USING R TO REDUCE TECHNICAL DEBT

Children's Hospital of Philadelphia
Jake Riley

12/8/2021

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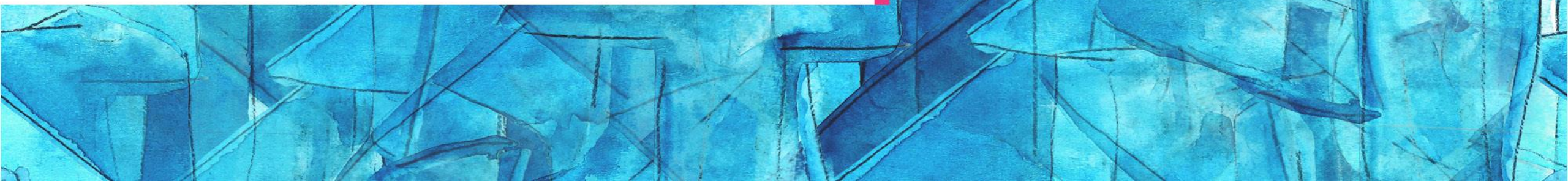

Jake Riley

- Clinical Analyst @ Children's Hospital of Philadelphia

- Author of several R packages

- Learned most of this from my time at CHOP

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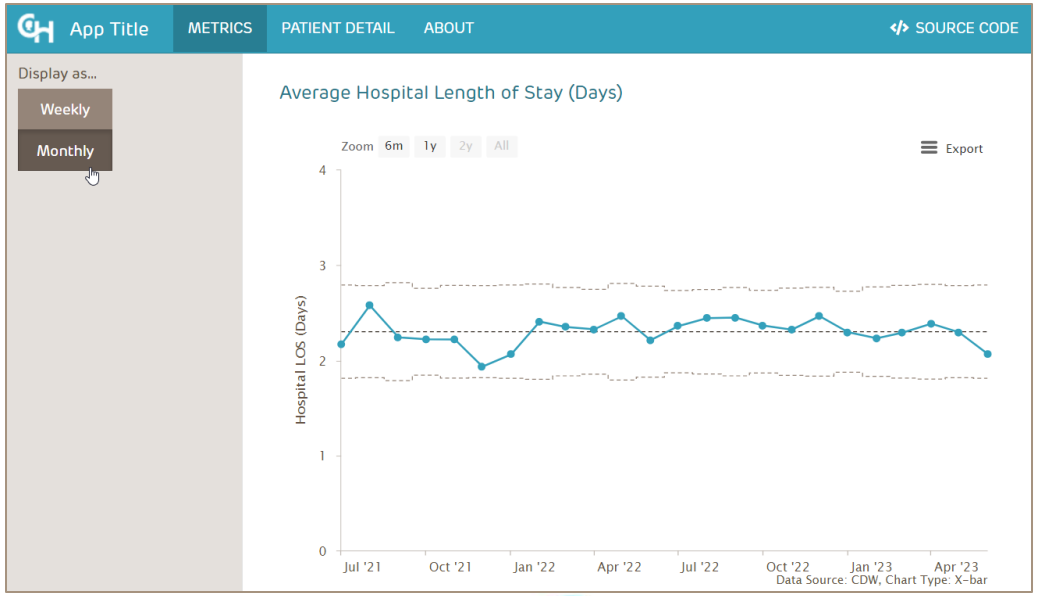
rocqi

- R for OCQI
- data connections
- visualization
- Rmd templates
- data sets

```
run_sql("select pat_key from patient limit 10")
run_sql_file("fact_ortho_patients.sql")
```



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technical debt

"is a concept in software development that reflects the **implied cost of additional rework** caused by choosing an easy (limited) solution now instead of using a better approach that might take longer" - wikipedia

- copy pasting code instead of using functions
- hard coding things that could be soft coded
- hard to read:
  - sparse annotation
  - messy style (lint)
  - object names too abstract (a, a1, a2, …)

