

# RCDS.com Front Page AB Test - R

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```
## -- Attaching packages ----- tidyverse 1.3.1 --
## v ggplot2 3.3.6      v purrr  0.3.4
## v tibble  3.2.1      v dplyr  1.1.4
## v tidyr   1.2.0      v stringr 1.4.0
## v readr   2.1.2      v forcats 0.5.1

## Warning: package 'tidyr' was built under R version 4.0.5
## Warning: package 'readr' was built under R version 4.0.5

## -- Conflicts ----- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()

## Linking to ImageMagick 6.9.12.3
## Enabled features: cairo, fontconfig, freetype, heic, lcms, pango, raw, rsvg, webp
## Disabled features: fftw, ghostscript, x11
```

## 1 Overview

The product team for website rcds.com wants to create front page that will result in more people reaching the product service page. The motivation for this comes from user feedback sessions where 5/30 users expressed difficulty finding where to purchase rcds.com products. The design team have proposed moving the button from the hamburger menu to the center of the page and increasing the size.

### 1.1 Design Variants

**Original:** Interaction of interest exists in hamburger menu. **Variant 1:** Interaction of interest is moved to the center of the page. **Variant 2:** Interaction of interest is moved to the center of the page and increased

in size.

## 1.2 Metrics of Interest

We need to measure the impact of the design change on users clicking the interaction to make it to the product service page, and also the impact on purchases/revenue.

1. **Primary Metric:** Click-Through-Rate (CTR) from landing page to service page
2. **Secondary Metric:** Purchases per user visit
3. **Secondary Metric:** Revenue per user visit
4. **Secondary Metric:** Total purchases
5. **Secondary Metric:** Total revenue

## 1.3 Simulation

This is a fictitious example created to practice with R, and therefore I simulated the datasets with the following parameters:

- $p_{\text{baseline, ctr}} : 0.22$
- $p_{\text{exp1, ctr}} : 0.23$
- $p_{\text{exp2, ctr}} : 0.25$

All simulated datasets had the same purchase rates for different products (the purchase page remains unchanged in this experiment):

- $p_{\$0, \text{ purchase}} : 0.41$
- $p_{\$35, \text{ purchase}} : 0.3$
- $p_{\$75, \text{ purchase}} : 0.19$
- $p_{\$150, \text{ purchase}} : 0.1$

See the script `R/data_simulation.R` for recreation of datasets.

## 1.4 Power Analysis

Now back to “reality”. Discussions between the product and data science team has indicated that we would impliment changes if we see a 2% lift in click through rate to the purchase page.

Because we believe our experimental pages will make it easier to progress on the website, we will be doing a one-sided analysis.

Utilizing a tool from UBC we can estimate how many visits we need in our website variants and how long it will take. We will use the following:

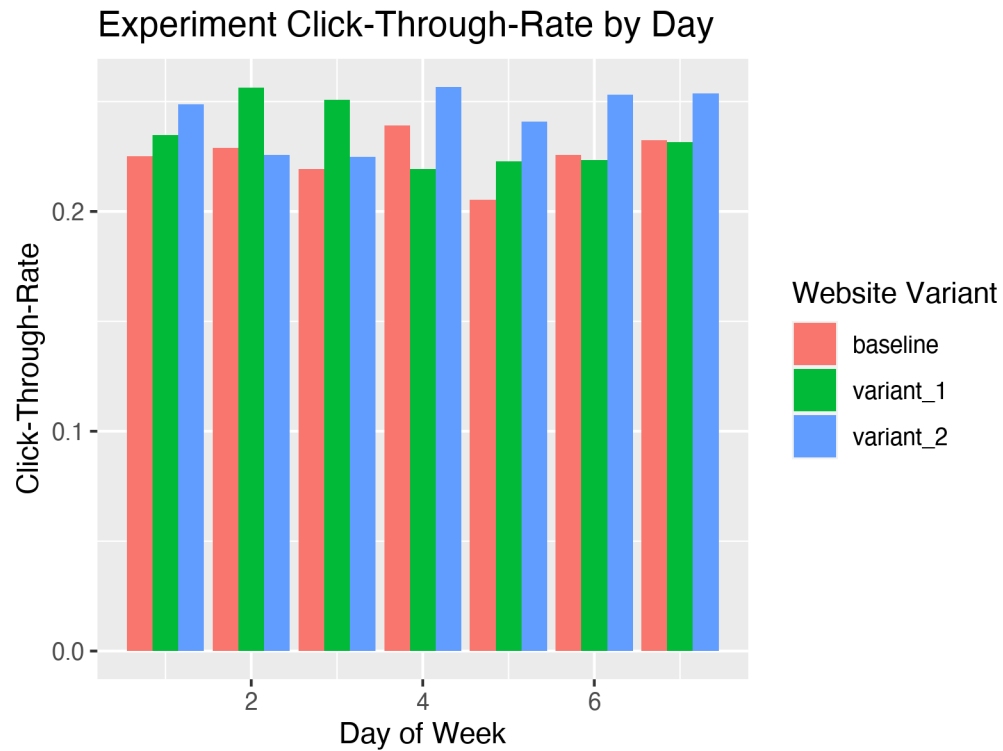
- $\beta = 0.80$
- $\alpha = 0.05$
- $p_{\text{baseline, ctr}} : 0.22$
- $p_{\text{change, ctr}} : 0.24$
- *Test Type : One – Sided*

This results in a needed 5,474 visits per website variant. The website averages 17,000 visits per week. This means that the experiment will take an estimated 7 days.

