

How does Social Connection Affect Mental Health

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Introduction

- Mental health issues have received increased attention due to the emergence of COVID-19, where people are isolated from each other physically.

Due to that reason, more and more people start interacting with people online.

- Our project aims to study the relationship between online and offline social connections and personal mental health by exploring CSCS data.
- This is a neat study for any audience curious about the best ways for (most) Canadians to interact with others that improves their mental health.

Content

- Variables Summary
- Connection Activities Based on PHQ Score
- Connection Activities Based on Self Happiness
- Online versus Offline
- Conclusion

Independent Categorical Variables

- Online Connection -

Checked In	Frequency of sent a text/private message to someone just to check in
Console Games	Frequency of a computer or console game with others
Group Discussion	Frequency of participated in an online discussion group
Group Video Chat	Frequency of having a video chat with a GROUP of friends or family
Online Games	Frequency of playing an online game with others
Phone Call	Frequency of having a phone conversation with a friend or family member
Text or Messaged	Frequency of receiving a text/private message from someone
Video Chat	Frequency of having a video chat with a friend or family member
Letter or Email	Frequency of receiving letter/email from others



Independent Categorical Variables

- Offline Connection -

Board games	Frequency of playing a board game with others
Church	Frequency of attending church, synagogue, temple
Coffee	Frequency of meeting someone for a meal, drink, dessert, or cup of coffee
Community	Frequency of volunteering in the community
Helped	Frequency of helping a neighbor or friend with a task or chore (e.g., yard work, moving)
Hug	Frequency of hugging someone
Talked family	Frequency of talking with family
Visited family	Frequency of visiting the family
Kissed Someone	Frequency of kissing someone
Wrote Letter	Frequency of writing a letter to a friend or family member