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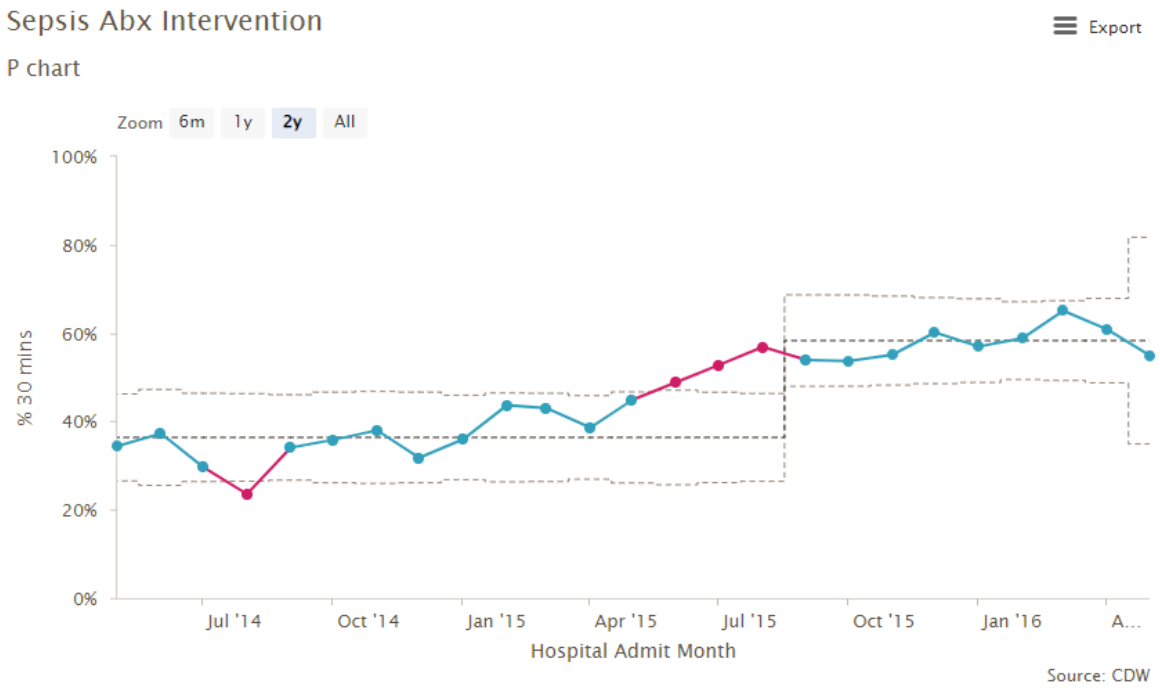
charts got us started

- spc() & hc_spc() – uses qichats2, ggplot2, highcharter

```
highchart(type = "stock") ▷
  hc_add_series(
    df, name = chart_title , hcaes(x = x, y = y),
    type = "line", dashStyle = "Solid", color = chop_colors("blue"),
    marker = marker_point(chop_colors("blue"))
  ) ▷
  hc_add_series(
    df, name = "UCL", hcaes(x = x, y = ucl),
    type = "line", dashStyle = "ShortDash", color = chop_colors("brown2"),
    step = "center", marker = list(enabled = FALSE)
  ) ▷
  hc_add_series(
    df, name = "Centerline", hcaes(x = x, y = cl),
    type = "line", dashStyle = "ShortDash", color = chop_colors("blue"),
    step = "center", marker = list(enabled = FALSE)
  ) ▷
  hc_add_series(
    df, name = "LCL", hcaes(x = x, y = lcl),
    type = "line", dashStyle = "ShortDash", color = chop_colors("brown2"),
    step = "center", marker = list(enabled = FALSE)
  ) ▷
  hc_title(text = "Some title about this chart")  ▷
  hc_subtitle(text = "P chart")  ▷
  hc_credits(enabled = TRUE, text = "Source: CDW") ▷
  hc_xAxis(title = list(text = "Hospital Admit Date"))) ▷
  hc_yAxis(title = list(text = "% 30 mins")) ▷
  hc_theme_chop()
```

```
hc_spc(
  data = df,
  x = x,
  chart = "p",
  title = "Some title about this chart",
  subtitle =  "P chart",
  caption = "Source: CDW",
  xlab = "Hospital Admit Date",
  ylab = "% 30 mins"
)
```



easy queries

- Use ODBC connections: connect, run query, disconnect

```
run_sql(
  sql = "select * from abc",
  dsn = "cdwprd",
  lowercase_names = TRUE
)
```

