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Research Paper

A Comparative Study of Varying Depression Levels amongst People with Different Demographics and Diagnoses

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ABSTRACT

The relationship between depression and gender make stronger with increasing age. The neurological health conditions also linked with depression. The centre for epidemiological studies – Depression is a 20-item scale published to measure rate of depressive symptoms that include restless sleep, poor appetite, and feeling lonely. The present research aims to understand whether the demographic details and the diagnosis of the participant was able to significantly explain the variance in the scores for the above scale. For the purpose of this study, a sample of 76 participant's data was observed. They were segregated based on their age, gender and clinical diagnosis in order to ease the analysis process. ANOVA was conducted on the above-mentioned data. It was noted that participants with epilepsy had a statistically significant depression score when compared to participants with mild cognitive impairment (Mean difference- +8.69). The results are discussed and further elaborated upon, with limitations of the study and recommendations for future research.

Keywords: *Depression, Epilepsy, Parkinson's disease, Mild cognitive impairment, Gender and Age.*

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Depression is defined as a common and serious mental illness which negatively affects an individual's daily life, it affects the individual's thought, behaviour and action. Depression does not include only a feeling of sadness but also a loss in interest in leisure activities. According to DSM V for an individual to be diagnosed with depression he/she must experience at least 5 symptoms for a period of 2 weeks and at least one symptom should be depressed mood or loss of pleasurable activities. The symptoms for depression include: 1) depressed mood 2) decreased interest in activities 3) significant weight loss 4) reduction in physical movement 5) fatigue 6) decrease in ability to think and concentrate 7) recurrent thoughts of death. Depression has a long history from being thought to be possessed by a demonic entity and being treated by priests rather that physicians, today depression is one of the treatable mental illnesses with the help of anti-depressants and cognitive behavioural therapy.

Epilepsy is defined as a neurological disorder which is characterised by seizures, periods of abnormal behaviour and sometimes loss of awareness. Epileptic seizures can be caused due a number of reasons like brain injury, stroke, brain tumour and birth defects. As mentioned above the individual experiencing epileptic seizure usually experiences abnormal neuronal activity in the cortex of the brain. To be diagnosed as epileptic seizure the individual should experience two unprovoked seizures. The common symptoms include 1) temporary confusion 2) staring spell 3) uncontrollable jerking movements of arms and legs 4) loss of consciousness 5) psychic symptoms like anxiety and fear. The most common form of epilepsy is temporal lobe epilepsy which is characterised by unprovoked focal seizure which originates from the temporal lobe of the brain. Epileptic seizures can not be cured completely but with the help of medication, sleep, and diet it provides some relief to the individual. About 80% of individuals experience some relief due to medication whereas the remaining 20% do not benefit from medication at all.

Parkinson's disease (PD) is defined as a neurodegenerative disorder that affects dopaminergic neurons in a specific area of the brain substantia nigra. Causes for Parkinson's disease remain unknown but gradually neurons break down and die and therefore due to less dopaminergic neurons in the brain it causes abnormal brain activity. Causes for Parkinson's disease is linked with genes (mutation of certain genes) and environmental triggers (exposure to certain toxins). Though Parkinson's does not lead to death certain complications can be fatal. There are five stages to Parkinson's disease. Stage 1 and 2 is considered early PD, stage 2 is mid PD and stage 4 and 5 is considered advanced PD. Stage 1 where the symptoms are mild and less noticeable. Stage 1 includes tremors in one hand or leg and the individual does not seek medical treatment. Stage 2 is characterised by tremors experienced in both sides of the body along with loss of facial expression and speech abnormalities. In stage 3 the individual loses control in balance and movement but still independent for daily activities like hygiene and eating. In stage 4 the individual is unable to walk independently and uses a walker for assistance. The individual is unable to live life independently and needs help for daily activities. Stage 5 is considered the chronic stage where the individual is unable to walk, stand, or get up from his/her chair without assistance. The patient may experience hallucinations in stage 5. There are no treatments for PD with the help of a healthy diet and certain foods PD can either be prevented or delayed. Most treatments relating to PD focus on providing a relief from pain.