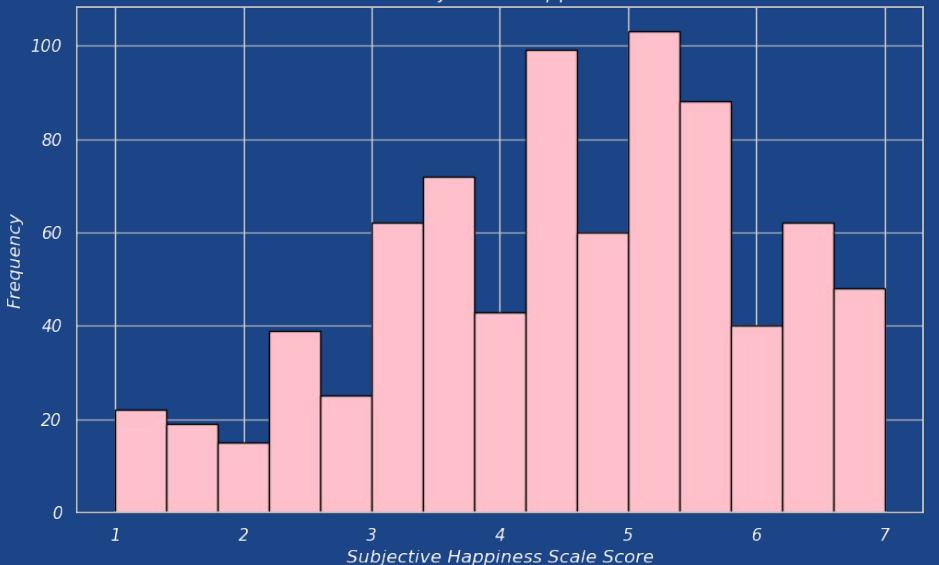
Dependent Variables

-Mental Health Score-

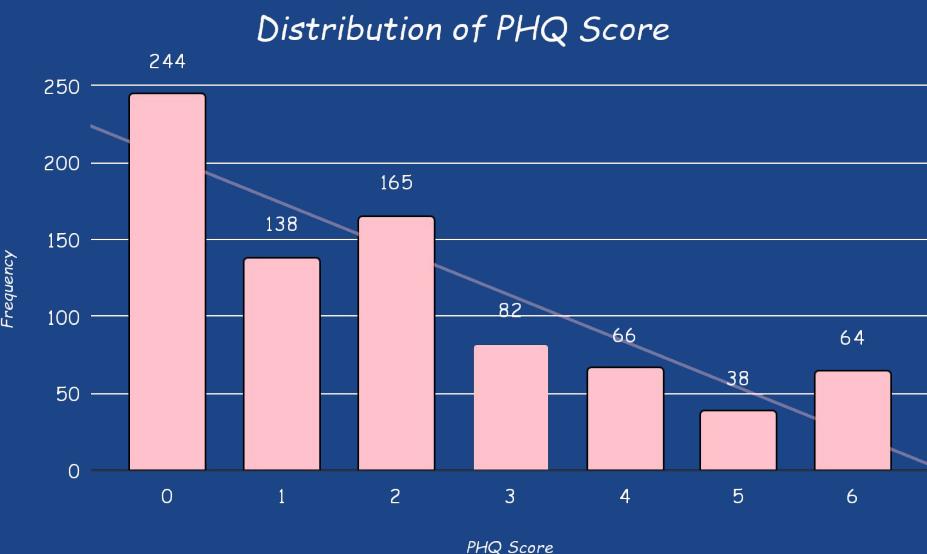
Subjective Happiness Scale Score	A brief, self-report measure consisting of a few items where participants rate their happiness relative to others or describe their general state of happiness. The scores from the SHS provide an index of subjective well-being or happiness as perceived by the individual. Higher scores indicating greater levels of subjective happiness. Lower scores suggesting lower levels of perceived happiness.
PHQ Score	Patient Health Questionnaire Score A widely used self-administered tool for assessing mental health, particularly symptoms of depression. Lower scores indicate better mental health, while higher scores suggest more severe depressive symptoms.

Quick Overview

Distribution of Subjective Happiness Scale Score



Distribution of PHQ Score



Question 1:

What is the most effective connection activity related to PHQ scores?

Motivation:

- Mental health matters. PHQ scores help track depression and well-being.
- Social connections are key to mental health—better connections mean better outcomes.
- Why this study? Online vs. offline activities dominate today's interactions; understanding their effects can shape better health strategies.



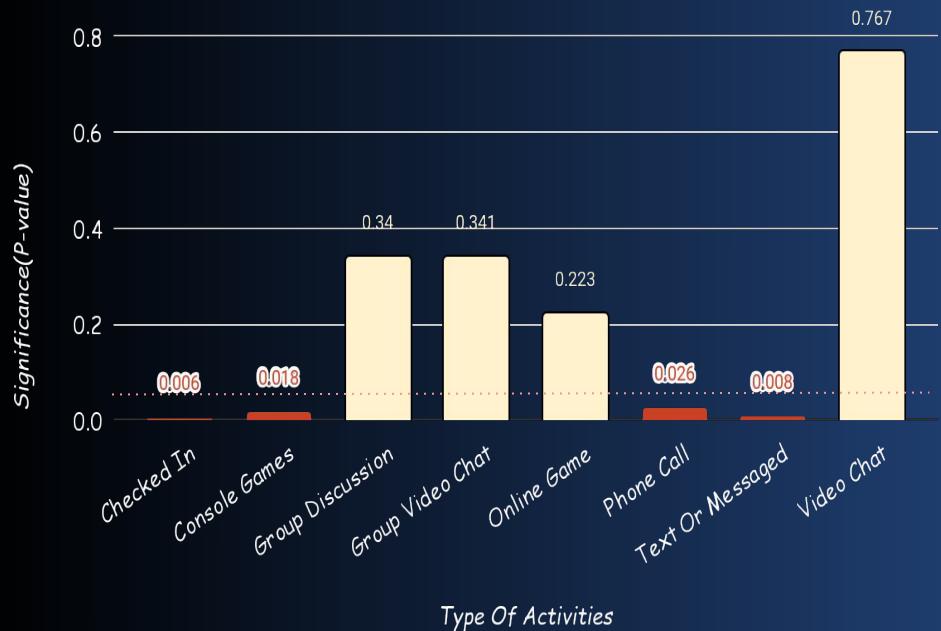
Analysis Approach:

