Milestone 2

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2022-06-19

Introduction

Milestone 1 was used to explore the different variables in the SWAN dataset that was subseted for the purpose of explaratory data analysis. In this report, multiple hypotheses will be tested to understand the relationships between the different groups depicted in the data subset. This dataset is used to assessed women at a crucial lifestage to properly provide health services and support for women in the 40's and 50's age group (Sutton-Tyrell et al. 1997).

Data Cleaning

Additional variables were added to the Milestone 1 subset to capture support the women interviewed felt they received.

```
rawData <-
  read_csv("SWANBaselineData_ProfessorKSubset (1).csv")
```

```
## New names:
## Rows: 3302 Columns: 33
## -- Column specification
## -------------------------------------------------------- Delimiter: "," ch
r
## (18): HBCHOLE0, MIGRAIN0, ANEMIA0, LISTEN0, TAKETOM0, CONFIDE0, HELPSIC0..
. dbl
## (15): ...1, SWANID, AGE0, HSWRKHR0, HOSPSTA0, PULSE0, SYSBP10, DIABP10, ..
.
## i Use `spec()` to retrieve the full column specification for this data. i
## Specify the column types or set `show_col_types = FALSE` to quiet this mes
sage.
## * `` -> `...1`
```

```
milestone2_subset <- subset(rawData, select = c(
  SWANID,
  AGE0,
  ANEMIA0,
  LISTEN0,
  TAKETOM0,
  CONFIDE0,
  HELPSIC0,
  SMOKERE0,
  PULSE0,
  HEIGHT0,
  WEIGHT0,
  RACE)
)
```

Data was cleaned and additional columns were formulated. Minority data was used to separate races that aren't as frequent as others, by taking all races below 20% (one fifth of the data because there are 5 races) and assigning them as a subdivision minority. Support Scores were calculated by updating each support column to a numeric scale and adding them together. The support score scale goes from 0 support to a score of 20 which means they feel the maximum support they could feel. The average support score was also calculated.

```
## # A tibble: 6 x 15
##   SWANID  AGE0 ANEMIA0 LISTEN0 TAKETOM0 CONFIDE0 HELPSIC0 SMOKERE0 PULSE0
##    <dbl> <dbl> <chr>     <dbl>    <dbl>    <dbl>    <dbl> <chr>     <dbl>
## 1  10005    48 No            5        5        5        1 No           36
## 2  10046    52 No            5        5        5        5 Yes          38
## 3  10056    51 Yes           4        4        4        5 No           36
## 4  10092    45 Yes           5        5        5        5 Yes          32
## 5  10126    48 Yes           5        5        5        5 No           40
## 6  10153    51 No            5        5        5        5 Yes          41
## # ... with 6 more variables: HEIGHT0 <dbl>, WEIGHT0 <dbl>, RACE <chr>,
## #   Subdivision <chr>, SupportScore <dbl>, SupportAvg <dbl>
```

```