- Also have

```
run_sql_file(
  path = "fact_ortho.sql",
  dsn = "cdwprd",
  lowercase_names = TRUE
)
```

- Returns a tibble

```
write_to_cdw(
  data,
  table_name,
  dsn = "QMR_DEV",
  overwrite = TRUE,
  ...
)
```

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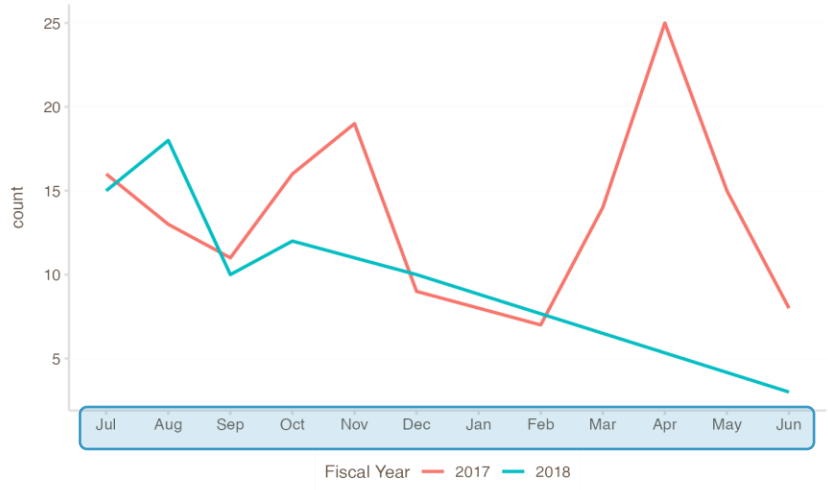
date helpers

- fiscal_month("2021-07-01") returns a factor list July -> June

```
fiscal_month("2020-07-01")
#> [1] Jul
#> Levels: Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun

fiscal_month("2020-11-01", format = "%B")
#> [1] November
#> 12 Levels: July August September October November December January ... June
```

```
ggplot(
 weekend_surgeries,
 aes(x = fiscal_month(surgery_dt), ...)
) +
geom_line()
```




```
fiscal_year("2021-01-01")
#> [1] 2021

fiscal_year("2021-07-01")
#> [1] 2022
```

```
# Fiscal Quarter can be formatted using 'glue' syntax
fiscal_quarter("2020-07-01")
#> FY'21 Q1

fiscal_quarter("2020-07-01", "{q}")
#> 1

fiscal_quarter("2020-07-01", "Q{q}'{yy}")
#> Q1'21

fiscal_quarter("2020-07-01", "{yyyy} Q{q}")
#> 2021 Q1
```

making pretty tables

- remove _key fields
- _date fields nicely formatted
- _ind fields
  - convert 0/1 values to Y/N (customizable)
  - remove _ind suffix
- Columns become title case
  - has wordbank to keep uppercase (customizable)

- naming conventions
  - prefixes: n_ → #, pct_ → %
  - suffixes: _mins → (Minutes),
  - also hr, wk, mon, qtr, yr, fy and plural hrs, wks, etc

visit_key	age_years	sex	ed_arrival_date	icd10_code	bone	ed_los_hours	sedation_pathway_ind	outside_imaging_ind	ketamine_given_ind	time_to_ketamine_mins
All	All	/	All	All	All	All	All	All	All	All
35590394	10	M	2021-07-04	S52.5	radius	5.3	1	0	1	263
85458397	14.2	M	2021-07-04	S59.0	ulna	5	0	0	0	
40604796	10.3	F	2021-07-04	S59.2	radius	5.5	1	0	0	
95357307	12.6	M	2021-07-05	S52.6	ulna	6	1	0	1	263
54304343	10.1	M	2021-07-05	S52.6	ulna	6.6	1	0	0	