- **Multiple Linear Regression** quantifies the relationship between connection activities and PHQ scores
- **Model 1:** Examines the impact of online activities on PHQ scores.
 - $\text{PHQ Score} = \beta_0 + \beta_1(\text{Checked In}) + \beta_2(\text{Computer Games}) + \beta_3(\text{Discussion Group}) + \dots + \beta_9(\text{Letter or Email}) + \text{error term}$
- **Model 2:** Examines the impact of offline activities on PHQ scores.
 - $\text{PHQ Score} = \beta_0 + \beta_1(\text{Board Games}) + \beta_2(\text{Church}) + \beta_3(\text{Coffee}) + \dots + \beta_8(\text{Visited Family}) + \beta_9(\text{kissed Someone}) + \beta_{10}(\text{Wrote Letter}) + \text{error term}$
- **Baseline:** "No connection activity" serves as the reference group
- **Model Fit and Robustness:** R^2 values (0.10 and 0.16) and residual analysis are used to evaluate model performance.
- **Focus on statistical significance** ($p\text{-value} < 0.05$) and **effect size** (coefficients).

Results of Online Model

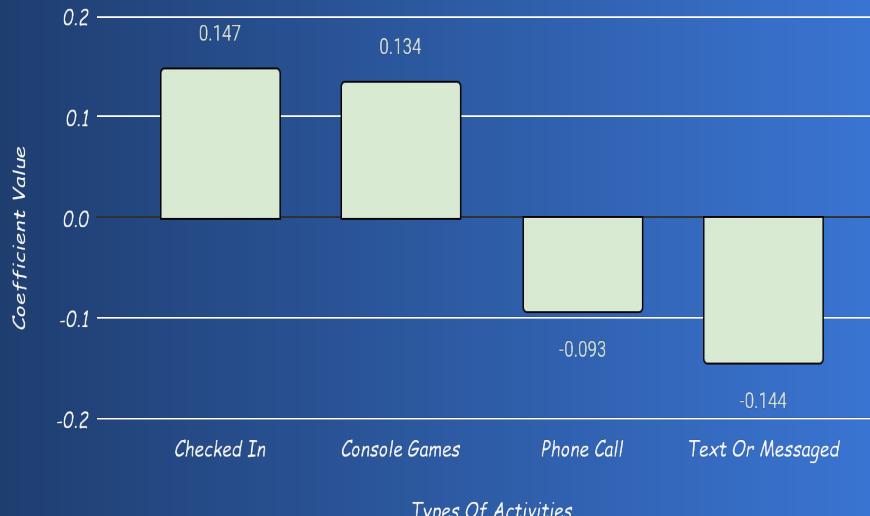
..... Significant level(0.05)

