

Constructing a medium complexity shiny app for power analysis

2024-01-24

Figure 1: under construction



1 Introduction

One of the most common tasks for a biostatistician is the calculation of a required sample size for a two group comparison based on a two sample Student's t-test. While common, this exercise is not trivial. There are numerous parameters to be set by the study investigators.

Want to be able to add CSS to shiny app: read:

2 Methods

3 Code

```
library(pacman)
p_load(DT, ggplot2, pwr, shiny, bsicons, bslib, ggplot2, plotly)
qc = "question-circle"
t1 = "Sample Size:"
t2 = "Total Sample Size. Both groups combined."
ui <- page_sidebar(
```

```

includeCSS("power1_style.css"),
title = "Power Calculator for Two Group Parallel Designs",
sidebar = sidebar(
  sliderInput("N", tooltip(list( t1, bs_icon(qc) ), t2 ), 0, 100, 50, 1),
  sliderInput("dropout", "Dropout Rate:", 0, .40, .10),
  htmlOutput("ittsizes"),
  htmlOutput("dropoutsizes"),
  radioButtons("dmeth", "Method for Effect Size", c(
    "SD Units (Cohen)" = "std",
    "Pct reduction" = "pct",
    "Diff in change scores" = "diff",
    "Change in active group" = "active"
  )),
  conditionalPanel(
    condition = "input.dmeth == 'std'",
    sliderInput("del", " delta", 0.0, 1.8, c(.20, 1.8), .1),
  ),
  conditionalPanel(
    condition = "input.dmeth == 'diff'",
    sliderInput("dff", " diff", 0, 10.0, c(1, 9), .1),
  ),
  conditionalPanel(
    condition = "input.dmeth == 'pct'",
    sliderInput("pct", "Pct. Reduction", 0, 1, c(.1, .9), .1),
  ),
  conditionalPanel(
    condition = "input.dmeth == 'active'",
    sliderInput("active", "Treatment group change",
      min = 1, max = 50, value = c(1, 50)
    )
  ),
  conditionalPanel(
    condition = "input.dmeth == 'diff' |
      input.dmeth == 'pct' | input.dmeth == 'active' ",
    sliderInput("sd0", "Placebo SD:", 1, 20, 5.0, .1),
    sliderInput("d0", "Placebo Change:", 0, 20, 10.0, .1),
  ),
  # sliderInput("del", " delta", 0.0, 1.8, c(.20, 1.8), .1),
  # sliderInput("dff", " diff", 0, 10.0, c(1, 9), .1),
  # sliderInput("pct", "Pct. Reduction", 0, 1, c(.1, .9), .1),

```

```

# sliderInput("sd0", "Placebo SD:", 1, 20, 5.0, .1),
# sliderInput("d0", "Placebo Change:", 0, 20, 10.0, .1),
# sliderInput("d1", "Active Change:", 0, 20, 7.0, .1),

checkboxInput("choice", "Additional parameter settings"),
conditionalPanel(
  condition = "input.choice == 1",
  numericInput("ratio", "Ratio of active to ctrl:", 1, .5, 5.0, .5),
  sliderInput("dropin", "Drop-in rate:", 0, .4, 0),
  numericInput("type1", "Type one error:", .05, .01, .2, .005),
  checkboxInput("sided", "One sided testing"),
),
),
layout_column_wrap(
  width = 1 / 2,
  card(
    height = 700,
    full_screen = TRUE, card_header("Power"), plotOutput("plot")
  ),
  card(
    height = 700,
    full_screen = TRUE, card_header("Data"), DT::dataTableOutput("df")
  ),
  card(
    max_height = 250,
    card_header("Summary"), verbatimTextOutput("eff1")
  ),
  card(
    max_height = 250,
    card_header("Pdf report"), downloadButton("report", "Download report")
  )
),
# verbatimTextOutput("eff0"),
# verbatimTextOutput("eff1"),
# verbatimTextOutput("eff2"),
# downloadButton("report", "Download report")
)

server <- function(input, output, session) {
  delv <- reactive(seq(input$del[1], input$del[2], (input$del[2] - input$del[1]) / 15))

