USING R TO AUTOMATE THE INVESTIGATION OF POTENTIAL PEDIATRIC HEALTH DISPARITIES

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R/Medicine

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CHOP is using R to jumpstart the investigation of potential pediatric health disparities

- An assessment of previous project work revealed a **dearth of initiatives** directly relating to the investigation of potential health disparities

- A strong desire to address this gap was not enough to overcome the challenges of performing **manual data analysis**

- We leveraged existing data infrastructure to create an internal R package that **automatically generates** stratified data sets and graphs

Who we are and who we serve

CHOP Facts

- The nation's first pediatric hospital
- 546 beds, >1 million inpatient and outpatient visits per year
- 250 active international patients per month
- Robust quality improvement program

BEST CHILDREN'S HOSPITALS
U.S.News & WORLD REPORT
RANKED IN 10 SPECIALTIES
2018-19

2017 Philadelphia Population Estimates

1,580,863 people
White: 44.8%
Black: 43.9%
Hispanic or Latino: 14.8%
Asian: 7.7%

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What is the purpose of quality improvement?

- Incorporating evidence-based care into practice with the goal of…
  - Standardizing/reducing variation
  - Increasing efficiency/reducing waste
  - Improving outcomes/minimizing harm

- CHOP's Office of Clinical Quality Improvement (OCQI) partners with clinical teams to help define issues, diagnose driving factors, test changes, and sustain progress

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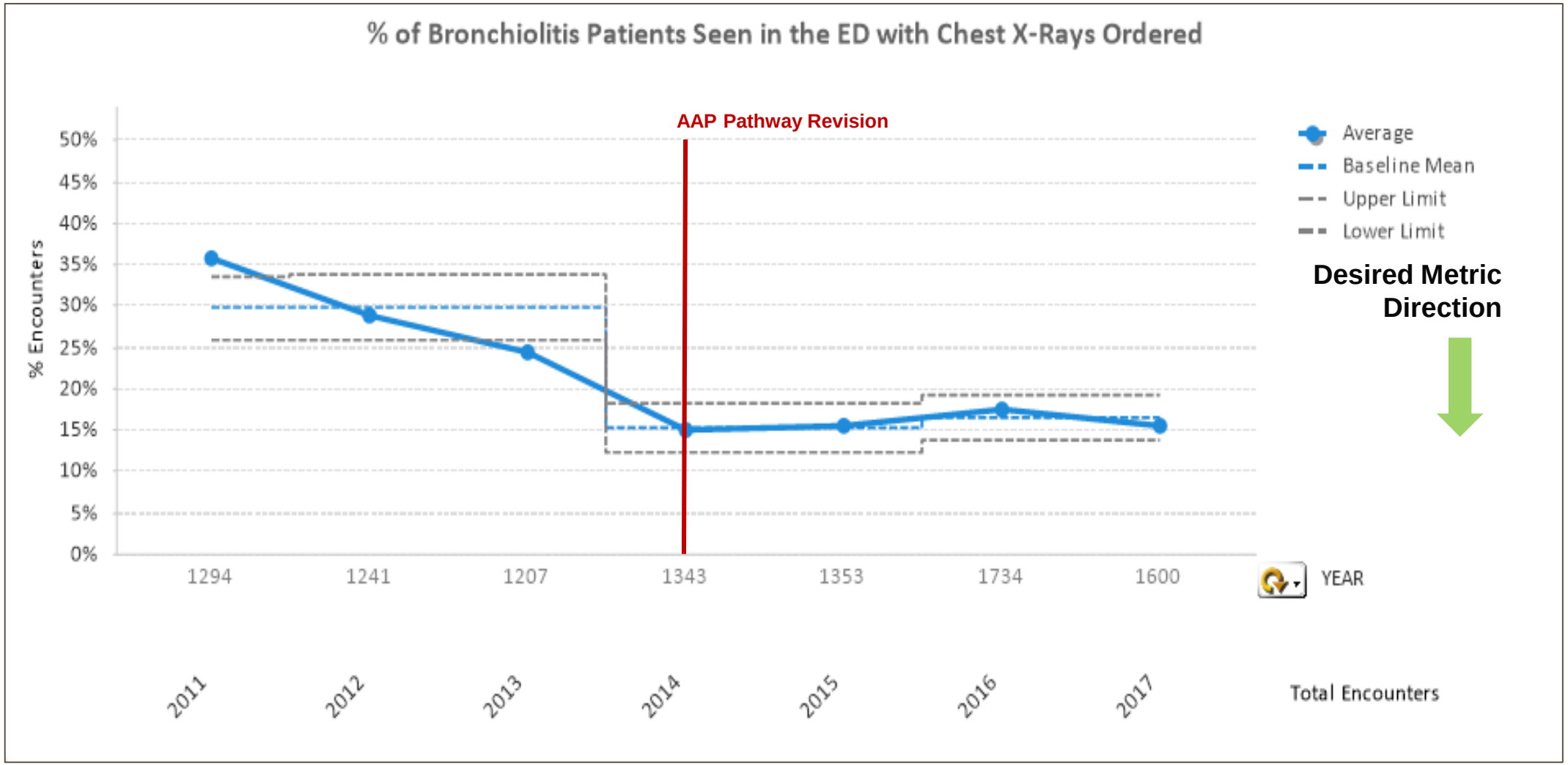
Reducing X-Ray Use: A successful QI initiative



