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Common factors and mental health conditions affecting Quality of Life and well-being of a person

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Abstract

Mental health is a term that refers to mental happiness that empowers people to manage the stresses of life, learn and work well, realize their abilities, and add to the community for goodness. The people are able to make decisions, build relationships and are able to shape the world that we live in. The main intention of this study is to consider each and every factor included in a person's lifestyle and his personal information and to check if these factors have any association with the mental health of that person. The study also calculates the Quality of Life (QoL) index score using the EQ-5D-3L method which is a value in the range of 0 to 1 where 0 represents the person is dead and 1 represents the person is fully healthy. The EQ-5D-5L index score is used to measure the quality of life for a larger dataset and it also gives more accuracy. But for this study with a much smaller dataset 3 level index score is more than enough. The study also focuses on analyzing the association of different life conditions and problems with the QoL index using correlation heatmaps and thereby finding the factors that affect the index value.

Keywords: Linear regression, Decision Tree, Random Forest, Mental Health, Quality of Life (Qol), Eq-5d-3l, Qol index.

1. Introduction

Mental health comprises of a persons psychological, emotional and the social well-being. It is based on how we feel, think and act. Moreover it determines how we are able to handle stress, and can make healthy choices for the betterment of our livelihood. Mental health is very essential at every stage of our life, from childhood and adolescence through adulthood. There are many factors that affect a good and peaceful living of a person. Adverse health conditions, mental illness, living conditions and surroundings are some of them. **Mental illness or mental health disorders** are the unstable mental health and emotional wellbeing condition of an individual. This is a disorder that affects a person's mood, behavior, emotions, feelings, work life and so on. Mental health stability plays a major role in the way you live and it plays a crucial part in maintaining the quality of life. The **Quality of Life (QoL)** is defined by the World Health Organization as “the perception of an individual of their position in life in the context of the value system and the culture in which they live and in relation to their goals, expectations, standards and concerns” [1]. The standard indicators for the quality of life include education, living conditions, family, mental

health, physical health, social interaction, family attachment etc. There are a large number of indicators that are associated with the quality of life. Here we are considering very few factors or indicators which help us conduct a study on the quality of life of people who are struggling with mental health disorders and of people who are not. For this study we conducted a survey with Google form in which we included 44 simple questions related to mental health as well as personal information and some questions based on the surroundings and lifestyle which is easily understandable by a layman and also included the 5 dimension questions with 3 levels for the calculation of quality of life using the parameter EQ-5D-3L. The main examples of mental health disorders that we have considered in the study is Uncontrolled Anger, Depression, Anxiety and Panic attacks, Attention deficit hyperactivity disorder (ADHD), Body Dysmorphia, Bipolar Disorder, Borderline Personality Disorder (BPD) and others.

EQ-5D is a standardized measure introduced by EuroQol Group to measure health related quality of life. It is developed by providing a simple and generic questionnaire to people for population health surveys. The questionnaire will be simple and general such that it will not focus on any specific health condition or disorders. In this study we are focusing on the health condition and living conditions of people above the age of 16. Among many methods in the EQ-5D group, the EQ-5D-3L and EQ-5D-5L method is very much suitable for people above the age of 16.

In this study we are considering the EQ-5D-3L method i.e., EQ-5 dimension-3 level method which includes 5 main questions or dimensions where each question has 3 levels of answers to choose.

Use of Quality of Life (QoL) has increased in the health sector over years. The QoL index value which is determined from the response obtained by the people ranges from 0 to 1 and the questionnaire is very much understandable by laymen. There are many studies and researches based on the quality of life and mental health disorders like depression, anxiety and schizophrenia. There is only a limited study about the prediction of QoL index from the already existing index values.

Prediction of quality of life in schizophrenia using machine learning models on data from Clinical Antipsychotic Trials of Intervention Effectiveness (CATIE) schizophrenia trial is a study conducted by Melissa Beaudoins and team in the health sector. The study is about accurately predicting the QoL of a person with Schizophrenia using Linear Regression model which is a supervised machine learning algorithm and other machine learning models. From the study it is clear that the person with schizophrenia will have a lower QoL index value and there are a lot of other factors affecting the quality of life index of a patient [2].

Quality of life of people with mental health problems: a synthesis of qualitative research is a study by Janice Connel and team. They conducted a qualitative study by using general measures like autonomy, self-perception, hope, hopelessness etc. from which they came to the conclusion that these general measures or domains fail to give an accurate study of the complexity of QoL index values [3].