Age Years	Sex	ED Arrival Date	ICD10 Code	Bone	ED LOS Hours	Sedation Pathway	Outside Imaging	Ketamine Given	Time To Ketamine (Minutes)
All	All	All	All	All	All	All	All	All	All
10	M	07/04/2021	S52.5	radius	5.3	Yes	No	Yes	263
14.2	M	07/04/2021	S59.0	ulna	5	No	No	No	
10.3	F	07/04/2021	S59.2	radius	5.5	Yes	No	No	
12.6	M	07/05/2021	S52.6	ulna	6	Yes	No	Yes	263

CHOP style guide is easy to follow

- chop_colors("blue-4", "pink2") – returns hex codes

- show_chop_colors() – returns a plot or a table

```
show_chop_colors()
```


```
> show_chop_colors("table")
# A tibble: 9 x 7
  shade blue    pink    green   brown   `dark-blue` white
  <int> <chr>   <chr>   <chr>   <chr>   <chr>       <chr>
1     1 #d6ecf1 #f6d2e0 #e4ebd8 #e0ddda -           -
2     2 #add9e4 #eca4c1 #c9d7b2 #c2bbb5 -           -
3     3 #85c6d6 #e377a3 #afc28b #a39990 -           -
4     4 #5cb3c9 #d94984 #94ae65 #958579 -           -
5     5 #33a0bb #d01c65 #799a3e #665546 -           -
6     6 #26778b #9c154c #5b732f #4d4035 -           -
7     7 #1a505e #680e33 #3d4d1f #332b23 -           -
8     8 #0d282f #340719 #1e2710 #191512 -           -
9    NA -       -       -       -       #005587     #fbfbfb
```

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easy themes

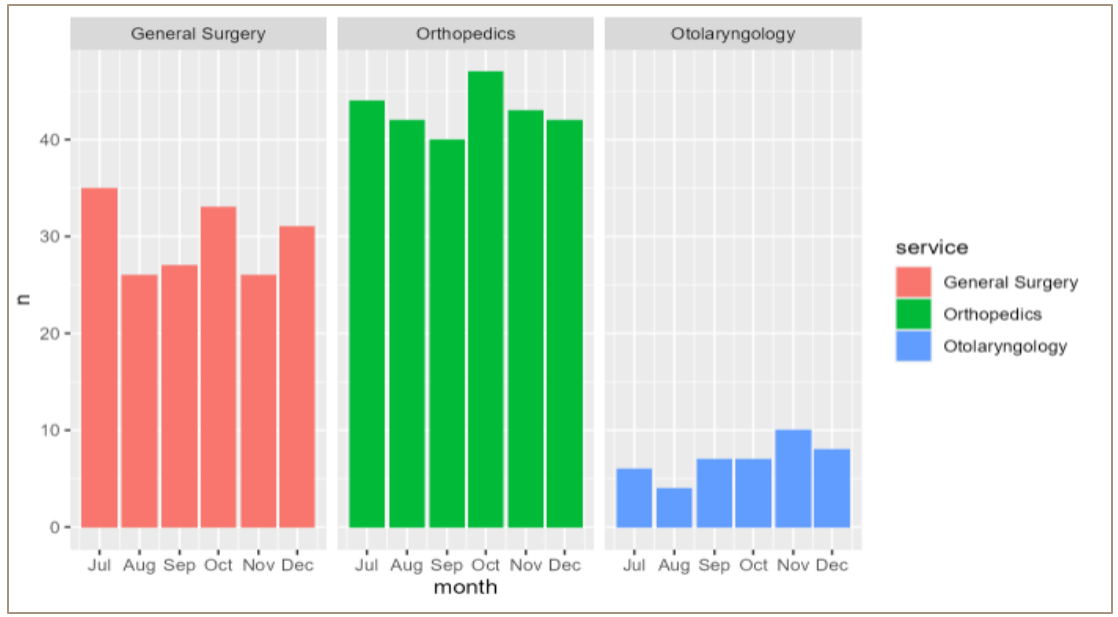
theme_chop() & hc_theme_chop ()

