Demographic Relationships of American Reading Habits

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Psych 308d: Assignment 1

Demographic Relationships of American Reading Habits

Results

Data analysis is in Appendix A. Observations containing a subset of only variables used for this analysis ($N = 2442$) contained 59 missing parameters in the dataset and were removed ($N = 2383$). Analysis continued with tests of assumptions of adequate expected variable category frequency counts which passed with each category cell having over 5 observations, and independence of observations between variables which also passed.

Hypothesis 1 tested if there was a relationship between sex and employment which was significant, χ^2 (7) = 73.30, $p < .001$, *Cramér's V* = .18, indicating a small effect size of discrepancy between compared expected and observed frequencies. The largest discrepancies were between employed full-time for men with lower observed frequencies versus expected and higher for women, and unemployed for men with higher observed frequencies versus expected with lower for women.

Hypothesis 2 tested if there was a relationship between sex and education which was not significant, χ^2 (6) = 4.44, $p = .617$, *Cramér's V* = .04, indicating a small effect size of discrepancy between compared expected and observed frequencies.

Hypothesis 3 tested if there was a relationship between marital status and employment which was significant, χ^2 (42) = 643.00, $p < .001$, *Cramér's V* = .21, indicating a small effect size of discrepancy between compared expected and observed frequencies. The largest discrepancies were among disabled employment status and divorced marital status (higher observed than expected); employed full-time and married (higher observed), never married (lower observed), and widowed (lower observed); not employed and married (lower observed), never married (higher observed); retired and living with partner (lower observed), never married (lower

observed), and widowed (higher observed); and, student and married (lower observed), and never married (higher observed).

Discussion

When testing the sample for demographic race frequencies among known population estimates using a goodness-of-fit test, the results indicated that this sample was similar to the national average with no significant difference from expected frequencies, χ^2 (5) = 2.46, p = .783. As such, this sample can be generalized as representative according to the demographic category of race.

The results according to Hypothesis 1 indicate that when accounting for reading habits, women tend to work more full-time jobs than men, and men being unemployed more often, indicating specific markets geared towards both of those populations such as management books for women, and how-to write resume books for men. The results according to Hypothesis 2 indicate that there is no discrepancy between education levels for men and women, and therefore no need to gender bias the marketing of book selling based on education or literacy. The results according to Hypothesis 3 indicate that there are many areas where marital status and employment are related, meaning niche markets for specific types of books to be marketed such as how to juggle a family while working full-time, managing major life changes such as disability and divorce, or books on being happy and single while being a student.

Appendix A

Statistical Analysis in R

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Main Analyses:

A set of researchers from a marketing company conducted a survey to investigate reading habits of Americans (this is a real dataset). Although a study has been published on this already, they have tasked you with investigating it further in order to understand the relationships between certain demographic variables of their sampled readers, inculding sex, employment, martial status, race, and age.

While your advisor thinks there might be some interesting results that could come from this data for an upcoming conference presentation, she only wants a sample write-up of a Results and Discussion section to start based on the following proposed RQs.

Research Questions to Investigate:

1: Is there a relationship between sex and employment?

2: Is there a relationship between sex and education?

3: Is there a relationship between marital status and employment?

Conceptual Addition: Following your analyses - please incorporate into the Discussion section of your write-up the following conceptual addition:

1.) Your advisor would also like your notes on a potentially interesting caveat for using this information to make generalizations to the general public. Specifically, your advisor wants you to test that the proportions of the sample match those which may be expected in the U.S. population for race, per the proportions below:

White: 80%

Black or African American: 12%

Asian or Pacific Islander: 3%

Mixed Race: 2%

Native American/American Indian: 1%

Other: 2%

2.) Following testing, interpret these results and discuss how this may affect your ability to interpret the data and make generalizations. What suggestions could you make moving forward?