Significance Of Online Connection

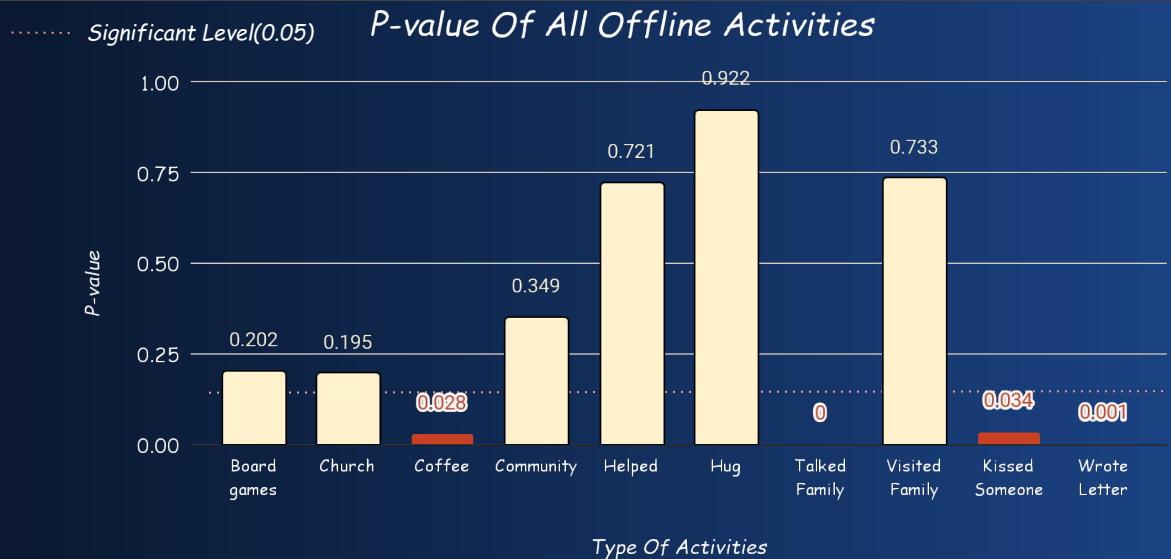


Interpretation: Positive coefficients indicate worse mental health (higher PHQ scores), while negative coefficients suggest improved mental health (lower PHQ scores).

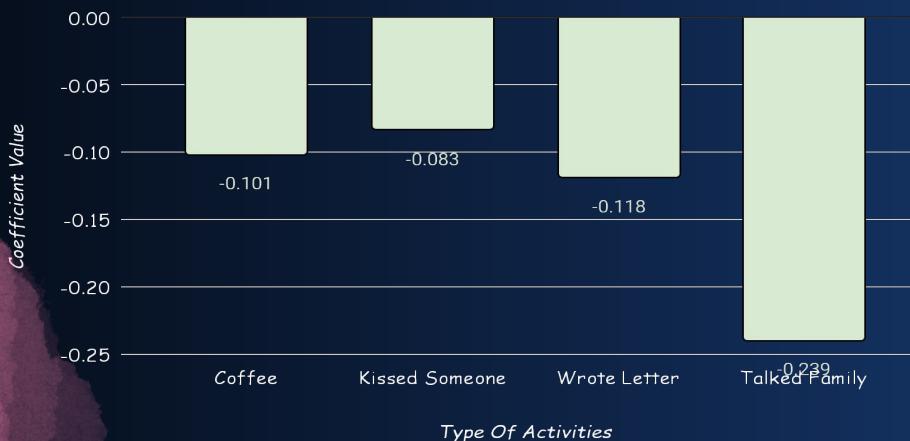
Coefficient For Statistically Significant Online Activity



Results of Offline Model



Coefficient Of Statistically Significant Offline Activities



Conclusion

Online Model:

Negative Influences (Positive Coefficients):

1. Checked In(+0.147): Shallow connections, potential stress.
2. Console Games (+0.134): Linked to increased stress or reduced productivity.

Positive Influences (Negative Coefficients):

1. Phone Calls (-0.093): Reflects meaningful communication, stress relief.
2. Texted Or Messaged (-0.144): Quick, efficient, and reduces stress.

Offline Model:

Positive Influences (Negative Coefficients):