- font family, font sizes, legend position, no grid lines, white background

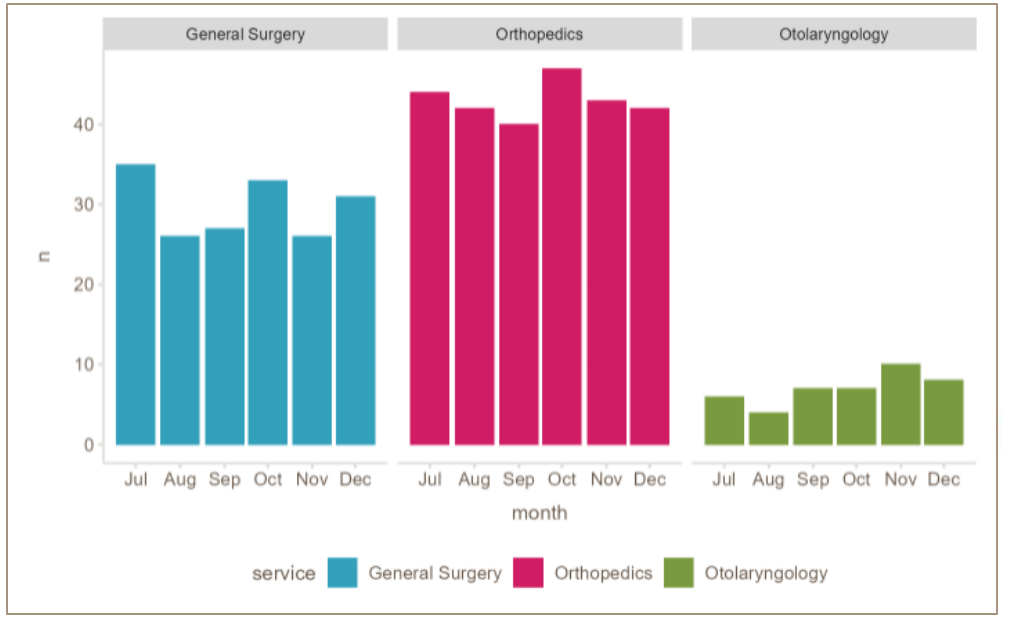
scale_fill_chop() & scale_color_chop()

- cycles through our CHOP colors

original



theme_chop() + scale_fill_chop()