Mild cognitive impairment refers to noticeable decline in cognitive functions like memory loss and/or thinking problem.in certain cases MCI tends to lead to dementia or Alzheimer's

disease but not always. It is important for individuals to get checked if whether memory loss is due to one's age or a symptom of Alzheimer or dementia. There are mainly two kinds of MCI 1) Amnestic MCI where an individual may forget important details like appointments or conversation details 2) Nonamnestic MCI which affects regions other than memory where the individual may lose the ability to make sound decisions or complete complex task. The main causes of MCI still remain unknown but researchers believe that the same reasons of dementia or Alzheimer's apply like age, family history. There does not exist a single medication but treatments are provided to help better the life of patients like regular exercise, healthy diet and participate in mentally engaging activities.

Depression was found to have a strong association with cognitive impairment in rural Indian population wherein, higher scores on depression were found to be associated with higher cognitive impairment (Ganguly, Dube, Johnston, Pandav, Chandra & Dodge, 1999). Depression was measured using a Hindi version of the Geriatric Depression Scale and the sample consisted of illiterate individuals aged above 55 years. It has been established that there is a difference in rates of cognitive impairment between educated and uneducated individuals (Das, Bose, Biswas, Dutt, Banerjee, Hazra, Raut, Chaudhuri & Roy, 2007).

One relatively consistent finding, as reported on a meta analysis; has been the positive correlation between severity of depression and impairment in executive functioning in the elderly population. Skills most affected have found to be verbal fluency and set shifting abilities (Austin, Mitchell, Goodwin, 2001).

Given the findings of these studies, it can be understood that literacy is an important factor which is probably mediating the effect of cognitive impairment on depression.
Through this research paper we aim to understand issues faced by individuals who are diagnosed with Epilepsy, Parkinson's disease and Mild Cognitive Impairment and the level of depression these patients endure. All the patients chosen for the sample are of Indian origin therefore as seen in the review of literature there is a shortage of papers which specifically focus on India.

Objectives

1. To explore how the level of depression varies amongst participants diagnosed with Parkinson's Disease (PD), Epilepsy and Mild Cognitive Impairment (MCI).
2. To understand how depression is exhibited itself in Indian patients with the above-mentioned disorders.
3. To understand how the level of depression varies with age.
4. To explore how the level of depression varies with gender.
5. To understand how the level of depression varies as a result of interaction between the specific diagnosis, age and gender.

METHODOLOGY

Sample

The study was conducted on a sample of 76 individuals. The sample was referred from the community. The data was collected between the years 2015 and 2019. Majority of the participants were right handed individuals. Detailed demographic details are given in the results section.

Patient Inclusion Criteria

1. The patient was seen by a neurologist within the data collection period. The patients had Cognitive problems with the neurological conditions of epilepsy, Parkinson's disease (PD) and Mild Cognitive Impairment (MCI).
2. The patient was diagnosed between the ages of 9 and 80 years
3. The patients were of Indian background.

Patient Exclusion Criteria

1. The patient was diagnosed with other progressive or degenerative neurological disorders.
2. The patient was diagnosed with other major co-morbid non-neurological disorders that would have an impact on quality of life (e.g. asthma requiring daily medication, renal failure);
3. The parent or caregiver had insufficient command over English or Kannada to complete questionnaires.
4. There were other developmental disabilities (e.g. autism, developmental delay);
5. They had some other neurological disorder.

Tools

Center for Epidemiological Studies-Depression: Depression scores were obtained for the sample using the Centre for Epidemiological Studies Depression Scale for Children (CES-D) and Center for Epidemiological Studies-Depression (CES-D - Adults), (Radloff, 1977).