## tibble [3,302 x 15] (S3: tbl_df/tbl/data.frame)
##  $ SWANID      : num [1:3302] 10005 10046 10056 10092 10126 ...
##  $ AGE0        : num [1:3302] 48 52 51 45 48 51 46 47 46 47 ...
##  $ ANEMIA0     : chr [1:3302] "No" "No" "Yes" "Yes" ...
##  $ LISTEN0     : num [1:3302] 5 5 4 5 5 5 5 3 4 2 ...
##  $ TAKETOM0    : num [1:3302] 5 5 4 5 5 5 5 4 4 2 ...
##  $ CONFIDE0    : num [1:3302] 5 5 4 5 5 5 5 3 4 3 ...
##  $ HELPSIC0    : num [1:3302] 1 5 5 5 5 5 4 2 4 2 ...
##  $ SMOKERE0    : chr [1:3302] "No" "Yes" "No" "Yes" ...
##  $ PULSE0      : num [1:3302] 36 38 36 32 40 41 33 30 35 31 ...
##  $ HEIGHT0     : num [1:3302] 151 156 162 167 164 ...
##  $ WEIGHT0     : num [1:3302] 49.5 67.7 54.4 88.9 77.2 ...
##  $ RACE        : chr [1:3302] "Hispanic" "Chinese/Chinese American" "Cauca
sian/ White Non-Hispanic" "Caucasian/ White Non-Hispanic" ...
##  $ Subdivision : chr [1:3302] "Minority" "Minority" "Majority" "Majority"
...
##  $ SupportScore: num [1:3302] 16 20 17 20 20 20 19 12 16 9 ...
##  $ SupportAvg  : num [1:3302] 4 5 4.25 5 5 5 4.75 3 4 2.25 ...
```

```
##      SWANID           AGE0         ANEMIA0             LISTEN0     
##  Min.   :10005   Min.   :42.00   Length:3302        Min.   :1.000  
##  1st Qu.:31808   1st Qu.:44.00   Class  :character  1st Qu.:4.000  
##  Median :54230   Median :46.00   Mode  :character   Median :4.000  
##  Mean   :54362   Mean   :45.85                      Mean   :4.206  
##  3rd Qu.:76745   3rd Qu.:48.00                      3rd Qu.:5.000  
##  Max.   :99992   Max.   :53.00                      Max.   :5.000  
##                  NA's   :5                          NA's   :5      
##     TAKETOM0        CONFIDE0       HELPSIC0       SMOKERE0        
##  Min.   :1.000   Min.   :1.00   Min.   :1.000   Length:3302       
##  1st Qu.:4.000   1st Qu.:4.00   1st Qu.:3.000   Class :character  
##  Median :5.000   Median :4.00   Median :4.000   Mode  :character  
##  Mean   :4.174   Mean   :4.19   Mean   :3.746                     
##  3rd Qu.:5.000   3rd Qu.:5.00   3rd Qu.:5.000                     
##  Max.   :5.000   Max.   :5.00   Max.   :5.000                     
##  NA's   :6       NA's   :5      NA's   :5
##      PULSE0         HEIGHT0         WEIGHT0           RACE
##  Min.   :17.00   Min.   :140.5   Min.   : 37.60   Length:3302
##  1st Qu.:32.00   1st Qu.:157.8   1st Qu.: 59.60   Class :character
##  Median :35.00   Median :162.4   Median : 70.60   Mode  :character
##  Mean   :35.19   Mean   :162.4   Mean   : 74.88
##  3rd Qu.:38.00   3rd Qu.:167.0   3rd Qu.: 85.50
##  Max.   :84.00   Max.   :186.2   Max.   :175.40
##  NA's   :7       NA's   :32      NA's   :14
##  Subdivision         SupportScore     SupportAvg
##  Length:3302        Min.   : 4.00   Min.   :1.000
##  Class :character   1st Qu.:15.00   1st Qu.:3.750
##  Mode  :character   Median :17.00   Median :4.250
##                     Mean   :16.32   Mean   :4.079
##                     3rd Qu.:19.00   3rd Qu.:4.750
##                     Max.   :20.00   Max.   :5.000
##                     NA's   :6       NA's   :6
```

