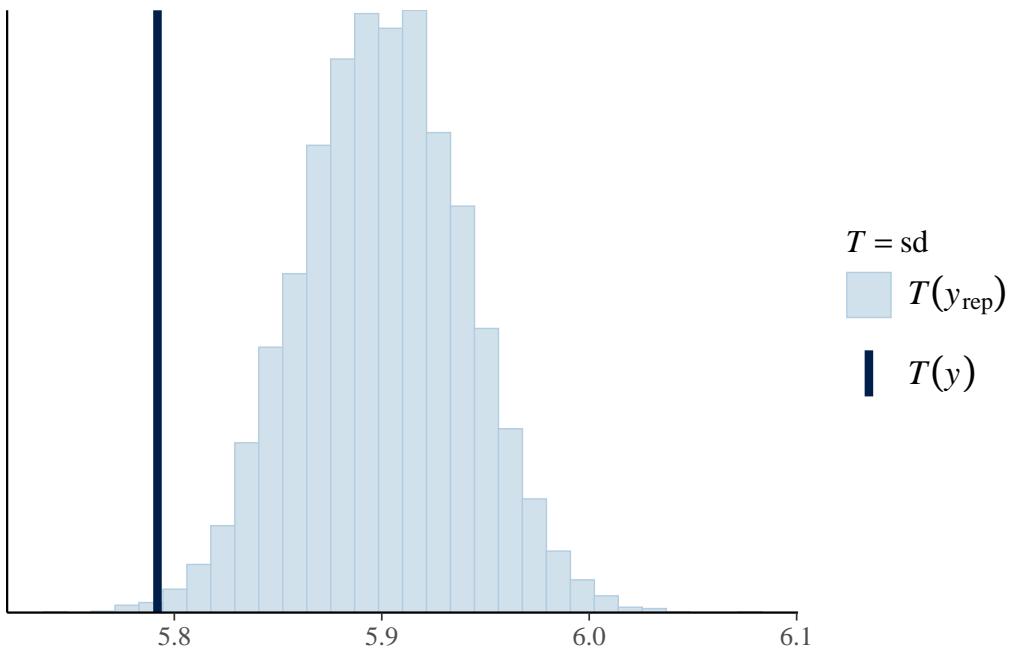
``stat_bin()` using `bins = 30`.` Pick better value with ``binwidth``.

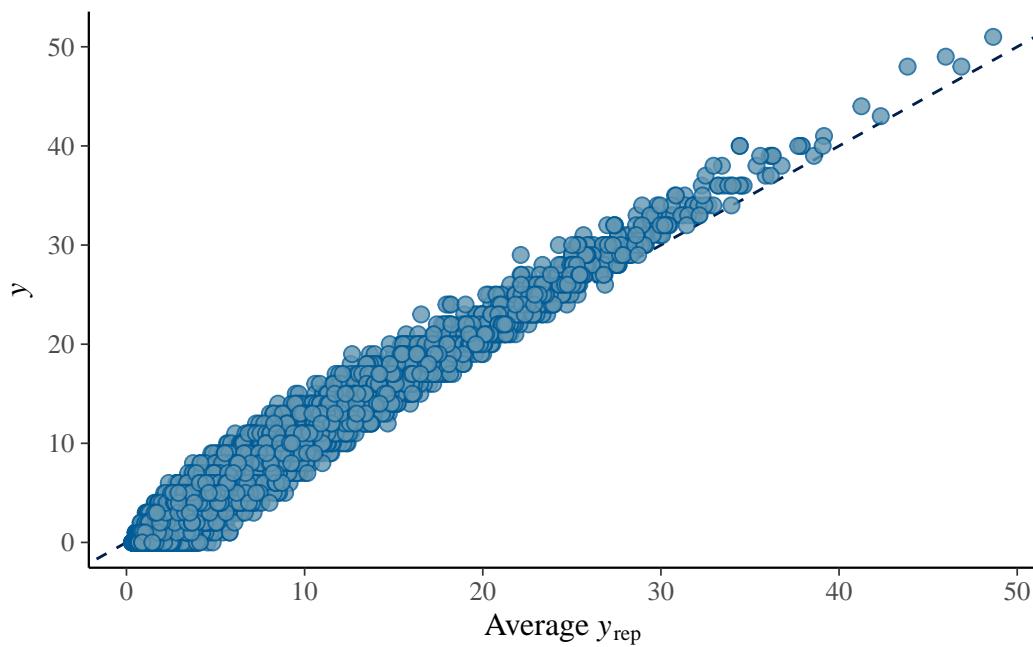


``stat_bin()` using `bins = 30`.` Pick better value with ``binwidth``.



```
`stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```





### Model 2b interaction analysis

```
$emtrends
adhd_diagnosis pds_f4_p_c.trend lower.HPD upper.HPD
0              0.0620    0.0401    0.0849
1              0.0209   -0.0135   0.0551
```

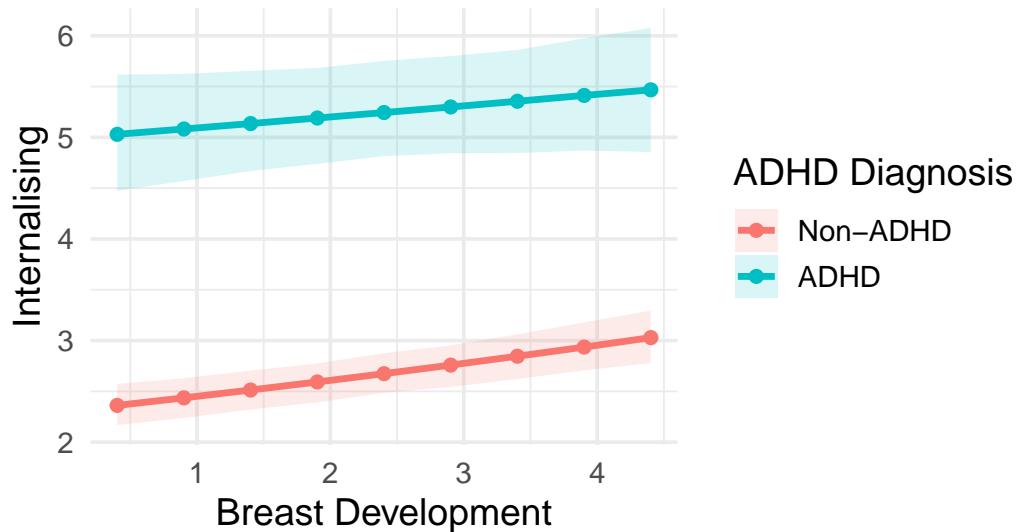
Results are averaged over the levels of: ethnicity  
 Point estimate displayed: median  
 HPD interval probability: 0.95

