



Optum Data Science Case Competition

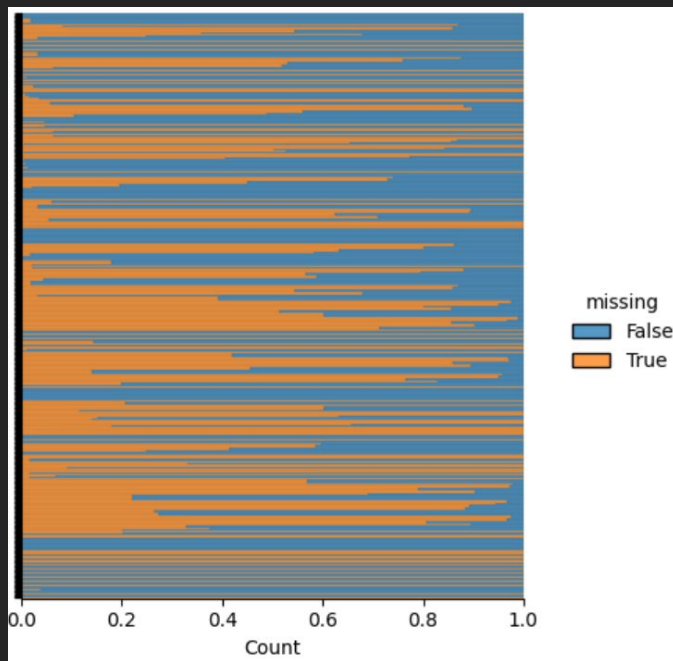
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| Problem

Which factors contribute the most to preventable hospitalizations?

Preprocessing Code Snippets

```
# Load the dataset as a pandas DataFrame  
chr_analytic_csv_path = Path.cwd().parent / "data" / "chr_analytic_data2022.csv"  
chr_analytic_df = pd.read_csv(chr_analytic_csv_path, skiprows=1)
```



Preprocessing Code Snippets

```
# Remove columns with more than 50% nan
chr_analytic_df.dropna(axis = 1, thresh = int(0.5 * len(chr_analytic_df)), inplace=True)
chr_analytic_df
```

```
# Remove non-numerical columns
numeric_chr_analytic_df = chr_analytic_df.drop(non_numerical_cols, axis = 1)
# Interpolate NaN values
numeric_chr_analytic_df.interpolate(inplace=True)
```

```
# Find correlation between columns
corr = numeric_chr_analytic_df.corr(method="pearson", numeric_only=True)
```

Correlation Analysis Code Snippets

```
# Create a series containing absolute value of correlations to preventable hospitable stays  
absolute_correlations = abs(raw_corr["v005_rawvalue"])
```

```
# Get the twenty columns most correlated with preventable hospital stays  
N_most_correlated = 20  
most_correlated = absolute_correlations.nlargest(N_most_correlated)
```

```
# linear regression  
a, b = np.polyfit(df[label], df["v005_rawvalue"], 1)
```