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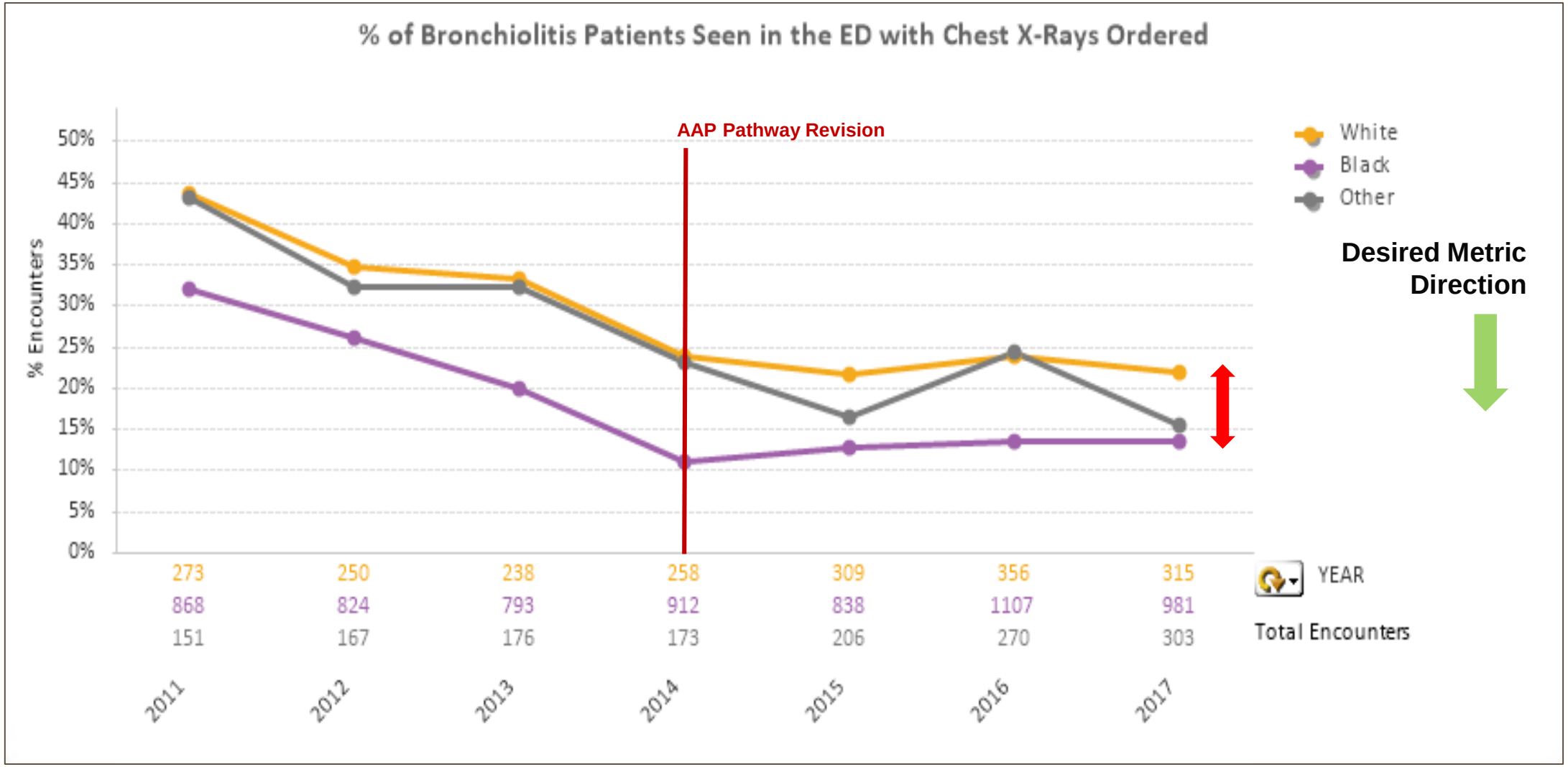
But what if we examine the data differently?



