D214 Capstone Project:

PA3 – Executive Summary

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Introduction:

My name is Jason Willis. This executive summary will concentrate on the following study: Healthcare Providers and Their Impact on Overall Hospital Ratings provided in a previous submission. I am a graduate student, completing a capstone project for Western Governors University's Masters in Data Analytics program.

Problem Statement and Hypothesis: The Patient Survey – Hospital Consumer Assessment of Healthcare Providers and Systems is a dataset provided by the Centers for Medicare and Medicaid Services. This survey poses questions asked of patients and their ratings over a few different clinical perspectives. What can a hospital learn from this survey? Can they affect the outcome, and if so, what services could they focus on? According to Schmocker (2015) "Readiness for discharge appears to be a clinically useful patient-reported metric, as those RFD have higher satisfaction with the hospital and physicians." Is this the only or best metric to use or can a hospital focus on provider care and strengthen their overall service ratings?

Hypothesis: Is communication from a doctor more statistically significant to a patient's overall hospital rating than a nurse?

- **Null hypothesis (H_0) –** Doctor communication does not have a more statistically significant impact on the overall hospital rating when compared to a nurse.
- **Alternate Hypothesis (H_1)** – Doctor communication has a more statistically significant impact on the overall hospital rating when compared to a nurse.

Data Analysis Process:

The Patient Survey – Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) dataset (2022) was selected to provide questions posed to patients about their care. The questions focused on were: "Nurse Communication", "Doctor Communication" and "Overall Hospital Rating". A 5-star rating system was utilized.

- Data analysis was performed on the refined data frame. Questions and ratings were grouped and aggregated. Mean ratings for 3,320 grouped responses were very close over all hospital systems. (Figure 1)

```
print('********'*5)
print('*** Describe Data ***')
print('********'*5)
print('* Median: ',df_clean.median())
print('********'*5)

print('Mode: ' + str(df_clean['Questions'].value_counts(ascending=True).loc[lambda x : x>1].to_
      '\n\n' + str(df_clean['Ratings'].value_counts(ascending=True).loc[lambda x : x>1].to_fram
```

```
****************************************
*** Describe Data ***
****************************************
* Median:  Ratings    3.0
dtype: float64
****************************************
Mode:                                          Questions
Nurse communication - star rating             3320
Doctor communication - star rating            3320
Overall hospital rating - star rating         3320

   Ratings
1      374
5      995
2     1903
4     3189
3     3499
```

```
df_grouped = df_clean.groupby(['Questions'],as_index=False).mean() #["Patient Survey Star Ratin
print(df_grouped)
```

```
                              Questions   Ratings
0     Doctor communication - star rating  3.238253
1      Nurse communication - star rating  3.259940
2  Overall hospital rating - star rating  3.263253
```

Figure 1 - Grouped Mean Rating Scores

- Boxplots were created to display the minimum, first quartile, median, third quartile, and maximum values of each grouped question; visually expressing a slight range and third quartile between doctor and nurse ratings. (Figure 2)

```
# Create Boxplot
df_clean.boxplot('Ratings', by='Questions', figsize=(10, 6))

control = df_clean['Ratings'][df_clean['Questions'] == 'Overall hospital rating - star rating']

grps = pd.unique(df_clean['Questions'].values)
d_data = {grp:df_clean['Ratings'][df_clean['Questions'] == grp] for grp in grps}

k = len(pd.unique(df_clean['Questions']))  # number of conditions
N = len(df_clean.values)  # conditions times participants
n = df_clean.groupby('Questions').size()[0] #Participants in each condition
```