seaborn



NumPy

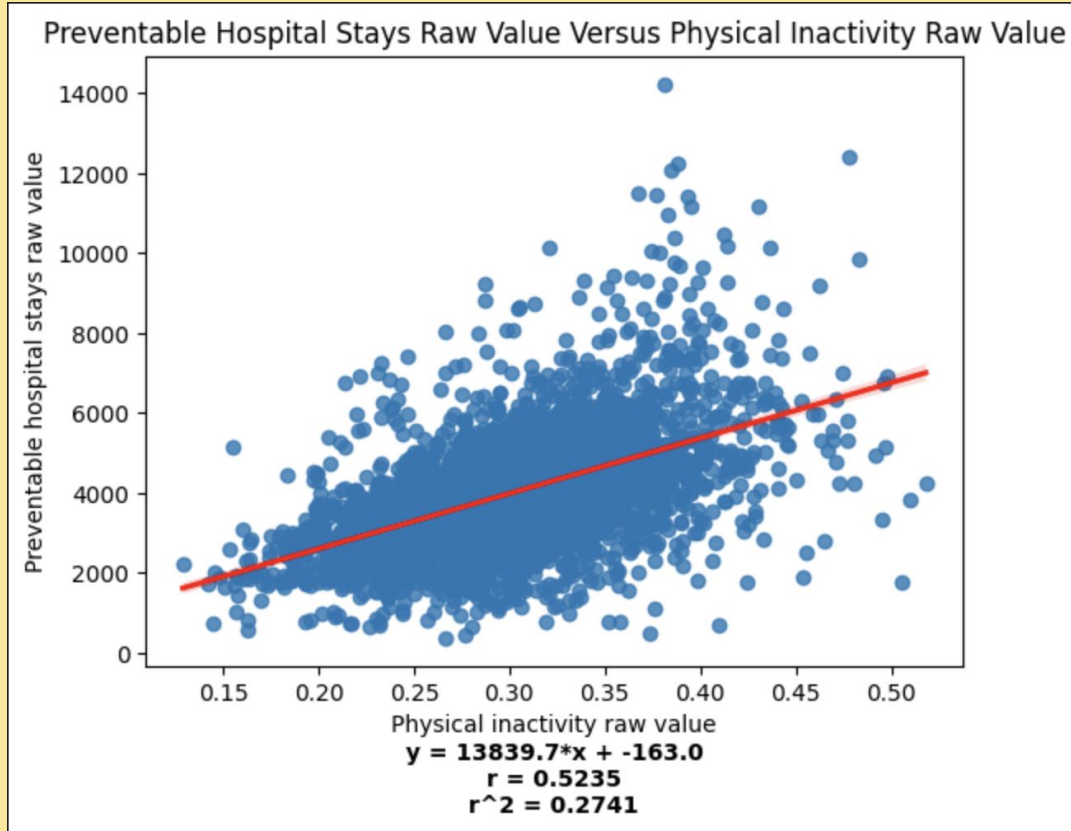
Results

We found that the following factors are most correlated with preventable hospital stays:

- **Physical Inactivity**
- **Insufficient Sleep**
- Poor or Fair Health
- Premature Age Adjusted Mortality
- Frequent Physical Distress
- **Frequent Mental Distress**
- Life Expectancy (Inverse Correlation)
- Adult Smoking
- Poor Physical Health Days
- Poor Mental Health Days

Out of these correlations, we chose to focus on physical inactivity, insufficient sleep, and frequent mental distress. These factors are widespread issues that make sense as causes of preventable hospital stays.

Results

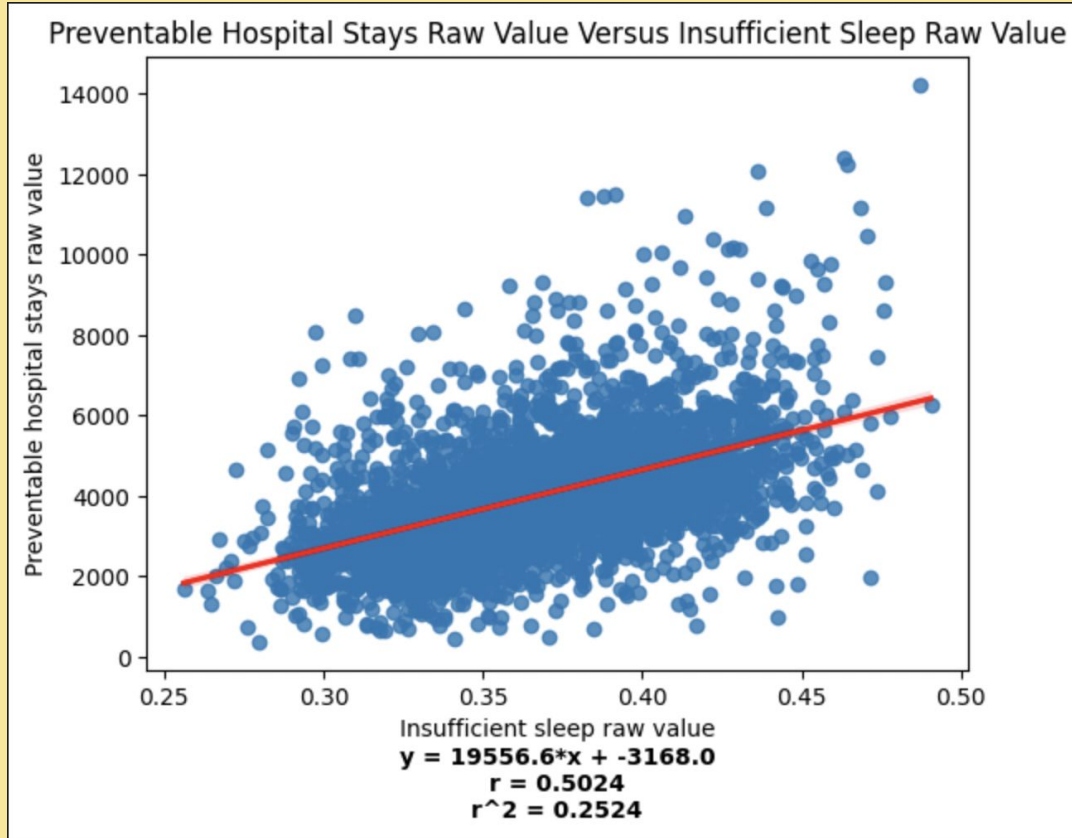


Physical Activity

An Aerobics Center Longitudinal Study with more than 80,000 patients (since 1920), showed that fitness level is a significant predictor of mortality.