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You won’t know if something might be happening unless you look.

We have *not* been looking and need to start

Total QI initiatives worked on by OCQI (completed or in progress) since July 2013**: 159**

Barriers to implementing a blanket disparities screen:

- Manual work to add in demographic data fields and generate stratified visualizations is time consuming
- Manual analysis = tougher implementation of a standardized screening protocol

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The need for simple, systematic approach to screening for potential disparities led to the creation of the internal *demographics* package.

The internal *demographics* package was the right solution

Resources at our disposal:

- Enterprise data warehouse containing data from our EMR
- Data mart structure where project cohorts and metrics were packaged into predefined tables
- Ongoing team initiative to increase R utilization
- Experience creating an internal R package to automatically generate statistical process control charts

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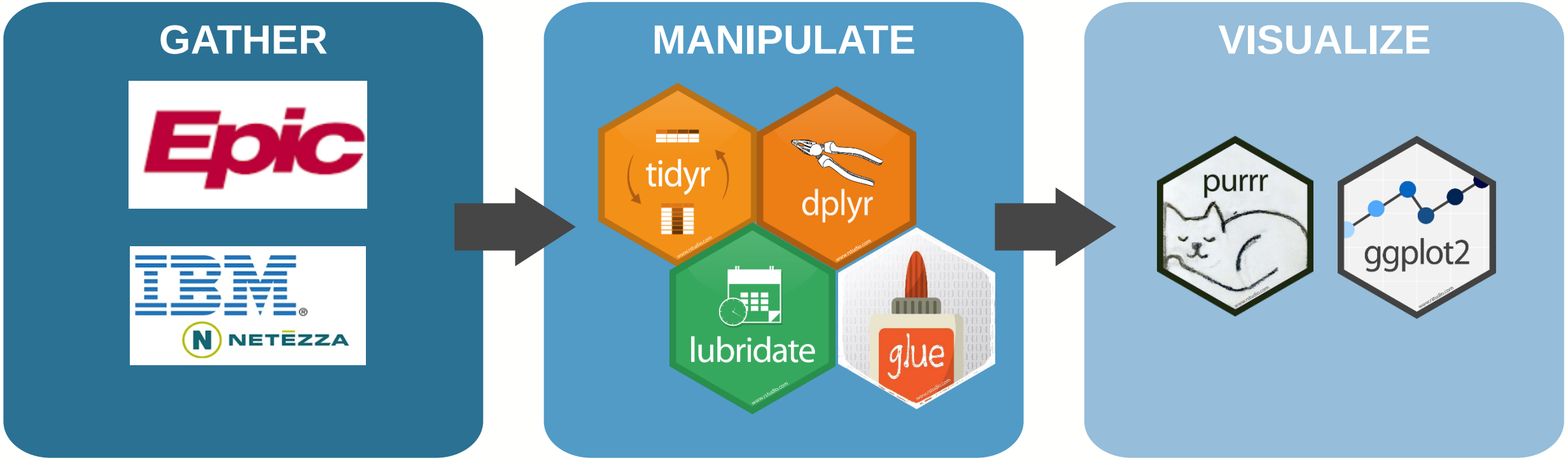
The *demographics* package automatically generates stratified charts