```

```

dffb <- reactive(delv() * input$sd0)
pctv <- reactive(delv() * input$sd0 / input$d0)
n1comp <- reactive(input$ratio * input$N / (input$ratio + 1) * ((1 - (input$dropin + input$d0)))
n2comp <- reactive(input$N / (input$ratio + 1) * ((1 - (input$dropin + input$d0))))
n1itt <- reactive(input$ratio * input$N / (input$ratio + 1))
n2itt <- reactive(input$N / (input$ratio + 1))

pow <- reactive(sapply(
  delv(),
  function(x) pwr.t2n.test(n1comp(), n2comp(), d = x)$power
))

powpct <- reactive(sapply(
  pctv(),
  function(x) pwr.t2n.test(n1comp(), n2comp(), d = x * input$d0 / input$sd0)$power
))

out <- reactive(data.frame(cbind(
  std = delv() |> round(3),
  pct = pctv() |> round(3),
  diff = dffb() |> round(3),
  power = pow() |> round(3)
)))
out1 <- reactive(
  out()[, c(input$dmeth, "power")] |> setNames(c("delta", "power"))
)

xaxis2_text <- reactive(if (input$dmeth == "std") {
  "~ ."
} else if (input$dmeth == "diff") {
  "~ . / input$sd0"
} else if (input$dmeth == "pct") "~ . * input$d0/ input$sd0")

xintercept_value <- reactive(if (input$dmeth == "std") {
  pwr.t2n.test(n1comp(), n2comp(), sig.level = input$type1, power = .8)$d
} else if (input$dmeth == "diff") {
  input$sd0 * pwr.t2n.test(n1comp(), n2comp(), sig.level = input$type1, power = .8)$d
} else if (input$dmeth == "pct") {
  pwr.t2n.test(n1comp(), n2comp(), sig.level = input$type1, power = .8)$d * (input$sd0 / input$d0)
})

```

```

output$df <- DT::renderDataTable(out(),
  server = FALSE,
  filter = "top", extensions = "Buttons",
  options = list(
    paging = FALSE, scrollCollapse = TRUE,
    buttons = c("copy", "csv", "pdf"),
    dom = "Bt", scrollX = 300, scrollY = 200
  )
)
plot_rmd <- reactive({
  chart <- ggplot(out1(), aes(x = delta, y = power)) +
    geom_line() +
    geom_hline(yintercept = 0.8, color = "red") +
    geom_vline(xintercept = xintercept_value(), color = "blue") +
    scale_y_continuous(
      name = "Power",
      limits = c(0, 1.0), breaks = seq(0, 1, .1)
    ) +
    scale_x_continuous(
      name = input$dmeth,
      sec.axis = sec_axis(
        trans = as.formula(xaxis2_text()),
        name = "Std. Effect Units"
      )
    ) +
    theme_bw()
  chart
})
output$plot <- renderPlot(ggplot(out1(), aes(x = delta, y = power)) +
  geom_line() +
  geom_hline(yintercept = 0.8, color = "red") +
  geom_vline(xintercept = xintercept_value(), color = "blue") +
  scale_y_continuous(
    name = "Power",
    limits = c(0, 1.0), breaks = seq(0, 1, .1)
  ) +
  scale_x_continuous(
    name = input$dmeth,
    sec.axis = sec_axis(
      trans = as.formula(xaxis2_text()),