```
$contrasts
contrast           estimate lower.HPD upper.HPD
adhd_diagnosis0 - adhd_diagnosis1  0.0412  0.00391  0.0764
```

Results are averaged over the levels of: ethnicity  
 Point estimate displayed: median  
 HPD interval probability: 0.95

Visualise model 2b interaction

## Associations Between Breast Development and Externalising



## Model 3 output

	Estimate	Est.Error	Q2.5	Q97.5
R2	0.869228	0.002223352	0.8648353	0.8735387

Family: poisson  
Links: mu = log  
Formula: cbcl\_scr\_syn\_external\_r ~ menarche\_status\_p \* adhd\_diagnosis + age\_years\_c + ethnic  
Data: imp\_df (Number of observations: 20697)  
Draws: 2 chains, each with iter = 8000; warmup = 4000; thin = 1;  
total post-warmup draws = 8000

Multilevel Hyperparameters:

~family\_id (Number of levels: 4916)

	Estimate	Est.Error	l-95% CI	u-95% CI	Rhat	Bulk_ESS	Tail_ESS
sd(Intercept)	0.8880	0.0283	0.8294	0.9409	1.0005	878	2002

~obs\_id (Number of levels: 20697)

	Estimate	Est.Error	l-95% CI	u-95% CI	Rhat	Bulk_ESS	Tail_ESS
sd(Intercept)	0.4906	0.0077	0.4755	0.5060	1.0004	3492	5059

~site\_id (Number of levels: 22)

	Estimate	Est.Error	l-95% CI	u-95% CI	Rhat	Bulk_ESS	Tail_ESS
sd(Intercept)	0.1478	0.0338	0.0925	0.2234	1.0001	4207	4576

~src\_subject\_id (Number of levels: 5652)

	Estimate	Est.Error	l-95% CI	u-95% CI	Rhat	Bulk_ESS	Tail_ESS
sd(Intercept)	0.7503	0.0291	0.6943	0.8084	1.0003	692	1715

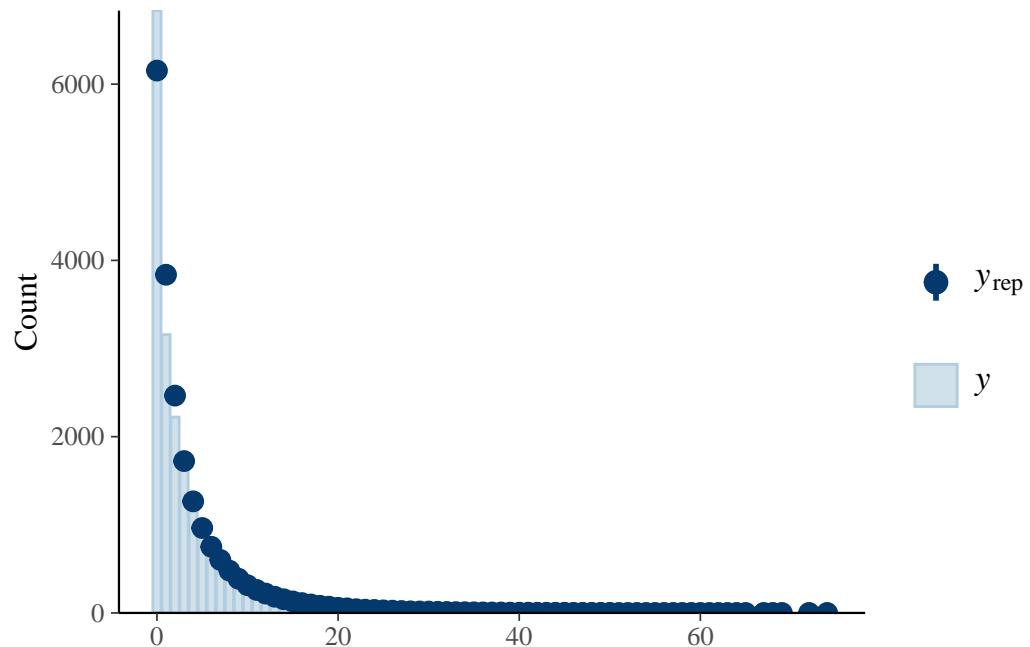
Regression Coefficients:

	Estimate	Est.Error	l-95% CI	u-95% CI	Rhat
Intercept	0.1790	0.0440	0.0924	0.2662	0.9999
menarche_status_pY	0.1308	0.0234	0.0845	0.1758	1.0009
adhd_diagnosis1	1.3394	0.0432	1.2549	1.4246	0.9998
age_years_c	-0.0555	0.0073	-0.0697	-0.0413	1.0007
ethnicity2	-0.0026	0.0568	-0.1141	0.1092	1.0005
ethnicity3	0.0079	0.0533	-0.0953	0.1131	1.0003
ethnicity4	-0.5590	0.1298	-0.8146	-0.3110	1.0004
ethnicity5	0.1007	0.0604	-0.0155	0.2194	1.0001
inr_c	-0.0275	0.0042	-0.0357	-0.0192	1.0001
menarche_status_pY:adhd_diagnosis1	-0.0934	0.0332	-0.1584	-0.0295	1.0000
			Bulk_ESS	Tail_ESS	

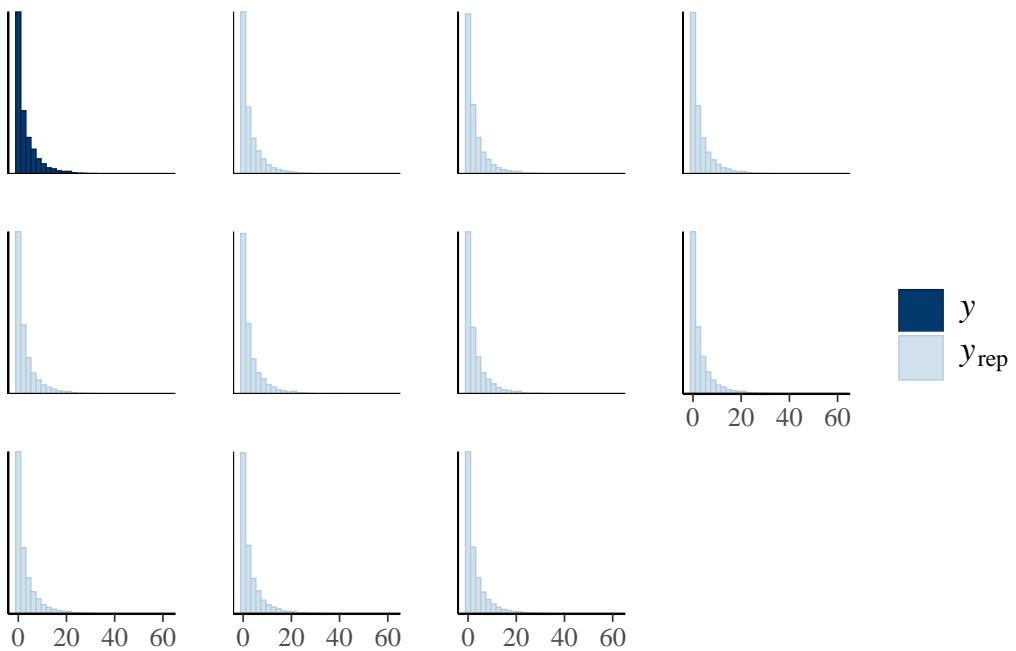
Intercept	3809	4637
menarche_status_pY	6425	6113
adhd_diagnosis1	4847	5463
age_years_c	5903	6037
ethnicity2	5724	5690
ethnicity3	6117	5858
ethnicity4	7783	6000
ethnicity5	6583	5763
inr_c	9195	6601
menarche_status_pY:adhd_diagnosis1	6953	5979

Draws were sampled using sampling(NUTS). For each parameter, Bulk\_ESS and Tail\_ESS are effective sample size measures, and Rhat is the potential scale reduction factor on split chains (at convergence, Rhat = 1).

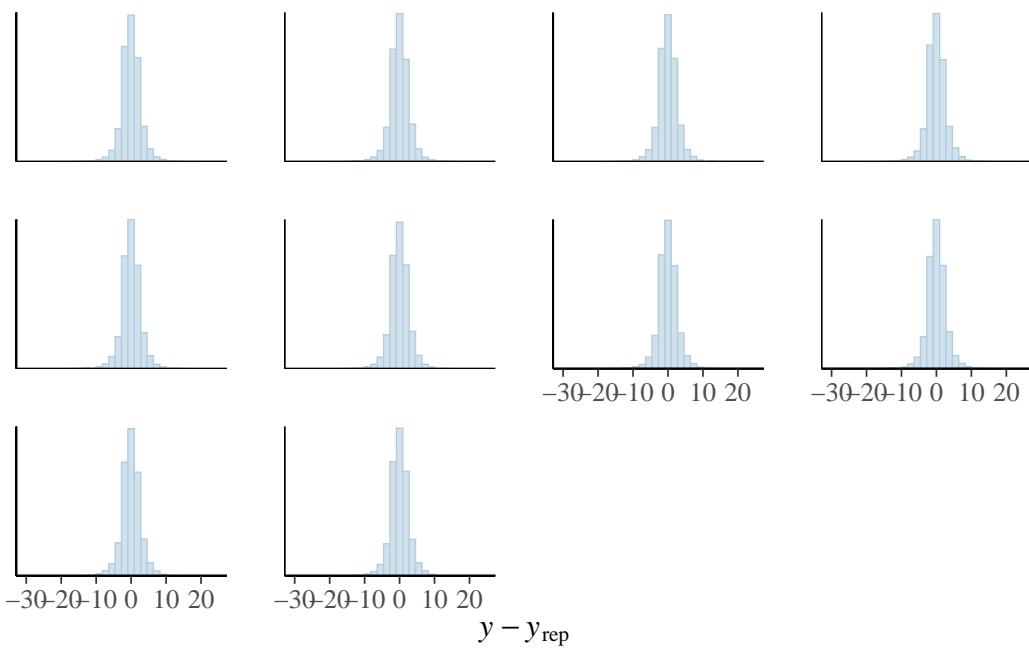
### model 3 posterior predictive diagnostics



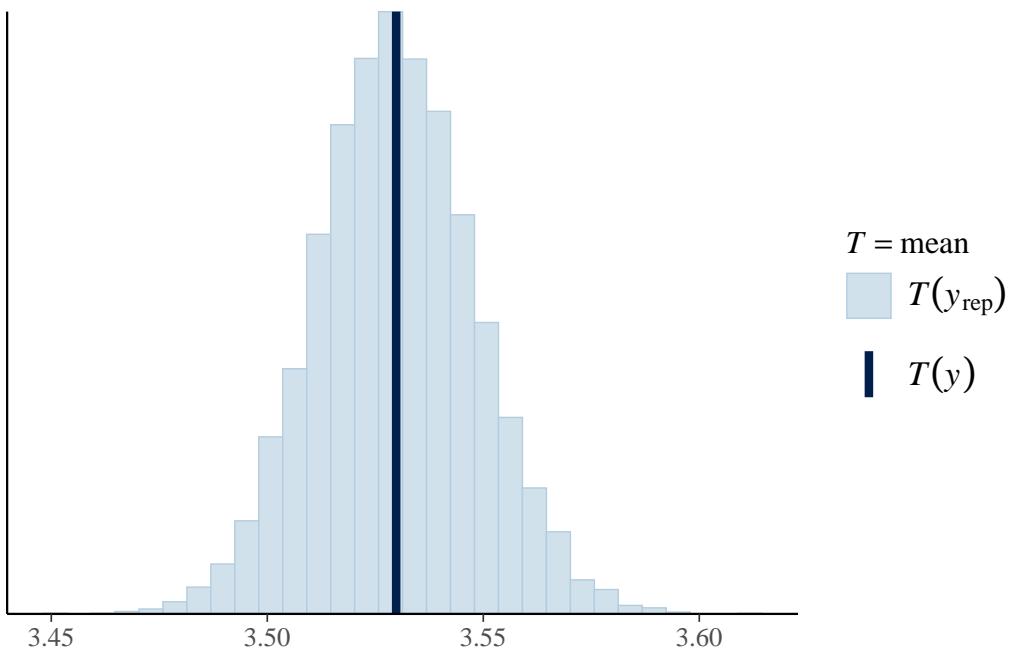
`stat\_bin()` using `bins = 30`. Pick better value with `binwidth`.



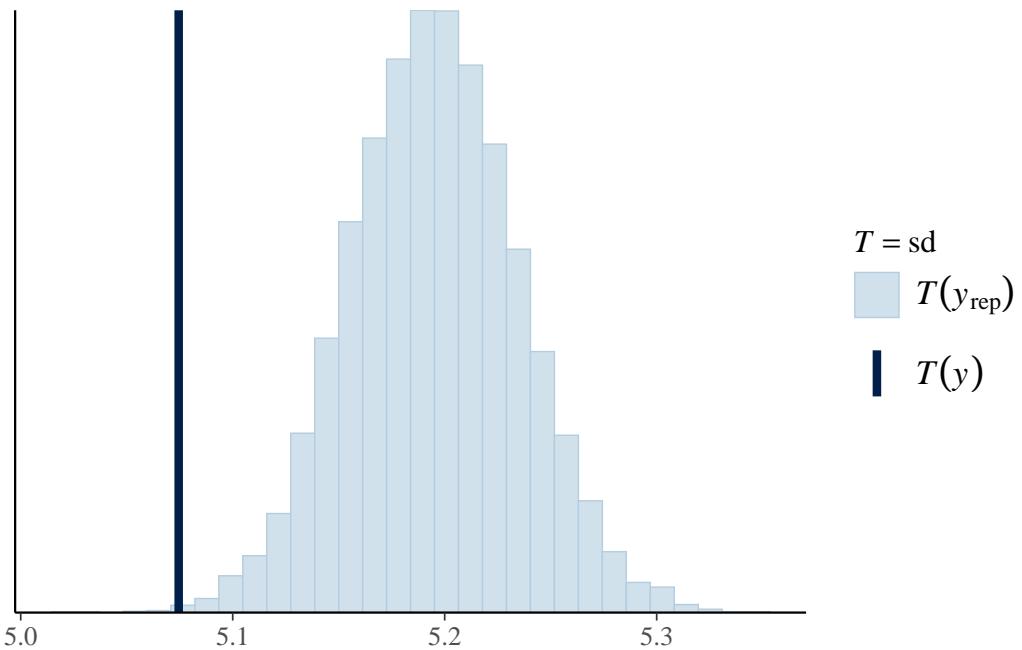
``stat_bin()` using `bins = 30`.` Pick better value with ``binwidth``.

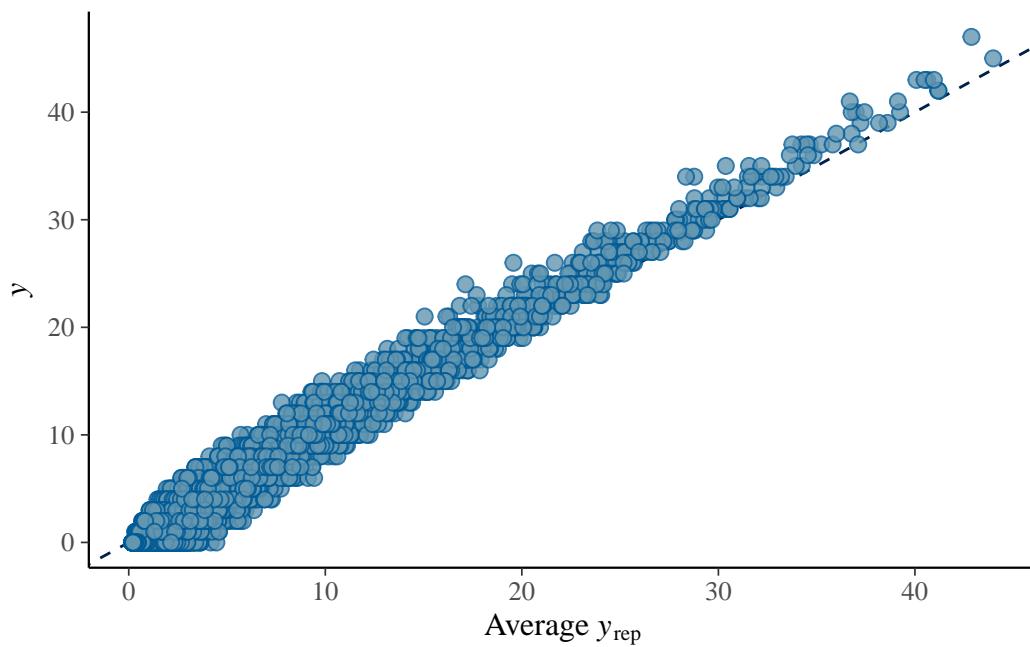


``stat_bin()` using `bins = 30`.` Pick better value with ``binwidth``.



```
`stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```





### Model 3 interaction analysis

adhd_diagnosis	menarche_status_p	emmmean	lower.HPD	upper.HPD
0	N	0.0891	-0.00137	0.184
1	N	1.4285	1.31426	1.536
0	Y	0.2196	0.11790	0.309
1	Y	1.4666	1.34735	1.582

Results are averaged over the levels of: ethnicity  
 Point estimate displayed: median  
 Results are given on the log (not the response) scale.  
 HPD interval probability: 0.95

```

adhd_diagnosis = 0:
  contrast estimate lower.HPD upper.HPD
  Y - N      0.131    0.0845    0.176

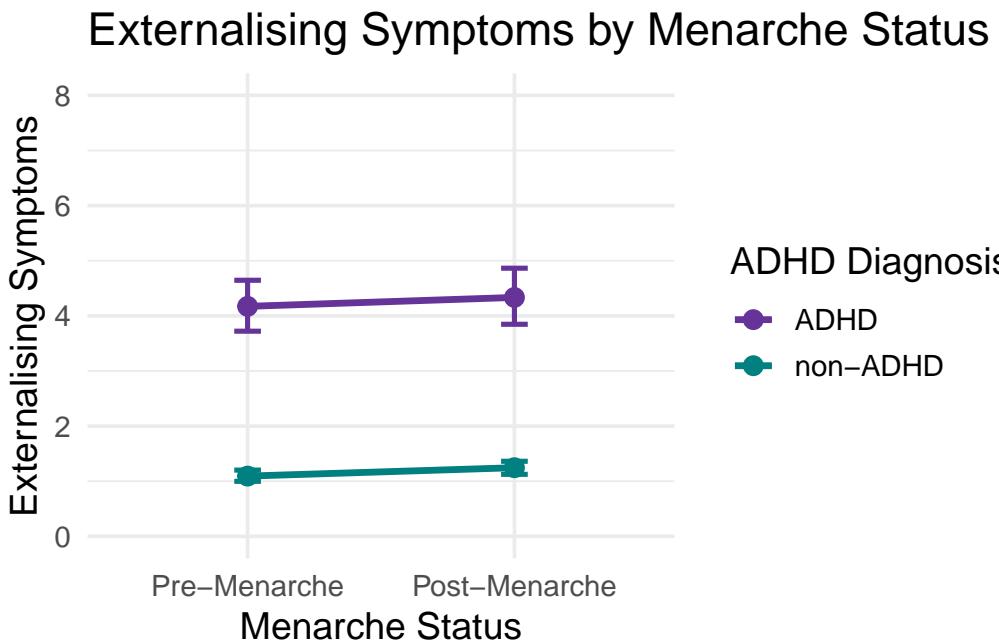
adhd_diagnosis = 1:
  contrast estimate lower.HPD upper.HPD
  Y - N      0.037   -0.0202    0.101

```

Results are averaged over the levels of: ethnicity  
 Point estimate displayed: median

Results are given on the log (not the response) scale.  
HPD interval probability: 0.95

### Visualise interaction Model 3



## Model 3b output

	Estimate	Est.Error	Q2.5	Q97.5	
R2	0.8685377	0.002208871	0.8641446	0.8727614	

Family: poisson  
Links: mu = log  
Formula: cbcl\_scr\_syn\_external\_r ~ pds\_f4\_p\_c \* adhd\_diagnosis + age\_years\_c + ethnicity + inr\_c  
Data: imp\_df (Number of observations: 21145)  
Draws: 2 chains, each with iter = 8000; warmup = 4000; thin = 1;  
total post-warmup draws = 8000

Multilevel Hyperparameters:

~family\_id (Number of levels: 4932)

	Estimate	Est.Error	l-95% CI	u-95% CI	Rhat	Bulk_ESS	Tail_ESS
sd(Intercept)	0.8781	0.0274	0.8231	0.9289	1.0006	998	2467

~obs\_id (Number of levels: 21145)

	Estimate	Est.Error	l-95% CI	u-95% CI	Rhat	Bulk_ESS	Tail_ESS
sd(Intercept)	0.5011	0.0077	0.4864	0.5164	1.0001	3070	4763

~site\_id (Number of levels: 22)

	Estimate	Est.Error	l-95% CI	u-95% CI	Rhat	Bulk_ESS	Tail_ESS
sd(Intercept)	0.1463	0.0335	0.0911	0.2226	1.0006	4545	5511

~src\_subject\_id (Number of levels: 5670)

	Estimate	Est.Error	l-95% CI	u-95% CI	Rhat	Bulk_ESS	Tail_ESS
sd(Intercept)	0.7367	0.0279	0.6835	0.7918	1.0006	812	1721

