

KidIQ: kidiq.csv

Widen the notebook.

```
• html"""  
• <style>  
•     main {  
•         margin: 0 auto;  
•         max-width: 2000px;  
•         padding-left: max(160px, 10%);  
•         padding-right: max(160px, 10%);  
•     }  
• </style>  
• """  
•  
•
```

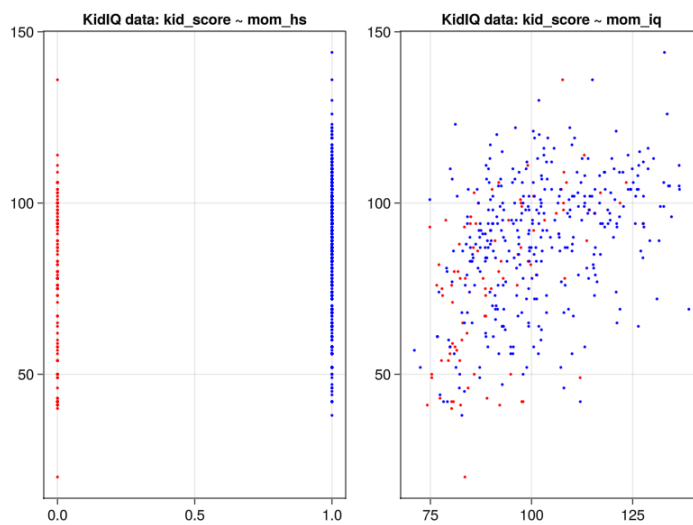
```
• using Pkg ✓ , DrWatson ✓
```

```
• begin  
•     # Specific to this notebook  
•     using GLM ✓  
•  
•     # Specific to ROSTuringPluto  
•     using Optim ✓  
•     using Logging ✓  
•     using Turing ✓  
•  
•     # Graphics related  
•     using GLMakie ✓  
•  
•     # Common data files and functions  
•     using RegressionAndOtherStories ✓  
•     import RegressionAndOtherStories: link  
•  
•     Logging.disable_logging(Logging.Warn)  
• end;
```

```
kidiq =
```

	kid_score	mom_hs	mom_iq	mom_work
1	65	1	121.118	4
2	98	1	89.3619	4
3	85	1	115.443	4
4	83	1	99.4496	3
5	115	1	92.7457	4
6	98	0	107.902	1
7	69	1	138.893	4
8	106	1	125.145	3
9	102	1	81.6195	1
10	95	1	95.0731	1
⋮ more				
434	70	1	91.2533	2

```
• kidiq = CSV.read(ros_datadir("KidIQ",  
"kidiq.csv"), DataFrame)
```



```

• let
•     f = Figure()
•     ax = Axis(f[1, 1]; title="KidIQ data:
•     kid_score ~ mom_hs")
•     scatter!(kidiq[kidiq.mom_hs .== 0,
•     :mom_hs], kidiq[kidiq.mom_hs .== 0,
•     :kid_score]; color=:red, markersize = 3)
•     scatter!(kidiq[kidiq.mom_hs .== 1,
•     :mom_hs], kidiq[kidiq.mom_hs .== 1,
•     :kid_score]; color=:blue, markersize =
•     3)
•     ax = Axis(f[1, 2]; title="KidIQ data:
•     kid_score ~ mom_iq")
•     scatter!(kidiq[kidiq.mom_hs .== 0,
•     :mom_iq], kidiq[kidiq.mom_hs .== 0,
•     :kid_score]; color=:red, markersize = 3)
•     scatter!(kidiq[kidiq.mom_hs .== 1,
•     :mom_iq], kidiq[kidiq.mom_hs .== 1,
•     :kid_score]; color=:blue, markersize =
•     3)
•     current_figure()
• end

```

```

• stan10_1 = "
• data {
•   int N;
•   vector[N] mom_hs;
•   vector[N] kid_score;
• }
• parameters {
•   real a;
•   real b;
•   real sigma;
• }
• model {
•   vector[N] mu;
•   a ~ normal(100, 10);
•   b ~ normal(5, 10);
•   mu = a + b * mom_hs;
•   kid_score ~ normal(mu, sigma);
• }
• ";

```

ppl10_1 (generic function with 2 methods)

```

• @model function ppl10_1(x, y)
•   a ~ Normal(100, 10)
•   b ~ Normal(5, 10)
•   σ ~ Exponential(1)
•   μ = a .+ b .* x
•   for i in eachindex(y)
•     y[i] ~ Normal(μ[i], σ)
•   end
• end