Factors associated with quality of life in patients with depression: A nationwide population-based study conducted by Yunji Cho and team is an interesting study. From this study they came to a conclusion that older age, lower level of education, lower status of lifestyle, adverse health conditions, obesity, unemployment etc. are the factors that affect the Qol index of people with depression [4] .

2. Materials and Methods

2.1 EQ-5D

EQ-5D is a standardized measure that is developed by Euroqol group which is an effort to develop a standard instrument to measure non diseases and a specific value for health-related quality of life. This is made possible using a specific kind of questionnaire which is being prepared for finding the index value of quality of life. EQ-5D is widely used today by health sectors of different countries and now it is being translated to different varieties of language. It can also be considered as a patient-reported outcome where the patient answers all the questions in the questionnaire and the answers thus obtained are then used to create the index of quality of life. The 5D represents the 5 questions that are asked in the questionnaire about the basic conditions of a person's health. The 5 dimensions mentioned here are mobility (the ability to move about), self-care, anxiety and depression, usual activities, and pain and discomfort. These are the 5 dimensions or questions that are always asked during the surveys.

2.2 EQ-5D-3L

There are different kinds of EQ_5D methods to find the quality of life like 3L, 5L, Y etc. For people of age above 16 EQ-5D-3L and 5L are used. The method that we consider here is the 3 level method which means that there will be 3 levels of options for each of the 5 questions asked. The 3 levels are no problem, slight or moderate problem, severe or worse condition of the 5 health conditions mentioned. The index value cannot be manually calculated; the eq index value calculator application will be provided by the Euroqol group if we give a request for non-commercial purpose. This index value can also be calculated using the eq5d function in the eq5d package of R package repository. This package is only available in the latest version of R studio. The eq5d function in R only supports a few countries in which unfortunately India is not a part. So after a detailed analysis and study we choose SriLanka for calculating the index. We chose SriLanka because the Asian countries in which the function is available are China, Malaysia, SriLanka, Japan, and a few others in which the nearest to India was SriLanka and the health index was almost similar in both the countries [5].

2.3 Prediction models

2.3.1 Linear Regression model

Linear Regression model is a statistical model that is used to find the relationship between a dependent variable and a set of independent variables. We will fit a regression model if the dependent variable is a numerical value. Here

the dependent variable is the eq-5d-3l index score. This method is used if the target variable is a numerical value. Regression is also used in many different fields like economics, election polls, social science, health and many more. Since there is more than one independent variable, the multiple regression models are used. The regression model is given as,

$$y=b_0+b_1x_1+.....+b_rx_r$$

Here there are r+1 weights to be determined and there are r inputs [6].

2.3.2 Decision Tree

Decision tree algorithm is a statistical algorithm which enables a person to make decisions about a certain condition. It is a regression model that forms a structure of a tree for classification and regression problems. In the decision tree they split up the whole datasets into nodes and subnodes which makes it easier to understand and analyze [7]. The final result will be in the form of a tree in which there will be nodes, subnodes, and leafs. An example of a decision tree is shown in figure 1.