Please report all relevant statistics per APA format and write for a professional audience.

```
library(pacman) #Package used to load all packages using p_load(); will install missing packages

## Warning: package 'pacman' was built under R version 3.5.3

p_load(vcd, MASS, jmv, gmodels, VIM)

dat <- read.csv("https://www.dropbox.com/s/zhhyiegj8gyakuu/Reading.csv?dl=1")
head(dat) # check to see if labels are needed. In this case they are not. See Chi2Demo.Rmd for how-to.

##   Age    Sex                       Race Married     Married.status
## 1  66   Male                       <NA>      No           Divorced
## 2  46   Male Native American/American Indian     Yes            Married
## 3  32   Male                    Mixed race      No Never been married
## 4  27   Male                    Mixed race     Yes            Married
## 5  16 Female                    Mixed race      No Never been married
## 6  55 Female       Asian or Pacific Islander      No           Divorced
##                    Education                  Employement
## 1            College graduate                      Retired
## 2         High school graduate             Employed full-time
## 3         High school graduate             Employed full-time
## 4         High school graduate             Employed full-time
## 5        High school incomplete             Employed part-time
## 6 Some college, no 4-year degree Have own business/self-employed
##                  Incomes
## 1 $20,000 to under $30,000
## 2       Less than $10,000
## 3       Less than $10,000
## 4 $40,000 to under $50,000
## 5 $10,000 to under $20,000
## 6 $40,000 to under $50,000
##   How.many.books.did.you.read.during.last.12months.
## 1                                                97
```

```
## 2                                97
## 3                                97
## 4                                97
## 5                                97
## 6                                97
##   Read.any.printed.books.during.last.12months.
## 1                               Yes
## 2                               Yes
## 3                                No
## 4                               Yes
## 5                               Yes
## 6                               Yes
##   Read.any.audiobooks.during.last.12months.
## 1                                No
## 2                               Yes
## 3                               Yes
## 4                                No
## 5                               Yes
## 6                               Yes
##   Read.any.e.books.during.last.12months.
## 1                              Yes
## 2                              Yes
## 3                              Yes
## 4                              Yes
## 5                               No
## 6                              Yes
##                    Last.book.you.read..youâ..
## 1                        Purchased the book
## 2                        Purchased the book
## 3 Borrowed the book from a friend or family member
## 4               Borrowed the book from a library
## 5                        Purchased the book
## 6                        Purchased the book
```

```
##   Do.you.happen.to.read.any.daily.news.or.newspapers.
## 1                                                  No
## 2                                                 Yes
## 3                                                 Yes
## 4                                                 Yes
## 5                                                 Yes
## 6                                                  No
##   Do.you.happen.to.read.any.magazines.or.journals.
## 1                                              Yes
## 2                                              Yes
## 3                                              Yes
## 4                                               No
## 5                                               No
## 6                                               No
```

Take a look at the data set,

```
#Subset to use only necessary variables
myvars <- c("Sex", "Race", "Married.status", "Education", "Employement")
dat.subset <- dat[myvars]

# Run descriptives for categorical variables

glimpse <- descriptives(data = dat.subset,
                        vars = c('Sex', 'Employement', 'Education', 'Married.status', 'Race'))
glimpse

##
##  DESCRIPTIVES
##
##  Descriptives
##  ---------------------------------------------------------------------
##              Sex    Employement    Education    Married.status    Race
##  ---------------------------------------------------------------------
##    N         2442          2442         2438              2427    2398
```