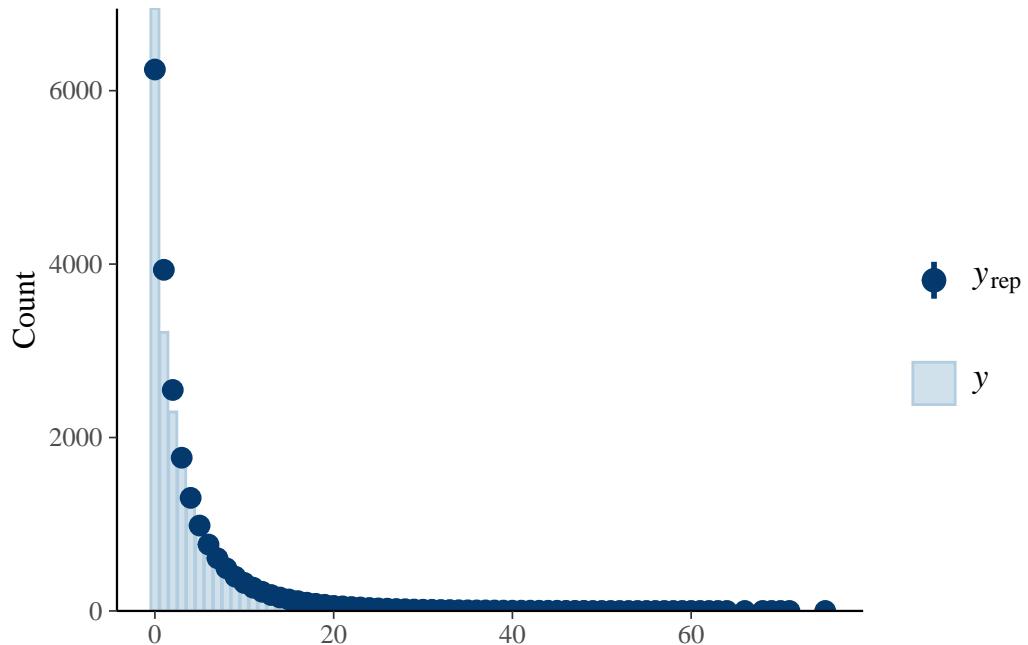
Regression Coefficients:

	Estimate	Est.Error	l-95% CI	u-95% CI	Rhat	Bulk_ESS
Intercept	0.2282	0.0440	0.1420	0.3118	1.0000	4678
pds_f4_p_c	0.1010	0.0145	0.0720	0.1290	1.0008	6872
adhd_diagnosis1	1.2952	0.0414	1.2131	1.3776	1.0001	6467
age_years_c	-0.0601	0.0068	-0.0733	-0.0467	1.0004	7465
ethnicity2	-0.0191	0.0564	-0.1306	0.0898	1.0001	5649
ethnicity3	0.0167	0.0526	-0.0860	0.1190	1.0005	5772
ethnicity4	-0.5023	0.1249	-0.7493	-0.2617	1.0004	7427
ethnicity5	0.0988	0.0598	-0.0184	0.2142	1.0002	5688
inr_c	-0.0265	0.0040	-0.0345	-0.0186	1.0001	8557
pds_f4_p_c:adhd_diagnosis1	-0.0800	0.0218	-0.1229	-0.0380	1.0002	6670
					Tail_ESS	

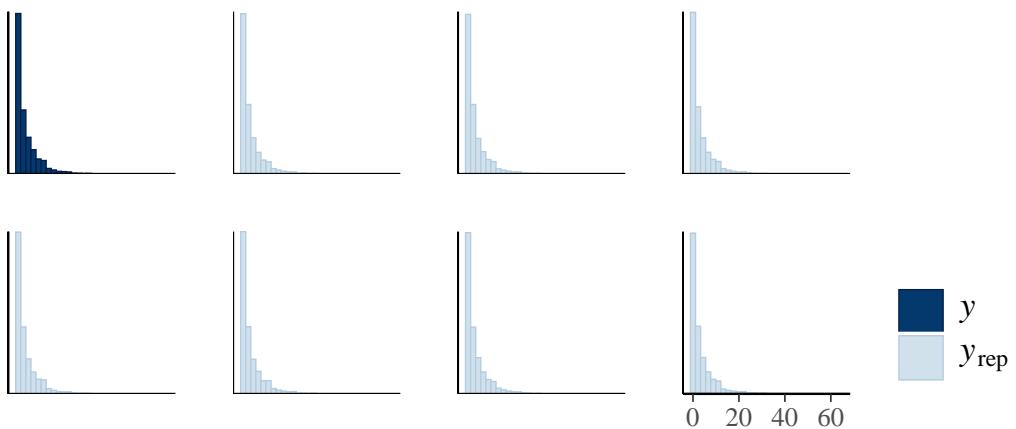
Intercept	4742
pds_f4_p_c	6429
adhd_diagnosis1	5840
age_years_c	6421
ethnicity2	5598
ethnicity3	5688
ethnicity4	5891
ethnicity5	6293
inr_c	6058
pds_f4_p_c:adhd_diagnosis1	6215

Draws were sampled using sampling(NUTS). For each parameter, Bulk\_ESS and Tail\_ESS are effective sample size measures, and Rhat is the potential scale reduction factor on split chains (at convergence, Rhat = 1).

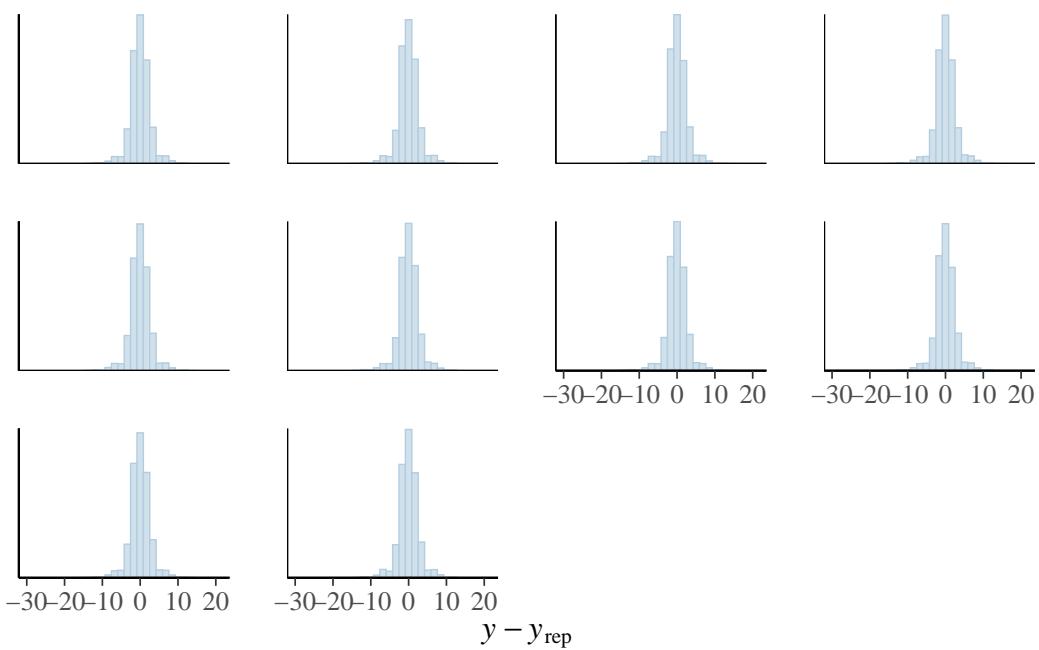
### model 3b posterior predictive diagnostics



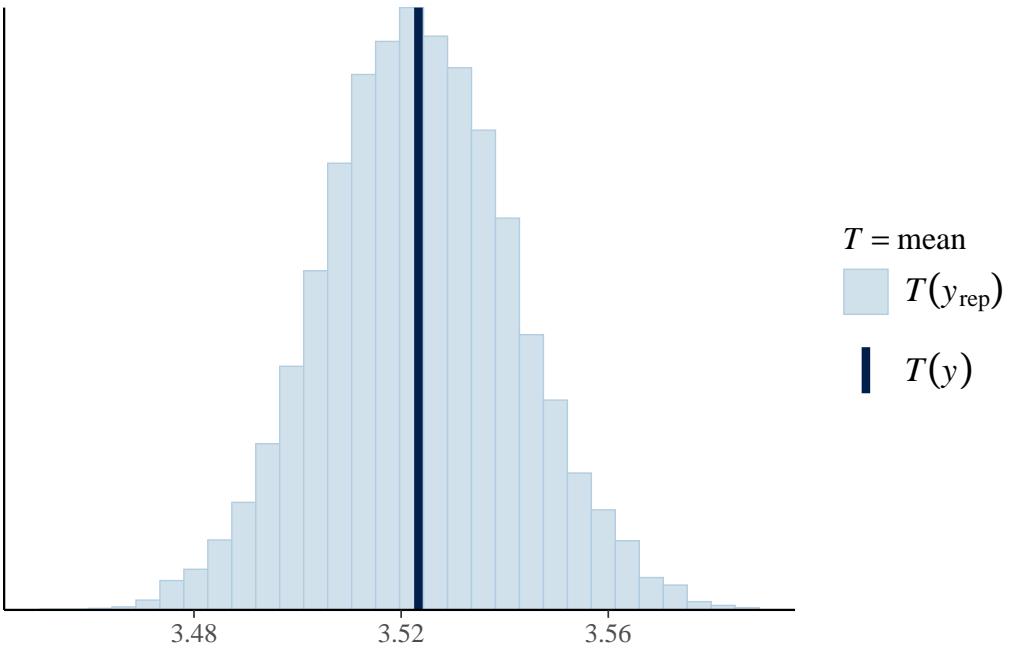
`stat\_bin()` using `bins = 30`. Pick better value with `binwidth`.



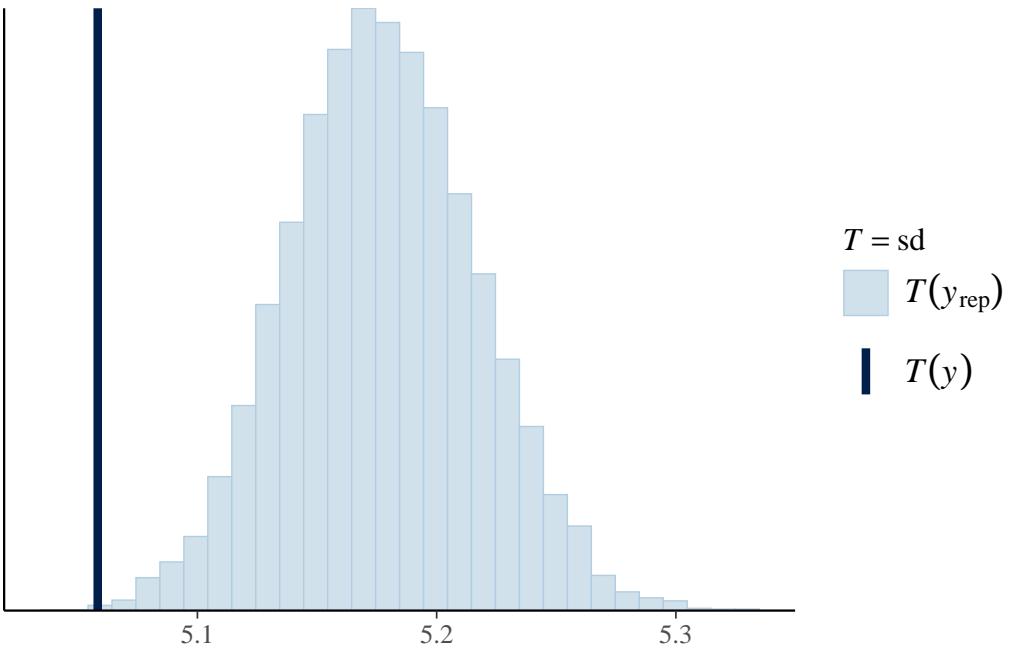
``stat_bin()` using `bins = 30`.` Pick better value with ``binwidth``.