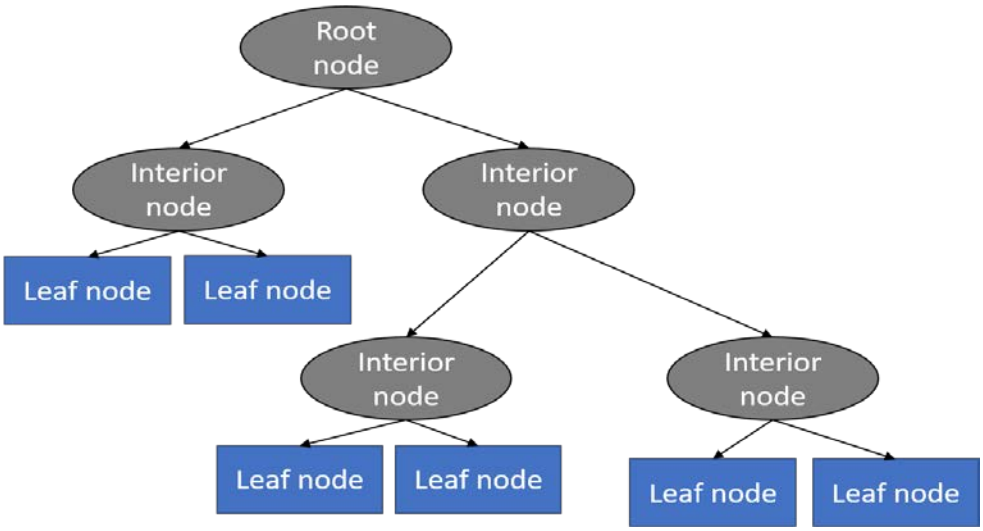

Fig. 1 A Decision Tree Model

2.3.3 Random Forest

Random forest is a collection of decision trees. It creates decision trees for different samples and then analyzes them independently. They are mainly used for classification and regression problems. They are used for prediction purposes also which is why we used this model for our study. It is a supervised machine learning algorithm. It is also called an ensemble method because they use more than 2 prediction models and combine them together to give a more accurate single model for a better study [8]. An example of a random forest is shown in figure 2.

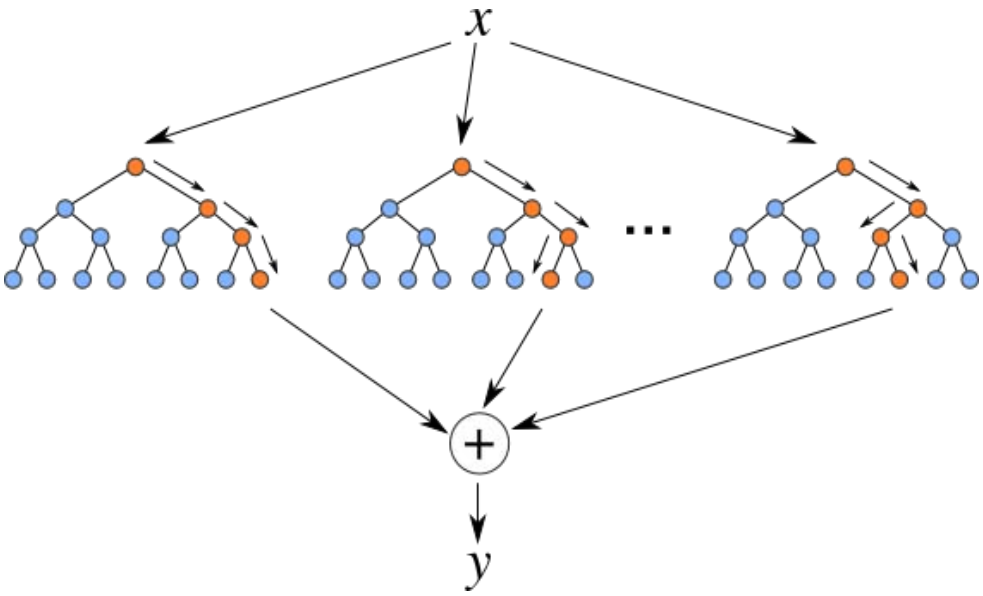

Fig. 2 A Random Forest Model

3. Results

Quality of Life (QoL) is a hot sensational topic in the health sector now. Not only in the health sector but also in economics, advertising executives consider this topic as a very sensational and important aspect. People in today's world consider health as the first priority in life. There are many factors that affect the QoL index. Some are health related whereas others are lifestyle, personality, gender etc. Some of the factors are:

- Satisfaction in life
- Joblessness or unemployment
- Living Style or Living status
- Health related conditions or illness (physical or mental)
- How positively or negatively one accepts the current environmental condition.
- One's interpretation of facts and events.
- Presence of physical, mental and social well-being.

Here in this study we are considering only factors that affect a person's physical and mental wellbeing not social aspects.

4. Descriptive Analysis

The data consists of the responses of 303 people including only men and women. Among 303 people we have 199 females and 104 men. All the people that are being considered in the study are above the age of 18 years old. About 60 percent of people come from a nuclear family and about 215 people in total are below the age of 30 years.

All the 303 people rated their mental health and it can be shown in figure 3.