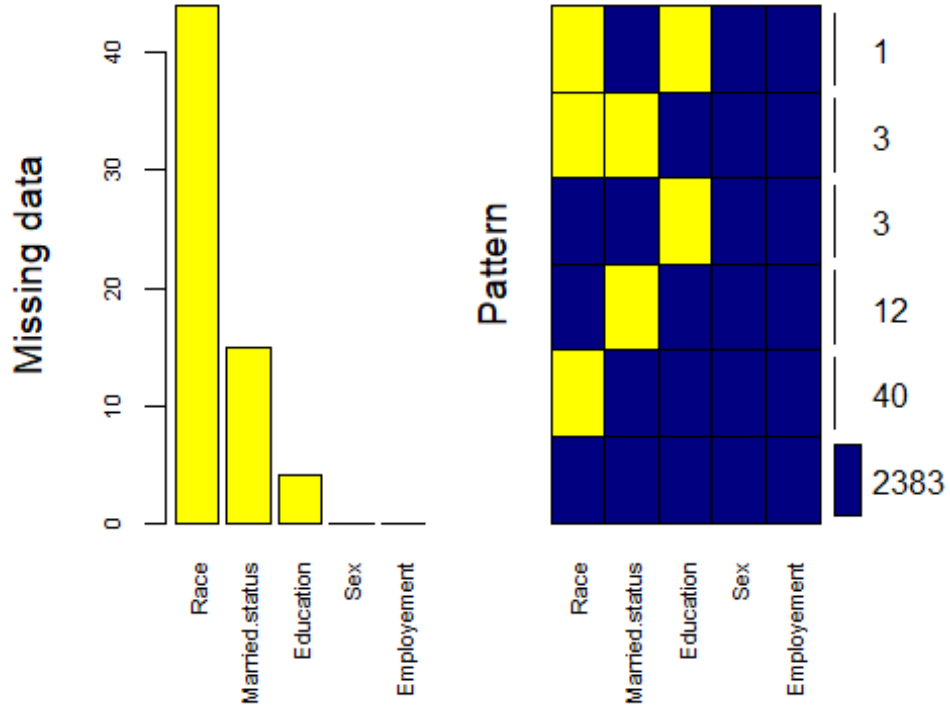
```
##   Missing      0          0          4          15     44
##   Mean
##   Median
##   Minimum
##   Maximum
##  ---------------------------------------------------------------------

# First thing to note is the Row for "Missing" DATA

#Option: delete list-wise
```

Check missing data for patterns

```
#check the pattern of missing data
VIM_plot <-aggr(dat.subset,
                col=c('navyblue', 'yellow'),
                numbers = TRUE,
                prop = FALSE,
                sortVars = TRUE,
                labels = names(dat.subset),
                cex.axis = .7,
                gap = 3,
                ylab = c("Missing data", "Pattern"))
```




```
##
##  Variables sorted by number of missings:
##       Variable Count
##           Race    44
##  Married.status    15
##      Education     4
##            Sex     0
##     Employement     0

#yellow bar chart is percentage missing from each variable
#blue and yellow chart shows pattern of missing data
```