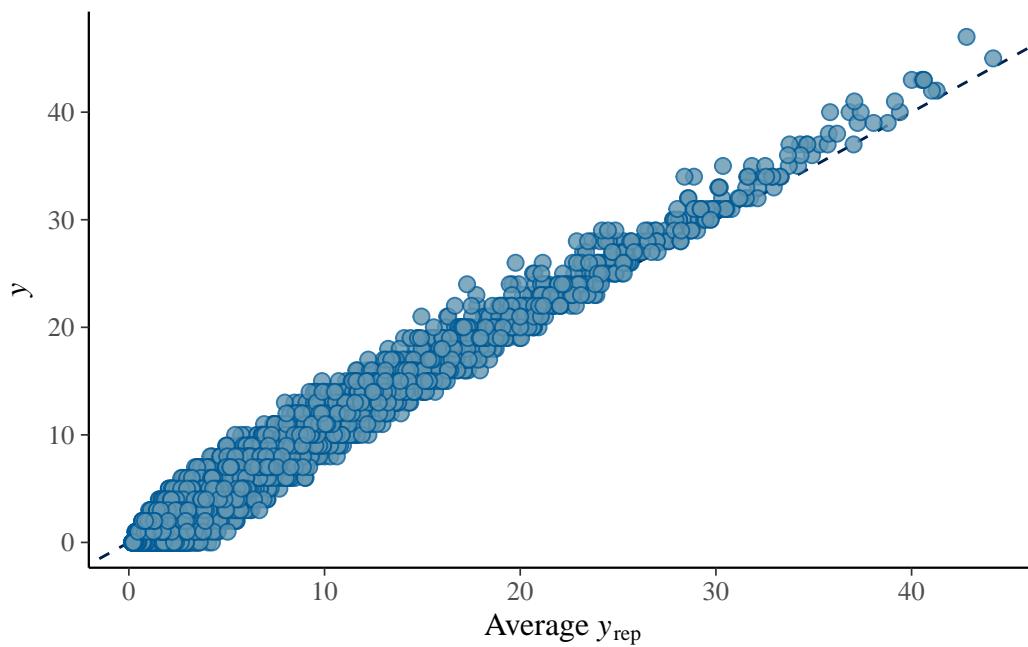


``stat_bin()` using `bins = 30`.` Pick better value with ``binwidth``.



```
`stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```





### Model 3b interaction analysis

```
$emtrends
adhd_diagnosis pds_f4_p_c.trend lower.HPD upper.HPD
0              0.1012    0.0708   0.1276
1              0.0208   -0.0190   0.0601
```

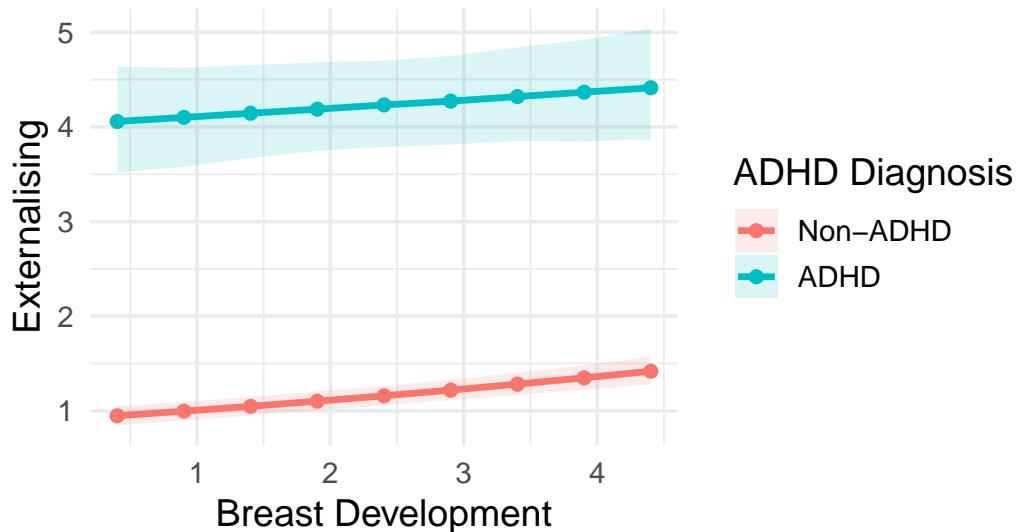
Results are averaged over the levels of: ethnicity  
 Point estimate displayed: median  
 HPD interval probability: 0.95

```
$contrasts
contrast           estimate lower.HPD upper.HPD
adhd_diagnosis0 - adhd_diagnosis1  0.0802   0.0389   0.124
```

Results are averaged over the levels of: ethnicity  
 Point estimate displayed: median  
 HPD interval probability: 0.95

Visualise Model 3b interaction

### Associations Between Breast Development and Externalising



## Model 4 output

```
Estimate  Est.Error      Q2.5      Q97.5
R2 0.8517121 0.00216706 0.8474381 0.8559586
```

```
Family: poisson
Links: mu = log
Formula: cbcl_scr_syn_internal_r ~ menarche_status_p * cbcl_scr_syn_attention_r_c + age_years_c
Data: imp_df (Number of observations: 20703)
Draws: 2 chains, each with iter = 8000; warmup = 4000; thin = 1;
       total post-warmup draws = 8000
```

Multilevel Hyperparameters:

~family\_id (Number of levels: 4922)

	Estimate	Est.Error	l-95% CI	u-95% CI	Rhat	Bulk_ESS	Tail_ESS
sd(Intercept)	0.6466	0.0175	0.6114	0.6801	1.0021	1509	3233

~obs\_id (Number of levels: 20703)

	Estimate	Est.Error	l-95% CI	u-95% CI	Rhat	Bulk_ESS	Tail_ESS
sd(Intercept)	0.3610	0.0059	0.3493	0.3727	1.0001	3068	5165

~site\_id (Number of levels: 22)

	Estimate	Est.Error	l-95% CI	u-95% CI	Rhat	Bulk_ESS	Tail_ESS
sd(Intercept)	0.1002	0.0230	0.0615	0.1521	1.0007	5795	5579

~src\_subject\_id (Number of levels: 5658)

	Estimate	Est.Error	l-95% CI	u-95% CI	Rhat	Bulk_ESS	Tail_ESS
sd(Intercept)	0.4639	0.0190	0.4265	0.5014	1.0025	1182	2511

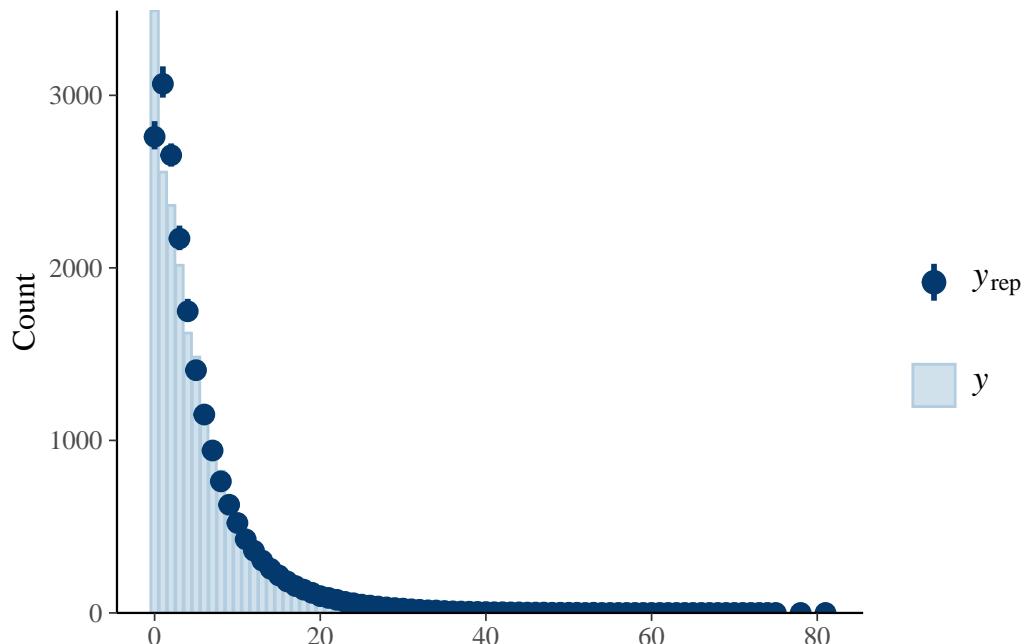
Regression Coefficients:

	Estimate	Est.Error	l-95% CI	u-95% CI	Rhat	Bulk_ESS	Tail_ESS
Intercept	1.2489	0.0288	1.1923	1.2951	1.0000	1000	1000
menarche_status_pY	0.0588	0.0156	0.0282	0.0864	1.0000	1000	1000
cbcl_scr_syn_attention_r_c	0.1423	0.0025	0.1374	0.1472	1.0000	1000	1000
age_years_c	0.0220	0.0053	0.0120	0.0373	1.0000	1000	1000
ethnicity2	-0.4311	0.0394	-0.5070	-0.5705	1.0000	1000	1000
ethnicity3	-0.0591	0.0366	-0.1304	-0.1895	1.0000	1000	1000
ethnicity4	-0.3045	0.0846	-0.4697	-0.6542	1.0000	1000	1000
ethnicity5	0.0146	0.0416	-0.0695	-0.0741	1.0000	1000	1000
inr_c	-0.0024	0.0029	-0.0080	-0.0093	1.0000	1000	1000
menarche_status_pY:cbcl_scr_syn_attention_r_c	0.0075	0.0032	0.0012	0.0099	1.0000	1000	1000

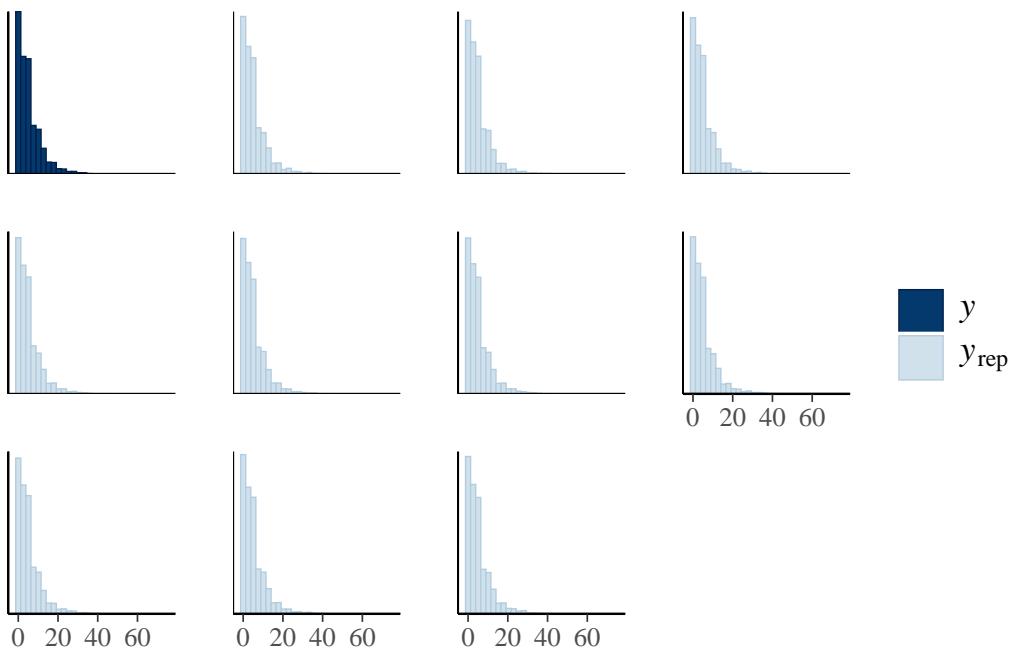
Intercept	1.3066	1.0003	6465	5872
menarche_status_pY	0.0895	1.0001	11443	6291
cbcl_scr_syn_attention_r_c	0.1473	1.0001	11306	6627
age_years_c	0.0326	1.0010	11325	6067
ethnicity2	-0.3541	1.0003	9370	6825
ethnicity3	0.0130	1.0007	9121	6491
ethnicity4	-0.1383	1.0002	9752	6503
ethnicity5	0.0950	1.0005	9255	5975
inr_c	0.0034	1.0006	11928	6437
menarche_status_pY:cbcl_scr_syn_attention_r_c	0.0138	0.9999	12143	6485

Draws were sampled using sampling(NUTS). For each parameter, Bulk\_ESS and Tail\_ESS are effective sample size measures, and Rhat is the potential scale reduction factor on split chains (at convergence, Rhat = 1).

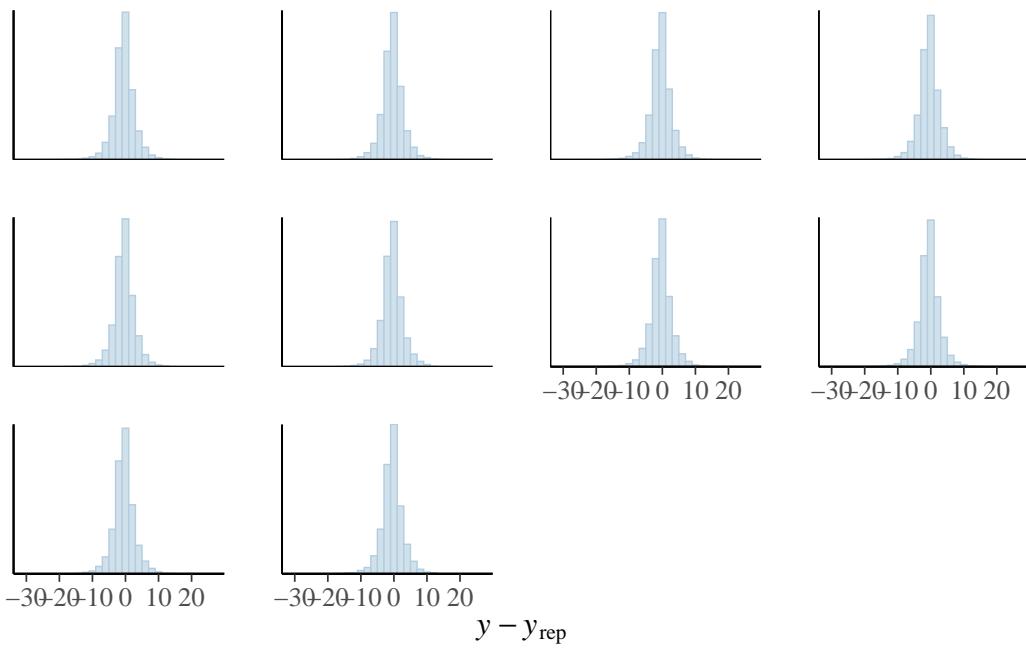
#### Model 4 posterior predictive diagnostics



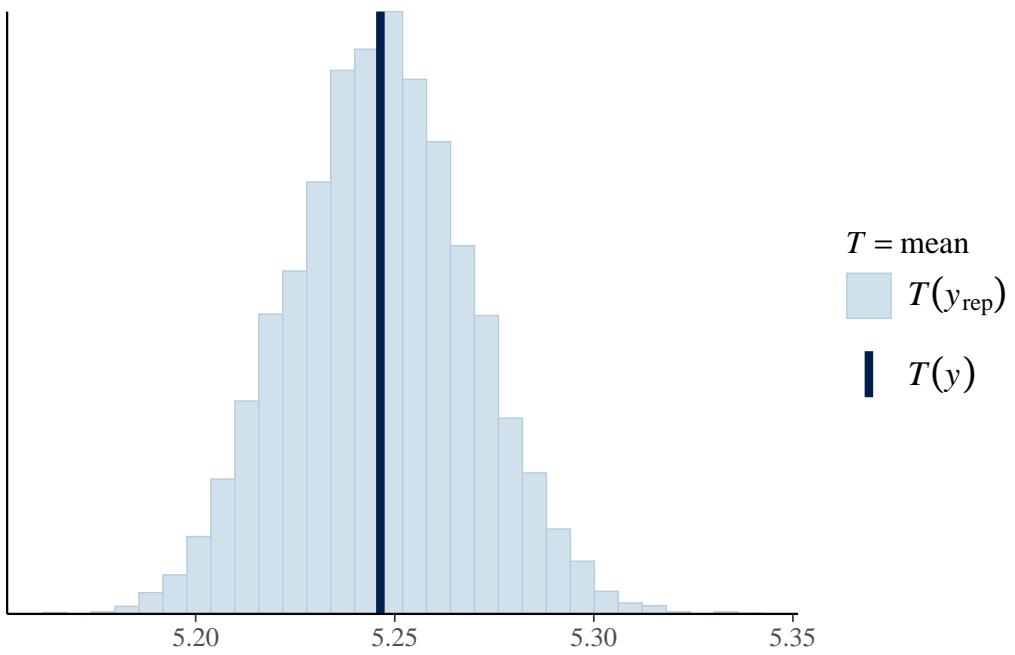
`stat\_bin()` using `bins = 30`. Pick better value with `binwidth`.



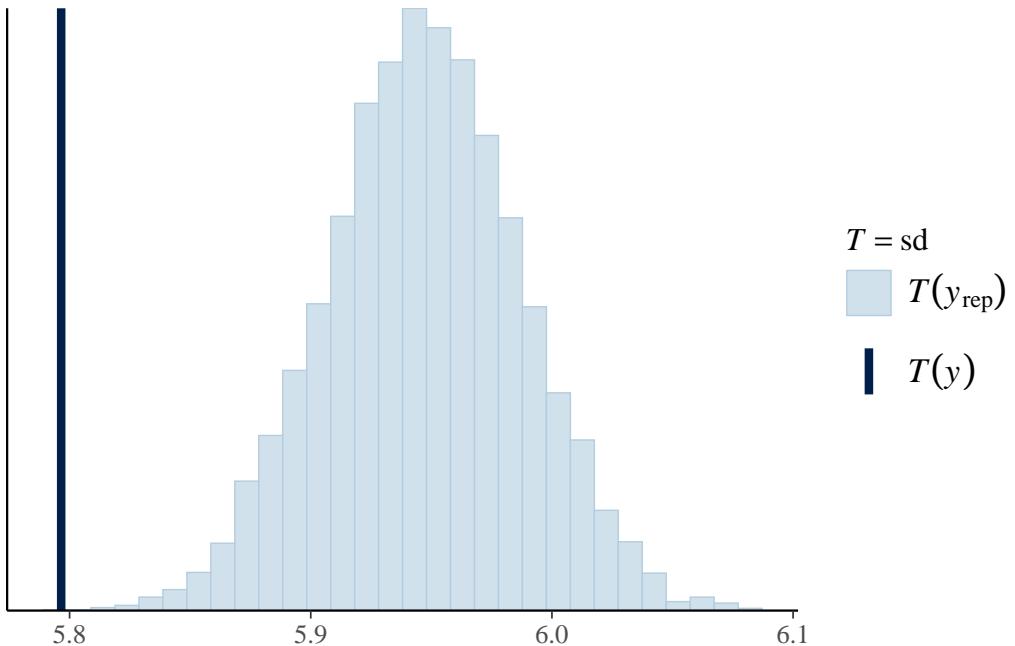
``stat_bin()` using `bins = 30`.` Pick better value with ``binwidth``.

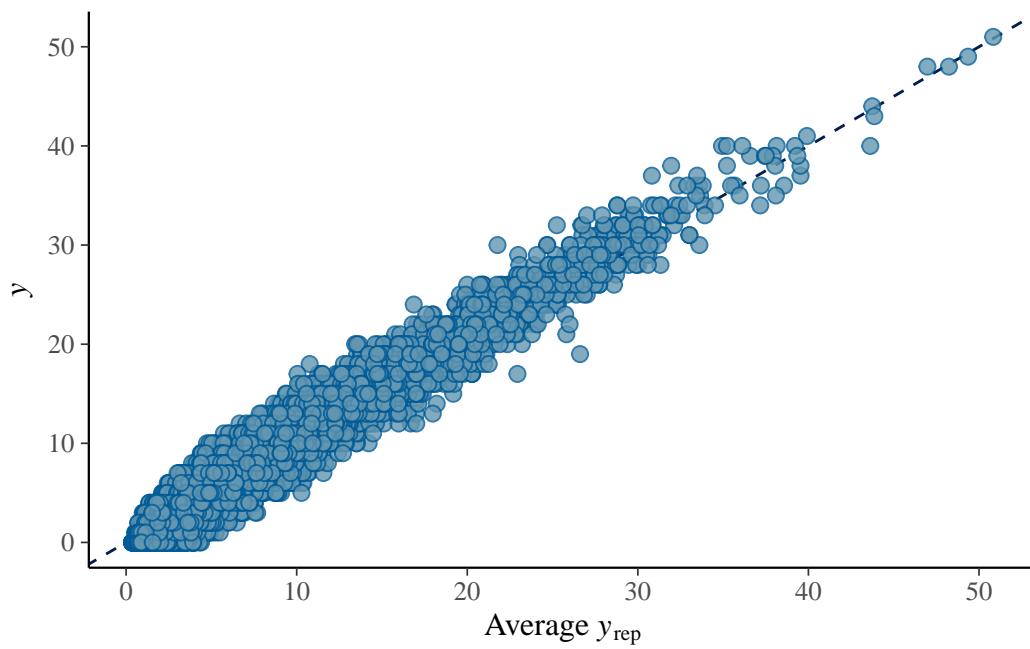


``stat_bin()` using `bins = 30`.` Pick better value with ``binwidth``.