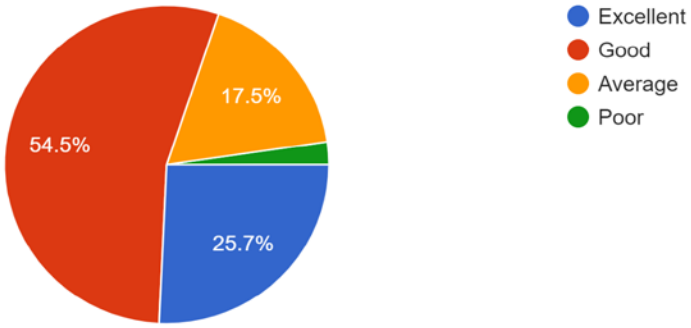

Fig. 3 A pie chart showing the mental health condition of people considered in the study

It is clear that 2.3 percent of people have poor mental health and 17.5 percent of people only have an average mental health. Total of 14 people have sought medical help at their worst mental health conditions. In the past 2 years 68 people had problems in their work life and usual activities due to mental health illness. But only 14 had sought medical help which is a very adverse condition. In India mental health awareness is so poor that it remains one of the hidden diseases in India due to Stigma, unawareness and misassumptions. This study has also shown that 144 people including the 14 people who have sought medical help are aware about their mental illness or unhealthy mental conditions. They are not coming forward or seeking help because they are unaware of the help that they can use and they don't want others around them to know about their mental health.

5. Model fitting and prediction

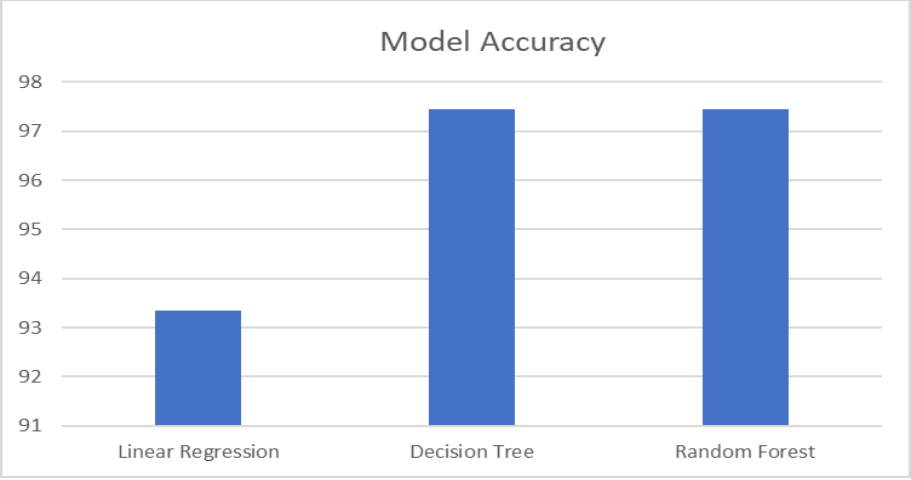

Fig. 4 The bar chart showing the accuracy of the fitted models

From the graph figure 4 it is clear that random forest and decision tree gives the most accurate result. Since the data is related to common health aspects, a prediction using any model will not always give an accurate result. Therefore necessary help and guidance should be considered from an authorized person.In this study we used 5 dimensions to measure the Quality of Life index. The eq-5d index was calculated using the eq5d( ) in R programming. After finding the QoL index we classified the data into two. The data is being classified as people having the QoL index 1 and less than1. People having QoL index 1 is considered as the healthiest and those having less than one are considered to be unhealthy in certain contexts. A person with QoL index 0 is considered to be dead but in this case there is no one having the QoL index 0. After analyzing both the classes it was clear that out of 14 people who have sought medical help two of them have a QoL index 1 which shows that those 2 have recovered from their mental illness which is a very positive response. The remaining 12 people have a lower QoL index which associates mental health and QoL.

From the total 303 people 143 people have a low eq-5d index and the rest have a healthy life. Using the Machine learning supervised learning algorithms we fitted 3 models to predict the eq-5d index using the existing data. The models we used were Linear Regression Model, Random forest and Decision Tree to predict the QoL index. The accuracy and mean absolute error are mentioned in table 1.

Table. 1 The accuracy and MAE of the model fitted

	Linear Regression	**Decision Tree**	**Random Forest**
Accuracy	93.35	97.453	97.453
Mean Absolute Error (MAE)	0.029558	0.0035394	0.004009

6. Association of every factor considered with QoL index

In the study we included 11 concerns about health to find their association with the QoL index. The 11 concerns include;

- How often do you sleep?
- Attention ability or academic performance rating
- Socializing ability
- Relationship with family
- Traumatic flashbacks
- Mood swings
- Susceptibility to infections and allergies

- Sadness or hopelessness
- Addiction to certain substances
- Restlessness and hyperactivity
- Fear and Anxiety

These 11 conditions are rated by people according to their perspective about themselves. The association of these factors with QoL index is then found out using Correlation Heatmaps.