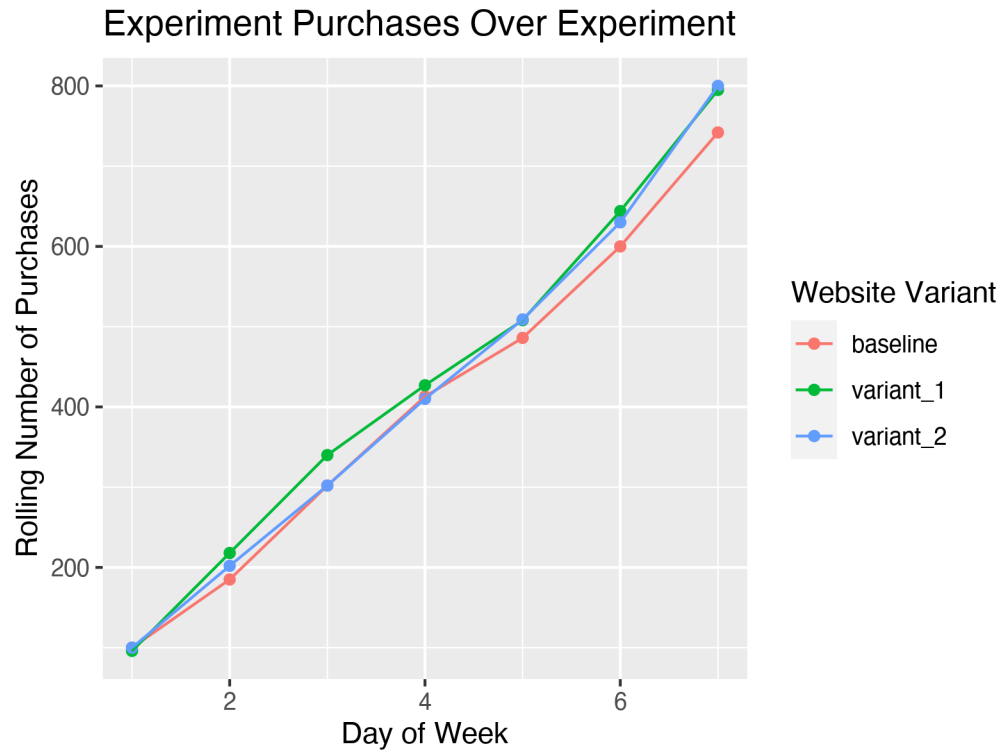
## 2 QAQC

To ensure the experiment is not harmful we will monitor CTR, purchases per day, and revenue per day.