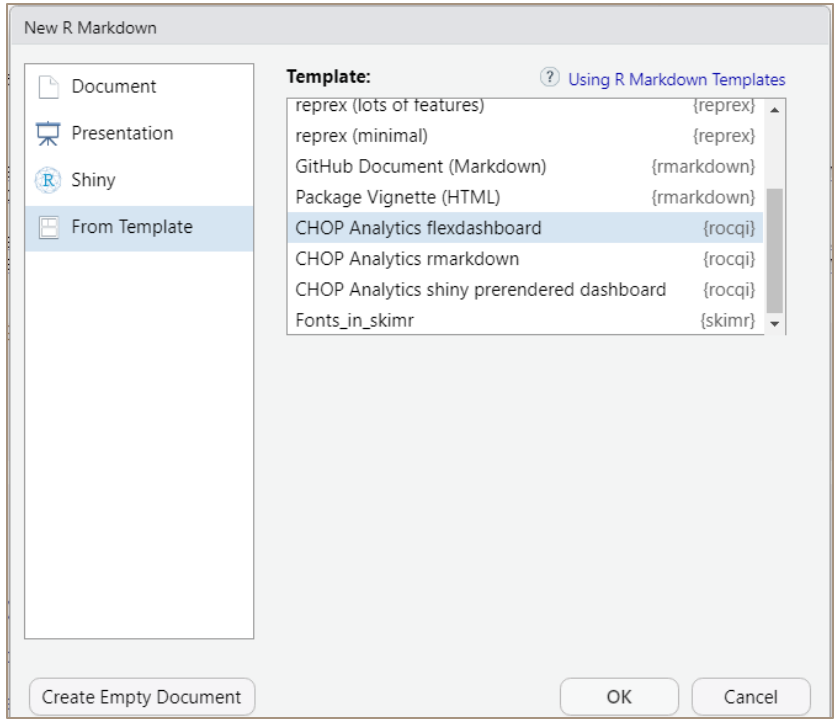


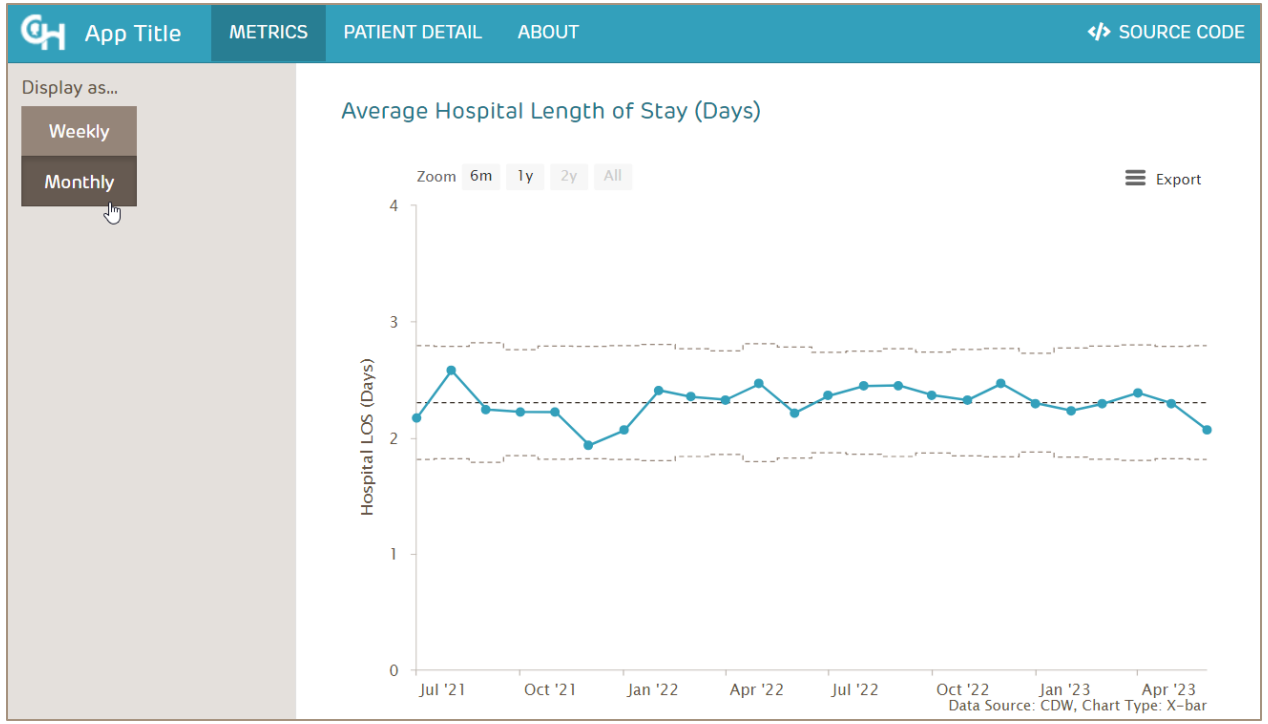
ready-to-go templates

- fonts, colors, logo, standard layout
- 3 templates:
  - flexdashboard
  - rmarkdown
  - shiny prerendered

```yaml
---
title: "App Title"
runtime: shiny
output:
  flexdashboard::flex_dashboard:
    orientation: rows
    vertical_layout: fill
    source_code: embed
    logo: https://github.research.chop.edu/pages/CQI/flexdashboard-theme/images/logo/chop-icon-header.png
    favicon: https://www.chop.edu/sites/all/themes/chop/favicon.ico
    css:
        - https://github.research.chop.edu/pages/CQI/chop-bootstrap/bootstrap-3/bootstrap.min.css
        - https://github.research.chop.edu/pages/CQI/flexdashboard-theme/css/flexdashboard.min.css
---