7. Correlation Heatmap

Correlation Heatmaps are used to find the relationship between two variables. From heatmaps we can say whether a variable is positively correlated or negatively correlated. The correlation value ranges from -1 to 1. If the value is negative or near to - 1 we can say that the variable is negatively correlated which means as one variable increases then the other variable decreases and vice versa. If the value is positive or near to +1 then we can say that the variable is positively correlated which means that if the value of one variable increases the value of the other variable also increases. In our case study we constructed a correlation heatmap (fig 5) of all the 11 variables mentioned above against the eq-5d index.

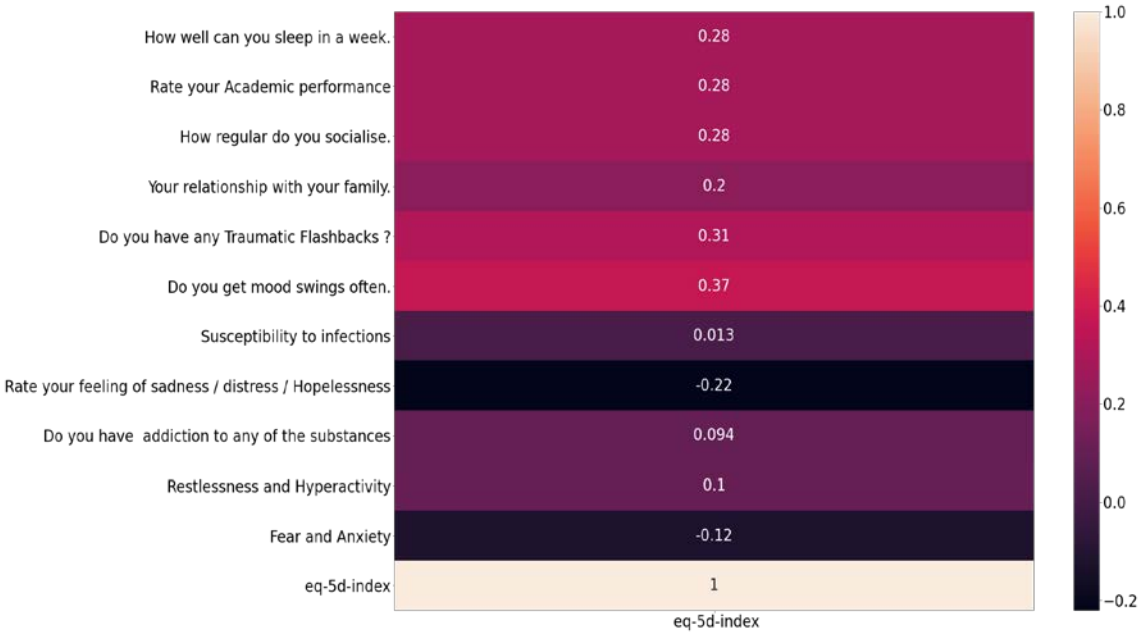

Fig. 5 Correlation Heatmap showing the association between variables

From this heatmap it is clear that the variables, Fear/Anxiety, feeling of sadness/distress/hopelessness, susceptibility to allergy, asthma or other infections, addiction to certain substances, Restlessness and hyperactivity, are negatively correlated to the value of the eq-5d index. i.e., the people having these symptoms have a lower Qol index.

Relationship with your family or guardian also plays a major role in the quality of life. People having traumatic flashbacks also have lower eq-5d index.

8. Conclusion

From this study we came to a conclusion that mental health disorders should be considered and treated as another non communicable disease. People in India should be given enough knowledge or awareness about how to treat mental health disorders and how to take care of a mentally ill person. The Quality of Life index is a numerical value which indicates the wellbeing of a person. People with mental health disorders will have a lower QoL index because they have issues in self-care and they have anxiety and depression and mental pain which are factors in calculating the QoL index. Good support in life and knowledge about a good and prosperous living will cure all the problems and will increase the health index of a person. A good relationship with the family members is very much necessary to lead a happy and peaceful life.

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