Description: Center for Epidemiological Studies-Depression (CES-D), initially published by Radloff in 1977, is a 20-item questionnaire that requests respondents/caregivers to rate how often over the past week they experienced symptoms related with depression, such as poor appetite, restless sleep, feeling sad and lonely. Scoring: 0 to 3 for each item (0 = Rarely or None of the Time, 1 = Some or Little of the Time, 2 = Moderately or Much of the time, 3 = Most or Almost All the Time). Scores range from 0 to 60, with high scores signifying greater depressive symptoms.

Statistical Analysis

Descriptive statistical measures mean and standard deviation were used to see the wide-ranging model of Depression of the respondents according to Gender, Age and Diagnosis (Neurological Conditions). ANOVA (Analysis of variance) factorial design 2 x 2 x 3, Bonferroni Multiple comparison tests were computed to verify whether there is a significant mean difference between various groups. All statistical analysis was done with the help of IBM-SPSS statistical software version 21.

RESULTS

Table 1: Between subject factors

Variables	Category	N
Age	Below 50-years	34
	Above 51-years	42
Gender	Male	52
	Female	24
Neurological Conditions	Epilepsy	33
	Parkinson's Disease (PD)	24
	Mild Cognitive Impairment Mild Cove Mild Cognitive Impairment (MCI)	19

In the above-mentioned table, three factors are considered: age, gender and diagnosis. Each of these factors are categorized for easy data collection. Age is split into less than 50 and more than 51, gender as male and female, and three categories for diagnosis are considered which are Epilepsy, Parkinson's and Mild Cognitive Impairment (MCI). Initially three age ranges were considered, however, the sample collected was found to have only a few cases falling under the middle age range. The table helps us understand the number of individuals under each category.

Table 2: Grand Mean

Mean	SED
21.40	1.53

The above table provides overall mean for the dependent variable which is the depression score on the CESD scale by considering all the factors and categories. The mean was found to be 21.402 with a standard error of 1.53. Therefore, the average level of depression within the sample is 21.402.

Table 3: Age mean

Age	Mean	SED
Below 50-years	23.72	2.24
Above 51-years	20.00	2.04

The table helps us understand the overall mean for the factor age for the dependent variable which is the depression scale. Less than 50 category has an average mean of 23.72 with a standard error of 2.24 and more than 51 with a mean of 20.00 with a standard error of 2.04. Participants with age less than 50 have a higher level of depression than individuals with age more than 51 as their mean is higher.

Table 4: Gender mean

Gender	Mean	SED
Male	20.27	2.19
Female	23.28	1.81

The above table helps us understand the mean for the factor gender for the dependent variable which is the depression scale. Male has a mean of 20.27 with a standard error of 2.19 and female has a mean 23.28 with a standard error of 1.81. It is observed that females have a higher prevalence of depression compared to men.

Table 5: Diagnosis mean

Diagnosis (Neurological conditions)	Mean	SED
Epilepsy	24.55	2.99
PD	21.49	2.44
MCI	16.53	1.95

The table provides information regarding the mean and standard error for the diagnosis factor. Epilepsy has a mean of 24.55 and a standard error of 2.99, Parkinson's has a mean of 21.49 with a standard error of 2.44 and MCI has a mean of 16.53 and a standard error of 1.95.

Dependent variable being the depression scale. Individuals with Epilepsy have a higher prevalence of depression followed by Parkinson's then MCI.

Table 6: Age x Gender mean

Age	Gender	Mean	SED
Below 50-years	Male	21.17	3.11
	Female	28.81	2.53
Above 51-years	Male	19.66	3.01
	Female	20.52	2.40

Comparing the gender category under less than 50 and more than 51 we see that females (28.818, 20.525 respectively) have scored more than the males (21.179, 19.665 respectively) under both categories indicating that there is greater prevalence of depression in the female group of individuals.

Now by comparing age we see that the female group in the less than 50 group has scored the highest indicating that there is greater prevalence of depression in individuals who females and are under the age of 50.