- Outputs three charts, stratifying the given metric by three different demographic categories:
  - Race/Ethnicity, Insurance Payer Type, Primary Language
- Demographic information added automatically to cohort based on patient medical record number and visit account number
- Charts can be either bar or run charts
  - Bar charts useful for an overall summary—default argument
  - Run charts useful to establish if differences changed over time

The *demographics* package automatically generates stratified charts

Back-End Process:



Retrieve demographic data and add to cohort

Prepare data for plotting

Iteratively generate plots

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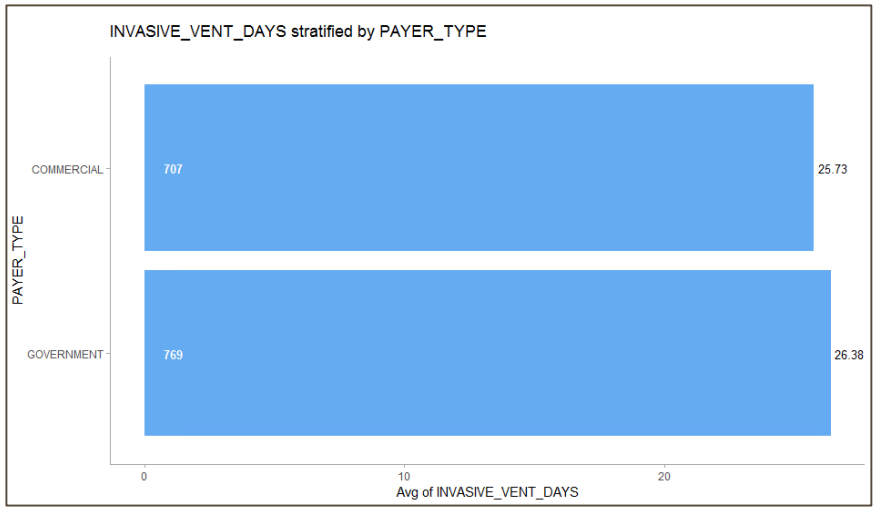
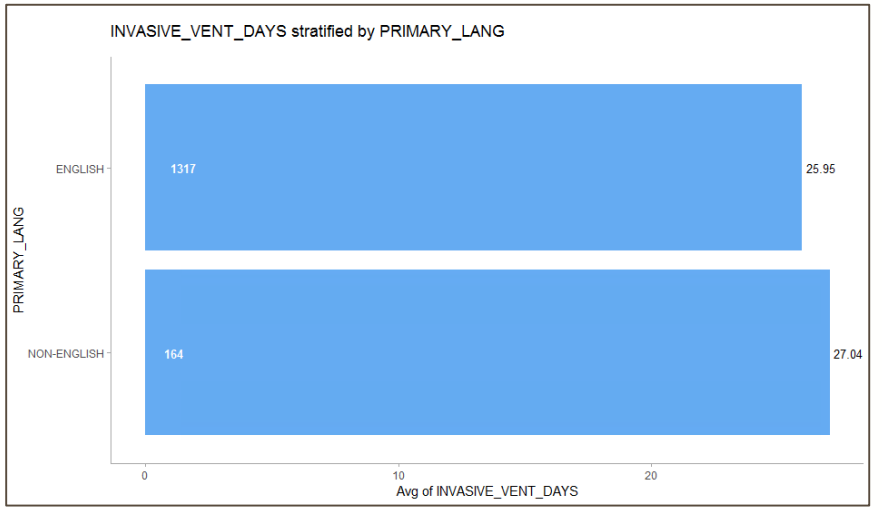
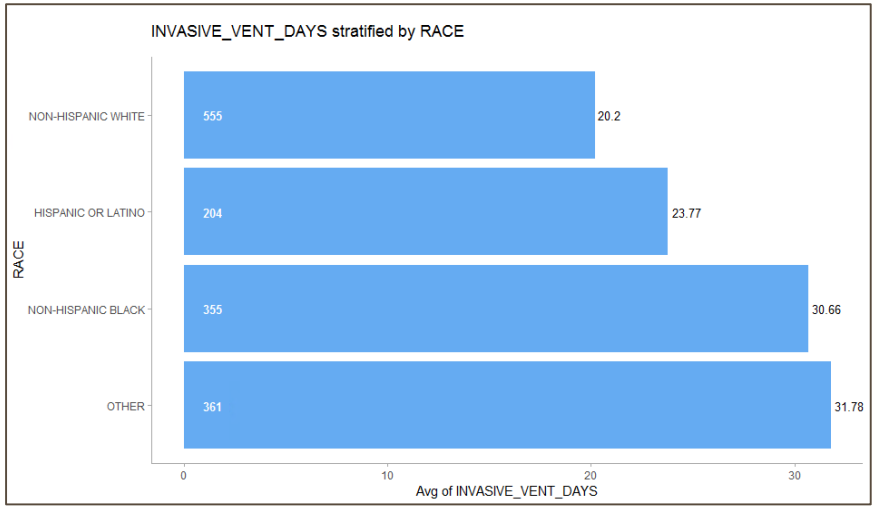
The *demographics* package automatically generates stratified charts

```
demographics::screen_demos(table = "COHORT_NAME", metric = "METRIC_NAME")
```