```
`stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```





### Model 4 interaction analysis

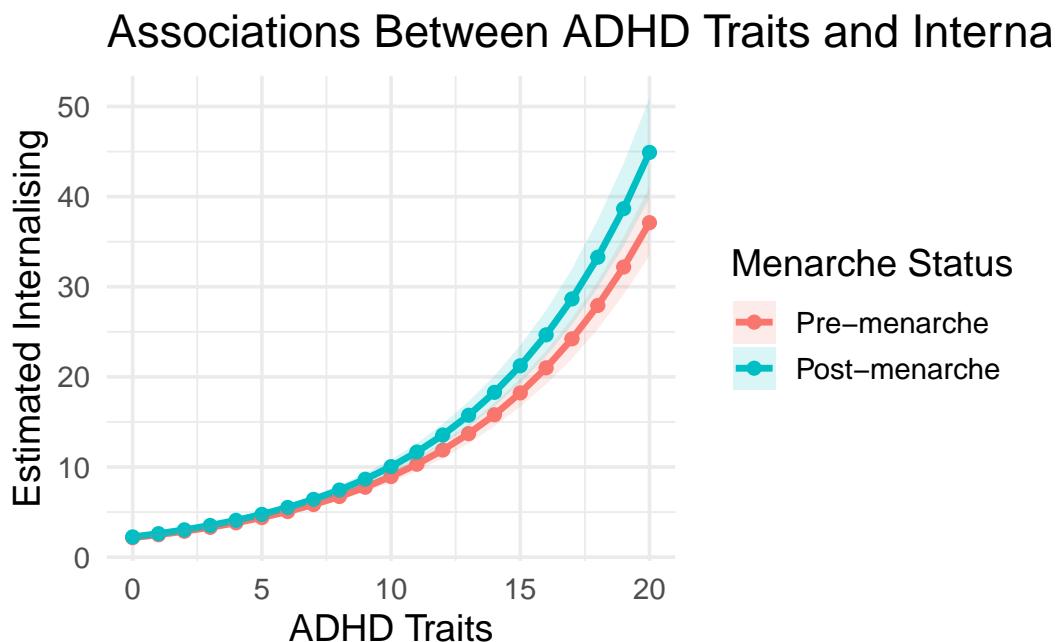
```
$emtrends
menarche_status_p cbcl_scr_syn_attention_r_c.trend lower.HPD upper.HPD
N                      0.142      0.137      0.147
Y                      0.150      0.144      0.156
```

Results are averaged over the levels of: ethnicity  
 Point estimate displayed: median  
 HPD interval probability: 0.95

```
$contrasts
contrast estimate lower.HPD upper.HPD
N - Y     -0.0075   -0.0139   -0.00146
```

Results are averaged over the levels of: ethnicity  
 Point estimate displayed: median  
 HPD interval probability: 0.95

**Visualise Model 4 interaction**



## Model 4b output

```
Estimate   Est.Error    Q2.5    Q97.5
R2 0.8514888 0.002143102 0.8472995 0.8557269

Family: poisson
Links: mu = log
Formula: cbcl_scr_syn_internal_r ~ pds_f4_p_c * cbcl_scr_syn_attention_r_c + age_years_c + e
Data: imp_df (Number of observations: 21152)
Draws: 2 chains, each with iter = 8000; warmup = 4000; thin = 1;
       total post-warmup draws = 8000

Multilevel Hyperparameters:
~family_id (Number of levels: 4939)
Estimate   Est.Error  l-95% CI  u-95% CI    Rhat Bulk_ESS Tail_ESS
sd(Intercept) 0.6394    0.0176   0.6040   0.6725 1.0020      1462     2819

~obs_id (Number of levels: 21152)
Estimate   Est.Error  l-95% CI  u-95% CI    Rhat Bulk_ESS Tail_ESS
sd(Intercept) 0.3661    0.0058   0.3549   0.3776 1.0003      3081     5184

~site_id (Number of levels: 22)
Estimate   Est.Error  l-95% CI  u-95% CI    Rhat Bulk_ESS Tail_ESS
sd(Intercept) 0.0977    0.0226   0.0610   0.1486 1.0009      6789     6455

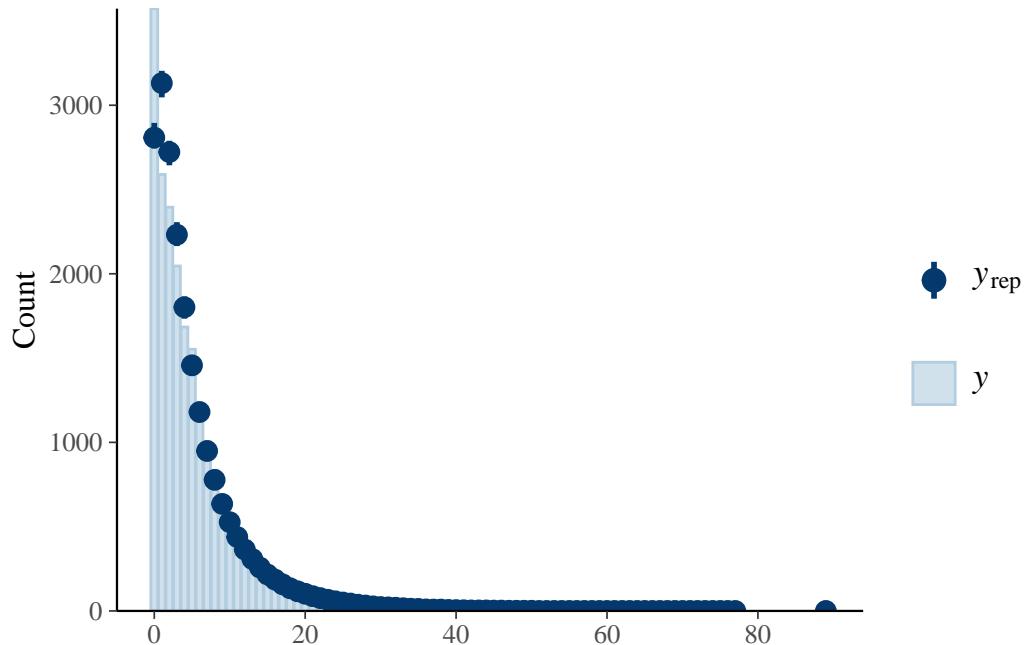
~src_subject_id (Number of levels: 5677)
Estimate   Est.Error  l-95% CI  u-95% CI    Rhat Bulk_ESS Tail_ESS
sd(Intercept) 0.4592    0.0194   0.4220   0.4988 1.0030      935      2146

Regression Coefficients:
Estimate   Est.Error  l-95% CI  u-95% CI    Rhat Bulk_ESS Tail_ESS
Intercept          1.2681    0.0285   1.2117   1.3247
pds_f4_p_c         0.0352    0.0097   0.0160   0.0543
cbcl_scr_syn_attention_r_c 0.1454    0.0022   0.1410   0.1499
age_years_c        0.0247    0.0050   0.0150   0.0345
ethnicity2        -0.4286    0.0388  -0.5026  -0.3515
ethnicity3        -0.0512    0.0358  -0.1211   0.0191
ethnicity4        -0.2876    0.0837  -0.4528  -0.1238
ethnicity5        0.0137    0.0410  -0.0679   0.0947
inr_c              -0.0010    0.0028  -0.0066   0.0045
pds_f4_p_c:cbcl_scr_syn_attention_r_c 0.0020    0.0021  -0.0020   0.0060
Rhat Bulk_ESS Tail_ESS
```

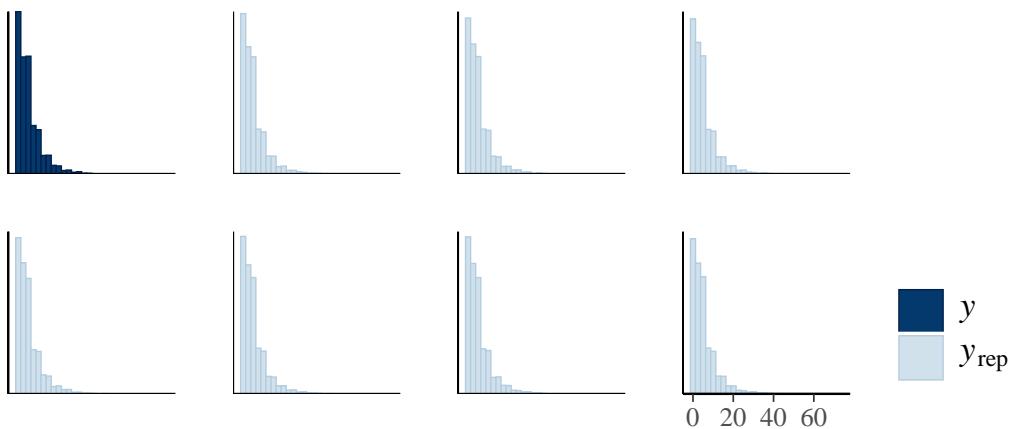
Intercept	1.0004	6506	5069
pds_f4_p_c	1.0000	10144	6068
cbcl_scr_syn_attention_r_c	0.9998	12273	6739
age_years_c	0.9999	10670	6832
ethnicity2	1.0001	9644	6021
ethnicity3	1.0001	8834	6013
ethnicity4	1.0007	9663	7006
ethnicity5	1.0003	9647	5838
inr_c	0.9999	12998	6785
pds_f4_p_c:cbcl_scr_syn_attention_r_c	0.9999	12812	6436

Draws were sampled using `sampling(NUTS)`. For each parameter, Bulk\_ESS and Tail\_ESS are effective sample size measures, and Rhat is the potential scale reduction factor on split chains (at convergence, Rhat = 1).