Table 7: age x diagnosis means

Age	Diagnosis	Mean	SED
Below 50-years	Epilepsy	21.00	8.42
	PD	22.98	2.14
	MCI	16.53	1.95
Above 51-years	Epilepsy	26.33	1.56
	PD	18.50	5.95
	MCI	-	-

In the less than 50 category, individuals with Parkinson's have scored the highest overall mean on the depression scale (22.988) while individuals with MCI have scored the least overall mean on the scale (16.534) indicating that the prevalence of depression is greater in Parkinson's as compared to the other two, being epilepsy and MCI, while the prevalence of depression is the least in the group of individuals with MCI. While in the more than 51 categories, individuals with epilepsy have scored the highest mean (26.338) on the depression scale indicating greater prevalence of depression in this group whereas MCI was not taken into consideration since the group didn't meet the inclusion criteria hence, we cannot know which group scored the lowest.

Table 8: gender x diagnosis

Gender	Diagnosis	Mean	SED
Male	Epilepsy	22.42	4.30
	PD	19.33	3.14
	MCI	17.81	2.53
Female	Epilepsy	28.81	2.53
	PD	25.80	3.76
	MCI	15.25	2.97

Above provided is the table for the participant's mean score on the center for epidemiologic studies depression scale. The mean scores were categorized based on the participant's gender and their consequent diagnosis. It was observed that amongst the male participants, people with epilepsy had the highest depression score with a mean value of 22.429. Amongst females, people with epilepsy had the highest depression score with a mean value of 28.818. While comparing the depression scores between males and females, females with epilepsy had a higher score than males. Women with Parkinson's had a higher depression score than men, however, males with mild cognitive impairment had a higher overall depression score than their female counterpart.

Table 9: Descriptive statistics

Age	Gender	Diagnosis	Mean	SD	N
Below 50-years	Male	Epilepsy	23.86	8.58	21
		PD	18.50	3.53	2
	Female	Epilepsy	28.82	8.47	11
Above 51-years	Male	Epilepsy	21.00	0	1
		PD	20.18	6.75	17
		MCI	17.82	10.71	11
	Female	PD	25.80	11.18	5
		MCI	15.25	5.80	8

Above provided is the table for the participant's mean score on the center for epidemiologic studies depression scale. The mean scores were categorized based on the participant's age, their consequent gender and followed by their respective diagnosis. It was found that participants less than the age of 50 scored higher on the depression scale as compared to participants above 51. Amongst men and women, it was observed that females scored more than men. Lastly, participants with epilepsy had the highest depression score, followed by participants with Parkinson's and the lowest mean score was that of participants with mild cognitive impairment.

Table 10: Between subject effects

Source	Type III Sum of Squares	df	Mean Square	F
Corrected Model	1294.41[a]	7	184.91	2.60*
Intercept	12172.51	1	12172.51	171.68*
Age	0.86	1	0.86	0.01
Gender	129.69	1	129.69	1.82
Diagnosis	181.46	2	90.73	1.28
Age x Gender	0.00	0	.	.
Age x Diagnosis	12.79	1	12.79	0.18
Gender x Diagnosis	141.35	1	141.35	1.99
Age x Gender x Diagnosis	0.00	0	-	-
Error	4821.11	68	70.89	
Total	42636.00	76		
Corrected Total	6115.52	75		

a. R Squared = .212 (Adjusted R Squared = .131); * Significant at 0.01 level

Above provided is the test of between-subject effects. The corrected model is one which takes into account the sums of squares that can be attributed to the set of all the between-subject effects, excluding the intercept. These include all the fixed and random factors and covariates and their interactions. This model takes into account the sum of squares around the grand mean for the dependent variable CESD. The F test conducted for this model is a test to determine whether the model as a whole account for any significant variance in the dependent variable. It was observed that the test for all the fixed factors and their interactions did not have any significant value independently that influenced the depression scores. Arguably, the most significant independent score was that of the gender code and that too had a value of 0.18 which is higher than the value of alpha. Hence it may be reasonable to assume that the fixed factors independently do not account for significant variance in the depression scores.
Though the corrected model provided a significant value lesser than 0.05, it was found that the R square value of the same was 0.212. Hence, implying that the model as a whole accounted for a meagre 21.2% of the variance in the dependent variable.