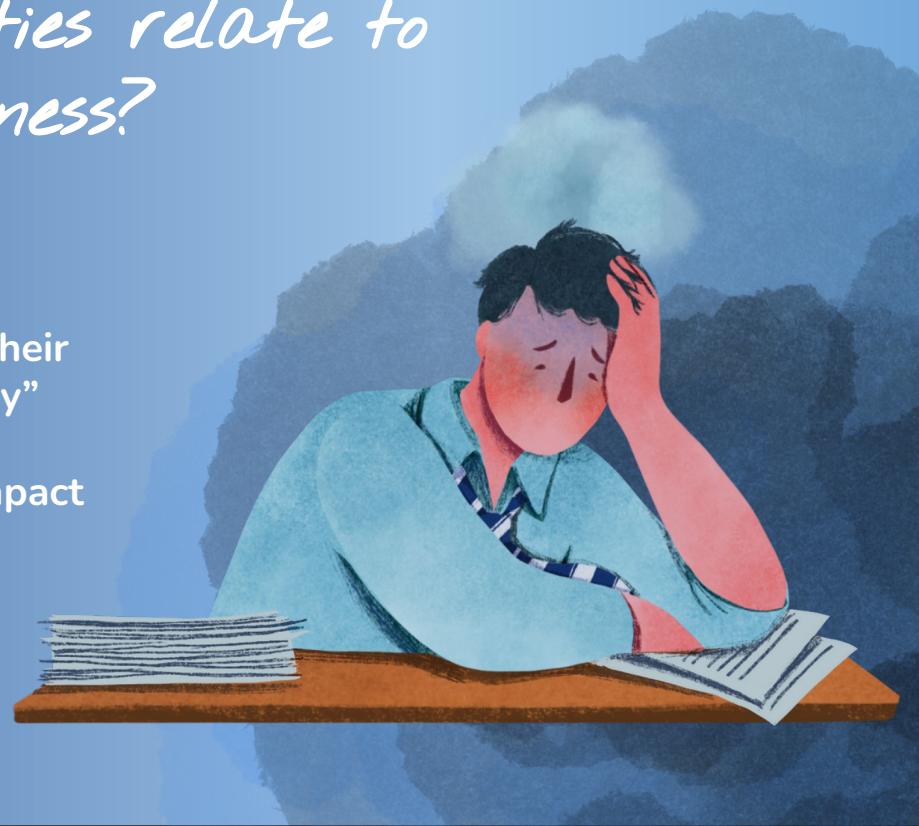
1. Kissed someone (-0.083): Reflects intimacy, reduces stress.
2. Coffee (-0.101): Relieves stress, strengthens connections.
3. Wrote letter (-0.118): Thoughtful and reflective communication.
4. Talked family (-0.239): Addresses issues, promotes closeness.

Question 2:

How do connection activities relate to one's Self-Sense of Happiness?

Motivation:

- Not all patients always have access to mental-health tests. Many of them view their mental health state merely by how “happy” they “think” they are.
 - That self-evaluation can turn and impact their mental-health.
- Therefore, self-evaluated happiness is an important aspect to look at.