```

► [parameters mean std naive_se

1	:a	92.1898	1.4186	0.02243
2	:b	9.97788	1.58614	0.025079
3	:σ	14.2134	0.47018	0.0074342

```

• begin
•   m10_1t = ppl10_1(kidiq.mom_hs,
•   kidiq.mom_iq)
•   chns10_1t = sample(m10_1t, NUTS(),
•   MCMCThreads(), 1000, 4)
•   describe(chns10_1t)
• end

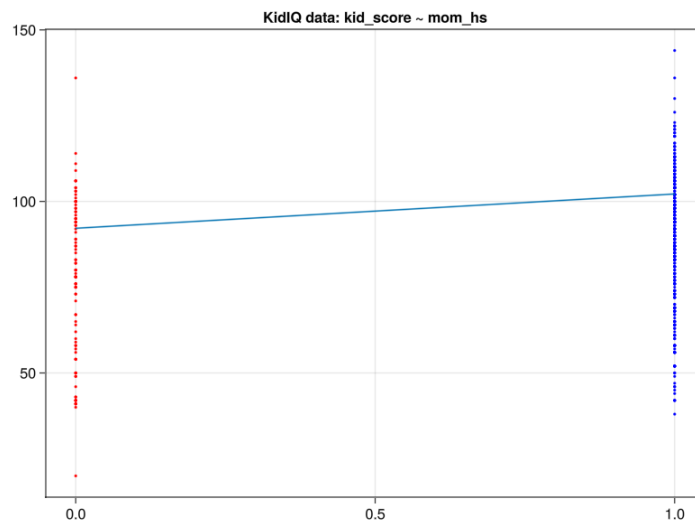
```

	parameters	median	mad_sd	mean	st
1	"a"	92.181	1.414	92.19	1.41
2	"b"	9.995	1.578	9.978	1.58
3	"σ"	14.201	0.471	14.213	0.47

```

• begin
•   post10_1t = DataFrame(chns10_1t)[: , 3:5]
•   ms10_1t = model_summary(post10_1t, [:a,
•   :b, :σ])
• end

```



```

• let
•   f = Figure()
•   ax = Axis(f[1, 1]; title="KidIQ data:
•   kid_score ~ mom_hs")
•   scatter!(kidiq[kidiq.mom_hs .== 0,
•   :mom_hs], kiddi[kidiq.mom_hs .== 0,
•   :kid_score]; color=:red, markersize = 3)
•   scatter!(kidiq[kidiq.mom_hs .== 1,
•   :mom_hs], kiddi[kidiq.mom_hs .== 1,
•   :kid_score]; color=:blue, markersize =
•   3)
•   lines!([0.0, 1.0], [ms10_1t[:a,
•   :median], ms10_1t[:a, :median] +
•   ms10_1t[:b, :median]])
•   current_figure()
• end

```

ppl10_2 (generic function with 2 methods)

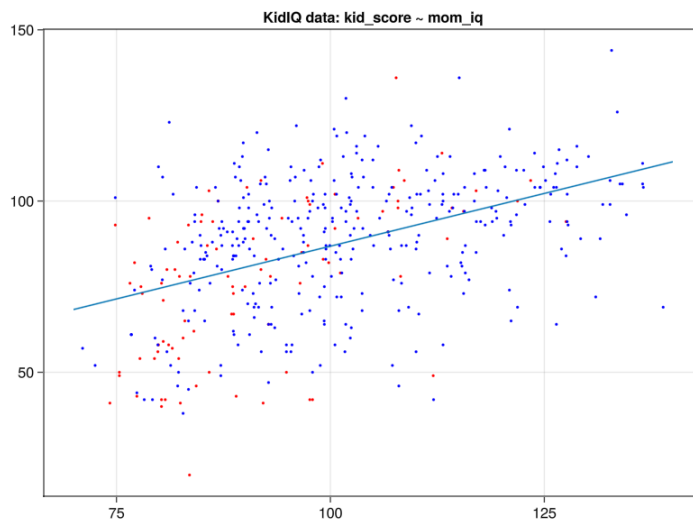
```
• @model function ppl10_2(x, y)
•   a ~ Normal(25, 3)
•   b ~ Normal(1, 2)
•   σ ~ Exponential(1)
•   μ = a .+ b .* x
•   for i in eachindex(y)
•     y[i] ~ Normal(μ[i], σ)
•   end
• end
```

► [parameters	mean	std	naive_
1	:a	25.1545	2.69175	0.042560
2	:b	0.616314	0.0276462	0.000437
3	:σ	17.9251	0.59097	0.009342

```
• begin
•   m10_2t = ppl10_2(kidiq.mom_iq,
•   kidiq.kid_score)
•   chns10_2t = sample(m10_2t, NUTS(),
•   MCMCThreads(), 1000, 4)
•   describe(chns10_2t)
• end
```