Remove missing cases and view data again with **observed frequencies**

```
# Option: Listwise deletion of missing data. New dataset is named "dat.no.NA"
dat.no.NA <- na.omit(dat.subset)


# check descriptives again
# no missing cases
```

```
glimpse.no.NA <- descriptives(data = dat.no.NA,
                      vars = c('Sex', 'Employement', 'Education', 'Married.status', 'Race'),
                      freq = TRUE)
glimpse.no.NA

##
##  DESCRIPTIVES
##
##  Descriptives
##  ---------------------------------------------------------------------
##              Sex     Employement    Education    Married.status    Race
##  ---------------------------------------------------------------------
##    N         2383          2383         2383             2383    2383
##    Missing      0             0            0                0       0
##    Mean
##    Median
##    Minimum
##    Maximum
##  ---------------------------------------------------------------------
##
##
##  FREQUENCIES
##
##  Frequencies of Sex
##  ----------------------------------------------
##    Levels    Counts    % of Total    Cumulative %
##  ----------------------------------------------
##    Female      1302          54.6           54.6
##    Male        1081          45.4          100.0
##  ----------------------------------------------
##
##
##  Frequencies of Employement
##  ---------------------------------------------------------------------
```

```
##   Levels                        Counts    % of Total    Cumulative %
## ------------------------------------------------------------------------
##   Disabled                        45          1.9           1.9
##   Employed full-time            1066         44.7          46.6
##   Employed part-time             315         13.2          59.8
##   Have own business/self-employed  47          2.0          61.8
##   Not employed for pay           396         16.6          78.4
##   Other                           10          0.4          78.9
##   Retired                        482         20.2          99.1
##   Student                         22          0.9         100.0
## ------------------------------------------------------------------------
##
##
##  Frequencies of Education
## ---------------------------------------------------------------------------------------------
##   Levels                                        Counts    % of Total    Cumulative %
## ---------------------------------------------------------------------------------------------
##   College graduate                               557         23.4          23.4
##   High school graduate                           515         21.6          45.0
##   High school incomplete                         202          8.5          53.5
##   None                                            28          1.2          54.6
##   Post-graduate training/professional school after college  468         19.6          74.3
##   Some college, no 4-year degree                 565         23.7          98.0
##   Technical, trade or vocational school AFTER high school   48          2.0         100.0
## ---------------------------------------------------------------------------------------------
##
##
##  Frequencies of Married.status
## ------------------------------------------------------------
##   Levels              Counts    % of Total    Cumulative %
## ------------------------------------------------------------
##   Divorced             192          8.1           8.1
##   Living with a partner  119          5.0          13.1
```

```
##   Married                 1304        54.7          67.8
##   Never been married       535        22.5          90.2
##   Separated                 35         1.5          91.7
##   Single                    48         2.0          93.7
##   Widowed                  150         6.3         100.0
## ---------------------------------------------------------
##
##
## Frequencies of Race
## ------------------------------------------------------------------------
##   Levels                        Counts    % of Total    Cumulative %
## ------------------------------------------------------------------------
##   Asian or Pacific Islander         62         2.6           2.6
##   Black or African-American        277        11.6          14.2
##   Mixed race                        54         2.3          16.5
##   Native American/American Indian   24         1.0          17.5
##   Other                             48         2.0          19.5
##   White                           1918        80.5         100.0
## ------------------------------------------------------------------------
```

Assumptions - 1. Adequate expected cell counts - 5 or more in 2 x 2 or 5 or more in 80% of cells for larger table - Otherwise, Fisher's test - 2. Independence of Observations - otherwise McNemar's test of dependent proportions

Chi-square Test of Independence

H1: Is Sex dependent upon Employement? Is there a relationship between Sex and Employement? H2: Is Sex dependent upon Education? Is there a relationship between Sex and Education? H3: Is Married dependent upon Employement? Is there a relationship between Married and Employement?

Cramer's V - small = .1; medium = .3, large = .5; indicates effect size of discrepancy between observed and expected scores

```
# Chi-square = Sum[(Observed - Expected)^2/Expected]
# Expected = [(# of row entries for cel)/(# total entries)] * (# of column entries for cel)
# Expected indicates expected values for each category if there is no relationship between two categorical variables
```

```
# df = (# rows - 1) * (# columns - 1)
# report APA, magnitude of effect (Cramer's V), direction of effect example (more or less than expected in each category - include Contingency Table)

H1 <- jmv::contTables(dat = dat.no.NA,
              rows = 'Employement',
              cols = 'Sex',
              exp = TRUE,
              phiCra = TRUE)

H1

##
##  CONTINGENCY TABLES
##
##  Contingency Tables
##  ---------------------------------------------------------------------------
##    Employement                          Female     Male       Total
##  ---------------------------------------------------------------------------
##    Disabled                  Observed        25        20       45
##                              Expected     24.59     20.41
##
##    Employed full-time        Observed       493       573     1066
##                              Expected    582.43    483.57
##
##    Employed part-time        Observed       188       127      315
##                              Expected    172.11    142.89
##
##    Have own business/self-employed  Observed        21        26       47
##                              Expected     25.68     21.32
##
##    Not employed for pay      Observed       266       130      396
##                              Expected    216.36    179.64
##
```

```
##   Other                    Observed        9        1      10
##                            Expected     5.46     4.54
##
##   Retired                  Observed      283      199     482
##                            Expected   263.35   218.65
##
##   Student                  Observed       17        5      22
##                            Expected    12.02     9.98
##
##   Total                    Observed     1302     1081    2383
##                            Expected  1302.00  1081.00
## ---------------------------------------------------------------------------
##
##
## <U+03C7>² Tests
## ------------------------------
##       Value    df    p
## ------------------------------
##   <U+03C7>²    73.3     7    < .001
##   N      2383
## ------------------------------
##
##
## Nominal
## --------------------------
##                  Value
## --------------------------
##   Phi-coefficient     NaN
##   Cramer's V        0.175
## --------------------------
```

```
H2 <- jmv::contTables(dat = dat.no.NA,
            rows = 'Education',
            cols = 'Sex',
```

```
          exp = TRUE,
          phiCra = TRUE)
```