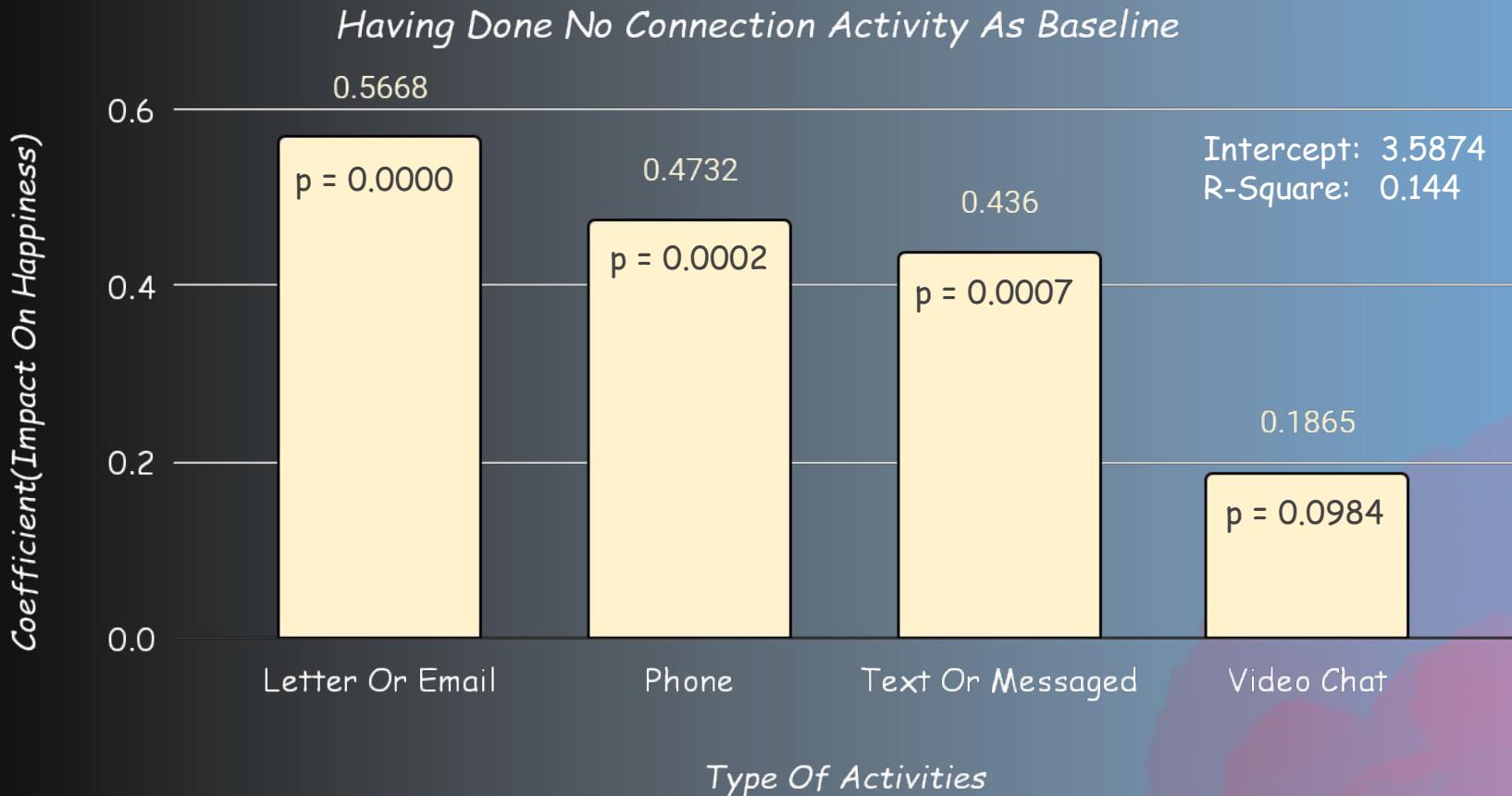


Analysis Approach

1. **Independent Variables:** All of the interaction activities; Categorical
2. **Dependent Variable:** Subjective happiness scale score; Continuous (0.00, 7.00)
3. **Data Transformation:** **categorical** independent variables into **binary**:
 - a. "Freq": performed frequently (e.g. daily, weekly).
 - b. "NAFreq": performed less frequently (e.g. <=monthly).
4. **Multiple Linear Regression:** predicts the dependent variable (**subjective happiness** score) using the binary variables as predictors.
 - a. The results **coefficients, p-values, R^2** were analyzed for independent variable significance and impact.