```

```

    name = "Std. Effect Units"
  )
) +
theme_bw()

state <- reactiveValues(sdel = c(NULL, NULL))
sdelv <- reactive(seq(state$sdel[1], state$sdel[2], (state$sdel[2] - state$sdel[1]) / 15))

observeEvent(input$pct | input$sd0 | input$d0, {
  print("change in pct begets change in sdel")
  state$sdel <- input$pct * input$d0 / input$sd0
})
observeEvent(input$sd0 | input$dff, {
  print("change in pct begets change in sdel")
  state$sdel <- input$dff / input$sd0
})
observeEvent(input$sd0 | input$del, {
  state$sdel <- input$del
})
observeEvent(state$sdel, {
  if (!identical(input$dff / input$sd0, state$sdel)) {
    updateSliderInput(session, "dff", value = state$sdel * input$sd0)
  }
  if (!identical(input$del, state$sdel)) {
    updateSliderInput(session, "del", value = state$sdel)
  }
  if (!identical(input$pct * input$d0 / input$sd0, state$sdel)) {
    updateSliderInput(session, "pct", value = state$sdel * input$sd0 / input$d0)
  }
})
# effsize <- renderText(round(pwr.t2n.test(n1comp(), n2comp(), sig.level = type1(), power =
output$ittsizes <- renderText(paste0(
  "ITT: N<sub>active</sub> = ",
  round(n1itt(), 0), ", N<sub>control</sub>= ",
  round(n2itt(), 0)
))
output$dropoutsizes <- renderText(paste0(
  "Completers: N<sub>active</sub> = ",
  round(n1comp(), 0), ", N<sub>control</sub>= ", round(n2comp(), 0)

```

```

))
eff_rmd <- reactive(
  paste0(
    "In summary, given the parameters:\\",
    "\\nSample size = ", input$N, "\\n",
    "\\ntype 1 error = ", input$type1, "\\n",
    "\\ndropout rate = ", input$dropout, "\\n",
    "\\ndropin rate = ", input$dropin, "\\n",
    "\\nactive to placebo ratio = ", input$ratio, "\\n",
    "\\neffect size method = ", input$dmeth, "\\n",
    "\\nA sample size of ", input$N, " has power of .80 to detect an effect of ",
    xintercept_value()
  )
)
output$eff1 <- renderText(paste0(
  "In summary, given the parameters:",
  "\\nSample size = ", input$N,
  "\\ntype 1 error = ", input$type1,
  "\\ndropout rate = ", input$dropout,
  "\\ndropin rate = ", input$dropin,
  "\\nactive to placebo ratio = ", input$ratio,
  "\\neffect size method = ", input$dmeth,
  "\\nA sample size of ", input$N, " has power of .80 to detect an effect of ",
  xintercept_value()
))
# output$eff2 <- renderText(
#   paste0(
#     "A sample size of ", input$N, " has 80% power to detect an effect of ",
#     xintercept_value()
#   )
# )
# observeEvent(input$N, {
#   browser()
# })

output$report <- downloadHandler(
  filename = "report.pdf",
  content = function(file) {
    tempReport <- file.path(tempdir(), "report.Rmd")
  }
)

```

```

file.copy("report.Rmd", tempReport, overwrite = TRUE)

params <- list(
  table1 = out(),
  plot1 = plot_rmd(),
  text1 = eff_rmd()
)

rmarkdown::render(tempReport,
  output_file = file,
  params = params,
  envir = new.env(parent = globalenv())
)
}
)
}

shinyApp(ui, server)

```

4 setting up modules

5 setting up with golem. step by step

Start with the video

[Building a basic Shiny app with Golem - Part I - YouTube](#)

Notes: rstudio provides a template under new file

6 References

[How to build a professional R Shiny app — part 1 | by Adrian Joseph, PhD | Towards Dev](#)

[How to build a professional R Shiny app — part 2 | by Adrian Joseph, PhD | Towards Dev](#)

[How to build a professional R Shiny app — part 3 | by Adrian Joseph, PhD | Towards Dev](#)

[Welcome | Outstanding User Interfaces with Shiny](#)

Want to make it extensible: try Golem.

[Introduction | Engineering Production-Grade Shiny Apps](#)