Table 11: Bonferroni Post Hoc test – Multiple Comparisons

(I) Diagnosis	(J) Diagnosis	Mean Difference (I-J)	Std. Error
Epilepsy	PD	4.22	2.25
	MCI	8.69*	2.42*
PD	Epilepsy	-4.22	2.25
	MCI	4.47	2.58
MCI	Epilepsy	-8.69*	2.42*
	PD	-4.47	2.586

*The error term is Mean Square (Error) = 70.899; * The mean difference is significant at the .01 level.*

Above provided is the Bonferroni post-hoc analysis of the data. This analysis conducts multiple comparisons between the three diagnoses of epilepsy, Parkinson's and Mild cognitive impairment and hence determines the diagnosis which has the most significant mean score on the depression scale. The mean differences between epilepsy and Parkinson's was found to not have a significant value with a score of only 4.22. The mean differences between Parkinson's and MCI was found to not have a significant value with a score of only 4.47. However, the mean difference between epilepsy and MCI was found to be significant at a value lower than alpha with a score of 8.69.

DISCUSSION

As seen in Table 1 individuals lesser than 50 experience major depression compared to individuals greater than 50. From the National Survey of Drug Use and Health (NSDUH) it is seen in the year 2017 17.3 million adults in the U.S experience a major depressive episode and the prevalent age group is between 18-25. In similar studies conducted in the Indian sub-continent it is observed that young adults particularly individuals aged between 14-24 years suffer from the mental illness depression (Singh & Gopalkrishna, 2014). This could be due to reasons such as obesity, high sexual behaviour, stress and tobacco use. In table 2 gender mean females are at a risk regarding depression with a mean of 23.28 compared to men. It is observed that 10-25% of women and 5-12% of men is the estimated prevalence of major depressive disorder (Bohra, Srivastava, & Bhatia, 2015). The main causes for women to experience major depressive episode include mentioned include stress, caring for children, caring for elderly, difficult relationship, and abuse (Bohra, Srivastava, & Bhatia, 2015).

Among the three diagnostic factors chosen Epilepsy, Parkinson's and Mild Cognitive Impairment from table 3 it is observed that participants who experienced epileptic seizures ranked high in the depression scale with a mean of 24.55 followed by Parkinson's (21.49) then MCI (16.53). There was no individual paper which focused on all three disorders, and explained why level of depression was higher for a particular disorder. From the results table it is seen that participants with Epilepsy have a higher level of depression follower by Parkinson's and then MCI. Some individuals suffer from epilepsy from a young age and therefore due to early usage of epileptic medications depression may be seen as a side effect of the medication. As Parkinson's and MCI is usually seen in later stages of life mostly individuals tend to come to terms with their condition regarding their disorder and depression. As due to less research regarding the above-mentioned topics it is difficult to come to conclusions.

Table 9 which helps understand the relationship between the three factors age, gender and diagnosis is congruent to the results found in the individual tables. Female less than 50 epileptic (28.82) have a higher level of depression compared to any other combination. But more research relating to depression and its correlation with other mental disorders helps in betterment of life style, and better policies with would provide better medical treatment.