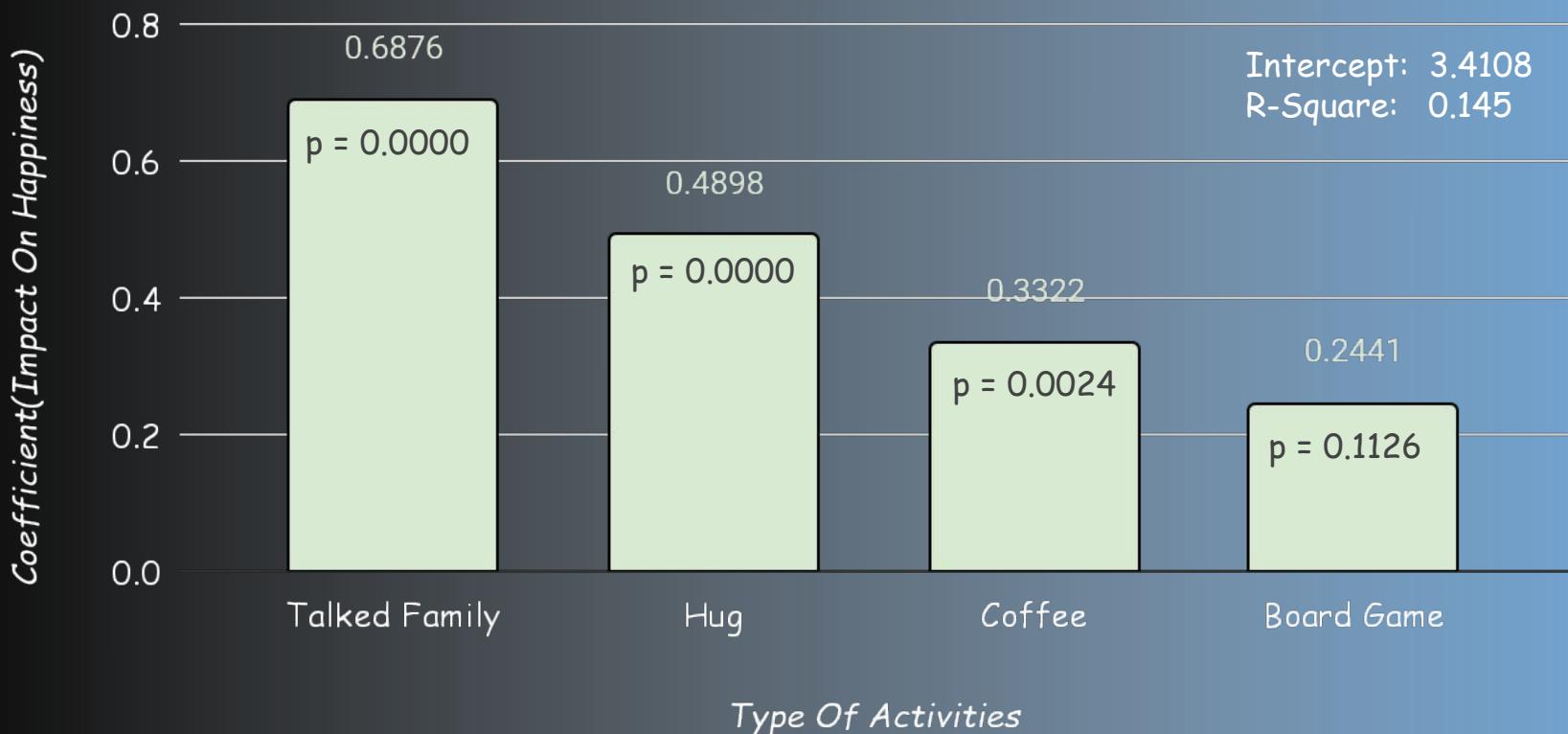
```
No_Offline_Model = 'WELLNESS_subjective_happiness ~ ' + ' + '.join(  
    [f"C({col}, Treatment(reference='NAFreq'))" for col in offline_dependent_variables.columns[:-1]]  
)
```

Online Connection's Impact On Happiness($p \sim 0.1$)



Offline Connection's Impact On Happiness(p~0.1)

Having Done No Connection Activity As Baseline



Question 3:

Which Is More Effective?
Offline Or Online Connection?

Motivation:

- Online and Offline activities offer different types of social connection experiences.
- Social connections have a significant impact on mental health and happiness but which one is better?
- Understanding which type of activity has a better impact can help researchers develop better support for mental health.