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How has the *demographics* package been used to identify potential disparities?

Case study #1: AKI in the ICU

Project Overview

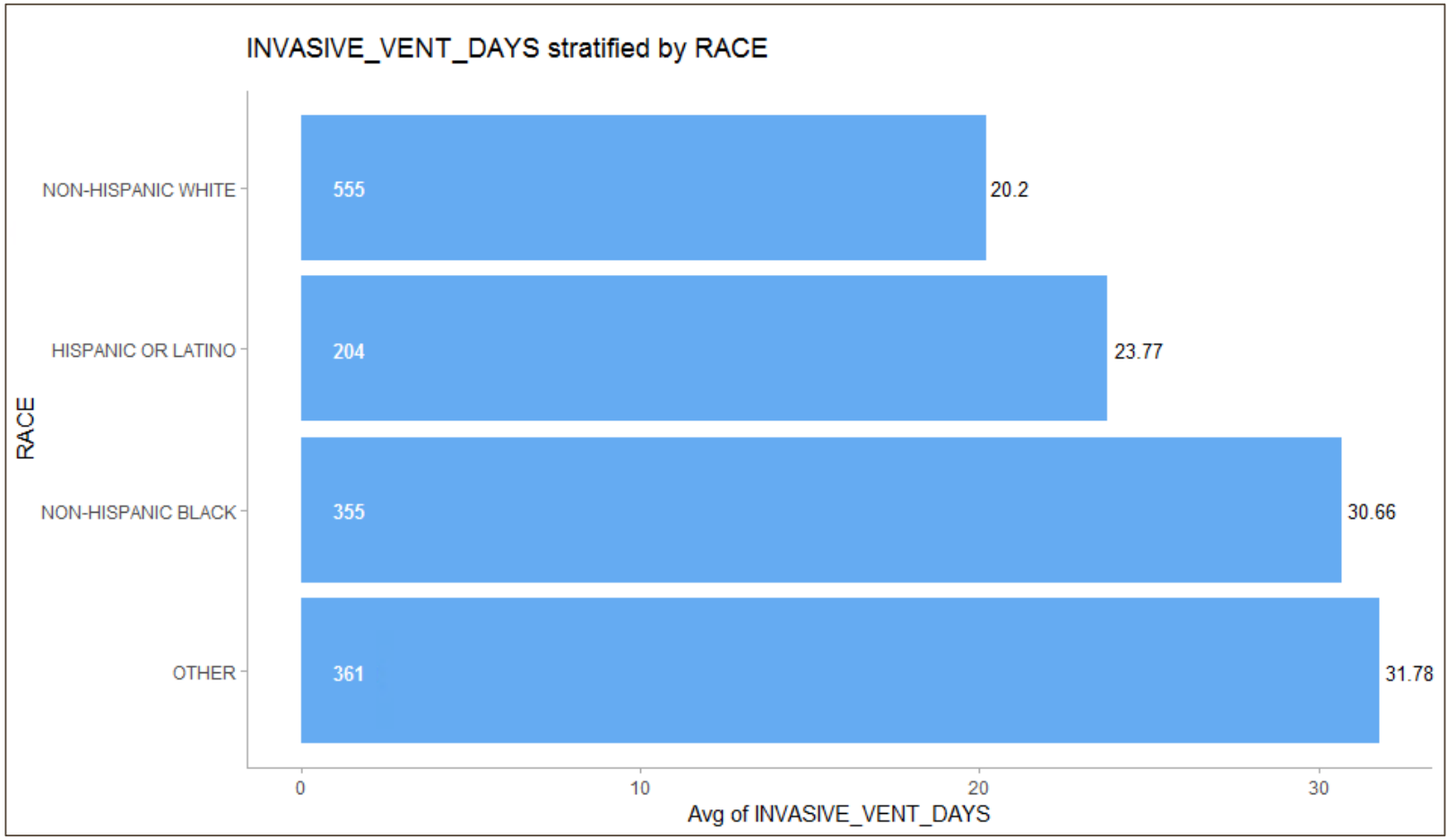
Cohort: Patients with acute kidney injury (AKI) in an intensive care unit (ICU) on invasive ventilation

Goal: Reduce the total days spent on invasive ventilation

Bar charts were generated because: there is limited historical data available for this cohort

Case study #1: AKI in the ICU

```
demographics::screen_demos(table = "FACT_AKI_COHORT", metric = "INVASIVE_VENT_DAYS")
```



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Case study #2: NPO Clear Fluid Fasting Time