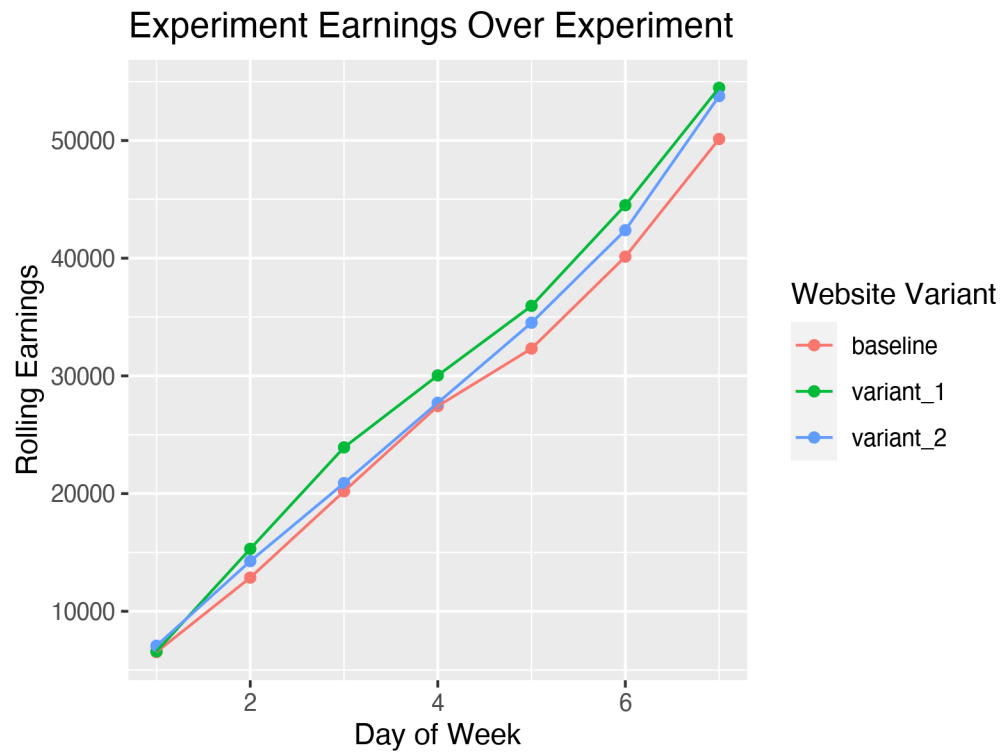
Beginning with daily CTR, this seems relatively consistent daily and raised no concerns.



Next, we can see that the purchases of the website variants have higher total purchases when looking at the rolling purchases over the course of the experiment.



Next, we can see that the earnings of the website variants have higher total purchases when looking at the rolling purchases over the course of the experiment.



In summary, nothing gave us cause to worry so the experiment ran its course.

### 3 Results

#### 3.1 Experiment 1: Fail to Reject

The experiment itself is a one-side proportion test (CTR).

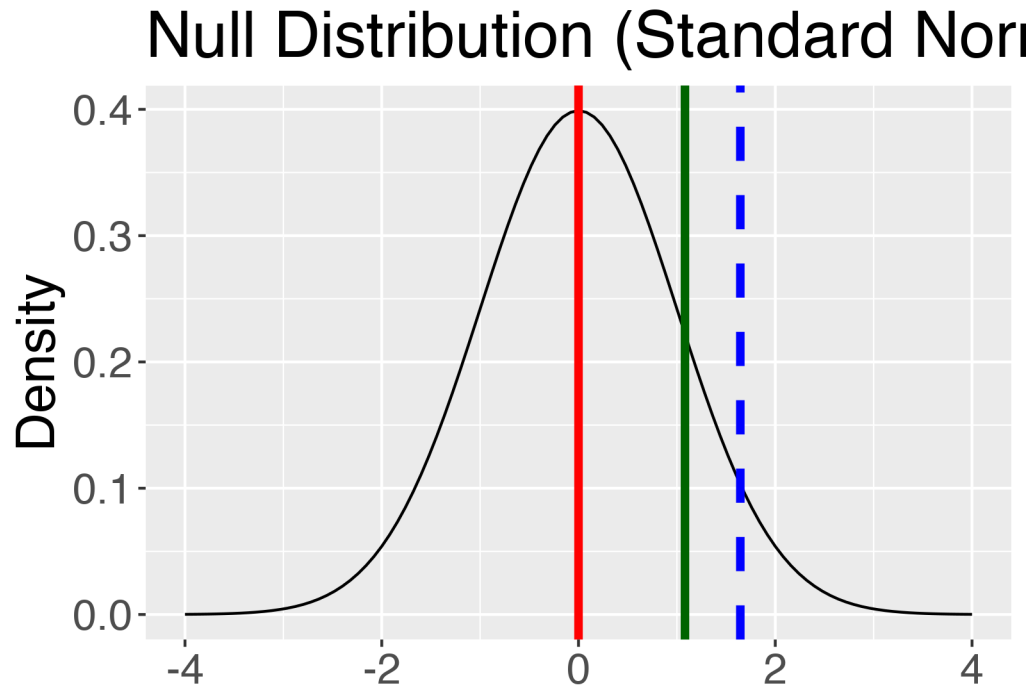
$H_0 : p_{\text{baseline}} = p_{\text{var1}}$  - There is no difference in the CTR between the baseline website and variant 1.