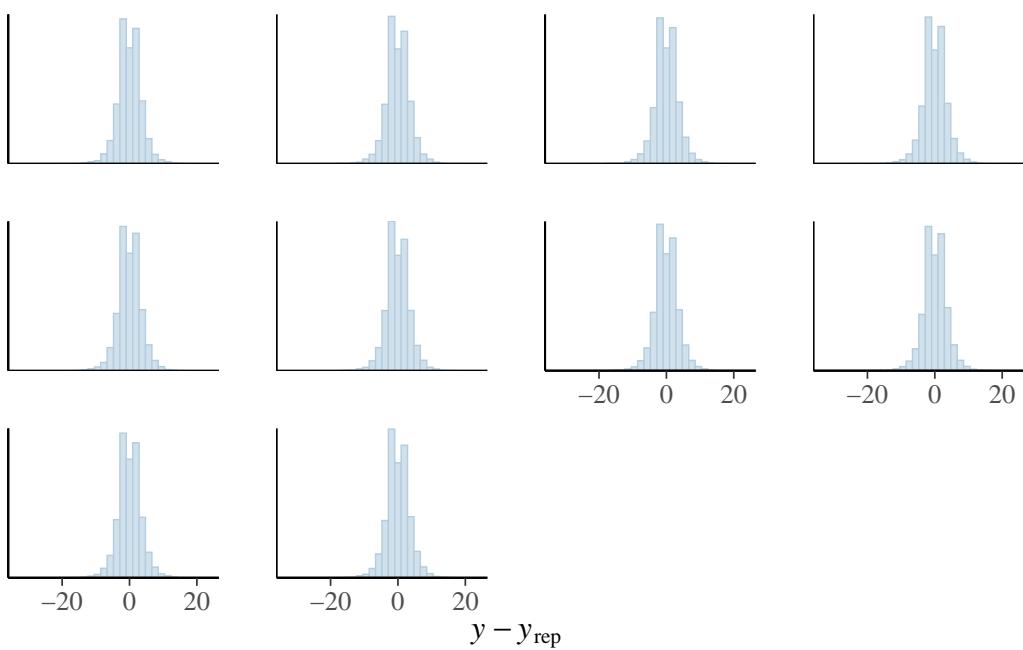
### model 4b posterior predictive diagnostics



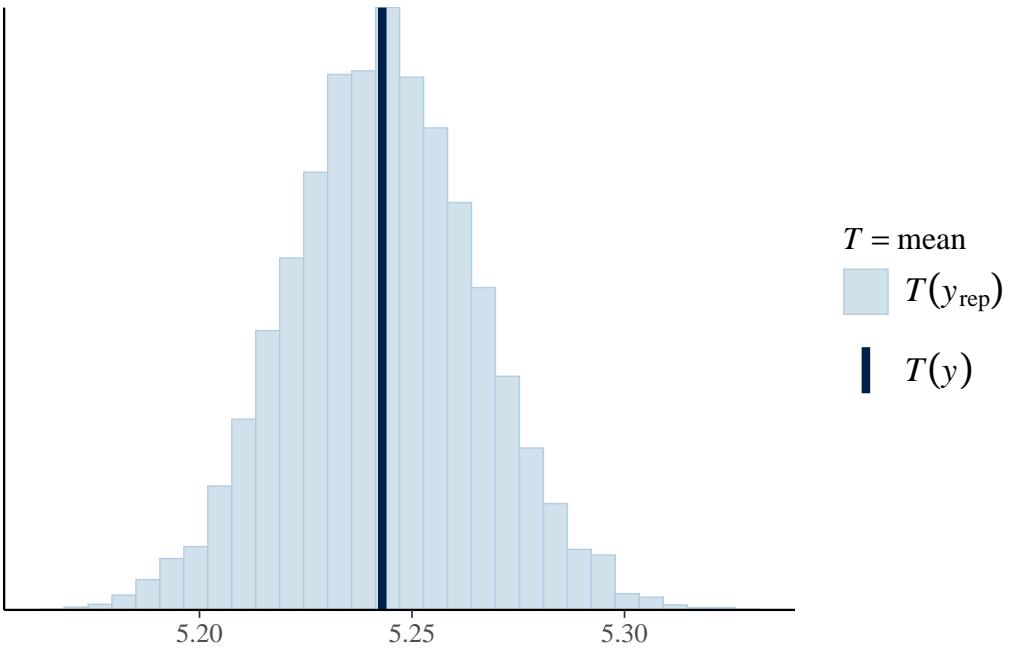
``stat_bin()`` using ``bins = 30``. Pick better value with ``binwidth``.



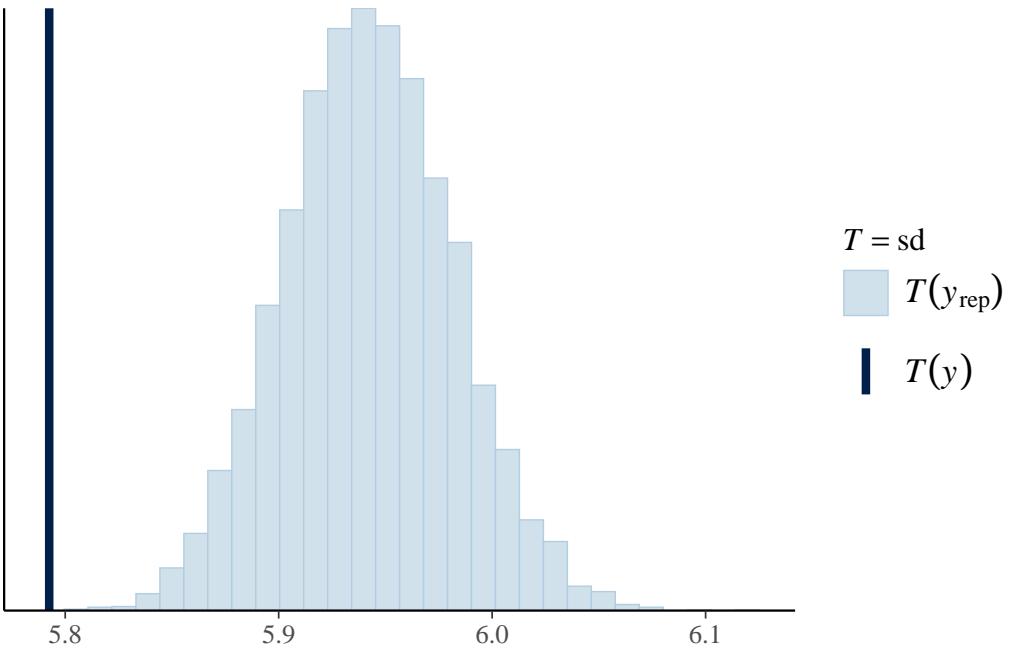
```
`stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```

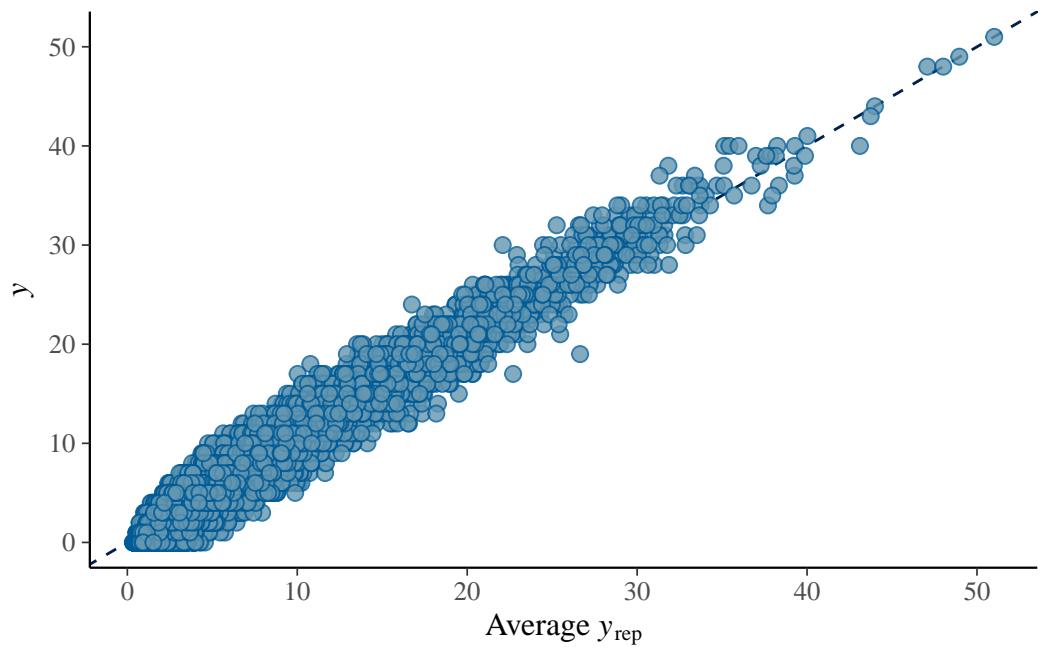


```
`stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```



```
`stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```





## Model 5 output

```
Estimate   Est.Error    Q2.5    Q97.5
R2 0.8724812 0.002087428 0.8683503 0.8765311
```