	parameters	median	mad_sd	mean	st
1	"a"	25.221	2.642	25.154	2.69
2	"b"	0.616	0.028	0.616	0.02

```
• begin
•   post10_2t = DataFrame(chns10_2t)[: , 3:5]
•   ms10_2t = model_summary(post10_2t, [:a,
•   :b, :sigma])
• end
```



```

• let
•   f = Figure()
•   ax = Axis(f[1, 1]; title="KidIQ data:
•   kid_score ~ mom_iq")
•   scatter!(kidiq[kidiq.mom_hs .== 0,
•   :mom_iq], kidiq[kidiq.mom_hs .== 0,
•   :kid_score]; color=:red, markersize = 3)
•   scatter!(kidiq[kidiq.mom_hs .== 1,
•   :mom_iq], kidiq[kidiq.mom_hs .== 1,
•   :kid_score]; color=:blue, markersize =
•   3)
•   x = LinRange(70.0, 140.0, 100)
•   lines!(x, ms10_2t[:a, :median] .+
•   ms10_2t[:b, :median] .* x)
•   current_figure()
• end

```

ppl10_3 (generic function with 2 methods)

```

• @model function ppl10_3(x, y, z)
•   a ~ Normal(25, 2)
•   b ~ Normal(5, 2)
•   c ~ Normal(1, 2)
•   σ ~ Exponential(1)
•   μ = a .+ b .* x .+ c .* y
•   for i in eachindex(y)
•     z[i] ~ Normal(μ[i], σ)
•   end
• end

```

	parameters	mean	std	naive_
1	:a	25.0229	1.8917	0.029910
2	:b	5.46953	1.49	0.023559
3	:c	0.574588	0.0239202	0.000378
4	: σ	17.7902	0.592148	0.009362

```

• begin
•   m10_3t = ppl10_3(kidiq.mom_hs,
•   kidiq.mom_iq, kidiq.kid_score)
•   chns10_3t = sample(m10_3t, NUTS(),
•   MCMCThreads(), 1000, 4)
•   describe(chns10_3t)
end

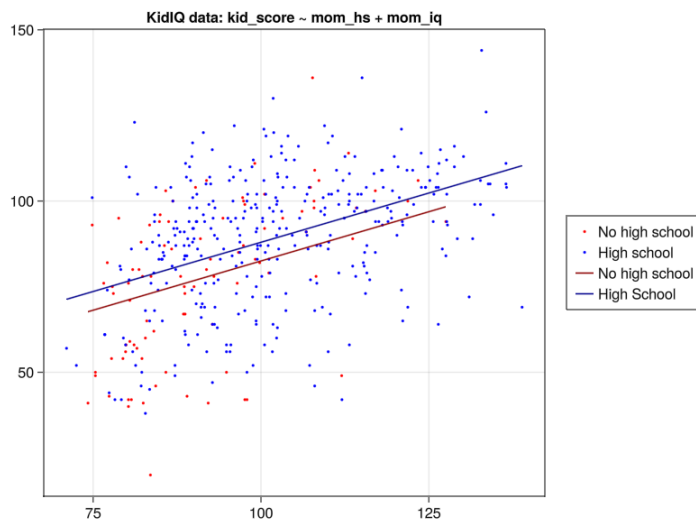
```

	parameters	median	mad_sd	mean	st
1	"a"	25.004	1.909	25.023	1.89
2	"b"	5.458	1.5	5.47	1.49
3	"c"	0.575	0.023	0.575	0.02
4	" σ "	17.781	0.599	17.79	0.59

```

• begin
•   post10_3t = DataFrame(chns10_3t)[: , 3:6]
•   ms10_3t = model_summary(post10_3t, [:a,
•   :b, :c, : $\sigma$ ])
end

```

```

let
  momnohs(x) = x == 0
  nohs = findall(momnohs, kidiq.mom_hs)

  momhs(x) = x == 1
  hs = findall(momhs, kidiq.mom_hs)

  f = Figure()
  ax = Axis(f[1, 1]; title="KidIQ data:
  kid_score ~ mom_hs + mom_iq")
  sca1 = scatter!(kidiq[kidiq.mom_hs .==
  0, :mom_iq], kidiq[kidiq.mom_hs .== 0,
  :kid_score]; color=:red, markersize = 3)
  sca2 = scatter!(kidiq[kidiq.mom_hs .==
  1, :mom_iq], kidiq[kidiq.mom_hs .== 1,
  :kid_score]; color=:blue, markersize =
  3)
  x = sort(kidiq.mom_iq[nohs])
  lin1 = lines!(x, ms10_3t[:a, :median] .+
  ms10_3t[:b, :median] .*
  kidiq.mom_hs[nohs] .+ ms10_3t[:c,
  :median] .* x;
  color=:darkred)
  x = sort(kidiq.mom_iq[hs])
  lin2 = lines!(x, ms10_3t[:a, :median] .+
  ms10_3t[:b, :median] .*
  kidiq.mom_hs[hs] .+ ms10_3t[:c,
  :median] .* x;
  color=:darkblue)
  Legend(f[1, 2],
  [sca1, sca2, lin1, lin2],
  ["No high school", "High school",
  "No high school", "High School"])
  current_figure()
end

```