$H_A : p_{\text{baseline}} \neq p_{\text{var1}}$  - The CTR of website variant 1 is greater than the baseline CTR.

Table 1: Variant 1 Summary

variant	click_rate	treatment_size	se	lower_ci	upper_ci
baseline	0.2257947	5474	0.0056511	0.2148338	0.2367601
variant_1	0.2345634	5474	0.0057271	0.2237806	0.2453507

```
## [1] "P-Value: 0.0128052562926621"
```



- Red:  $Z_{H_0}$
- Blue:  $Z_{H_A}^*$
- Green:  $\hat{Z}$

We can see that  $\hat{Z}$  for experiment 1 is less than  $Z_{H_A}^*$  AND the p-value for this experiment is 0.138 which is less than our  $\alpha$ . Therefore, we FAIL to reject the original website in favor of variant 1.

### 3.2 Experiment 2: Reject the NULL

The experiment itself is a one-side proportion test (CTR).

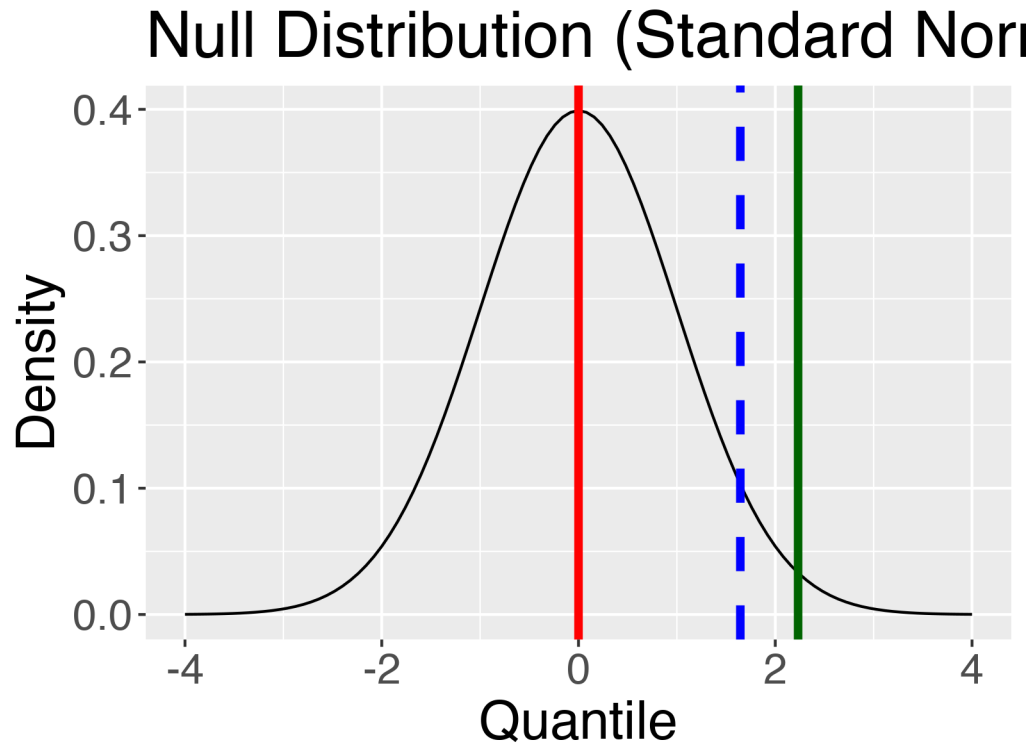
$H_0 : p_{\text{baseline}} = p_{\text{var2}}$  - There is no difference in the CTR between the baseline website and variant 1.

$H_A : p_{\text{baseline}} \neq p_{\text{var2}}$  - The CTR of website variant 1 is greater than the baseline CTR.

Table 2: Variant 2 Summary

variant	click_rate	treatment_size	se	lower_ci	upper_ci
baseline	0.2257947	5474	0.0056511	0.2148338	0.2367601
variant_2	0.2438802	5474	0.0058041	0.2323712	0.2559372

## [1] "P-Value: 0.0128052562926621"



- Red:  $Z_{H_0}$
- Blue:  $Z_{H_A}^*$
- Green:  $\hat{Z}$

We can see that  $\hat{Z}$  for experiment 2 is less than  $Z_{H_A}^*$  AND the p-value for this experiment is 0.013 which is less than our  $\alpha$ . Therefore, we REJECT the original website in favor of variant 2.

### 3.3 Confidence Intervals