H2

```
##
##  CONTINGENCY TABLES
##
##  Contingency Tables
##  ---------------------------------------------------------------------------------------------
##    Education                                             Female    Male      Total
##  ---------------------------------------------------------------------------------------------
##    College graduate                                Observed      314       243       557
##                                                    Expected     304.3     252.7
##
##    High school graduate                            Observed      276       239       515
##                                                    Expected     281.4     233.6
##
##    High school incomplete                          Observed      108        94       202
##                                                    Expected     110.4      91.6
##
##    None                                            Observed       13        15        28
##                                                    Expected      15.3      12.7
##
##    Post-graduate training/professional school after college    Observed      245       223
468
##                                                    Expected     255.7     212.3
##
##    Some college, no 4-year degree                  Observed      322       243       565
##                                                    Expected     308.7     256.3
##
##    Technical, trade or vocational school AFTER high school     Observed       24        24
48
##                                                    Expected      26.2      21.8
```

```
##
##   Total                                    Observed      1302      1081     2383
##                                          Expected    1302.0    1081.0
## ---------------------------------------------------------------------------------------------
##
##
## <U+03C7>² Tests
## ------------------------------
##         Value    df    p
## ------------------------------
##   <U+03C7>²     4.44     6    0.617
##   N      2383
## ------------------------------
##
##
## Nominal
## ------------------------------
##                    Value
## ------------------------------
##   Phi-coefficient       NaN
##   Cramer's V         0.0432
## ------------------------------
```

```
H3 <- jmv::contTables(dat = dat.no.NA,
              rows = 'Employement',
              cols = 'Married.status',
              exp = TRUE,
              phiCra = TRUE)


H3
```

```
##
## CONTINGENCY TABLES
##
```

```
##  Contingency Tables
## ------------------------------------------------------------------------------------------------------------------------
-------------------------------------
##    Employement                          Divorced    Living with a partner    Married    Never
been married    Separated    Single    Widowed    Total
## ------------------------------------------------------------------------------------------------------------------------
-------------------------------------
##    Disabled                   Observed         13                  2        18                5
3        2         2       45
##                               Expected       3.626               2.247      24.62             10.10
0.661     0.906      2.833
##
##    Employed full-time         Observed         92                 65       672               184
13       18        22     1066
##                               Expected      85.888              53.233     583.33            239.32
15.657    21.472     67.100
##
##    Employed part-time         Observed         14                 15       134               134
3        7         8      315
##                               Expected      25.380              15.730     172.37            70.72
4.627     6.345     19.828
##
##    Have own business/self-employed    Observed          3                  3        35
4          0        0         2      47
##                               Expected       3.787               2.347      25.72             10.55
0.690     0.947      2.958
##
##    Not employed for pay       Observed         14                 28       138               176
12       13        15      396
##                               Expected      31.906              19.775     216.69            88.90
5.816     7.977     24.927
##
##    Other                      Observed          0                  1        6                 0          0
```

```
1         2       10
##                            Expected       0.806                0.499       5.47              2.25
0.147     0.201      0.629
##
##    Retired                   Observed         56                   5        297                15
4         6         99      482
##                            Expected      38.835               24.070     263.75             108.21
7.079     9.709     30.340
##
##    Student                   Observed          0                   0         4                 17          0
1         0       22
##                            Expected       1.773                1.099      12.04              4.94
0.323     0.443      1.385
##
##    Total                     Observed        192                 119       1304               535
35        48        150     2383
##                            Expected     192.000              119.000    1304.00            535.00
35.000    48.000    150.000
## ---------------------------------------------------------------------------------------------------------------
-------------------------------------
##
##
## <U+03C7>² Tests
## ------------------------------
##        Value    df    p
## ------------------------------
##   <U+03C7>²     643    42    < .001
##   N      2383
## ------------------------------
##
##
## Nominal
## --------------------------
```

```
##                  Value
## --------------------------
##   Phi-coefficient     NaN
##   Cramer's V        0.212
## --------------------------
```

