Carnegie Mellon University
Tepper School of Business

Vitalant Blood Donation CMU Capstone

MS Business Analytics Program

Meet the team

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ABSTRACT

Vitalant, the nation's largest independent and nonprofit blood services provider, has been facing declining blood donations over the past decade. The United States as a whole is facing blood supply shortage.

Pittsburgh area donor information for a 12 year period was the basis of examination, analyzing, and modeling for the team. Data was taken through many iterations of analyzing trends and developing churn prediction models.

The team confirmed a handful of the theories posited by the Vitalant team sponsors, and brought new information to light.
The disparity among older and younger donors was confirmed, yet the team was able to identify that this is mainly due to lack of returning donors in younger generations. Donors that returned acted similarly across all generations.

The team was able to isolate which factors are indicative of higher churn (or lower retention), which are mainly the amount of prior visits and whether the previous visit was successful.

While the team was able to confirm many suspicious and bring new trends to light, many of these analyses can be continued for future work to continue to understand the donor base behavior, especially as more data becomes available.

INTRODUCTION

Vitalant is the nation's largest independent, nonprofit blood services provider exclusively focuses on providing lifesaving blood and comprehensive transfusion medicine services

Blood donations have decreased over the past decade. Hindered further by COVID, a lack of blood donors has the United States facing a nationwide blood shortage

Pittsburgh has been particularly problematic in terms of blood donations. As a health tourism destination, Pittsburgh needs more blood than the average U.S. city (at least 600 donations a day) - Vitalant currently sees less than half of that on average. Aging donors and closure of schools and offices has been particularly challenging on the local blood supply

Donations: Timeline (2012 - 2022)
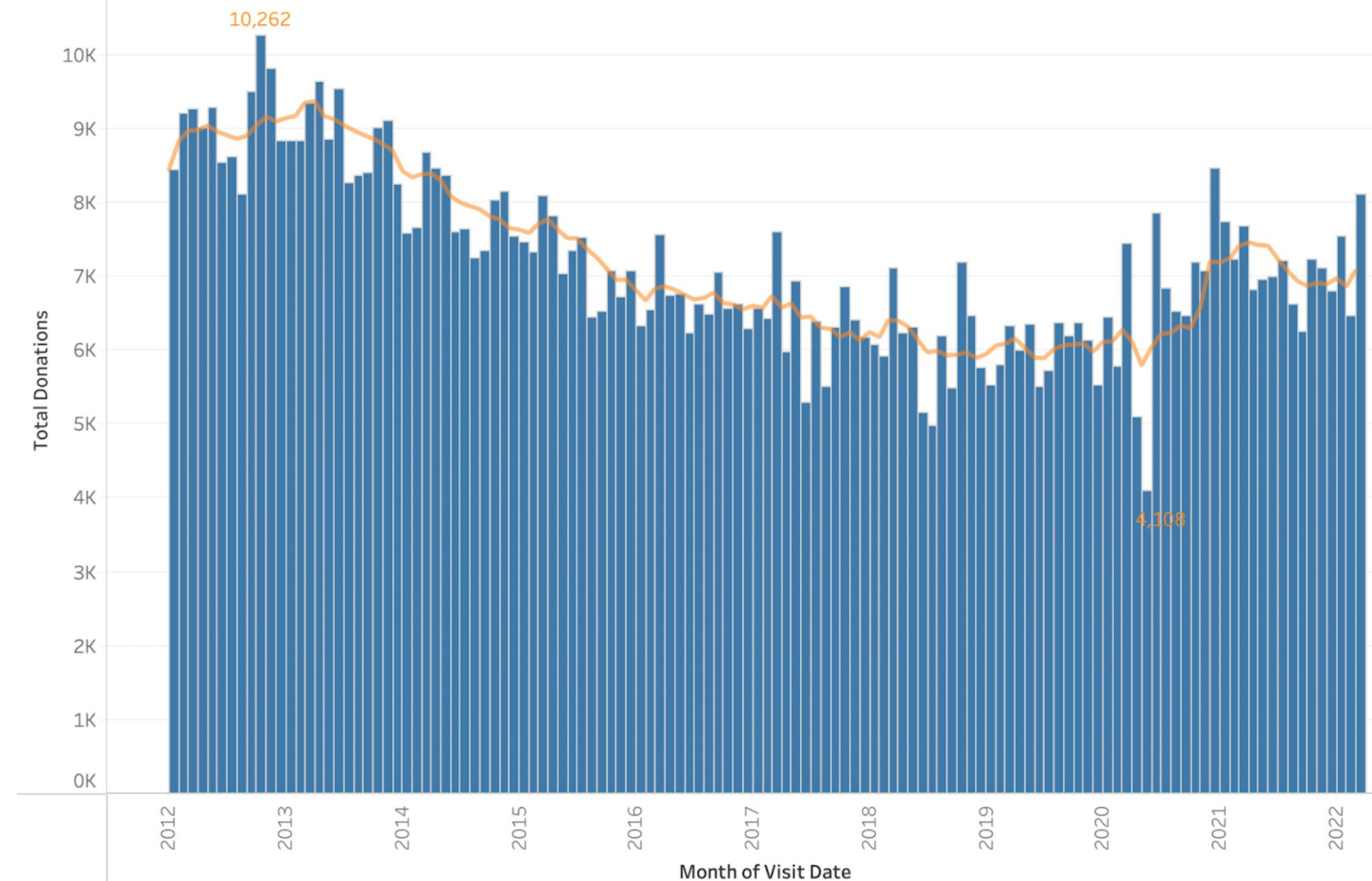
METHODS AND MATERIALS

