

Stan from R: a cmdstanr quick start

NRES 746

1. Install (once, ~20-30 min, mostly waiting)

Get a C++ toolchain. Windows: install the Rtools version that matches your R (Rtools45 for R 4.5, Rtools44 for R 4.4) from <https://cran.r-project.org/bin/windows/Rtools/>. Mac: in the Terminal, run `xcode-select --install`.

Install cmdstanr and Stan, in R:

```
install.packages("cmdstanr",
                 repos = c("https://stan-dev.r-universe.dev", getOption("repos")))
library(cmdstanr)
check_cmdstan_toolchain(fix = TRUE) # checks (and tries to fix) the C++ setup
install_cmdstan(cores = 2)          # downloads and builds Stan
cmdstan_version()                   # success: prints a version number
```

2. Fit a model

Save the model as `myxo.stan` (RStudio's File > New File > Stan File checks your syntax):

```
data {
  int<lower=0> N;
  vector<lower=0>[N] titer;
}
parameters {
  real<lower=0> shape;
  real<lower=0> scale;
}
model {
  titer ~ gamma(shape, 1 / scale); // Stan's gamma uses shape and rate
}
```

Then, in R:

```
library(cmdstanr)
myxo <- read.csv("https://kevintshoemaker.github.io/NRES-746/data/MyxoTiter_sum.csv")
titer <- myxo$titer[myxo$grade == 1]
mod <- cmdstan_model("myxo.stan") # compiles (once per model)
fit <- mod$sample(data = list(N = length(titer), titer = titer),
                  chains = 4, parallel_chains = 4, seed = 1)
fit$summary() # means, intervals, R-hat, ESS
fit$diagnostic_summary() # divergences, tree depth
draws <- fit$draws(format = "draws_df") # one row per draw
```

3. Before you trust the results

- $\hat{R}$ (rhat) below 1.01 for every parameter.
- Effective sample size (`ess_bulk`, `ess_tail`) above about 400.
- Zero divergent transitions. If you get some, try `adapt_delta = 0.95` in `$sample()`; if they don't go away, reparameterize the model.
- Look at trace plots: `bayesplot::mcmc_trace(fit$draws())`.

4. Common problems

- **Toolchain errors (Windows):** wrong Rtools version for your R, or Rtools not on the path. Rerun `check_cmdstan_toolchain(fix = TRUE)`.
- **Install fails on a path with spaces or non-English characters:** install to a simple folder, `install_cmdstan(dir = "C:/cmdstan")`, then in each new session run `set_cmdstan_path("C:/cmdstan/<version>")`.
- **Model won't compile:** Stan gives the line number; look for a missing `;`, an undeclared variable, or `int` vs. `real`.
- **Stuck on an error message?** Paste it into a web search or an AI assistant.

Learn more: <https://mc-stan.org/cmdstanr/>; <https://mc-stan.org/docs/>; *Statistical Rethinking*, Ch. 9.