```
Family: poisson
Links: mu = log
Formula: cbcl_scr_syn_external_r ~ menarche_status_p * cbcl_scr_syn_attention_r_c + age_years_c
Data: imp_df (Number of observations: 20703)
Draws: 2 chains, each with iter = 8000; warmup = 4000; thin = 1;
       total post-warmup draws = 8000
```

Multilevel Hyperparameters:

~family\_id (Number of levels: 4922)

	Estimate	Est.Error	l-95% CI	u-95% CI	Rhat	Bulk_ESS	Tail_ESS
sd(Intercept)	0.7308	0.0266	0.6777	0.7805	1.0009	1191	2373

~obs\_id (Number of levels: 20703)

	Estimate	Est.Error	l-95% CI	u-95% CI	Rhat	Bulk_ESS	Tail_ESS
sd(Intercept)	0.3701	0.0077	0.3550	0.3854	1.0020	2896	5625

~site\_id (Number of levels: 22)

	Estimate	Est.Error	l-95% CI	u-95% CI	Rhat	Bulk_ESS	Tail_ESS
sd(Intercept)	0.1093	0.0283	0.0618	0.1735	1.0002	7249	5722

~src\_subject\_id (Number of levels: 5658)

	Estimate	Est.Error	l-95% CI	u-95% CI	Rhat	Bulk_ESS	Tail_ESS
sd(Intercept)	0.6974	0.0249	0.6492	0.7472	1.0011	1305	2326

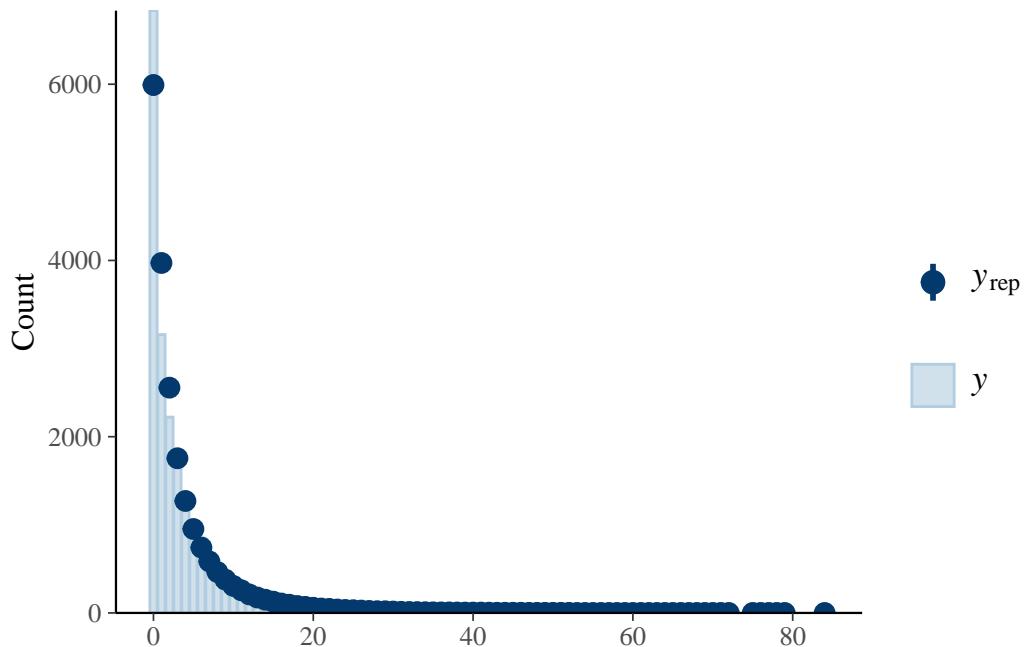
Regression Coefficients:

	Estimate	Est.Error	l-95% CI	u-95% CI	Rhat	Bulk_ESS	Tail_ESS
Intercept	0.4899	0.0353	0.4202	0.5593	1.0000	1191	2373
menarche_status_pY	0.0725	0.0193	0.0348	0.1100	1.0000	2896	5625
cbcl_scr_syn_attention_r_c	0.1832	0.0030	0.1774	0.1990	1.0000	7249	5722
age_years_c	-0.0493	0.0064	-0.0620	-0.0366	1.0000	1305	2326
ethnicity2	-0.0505	0.0491	-0.1485	-0.0505	1.0000	1191	2373
ethnicity3	-0.0195	0.0455	-0.1070	-0.0195	1.0000	2896	5625
ethnicity4	-0.5357	0.1137	-0.7582	-0.5357	1.0000	7249	5722
ethnicity5	0.0445	0.0537	-0.0603	0.0445	1.0000	1305	2326
inr_c	-0.0234	0.0036	-0.0305	-0.0234	1.0000	1191	2373
menarche_status_pY:cbcl_scr_syn_attention_r_c	0.0125	0.0037	0.0053	0.0125	1.0000	2896	5625
	u-95% CI	Rhat	Bulk_ESS	Tail_ESS			

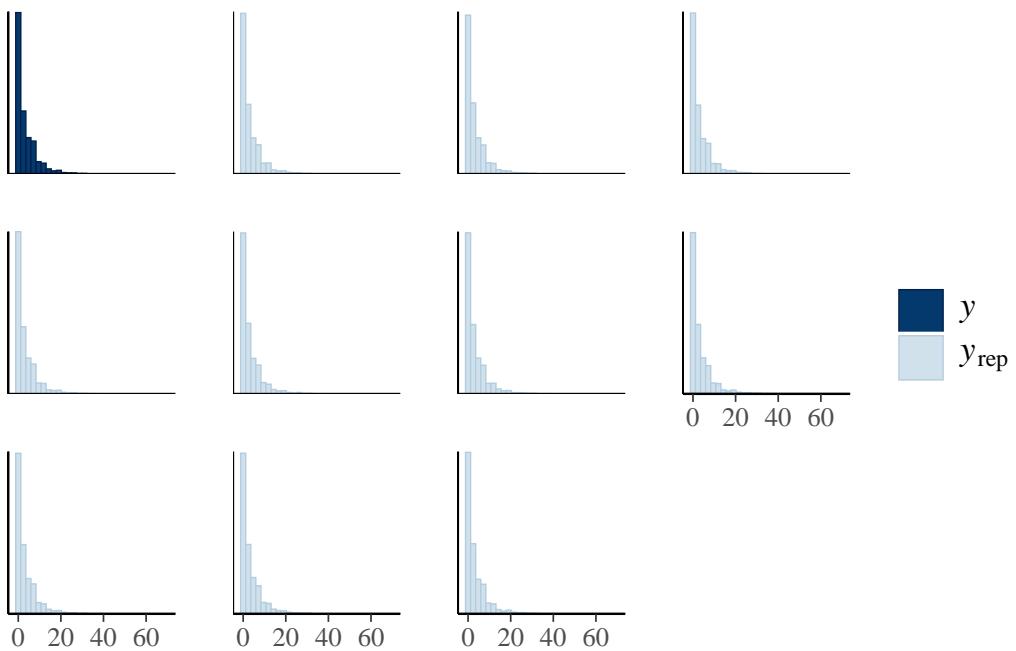
Intercept	0.5603	0.9998	8195	5607
menarche_status_pY	0.1102	1.0007	11681	6528
cbcl_scr_syn_attention_r_c	0.1892	0.9999	9452	6604
age_years_c	-0.0369	1.0010	11245	6271
ethnicity2	0.0472	1.0006	9890	5582
ethnicity3	0.0705	1.0005	10774	6248
ethnicity4	-0.3159	1.0003	10681	6245
ethnicity5	0.1483	0.9999	10847	6277
inr_c	-0.0162	1.0005	12957	6389
menarche_status_pY:cbcl_scr_syn_attention_r_c	0.0197	1.0001	11787	6141

Draws were sampled using `sampling(NUTS)`. For each parameter, Bulk\_ESS and Tail\_ESS are effective sample size measures, and Rhat is the potential scale reduction factor on split chains (at convergence, Rhat = 1).

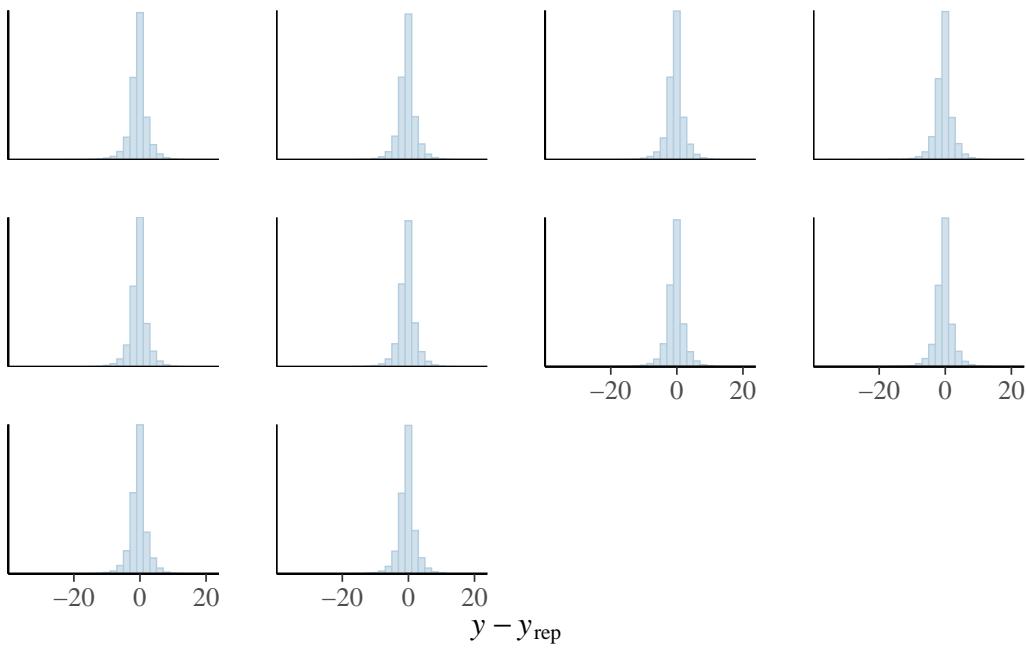
### Model 5 posterior predictive diagnostics



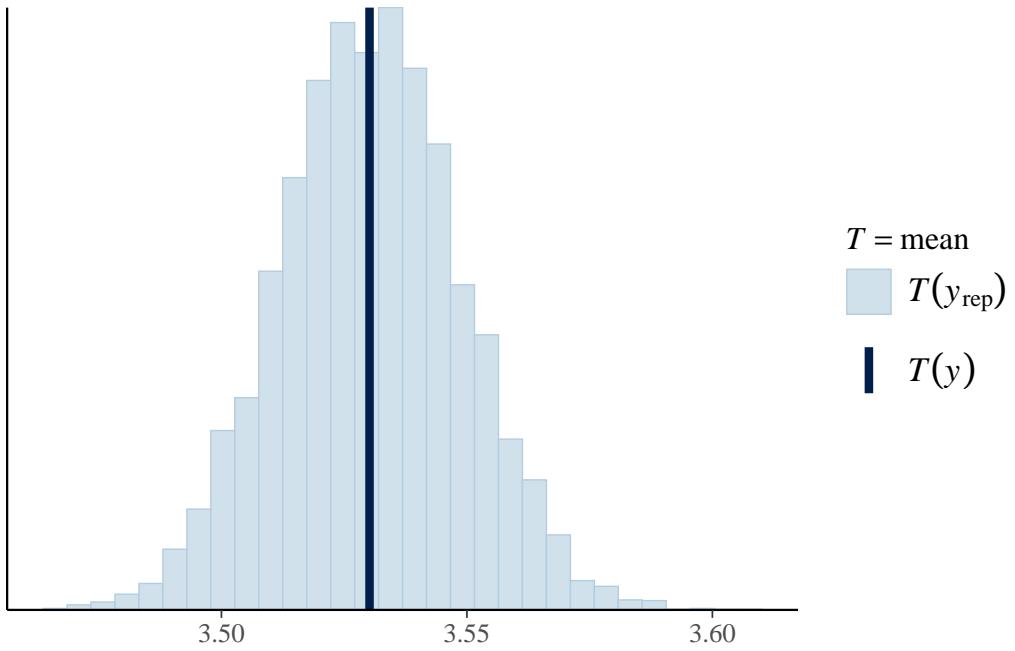
``stat_bin()`` using ``bins = 30``. Pick better value with ``binwidth``.



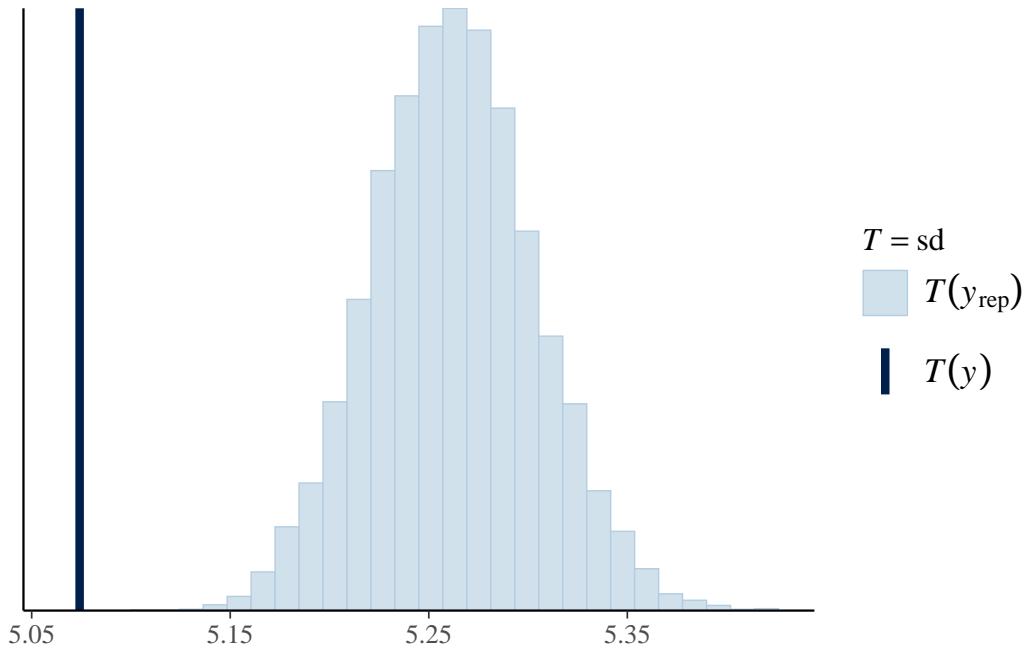
``stat_bin()` using `bins = 30`.` Pick better value with ``binwidth``.

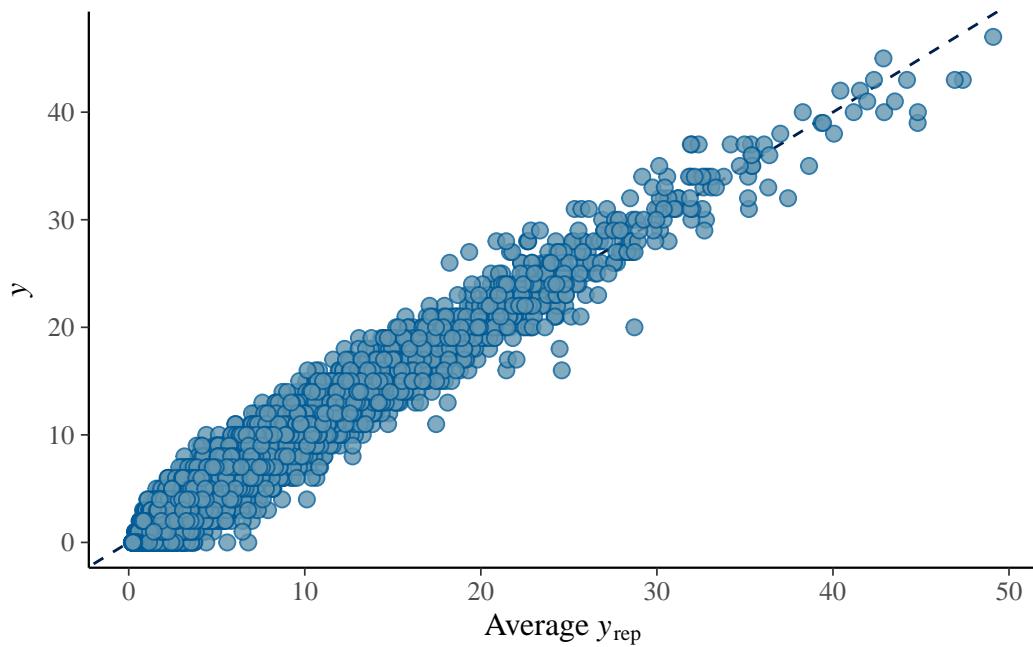


``stat_bin()` using `bins = 30`.` Pick better value with ``binwidth``.