It was found that the between subject effects corrected model accounts for 21.2 % variance in the depression scores for the participants. Though the value was deemed significant by the analysis software, it accounted for only one-fifth of an explanation to our sample's scores on the depression scale. Depression is a complex trait that occurs due to multiple reasons and till date no particular research has been able to pin point an adequate combination of factors that may lead to depression. Most of the existing research has only been able to provide plausible reasons as to what causes depression in their sample, the factors that they take into consideration have not be able to provide a strong explanation of the consequent depression scores. Our research conducted aims to explain the sample's scores on depression based on their age, gender, specific diagnosis and the interaction of the three factors, however, just like the existing research our model was only able to provide a weak explanation to the depression scores of our sample. It has been proved previously that genetic factors play an important role in deciding whether a person is more likely to be diagnosed with depression or not, the data collected from the sample does not take into account these genetic factors and this may be one of the reasons as to why the factors considered in this study are able to provide only a weak explanation for the same. The stress-diathesis states that the effects of stress on depression are based on the genetic vulnerability of the person. Hence, a person is at a higher chance of being diagnosed with depression if they possess both the genetic predisposition toward it and life events that cause significant stress. Our study does not take into consideration the interaction between the genetic vulnerability and any major stressful life events that could have led to the depression and hence our value of R square may be low. However, the significance value for our corrected model is lower than alpha and hence the alternate hypothesis H1 must be accepted while simultaneously rejecting our null hypothesis for the same.

The Bonferroni multiple comparisons test was conducted to ascertain whether participants falling under a particular diagnosis tended to score significantly better or worse than participants with another diagnosis on their depression scores. On examining the analysis, it was found that the participants diagnosed with epilepsy did score higher than participants diagnosed with Parkinson's with an average difference of 4.22. However, this difference did

not yield a significant value. Also, participants diagnosed with Parkinson's tended to do worse than participants who had mild cognitive impairment with an average difference of 4.47. This too did not yield a significance value below alpha.

Lastly, it was found that participants diagnosed with epilepsy tended to do worse than participants who had mild cognitive impairment with an average difference of 8.69. The significance value attained for the same was found to be less than 0.05, hence ascertaining that participants with epilepsy tended to have a significantly higher score on the depression scale when compared to participants with mild cognitive impairment. This may be due to the fact that the onset of mild cognitive impairment is gradual and the person overtime may get accustomed to the deficits that are occurring with regard to their cognitive functioning.

Taking all of this into consideration, it may be inferred that the 2^{nd} and 4^{th} null hypotheses are accepted as no significant difference was found. However, the third null hypothesis must be rejected owing to the fact that there was a significant difference between the scores of participants with epilepsy and participants with mild cognitive impairment.

CONCLUSION

One of the primary objectives of this study was to provide an insight on an Indian sample of participants and observe whether their specific diagnosis played a role in ascertaining their depression scores. The most essential finding of this study is that people with epilepsy do have a statistically significant difference when compared to people with Mild cognitive impairment based on their depression scores. Apart from this, while examining the individual factors and their respective depression scores certain essential observations were made. Lastly, the corrected model that was used to explain the score on the depression scale was found have to have a significance value of less than alpha, however, the extent of this explanation was found to be merely 21%. Hence implying that there are various other factors that are not considered in this study that may explain the scores on the depression variable with a stronger association.

This study may help clinicians in determining their priorities with regard to which obstacles they would want to tackle quickly and effectively. However, the readers must take the above results with a pinch of salt as there are certain limitations to this study. Firstly, the sample was not vast enough to have an adequate *n* value for each sub category under the combination of factors. Secondly, the scale used to measure their depression score was a scale devised in America and though the clinician did his best to translate everything to the participants language, some cultural differences are bound to occur. Lastly, one limitation of our study that may be used as a base for future research is that of considering the participant's genetic predisposition which inadvertently influences the probability that they may be diagnosed with depression.

In conclusion, though this study is novel with regard to the Indian sub-continent, it was not able to explain to a great extent the variance of depression scores in our sample. Hence, future research backed by high funding is essential to be able to look at the vast number of factors that may eventually be able to explain the same.

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Conflict of Interest

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A Comparative Study of Varying Depression Levels amongst People with Different Demographics and Diagnoses

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