Question 1: Do women with anemia have the same pulse as women who do not have anemia?

Anemia is a blood disease which can be genetic or caused by diet and lack of specific nutrients. To understand if anemia has an effect on the pulse of women in their 40’s and 50’s, two samples of 100 were analyzed from the SWAN population, one sample set with women who have been diagnosed with anemia and one sample set with women who were not diagnosed with anemia. They were compared to each other using the Welch Two Sample t Test.

State the Null Hypothesis, Alternative Hypothesis, and Claim.

$$H_0:\mu_1=\mu_2\\H_1:\mu_1\neq\mu_2$$

```
## [1] "mu1 is equal to mu2"

## [1] "mu1 does not equal mu2"

## [1] "Women with anemia have a different average pulse than women without i
t"
```

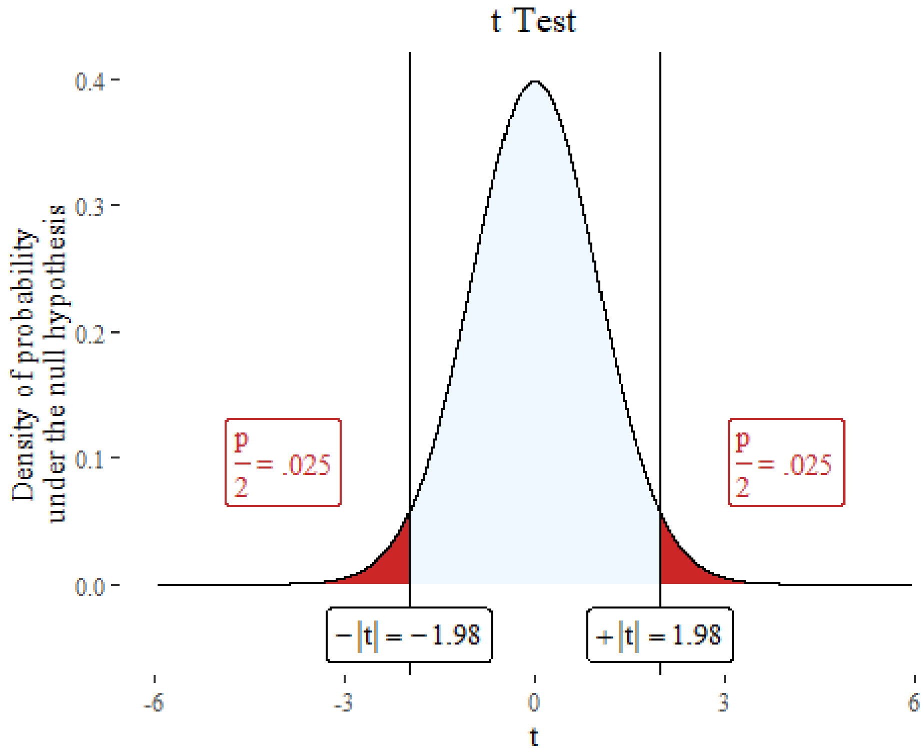
Data was subsetted for the comparison.

```
##      SWANID           AGE0         ANEMIA0             LISTEN0
##  Min.   :10056   Min.   :42.00   Length:1152        Min.   :1.000
##  1st Qu.:33751   1st Qu.:43.00   Class :character   1st Qu.:4.000
##  Median :57060   Median :46.00   Mode  :character   Median :4.000
##  Mean   :55669   Mean   :45.84                      Mean   :4.159
##  3rd Qu.:76998   3rd Qu.:48.00                      3rd Qu.:5.000
##  Max.   :99809   Max.   :53.00                      Max.   :5.000
##
##     TAKETOM0        CONFIDE0        HELPSIC0      SMOKERE0
##  Min.   :1.000   Min.   :1.000   Min.   :1.000   Length:1152
##  1st Qu.:4.000   1st Qu.:4.000   1st Qu.:3.000   Class :character
##  Median :5.000   Median :4.000   Median :4.000   Mode  :character
##  Mean   :4.135   Mean   :4.122   Mean   :3.648
##  3rd Qu.:5.000   3rd Qu.:5.000   3rd Qu.:5.000
##  Max.   :5.000   Max.   :5.000   Max.   :5.000
##
##      PULSE0         HEIGHT0         WEIGHT0           RACE
##  Min.   :17.00   Min.   :140.5   Min.   : 39.00   Length:1152
##  1st Qu.:32.00   1st Qu.:158.2   1st Qu.: 59.90   Class :character
##  Median :34.00   Median :162.7   Median : 71.00   Mode  :character
##  Mean   :34.95   Mean   :162.7   Mean   : 75.51
##  3rd Qu.:38.00   3rd Qu.:167.0   3rd Qu.: 86.83
##  Max.   :53.00   Max.   :186.2   Max.   :175.40
##                  NA's   :12      NA's   :4
##  Subdivision         SupportScore     SupportAvg
##  Length:1152        Min.   : 4.00   Min.   :1.000
##  Class :character   1st Qu.:14.00   1st Qu.:3.500
##  Mode  :character   Median :17.00   Median :4.250
##                      Mean   :16.06   Mean   :4.016  
##                      3rd Qu.:19.00   3rd Qu.:4.750  
##                      Max.   :20.00   Max.   :5.000  
##
```

```
##      SWANID           AGE0         ANEMIA0             LISTEN0     
##  Min.   :10005   Min.   :42.00   Length:2126        Min.   :1.000  
##  1st Qu.:30444   1st Qu.:44.00   Class :character   1st Qu.:4.000  
##  Median :52970   Median :46.00   Mode  :character   Median :4.000  
##  Mean   :53631   Mean   :45.85                      Mean   :4.232  
##  3rd Qu.:76745   3rd Qu.:48.00                      3rd Qu.:5.000  
##  Max.   :99992   Max.   :53.00                      Max.   :5.000  
##                                                                    
##     TAKETOM0        CONFIDE0        HELPSIC0       SMOKERE0        
##  Min.   :1.000   Min.   :1.000   Min.   :1.000   Length:2126       
##  1st Qu.:4.000   1st Qu.:4.000   1st Qu.:3.000   Class :character  
##  Median :5.000   Median :4.000   Median :4.000   Mode  :character  
##  Mean   :4.196   Mean   :4.228   Mean   :3.801                     
##  3rd Qu.:5.000   3rd Qu.:5.000   3rd Qu.:5.000                     
##  Max.   :5.000   Max.   :5.000   Max.   :5.000                     
##  NA's   :1                                                         
##      PULSE0         HEIGHT0         WEIGHT0           RACE          
##  Min.   :19.00   Min.   :141.0   Min.   : 37.60   Length:2126       
##  1st Qu.:32.00   1st Qu.:157.3   1st Qu.: 59.50   Class :character  
##  Median :35.00   Median :162.1   Median : 70.40   Mode  :character  
##  Mean   :35.31   Mean   :162.2   Mean   : 74.54                     
##  3rd Qu.:38.00   3rd Qu.:167.0   3rd Qu.: 85.00                     
##  Max.   :84.00   Max.   :184.0   Max.   :172.10                     
##                  NA's   :20      NA's   :10                         
##  Subdivision         SupportScore     SupportAvg   
##  Length:2126        Min.   : 4.00   Min.   :1.000  
##  Class :character   1st Qu.:15.00   1st Qu.:3.750  
##  Mode  :character   Median :17.00   Median :4.250  
##                     Mean   :16.46   Mean   :4.115  
##                     3rd Qu.:19.00   3rd Qu.:4.750  
##                     Max.   :20.00   Max.   :5.000  
##                     NA's   :1       NA's   :1      
```

```
## # A tibble: 6 x 15
##   SWANID  AGE0 ANEMIA0 LISTEN0 TAKETOM0 CONFIDE0 HELPSIC0 SMOKERE0 PULSE0
##    <dbl> <dbl> <chr>     <dbl>    <dbl>    <dbl>    <dbl> <chr>     <dbl>
## 1  77803    45 Yes           2        2        3        4 Yes          37
## 2  53815    43 Yes           5        5        5        4 No           41
## 3  86330    48 Yes           4        4        4        4 Yes          32
## 4  82127    48 Yes           4        4        4        2 Yes          38
## 5  48532    42 Yes           4        5        4        3 Yes          25
## 6  30144    48 Yes           5        5        4        5 No           30
## # ... with 6 more variables: HEIGHT0 <dbl>, WEIGHT0 <dbl>, RACE <chr>,
## #   Subdivision <chr>, SupportScore <dbl>, SupportAvg <dbl>
## # A tibble: 6 x 15
##   SWANID  AGE0 ANEMIA0 LISTEN0 TAKETOM0 CONFIDE0 HELPSIC0 SMOKERE0 PULSE0
##    <dbl> <dbl> <chr>     <dbl>    <dbl>    <dbl>    <dbl> <chr>     <dbl>
## 1  28625    43 No            4        4        4        1 No           34
## 2  35238    42 No            4        4        4        4 Yes          38
## 3  92035    48 No            2        2        2        4 Yes          33
## 4  67693    51 No            5        5        5        5 No           42
## 5  41659    45 No            5        5        4        5 No           38
## 6  40956    44 No            5        5        5        4 No           32
## # ... with 6 more variables: HEIGHT0 <dbl>, WEIGHT0 <dbl>, RACE <chr>,
## #   Subdivision <chr>, SupportScore <dbl>, SupportAvg <dbl>
```