```





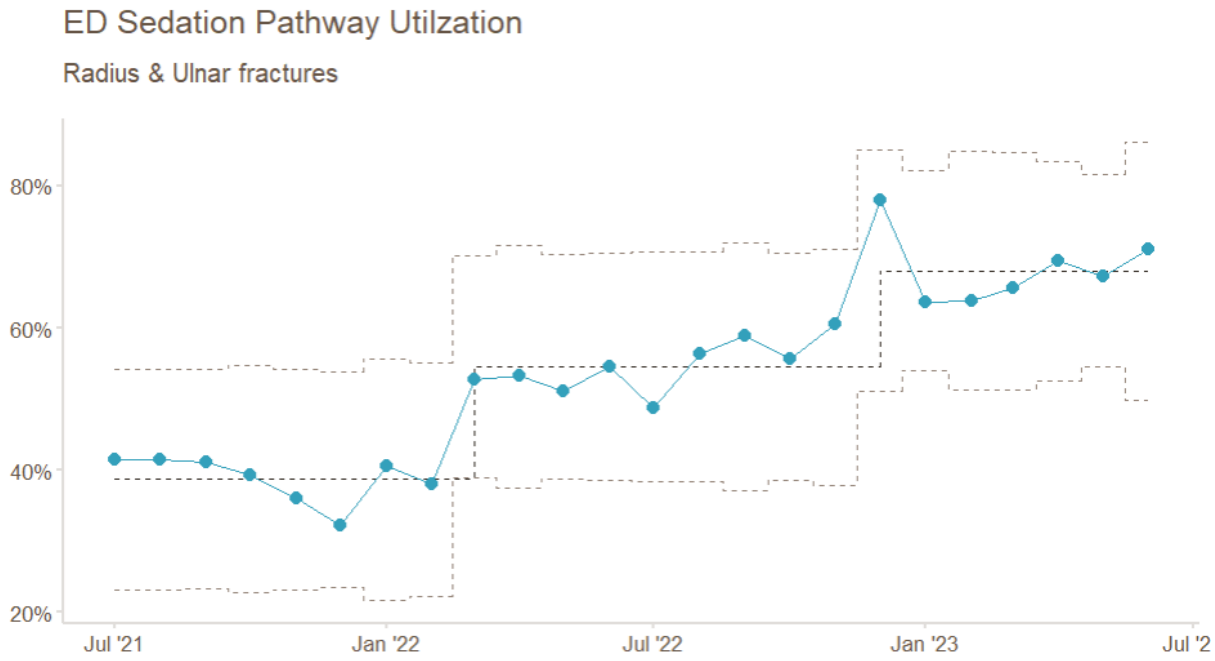
built in data sets

- ed_fractures & surgeries

- used in help file documentation, vignettes, & slack for troubleshooting

- reflects the kinds of distributions & problems we often see in the data

- created programmatically, no sensitive data



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honorable mentions

nice_display_names()

- uses regex and wordbank to nicely title a vector of values

recode_indicator()

- recodes 0, 1, and NA values

remove_incomplete_end_dates()

- removes data if still in current timeframe (day, week, month, year)

add_date_columns()

- add columns based on date field _day, _week, _month, etc via floor_date()

how it's done

Prioritization

- Monthly sprint meetings – GitHub issues > project board
- we have merged 248 PRs over 33 releases

Maintenence

- feature branches → committed to GitHub (enterprise)
- PR → code review & CI (continuous integration) via webhooks & Jenkins
  - tests – testthat & covr
  - style – tidyverse style guide, lintr
  - spelling
- main branch regularly updated with periodic releases → CHOPRAN

Documentation

- roxygen2 for all function documentation
- pkgdown for rendering the package site

impact

- 18 authors, 3 maintainers
- Adam Rudofker • Brendan Graham • Christian Minich • Connie Tan • Emily Schriver • Ezra Porter • Jake Riley • Joe Mirizio • Kyle Winser • Matt Devine • Matt Dye • Max Seidman • Nathaniel Schmucker • Paul Wildenhain • Renée Bruhn • Ryan Hawkins • Yuchen Zhang • Zach Dravis

- great way to share best practices with each other

- several of us have since authored our own packages

- contribution back to highcharter, qicharts2, ggplot2 with bugs, feature requests, and pull requests

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