The team was presented with 12 years of historical blood donation activity data for the Pittsburgh regional area. The data included basic information about a blood donation (such as donation date, age, sex, location, and blood type).

Upon initial data discovery, the team discovered that Churn would be an important area of focus during the project due to 1) high levels were observed in the data (90%+ for certain cohorts), 2) they were increasing over time, and 3) the Vitalant team did not appear to have analytics capabilities available to measure this on their own.

Generation and donor behavior analysis surfaced important insights about donor cohorts over the 12-year period in question.

These analyses were approached from a holistic perspective spanning but not limited to the following areas:

- Data Cleaning & Aggregation
- Feature Engineering
- KPI definition to measure core business areas
- Descriptive reports of historical trends
- Logistic Regression to predict Churn
- Demographic statistics of local/regional populations and age cohorts
- Behavioral analysis

RESULTS

A couple selected results & insights the team was able to generate:

1. The team was able to build a Logistic Regression model with **78% accuracy for whether a donor will churn** (return within 400 days) after providing a blood donation. The model weights provide interesting insights:
   a. Appeals towards type O donors have been effective
   b. Promotions may lead to increased donors with slightly higher likelihood to churn
   c. Number of prior successful visits is one of the best indicators that a donor will donate additionally in the future (past donations is a good indicator of future donations)

2. Over the past 12 years, it's been identified that **younger cohorts appear to be churning at a higher rate** in more recent years.