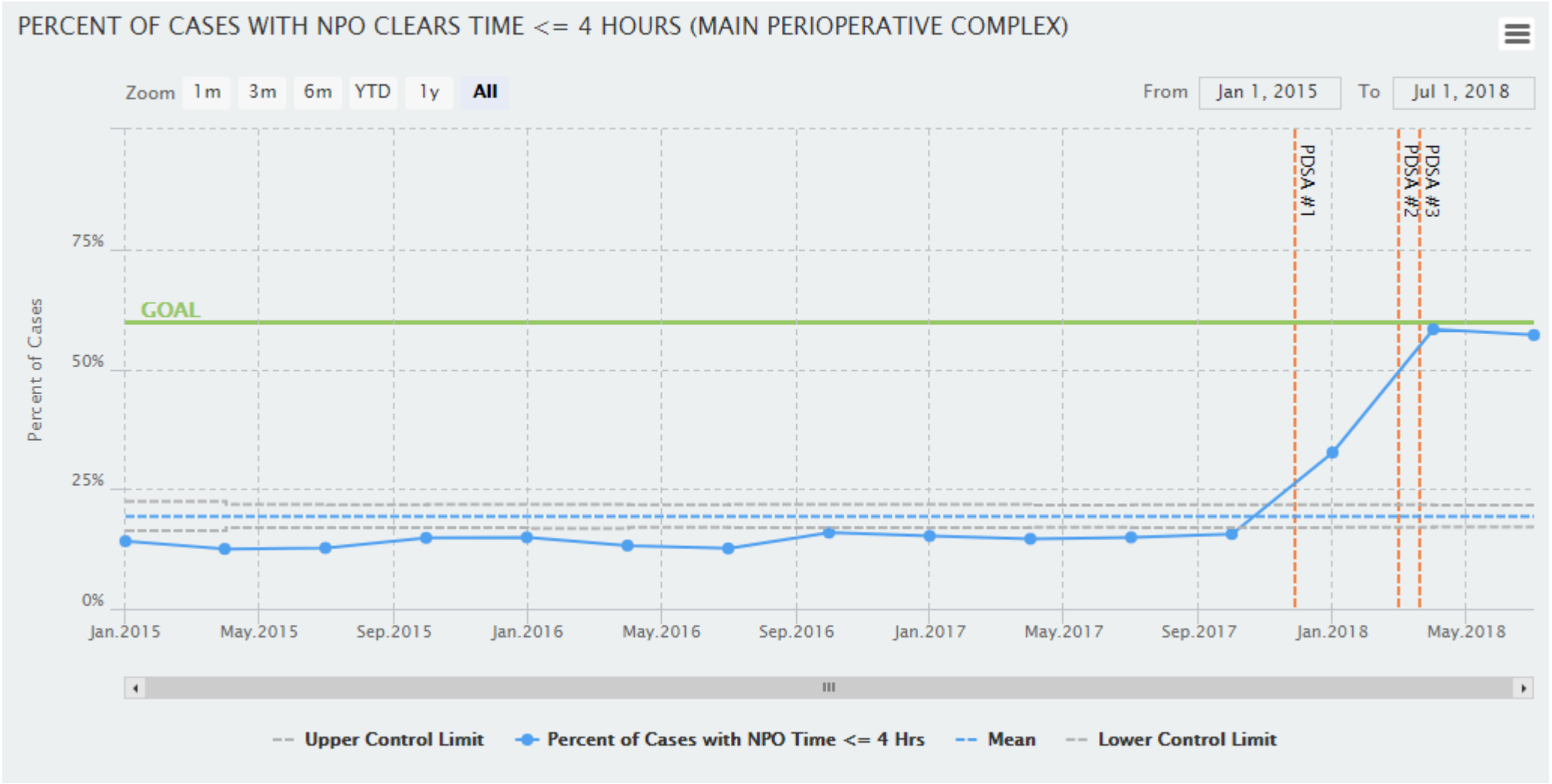
Project Overview

Cohort: Patients coming from home for an anesthetic procedure who were discharged on the same day

Goal: Reduce the NPO clear fluid fasting time to 4 hours or less for 60% of cases

Run charts were generated because: there is ample historical data from the point of the first intervention