Critical values were calculated for a two tailed test with an alpha of 0.05. The critical value was calculated to be -1.98 to 1.98. which can be seen in the plot below.



The t statistic was then calculate to compare against the critical values. If the t was located in the red regions of the t Test graph, it would result in a reject the Null Hypothesis, otherwise it would fail to reject.

```
##          t
## -0.2571732
```

Making the decision based on the critical value and t statistic, do not reject the null hypothesis because the t statistic is not in the critical region and is -1.98 < t < 1.98.

```
## [1] "Do not reject Null Hypothesis"
```

Summary of results.

```
## There is not enough evidence to support the claim: Women with anemia have
a different average pulse than women without it
```

Because the data resulted in a fail to reject the Null Hypothesis, there is not enough evidence to support the claim that there is a difference in pulse between patients with previously diagnosed anemia and patients who were not diagnosed with anemia.

Question 2: Is the proportion of women who smoke at age 45 the same as all women who smoke in the SWAN dataset?

The mean age in years of the SWAN dataset is slightly over 45 years old, Smokers vs non-smokers is relatively even in terms of proportions (review Milestone 1 for that analysis). To understand if 45 year olds are distributed the same as the remainder of the population, proportion of smokers from both groups were analyzed to understand the relationship.

Data was subsetted for the purpose of this analysis to include a sample of 45 year olds from the SWAN dataset.

```
smokers <- milestone2_subset %>% filter(SMOKERE0=="Yes") %>% nrow()
Total <- filter(milestone2_subset, !is.na(SMOKERE0)) %>% nrow()
pop_prop <- smokers/Total
fortyfivers <- filter(milestone2_subset, AGE0==45)
```

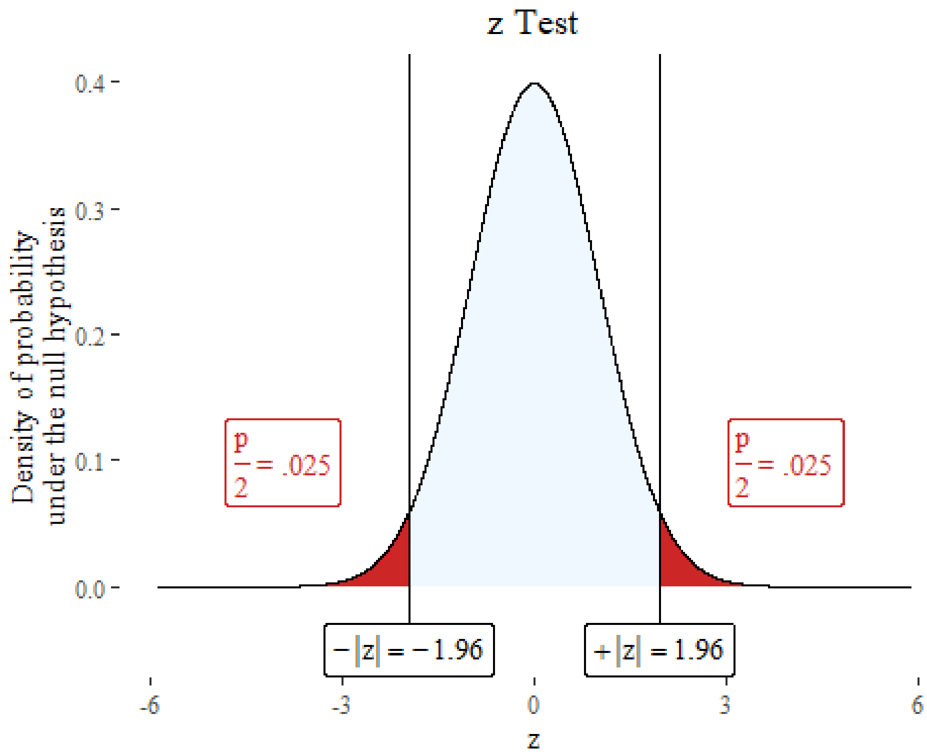
State the Null Hypothesis, Alternative Hypothesis, and Claim.

```
## Null: p = 43 %

## Alternative: p neq 43 %

## [1] "The proportion of smokers at age 45 is equal to the proportion of smo
kers in the SWAN dataset"
```

Proportions were calculated for the one sample Z-test for a proportion.

```
p <- pop_prop
q <- 1-p
smoker_45 <- fortyfivers %>% filter(SMOKERE0=="Yes") %>% nrow()
n <- filter(fortyfivers, !is.na(SMOKERE0)) %>% nrow()
phat <- smoker_45/n
```

Critical values were calculated for a two tailed test with an alpha of 0.05. The critical value was calculated to be -1.96 to 1.96. which can be seen in the plot below.



The z statistic was then calculate to compare against the critical values. If the z was located in the red regions of the z Test graph, it would result in a reject the Null Hypothesis, otherwise it would fail to reject.

```
## [1] 1.111843
```

Making the decision based on the critical value and z statistic, do not reject the null hypothesis because the z statistic is not in the critical region and is -1.96 < z < 1.96.

```
decision <- if(abs(cv)>abs(z)){
  "Do not reject Null Hypothesis"
}else{
  "Reject Null Hypothesis"
}
decision

## [1] "Do not reject Null Hypothesis"
```

Summary of results:

```
## There is enough evidence to support the claim: The proportion of smokers a
t age 45 is equal to the proportion of smokers in the SWAN dataset
```

The claim aligned with the Null Hypothesis in this instance. The summary for this analysis that there was enough evidence to support the claim that there is no statistical difference between the proportion of smokers at age 45 to those in the SWAN dataset.

There was an additional question that tried to identify if there was a difference in support between minorities and between majority racial subdivisions. After further analysis, the data was determined to be skewed and not normally distributed, therefore that analysis is not included in this report.

Bibliography

Sutton-Tyrrell, Kim, Selzer, Faith, Sowers, MaryFran, R. (Mary Frances Roy), Neer, Robert, Powell, Lynda, Gold, Ellen B., … McKinlay, Sonja. Study of Women's Health Across the Nation (SWAN): Baseline Dataset, [United States]. (1997). Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2019-05-15. https://doi.org/10.3886/ICPSR28762.v5\

Waters, A. (2022). Milestone 1.