Churn: First Donation by Age
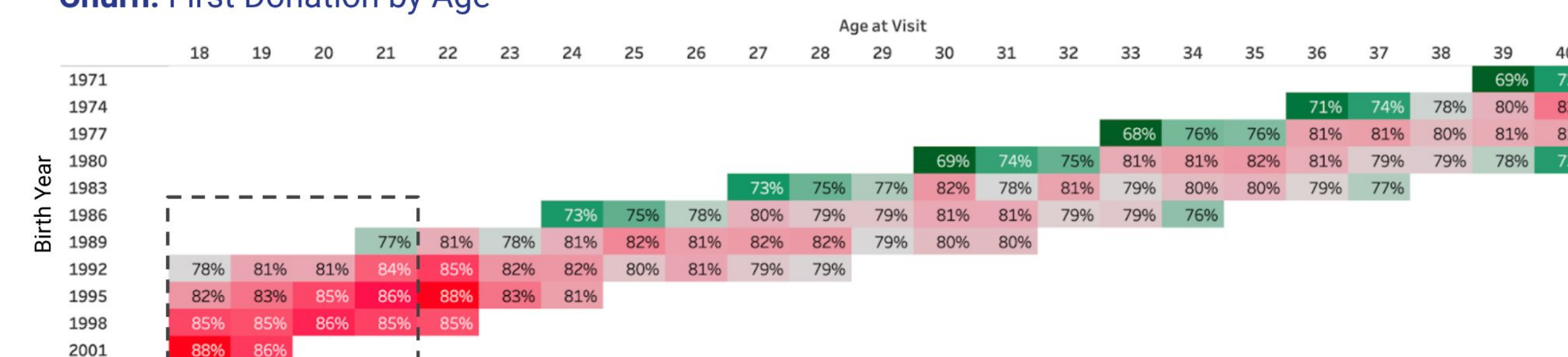
Repeat Donors by Generation
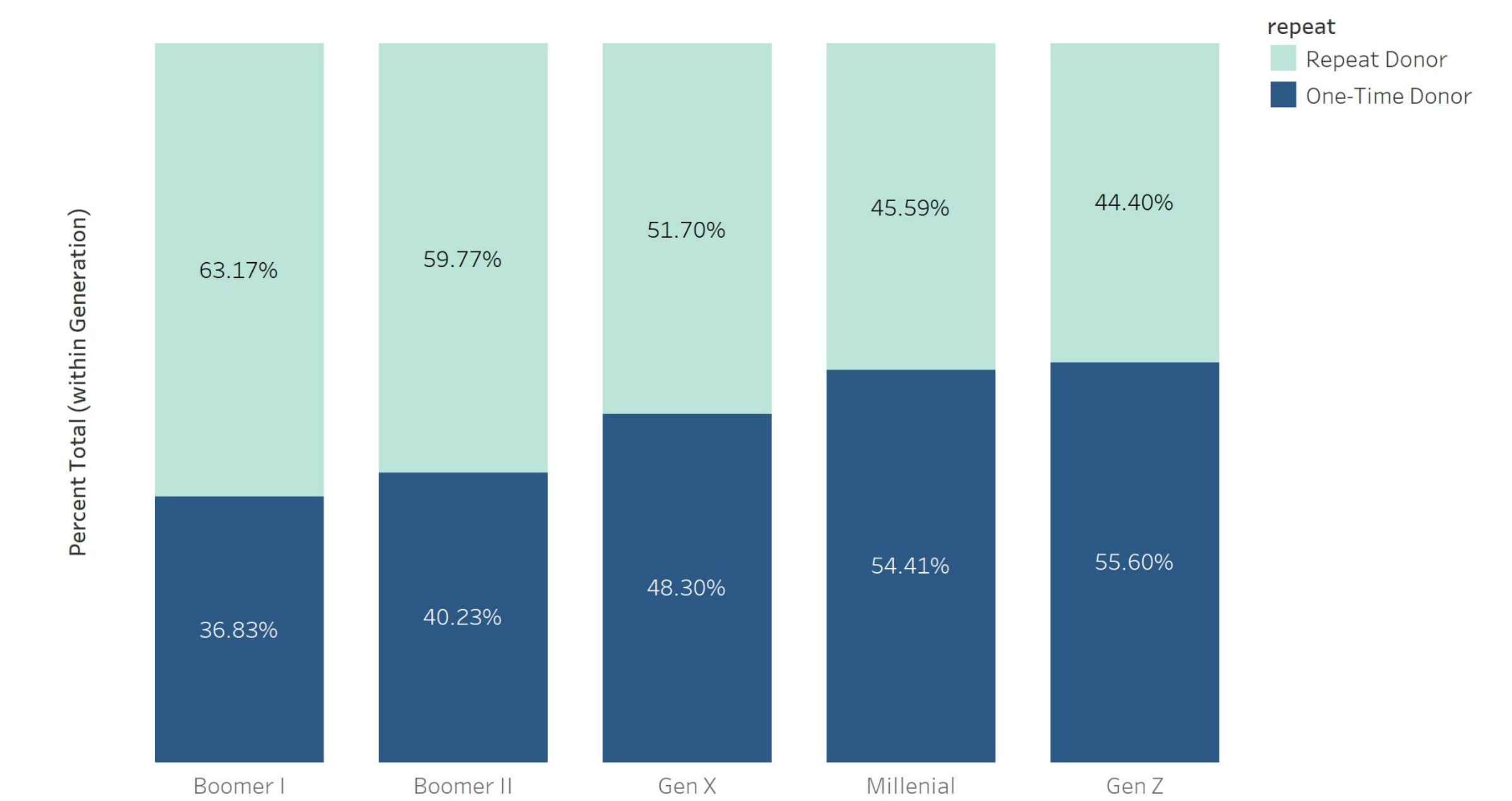
DISCUSSION

1. One interesting challenge with our data only going back 12 years is determining why older generations appear to churn less frequently than younger generations.
   a. One assumption was that older generations grew up around war and had stronger feelings of loyalty and honor that made them more likely to donate frequently.
   b. A second possibility is that age is a determining factor and not generation. Boomers may appear to donate more frequently than Gen Z because Boomers in our data are at a more optimal donation age.
   c. A third possibility is that number of donations is the true determining factor. Maybe older donors are more reliable simply because they have donated for a longer period.
2. A second challenge with our data is deciding when to consider a donation as 'first time'
   a. Just because the donor appears for the first time in our dataset, does not necessarily mean they did not donate prior to our observed data.
3. A third challenge is not knowing how people behave in the long run. For example, how often do people stop donating for 10+ years, only to return at a later time, and even become regular donors?

CONCLUSIONS

1. Age and previous donation frequency are strong predictors for future donations. Young donors (20s and 30s) are likely to donate more frequently in future decades (in their 40s, 50s, and 60s)
   a. We found evidence to support age was a strong determining factor for donor behavior (frequency and likelihood to churn) by observing donor behavior by birth year.
   b. Regression analysis pointed to number of previous donations as another strong indicator of future donations (likelihood to keep donating)
2. First time donors have high likelihood of churn (not returning for a second donation)
   a. If Vitalant can get a first time donor to come back for a 2nd or 3rd donation, they are much more likely to retain them for future donations.

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