(American Physiology Association, 2009)

Results



Sleep

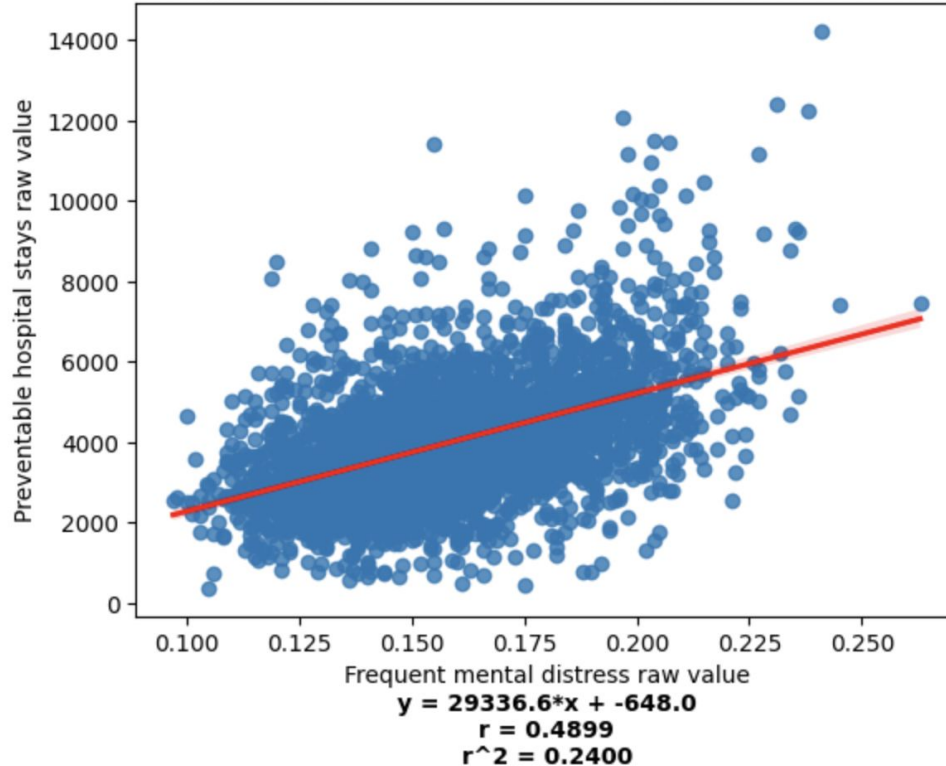
“NIH research shows that not getting enough sleep is associated with excess body weight and obesity.”

“A review of 10 studies involving more than 18,000 people found that people who got between 7 and 8 hours of sleep per day have the lowest risk of diabetes”

(Centers for Disease Control and Prevention, 2019)

Results

Preventable Hospital Stays Raw Value Versus Frequent Mental Distress Raw Value



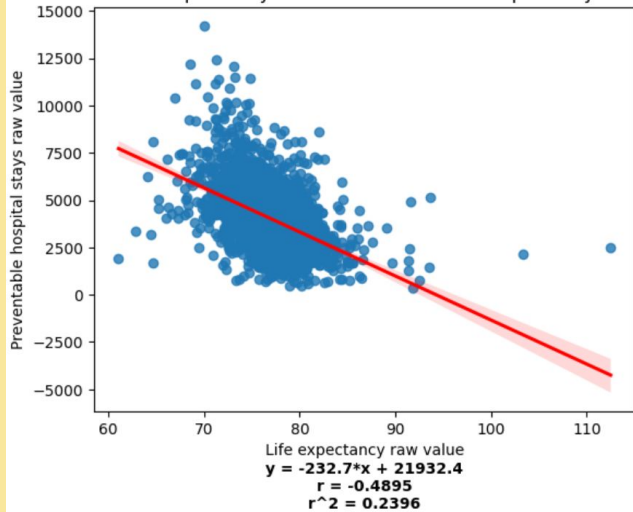
Mental Distress

“Someone can have frequent mental distress when they feel emotionally unhealthy, or very sad, anxious, or troubled, for at least 14 out of 30 days” leading to them to “Visit the doctor more.”