Case study #2: NPO Clear Fluid Fasting Time



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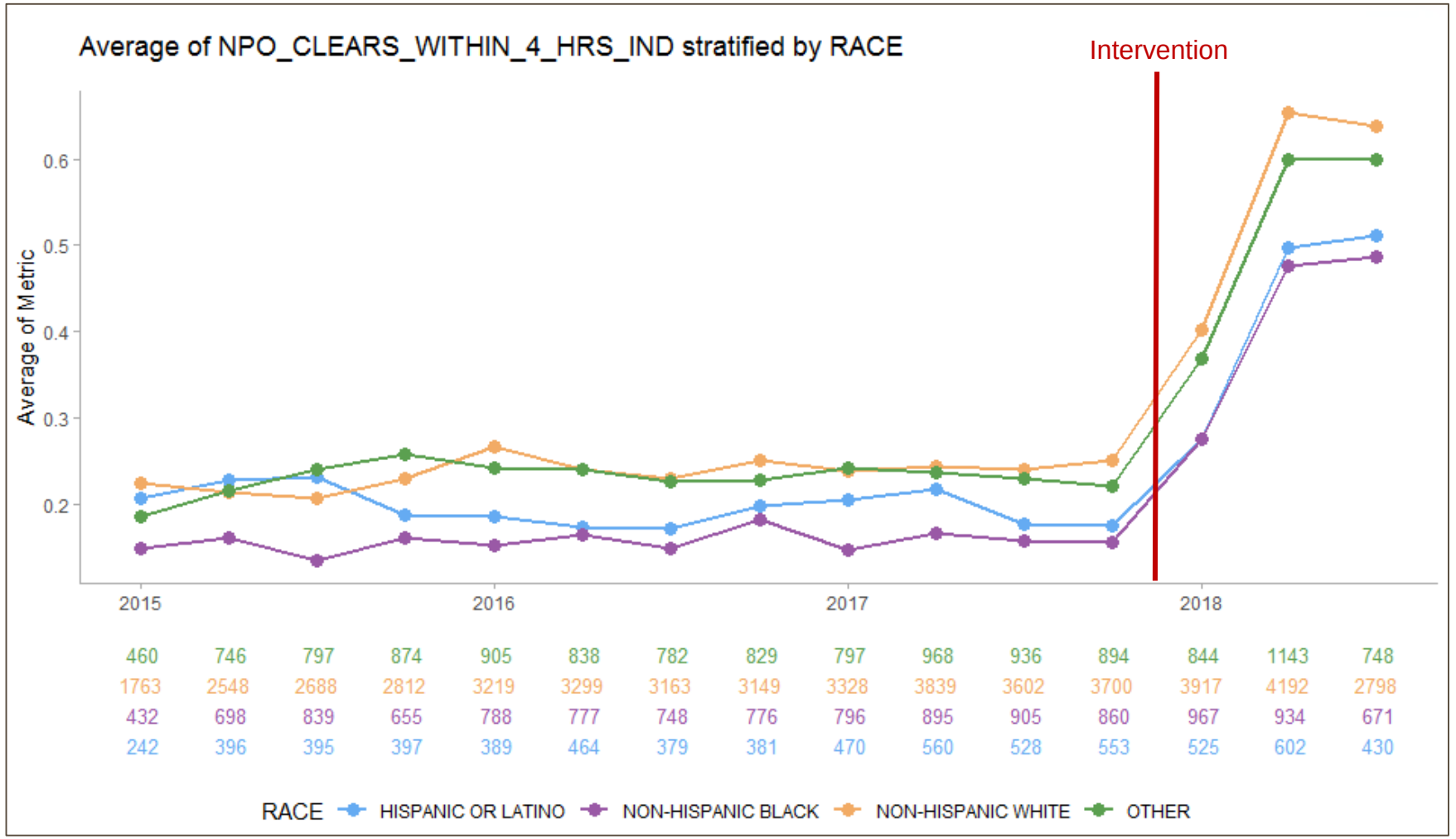
Case study #2: NPO Clear Fluid Fasting Time

```
demographics::screen_demos(table = "FACT_NPO", metric = "NPO_CLEARS_WITHIN_4_HRS_IND", date = "ANES_DT",
                           chart_type = "run")
```



Pre-Intervention #1 (Dec 2017) Average:
Non-Hispanic White: 24%
Non-Hispanic Black: 16%
Difference: 8%

Post-Intervention #1 Average:
Non-Hispanic White: 53%
Non-Hispanic Black: 37%
Difference: 16%

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Moving Forward

Technical Enhancements

- Leverage data marts and project metadata repository to automatically run function
- Create dashboard for easy exploration
- Add more stratification variables

Infrastructure Building

- Establish a workgroup dedicated to disparities investigation
- Use data to generate stories and create guidance

The package is not for drawing conclusions, but for having data to serve as a starting point.

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Summary

Disparities potentially exist, but investigation must precede action.

R is a great tool for automating analyses addressing organizational gaps.

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GitHub mirror: https://github.com/chop-analytics/demographics

CHOP's QI Program: https://www.chop.edu/centers-programs/quality-and-patient-safety

Also, we're hiring! Contact us for more information if interested!

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