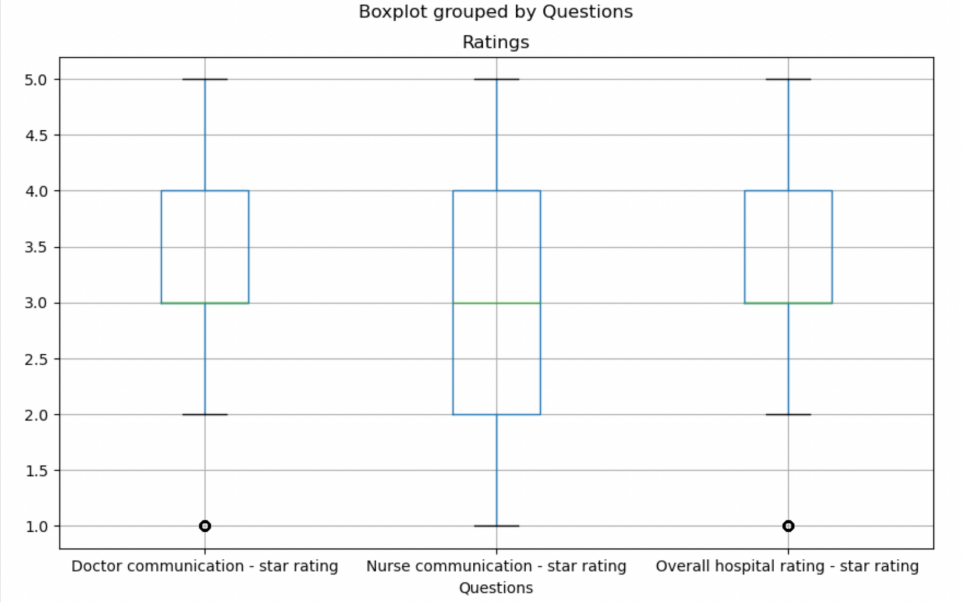

Figure 2 - Boxplot of Grouped Results

- One-way ANOVA was calculated. (Figure 3)

```
# Set up ANOVA Model
mod = ols('Ratings ~ C(Questions)', # Note the Catigorical Data C()
              data=df_clean).fit()

# Carry out the ANOVA
aov_table = sm.stats.anova_lm(mod)
print(aov_table)
```

```
                df       sum_sq   mean_sq         F    PR(>F)
C(Questions)   2.0     1.224297  0.612149  0.614114  0.541141
Residual    9957.0  9925.130723  0.996799       NaN       NaN
```

```
print(mod.summary())
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:                Ratings   R-squared:                       0.000
Model:                            OLS   Adj. R-squared:                 -0.000
Method:                 Least Squares   F-statistic:                    0.6141
Date:                Thu, 08 Sep 2022   Prob (F-statistic):              0.541
Time:                        00:24:30   Log-Likelihood:                -14115.
No. Observations:                9960   AIC:                         2.824e+04
Df Residuals:                    9957   BIC:                         2.826e+04
Df Model:                           2
Covariance Type:            nonrobust
================================================================================================================================
                                                     coef    std err          t      P>|t|      [0.025      0.975]
--------------------------------------------------------------------------------------------------------------------------------
Intercept                                         3.2383      0.017    186.886      0.000       3.204       3.272
C(Questions)[T.Nurse communication - star rating]    0.0217      0.025      0.885      0.376      -0.026       0.070
C(Questions)[T.Overall hospital rating - star rating]    0.0250      0.025      1.020      0.308      -0.023       0.073
==============================================================================
Omnibus:                      241.290   Durbin-Watson:                   0.859
Prob(Omnibus):                  0.000   Jarque-Bera (JB):              147.053
Skew:                          -0.151   Prob(JB):                     1.17e-32
Kurtosis:                       2.487   Cond. No.                         3.73
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
```

Figure 3 - Analysis of Variance (ANOVA)

Outline of Findings: ANOVA uses an F-statistic which measures mean equality of a group and a p-value to measure probability under the assumed hypotheses. The F-statistic of the data was 0.6141 and the p-value was 0.541; thus, we fail to reject the null hypotheses. Both independent variables seem to be important to a hospitals overall rating.

Limitations: One disadvantage of choosing ANOVA to analyze Likert scale data seemed to be within the limitation of the survey interpretations themselves. The questions to be rated are still able to be interpreted by the individual which may differ when compared to the research objectives. Additionally, limitations within the current survey point's to how providers

communicate, but this really isn't the whole story. Trying to understand why a patient provided a certain rating will help illuminate where focus is needed.

Proposed Actions: Since a patients experience with their doctor and nurse are both important to the hospital's overall rating, continued training and improved provider/patient relations should be strived for. Additionally, more specific questions could be added to the patient survey to dig deeper into understanding what key behaviors could be championed to improve.

Expected Benefits: Failing to reject the null hypotheses provide an understanding to provider staff that both doctor and nurse communication are important to a hospitals overall rating. This understanding should help dispel a hierarchy of proposed importance between provider staff. Additionally, by focusing on improving provider rating scores, hospitals are empowered to improve their overall patient services and hospital rating score.

References

Sewell, W. (n.d.). Lecture: D207 T2 – Welcome to D207 EDA Webinar. Western Governors University. Found Here: https://wgu.hosted.panopto.com/Panopto/Pages/Viewer.aspx?id=fcf752f1-6ff7-4286-9100-ad1f016a98d6

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Norman G. Likert scales, levels of measurement and the "laws" of statistics. Adv Health Sci Educ Theory Pract. 2010 Dec;15(5):625-32. doi: 10.1007/s10459-010-9222-y. Epub 2010 Feb 10. PMID: 20146096.

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