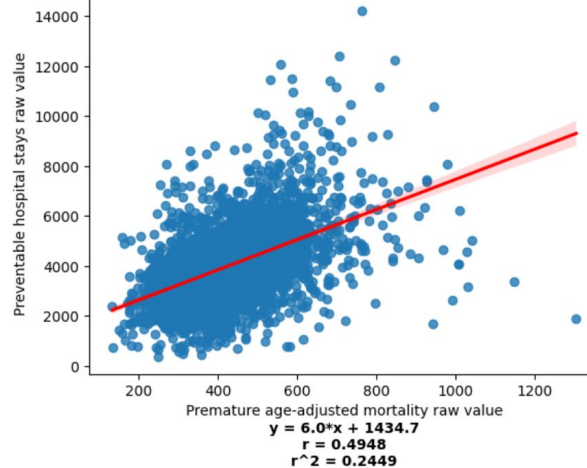
(Centers for Disease Control and Prevention, 2020)

Results

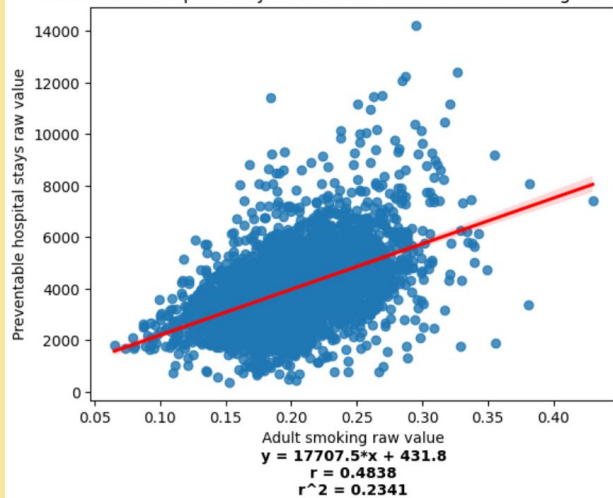
Preventable Hospital Stays Raw Value Versus Life Expectancy Raw Value



Preventable Hospital Stays Raw Value Versus Premature Age-adjusted Mortality Raw Value



Preventable Hospital Stays Raw Value Versus Adult Smoking Raw Value





Our Solution

Improving the already existing UHG Rewards app by incentivising working out and maintaining a sleep schedule through friendly competition.

- The app gathers sleep and exercise data from IOS and Android health apps as well as fitness monitoring devices.
- Leaderboards track the top performers for exercise and sleep in your town.
- Insurance discounts are dynamic and given monthly for certain fitness achievements as well to the top performers in the community.

| Next Steps

Starting Developing the App

Community

- The app uses user location to create a local leaderboard.
- Allows user to add friends on the app to promote friendly competition.
- The app allows people to organize and advertise community exercise events such as sports groups or classes.
- The app encourages exercise and sleep, which also improves general mental health.
 - “The 6 week aerobic exercise intervention resulted in significant improvements in self-reported depression, overall perceived stress, and perceived stress due to uncertainty” (nih.gov)

Rewards

- Users will receive discounts on their insurance premiums based on their leaderboard position.
- Each user has access to activity challenges which provide fitness-related rewards.
 - Ex: Gym membership, fitness equipment, wearables, etc.

Sources

Centers for Disease Control and Prevention. (2019, September 25). *Lack of Physical Activity*. Centers for Disease Control and Prevention.

<https://www.cdc.gov/chronicdisease/resources/publications/factsheets/physical-activity.htm>

How does inadequate sleep affect health? (2019, April 29). [Http://Www.nichd.nih.gov/](http://www.nichd.nih.gov/).

<https://www.nichd.nih.gov/health/topics/sleep/conditioninfo/inadequate-sleep>

National Centers on Birth Defects and Developmental Disabilities (2020). Mental Distress Among Adults with disabilities: An Easy-Read Summary. Available at: CDC MMWR WEB PAGE <https://www.cdc.gov/mmwr/index2020.html>

Physical Inactivity Poses Greatest Health Risk to Americans, Research Shows. (2021). Apa.org.

<https://www.apa.org/news/press/releases/2009/08/physical-inactivity>

Regular Physical Activity, Short-Term Exercise, Mental Health, and Well-Being Among University Students: The Results of an Online and a Laboratory Study

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7264390/>

Thank you!
Questions?