Conceptual Question: Goodness-of-Fit

H0: Proportions fit expected values for Race Ha: Proportions do not fit expected values for Race

Order Matters Asian or Pacific Islander: 3% Black or African American: 12% Mixed Race: 2% Native American/American Indian: 1% Other: 2% White: 80%

```
# H0 = equal proportions in each category; Ha = unequal proportions in each category
# Chi-square = Sum[(Observed - Expected)^2/Expected]
# df = # of categories - 1

# use print(levels(dat.no.NA$Race)) to check for order of list in order to apply ratios accurately
# in this case it is in alphabetical order

# First checking unweighted expected values
# H0: equal proportions in each category
# Ha: unequal proportions in each category
goodness <- jmv::propTestN(data = dat.no.NA,
                           var = 'Race',
                           expected = TRUE,
                           ratio = c(1, 1, 1, 1, 1, 1))

goodness
```

```
##
##  PROPORTION TEST (N OUTCOMES)
##
##  Proportions
##  ---------------------------------------------------------------------
```

```
##   Level                              Count    Proportion
## ---------------------------------------------------------------------
##   Asian or Pacific Islander          Observed       62       0.0260
##                                      Expected      397       0.167
##
##   Black or African-American          Observed      277       0.1162
##                                      Expected      397       0.167
##
##   Mixed race                         Observed       54       0.0227
##                                      Expected      397       0.167
##
##   Native American/American Indian    Observed       24       0.0101
##                                      Expected      397       0.167
##
##   Other                              Observed       48       0.0201
##                                      Expected      397       0.167
##
##   White                              Observed     1918       0.8049
##                                      Expected      397       0.167
## ---------------------------------------------------------------------
##
##
## <U+03C7>² Goodness of Fit
## ----------------------
##   <U+03C7>²     df    p
## ----------------------
##   7097     5    < .001
## ----------------------

# Ha holds

# check with weights added from conceptual question
goodness.weighted <- jmv::propTestN(data = dat.no.NA,
                                    var = 'Race',
```

```
                        expected = TRUE,
                        ratio = c(.03, .12, .02, .01, .02, .80))

goodness.weighted

##
##  PROPORTION TEST (N OUTCOMES)
##
##  Proportions
##  ---------------------------------------------------------------------
##    Level                                Count    Proportion
##  ---------------------------------------------------------------------
##    Asian or Pacific Islander         Observed       62       0.0260
##                                Expected       71       0.0300
##
##    Black or African-American         Observed      277       0.1162
##                                Expected      286       0.1200
##
##    Mixed race                        Observed       54       0.0227
##                                Expected       48       0.0200
##
##    Native American/American Indian   Observed       24       0.0101
##                                Expected       24       0.0100
##
##    Other                             Observed       48       0.0201
##                                Expected       48       0.0200
##
##    White                             Observed     1918       0.8049
##                                Expected     1906       0.8000
##  ---------------------------------------------------------------------
##
##
##  <U+03C7>² Goodness of Fit
##  ----------------------
```

```
##   <U+03C7>²     df    p
## ----------------------
##   2.46     5    0.783
## ----------------------

# H0 holds
```