Analysis Approach:

1. Assign numeric values for each category in the independent variables.
2. Make composite scores for both online and offline activity frequency.
 - a. Online score being the sum of all values for independent variables associated online activity
 - b. Offline score being the sum of all values for independent variables associated offline activity
3. Create a multiple linear regression model with online and offline composite scores as independent variables and happiness score as dependent variable
 - a. $\text{Wellness Measure} = \beta_0 + \beta_1(\text{Online Composite}) + \beta_2(\text{Offline Composite}) + \epsilon$
4. Compare coefficients (β_1 and β_2).
 - a. If $\beta_1 > \beta_2$ online connection has a stronger effect.
 - b. If $\beta_2 > \beta_1$ offline connection has a stronger effect.
5. Look at p-values for β_1 and β_2 to test significance. Examine R-squared to evaluate the model's fit. The model will be tested with training and test data to test for overfitting.

How I prepared the Data:

Independent Variables Numerical Value Assignment							
	Not in the past three months	Less than monthly	Monthly	A few times a month	Weekly	A few times a week	Daily or almost daily
Regular variables	0	1	2	3	4	5	6
Effective variables	0	2	4	6	8	10	12

R-squared results:

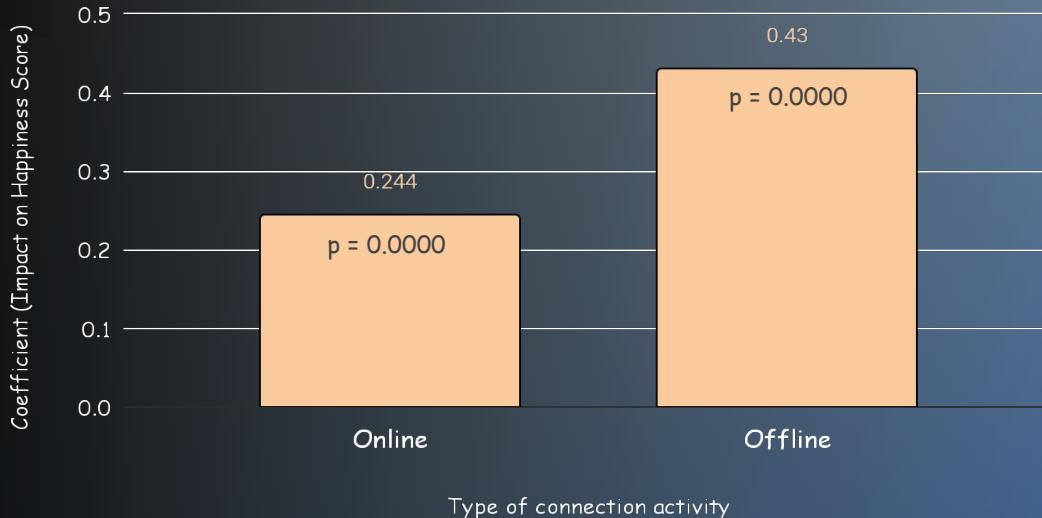
On a split of 80% for training data and 20% for testing data:

- R-squared for training data (In-Sample) was 0.206
- R-squared for test data (Out-of-Sample) was 0.209
- R-squared for all data (no splits) was 0.203

The similarity in R-squared suggests that the model generalizes well and is not specifically fitted to one dataset. A general R-squared of 0.203 suggests that the model explains a moderate 20.3% of variability in happiness scores.

Results & Interpretation

Online vs. Offline connection Impact on Happiness Scores



Interpretation:

1. Online connection has a statistically significant positive impact on wellness.
2. Offline connection has a statistically significant positive impact on wellness.
3. Offline connection appears to have a larger impact on wellness than online connection ($\beta_2 > \beta_1$).

Intercept (β_0): 4.5861
R-Square: 0.203
Cond. No. : 1.87

Online: β_1
Offline: β_2

Overall Conclusion & Limitations

Findings:

1. Positive role of specific online interactions
2. Offline have a stronger positive influence on depressive symptoms and self rated happiness score
3. Offline connections outperform online interactions

Limitations:

1. Mental health is multi-faceted and influenced by numerous factors beyond social connections ethical restrictions may limit the scope or depth of analyses.
2. Selection Bias
3. Research may oversimplify online and offline interactions

Acknowledgements

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Thank you TA Lisa for all of your help and TUT 0207 peers for the any feedbacks.

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