```
`stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```





### Model 5 interaction analysis

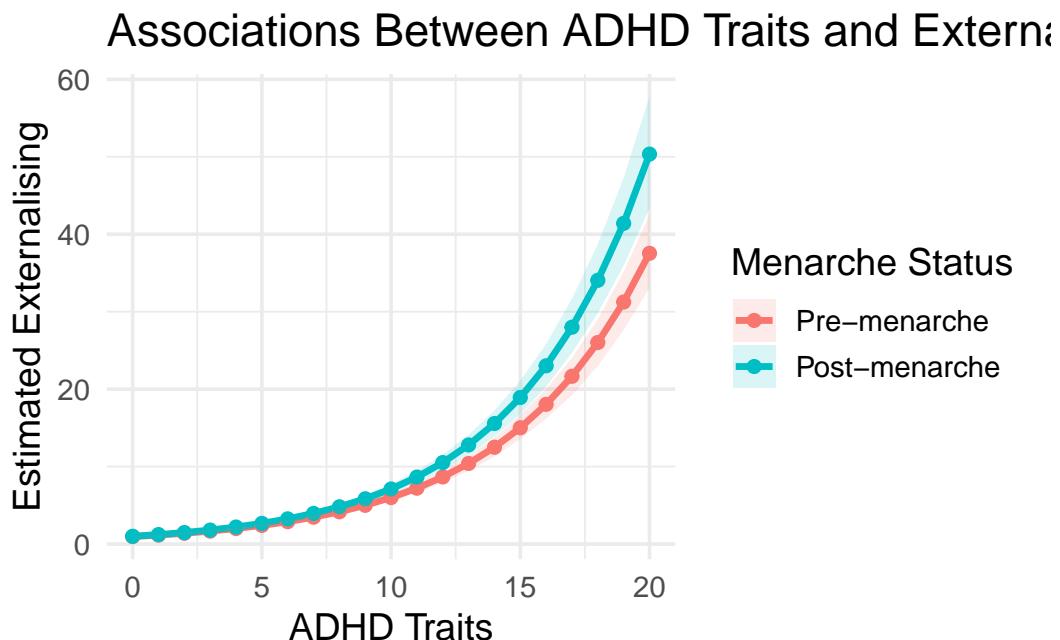
```
$emtrends
menarche_status_p cbcl_scr_syn_attention_r_c.trend lower.HPD upper.HPD
N                      0.183      0.177      0.189
Y                      0.196      0.189      0.203
```

Results are averaged over the levels of: ethnicity  
 Point estimate displayed: median  
 HPD interval probability: 0.95

```
$contrasts
contrast estimate lower.HPD upper.HPD
N - Y     -0.0126   -0.0196   -0.0053
```

Results are averaged over the levels of: ethnicity  
 Point estimate displayed: median  
 HPD interval probability: 0.95

Visualise Model 5 interaction



## Model 5b output

```
Estimate   Est.Error    Q2.5    Q97.5
R2 0.8718329 0.002052838 0.8677182 0.8758205

Family: poisson
Links: mu = log
Formula: cbcl_scr_syn_external_r ~ pds_f4_p_c * cbcl_scr_syn_attention_r_c + age_years_c + e
Data: imp_df (Number of observations: 21152)
Draws: 2 chains, each with iter = 8000; warmup = 4000; thin = 1;
       total post-warmup draws = 8000

Multilevel Hyperparameters:
~family_id (Number of levels: 4939)
Estimate   Est.Error    l-95% CI   u-95% CI   Rhat Bulk_ESS Tail_ESS
sd(Intercept) 0.7234    0.0264    0.6701    0.7725 1.0007     1166    2427

~obs_id (Number of levels: 21152)
Estimate   Est.Error    l-95% CI   u-95% CI   Rhat Bulk_ESS Tail_ESS
sd(Intercept) 0.3759    0.0074    0.3616    0.3908 1.0000     3096    4901

~site_id (Number of levels: 22)
Estimate   Est.Error    l-95% CI   u-95% CI   Rhat Bulk_ESS Tail_ESS
sd(Intercept) 0.1080    0.0272    0.0620    0.1687 1.0003     5360    5155

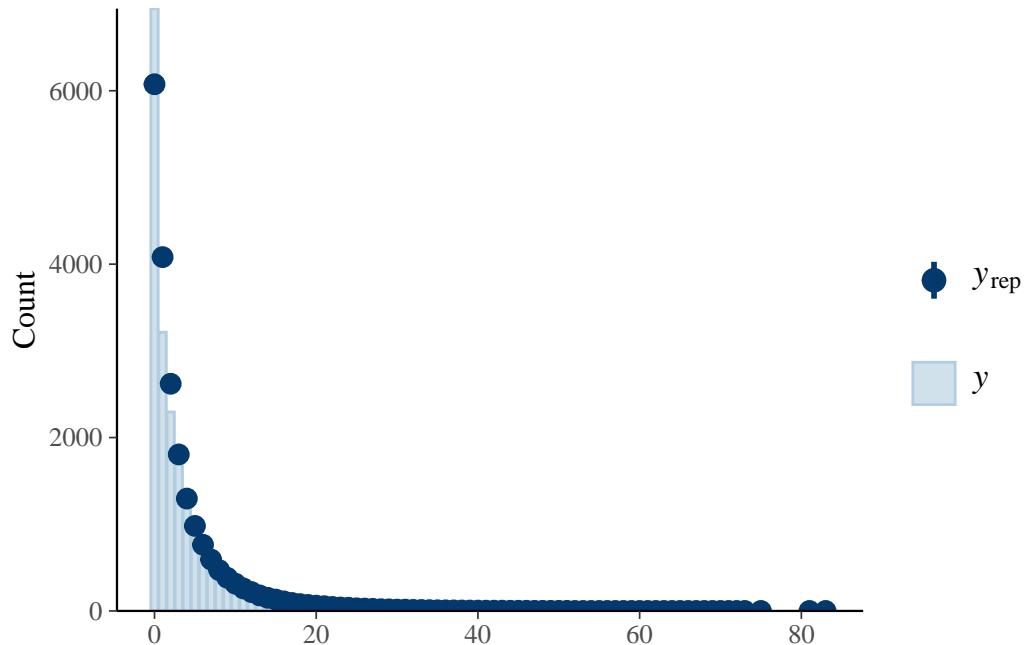
~src_subject_id (Number of levels: 5677)
Estimate   Est.Error    l-95% CI   u-95% CI   Rhat Bulk_ESS Tail_ESS
sd(Intercept) 0.6853    0.0251    0.6379    0.7357 1.0006     1121    2021

Regression Coefficients:
Estimate   Est.Error    l-95% CI   u-95% CI   Rhat Bulk_ESS Tail_ESS
Intercept          0.5179    0.0343    0.4506    0.5868
pds_f4_p_c         0.0571    0.0120    0.0335    0.0806
cbcl_scr_syn_attention_r_c 0.1883    0.0027    0.1830    0.1936
age_years_c        -0.0461    0.0061   -0.0582   -0.0341
ethnicity2         -0.0589    0.0479   -0.1530    0.0341
ethnicity3         -0.0081    0.0454   -0.0973    0.0811
ethnicity4         -0.4865    0.1099   -0.7035   -0.2665
ethnicity5         0.0400    0.0534   -0.0637    0.1433
inr_c              -0.0214    0.0036   -0.0285   -0.0143
pds_f4_p_c:cbcl_scr_syn_attention_r_c -0.0018    0.0023   -0.0063    0.0029
                                              Rhat Bulk_ESS Tail_ESS
```

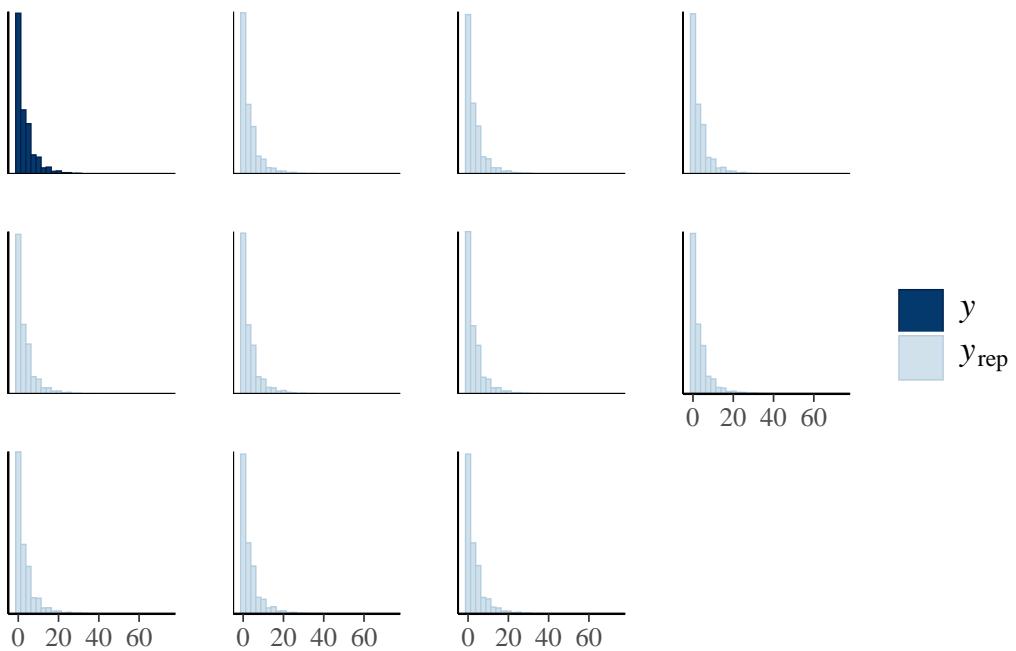
Intercept	1.0001	6532	5413
pds_f4_p_c	1.0002	10382	6107
cbcl_scr_syn_attention_r_c	1.0002	9331	6466
age_years_c	1.0004	9959	6256
ethnicity2	1.0002	8770	5915
ethnicity3	1.0005	8420	6317
ethnicity4	1.0003	10522	6031
ethnicity5	1.0000	8569	5581
inr_c	0.9999	11663	6597
pds_f4_p_c:cbcl_scr_syn_attention_r_c	0.9999	11304	6858

Draws were sampled using sampling(NUTS). For each parameter, Bulk\_ESS and Tail\_ESS are effective sample size measures, and Rhat is the potential scale reduction factor on split chains (at convergence, Rhat = 1).

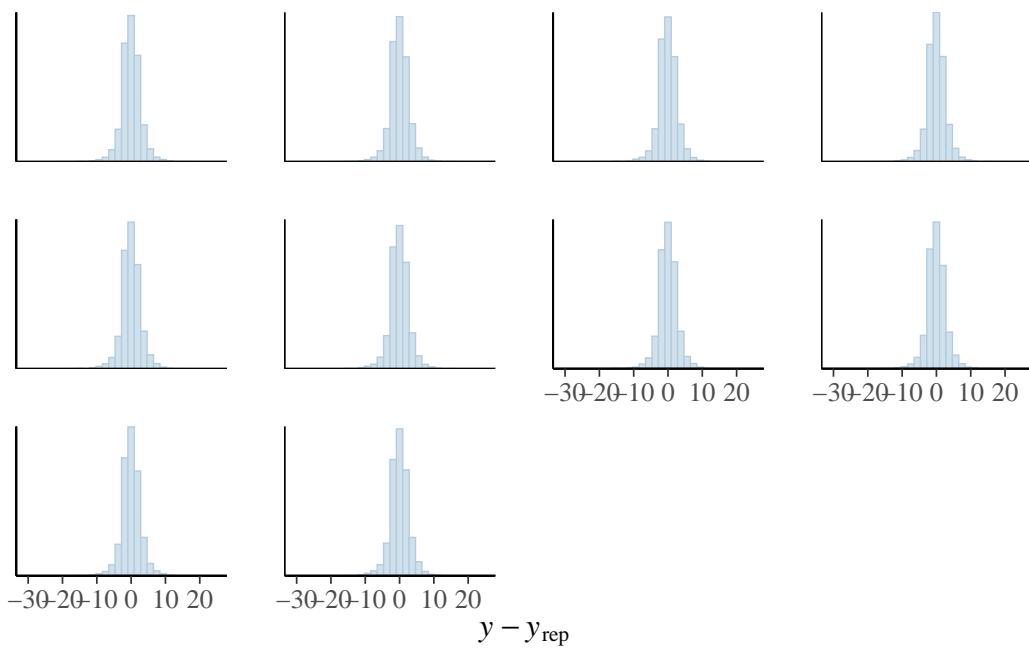
### model 5b posterior predictive diagnostics



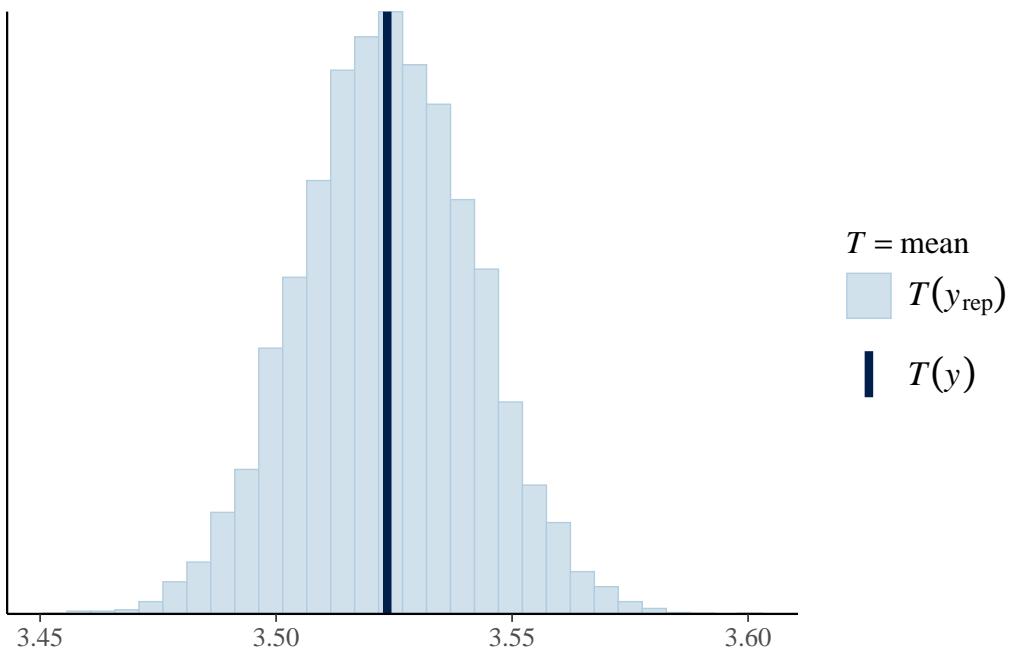
`stat\_bin()` using `bins = 30`. Pick better value with `binwidth`.



``stat_bin()` using `bins = 30`.` Pick better value with ``binwidth``.



``stat_bin()` using `bins = 30`.` Pick better value with ``binwidth``.



```
`stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```

