

Identification of Factors Responsible for Early Onset of Dementia Among IT Sector Workers in India: A Survey Approach

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Abstract : The Information Technology sector has become the backbone of the Indian economy, especially with the rise in digitalization, privatization, and globalization. Due to factors like rapid changes in technology, increase in competition, increase in population, job requirements, et cetera, the IT sector has become extremely volatile and complex, which leads to stress and frustration in employees. Issues like stress, instigate the development of physical and mental health problems including dementia. Early detection of these symptoms can help in controlling the situation by inducing major lifestyle changes and counselling. The focus in this research is on Dementia which is a progressive condition that can eventually impair a person's ability to work. The aim is to analyse the onset of Dementia in employees of the IT sector, in its earliest stages using the Dementia Screening questionnaire. We have examined a few of the factors affecting it like the number of employees in the organization, stress, with focus on age and gender, so that we can determine the groups at the maximum risk. The study also shows how stress affects decision making in these employees. This data would help to frame such policies in the organization which could help to reduce the factors causing dementia.

IndexTerms - IT sector, dementia, cognitive impairment, early detection, ad8.

I.INTRODUCTION

The Indian Service sector is the backbone and one of the major contributors of the Indian economy. It shares around 54.3% [1] of the Indian GDP. This sector includes the \$191 billion Information Technology industry and its enabled services. The IT industry supports over 40 lakh jobs in India [2]. The IT sector employees are known for their representation such as professional, ethical, globally oriented, clean and transparent, growth-oriented, youth dominated, ambitious, entrepreneurial workforce [3]. The IT sector is infamous for its VUCA (volatility, uncertainty, complexity, ambiguity) properties. Feeling of uncertainty about life, leading to stress, frustration, fear, anxiety, panic, depression, and sleep problems are frequently seen now and they affect all the areas of human life, whether personal or professional [4]. As per Carol Upadhya, the IT industry is process-oriented. It means that the concept of process is central to the industry, which reduces the work to quantifiable units of time, productivity, and output. These are measured by work and project management metrics. These processes are independent of any particular employee because they depend on the time and effort the employees put in carrying out their work rather than their specialized knowledge. As a result, the industry ends up being very mechanical [5]. The advent of globalization and privatization have brought a new culture in terms of work relationships, job insecurity, uncertainty in career planning, which is further exacerbated due to rapid technological development [7]. Companies like Infosys, follow a global services delivery model. This means that they work round the clock because tasks are shifted sequentially across different time zones to all the team members, in the chain of employees [6]. This work culture ends up putting extreme pressure on the engineers, who have to meet their deadlines, without compromising the quality and performance goals. Apart from the pressure of delivering services efficiently, they also have to be cost-effective [7]. Stress is extremely high in this sector. This could be due to factors like the nature and culture of work, achievement of targets and goals, shifts of work and work timings, work burden, and the like [7]. Stress can eventually lead to other problems like fatigue, hypertension, acid peptic diseases, insomnia, diabetes, gastric issues, alcoholism, blood pressure issues, skin disorders, and other ailments. This could cause major mental and physical impairments in employees. In recent studies, it has been found that the frequency of cases of dementia has increased in present times. It is a general misconception that dementia is an "old person's disease" and is a natural part of aging. In general, dementia includes a wide variety of symptoms like loss of memory, changes in mood and related unpredictability, and problems with communicating and reasoning [8]. It is a broad term which refers to a wide range of neurological disorders that cause a progressive decline in cognitive functioning [9]. As per a research, people under the age of 65 years, are also prone to dementia and may start developing symptoms even before reaching 65 years of age [8]. This condition is known as Early-Onset Dementia (EOD). It has been noticed that approximately 13.4 people per 100000 people per year in the age group 30-64 show symptoms of EOD [10]. Lack of early detection and delays in treatment make situations worse for these people. Moreover, there is a lack of awareness and ignorance towards such kinds of disorders, which make the personal and professional lives of employees miserable. Unfortunately, dementia is usually detected in the later stages of life when it progresses into actually visible symptoms and starts hampering day to day activities of people. It is generally diagnosed when people start showing cognitive changes, which are known as Mild Cognitive Impairment (MCI) [11]. These symptoms of cognitive declination are usually first noticed by immediate contacts, including family members, peers and colleagues. In both the stages of EOD or MCI, the cognitive issues start interfering with the workability of the employee [12], even before they retire from professional life. It hampers their self-esteem and motivation [13], further causing them to develop other mental issues like depression. With the increase in the average age of the

working population, it has become even more necessary to understand these issues and provide solutions to deal with them. Organizations are required to analyse and make decisions regarding the appropriate interventions that could help in better work performance for people with brain disorders associated with cognitive deterioration [14]. The brief explanation of the structure of this paper is elaborated as follows. Section (2) of this paper discusses the methodology including the assessment tools used, methods implemented and the participants in this survey. Section (3) discusses the results and findings obtained from this survey. Section (4) concludes this paper with the accomplishments of this survey.

III. METHODOLOGY

The following three subsections provide information about the participants, assessment tools used, and the methods and procedures implemented to gather the data samples.

2.1 Participants

The survey has been conducted on IT Sector workers, employed in distinctive organizations pan India, independent of their location, age, gender, position, background, et cetera, with their consent. The survey sample consists of 116 participants who enthusiastically took part in our survey and are associated with different work backgrounds including both, technical and non-technical. The collected sample contains data of 116 adults out of which 41 are Females, 74 are Males and 1 is from Prefer Not to Say category. The sample of each participant includes information regarding their age, gender, work background (Technical/Non-technical), and their responses for the questions in the AD8 Dementia Screening questionnaire [15].

2.2 Materials

The Cognitive Assessment Tool used in our survey is the influential AD8 Dementia Screening Interview which is a copyrighted instrument of the Washington University, St. Louis, Missouri [16]. This tool is in the form of questionnaires that can be distributed to the numerous respondents/participants of the selected target group. This questionnaire helps us to segregate the participants into two categories i.e. "Normal Cognition" and "Cognitive impairment is likely to be present". It has been known that a screening test alone is inadequate in diagnosing a dementing disorder. However, the AD8 tool is known to be sufficiently sensitive in the detection of early cognitive changes that are associated with a variety of common dementing disabilities. The AD8 consists of eight questions related to issues like, "problems with judgment", "interest in hobbies/activities", "repetition of actions", along with others which is shown in Figure 1 of this paper. It displays the AD8 Dementia Screening Questionnaire which consists of the eight questions on the basis of which we will mark down the scores of each individual participant. There are three columns corresponding to each question namely- "Yes, A Change", "No, No Change", and "N/A, Don't Know" and each of these questions carry 1 score making the total score 8. The final score of each individual is marked by calculating the sum of the total number of items noted as "Yes, A change". According to the AD8 Screening Interview, if the final score of the participant ranges between 0-1 then the individual is categorized as "Normal Cognition". If the final score is 2 or greater, then the individual is grouped in the "Cognitive impairment is likely to be present" category [15]. We used Orange Data Mining Open Source Software [17] for visualizing the collected data samples of each of the participants and determining the relationships between their responses with various factors that could lead to dementia. It also helped us in categorizing the participants into two groups i.e. "Normal Cognition" and "Cognitive Impairment". As a result, we could detect the individuals at the early stage of dementia and find out the ratio of impaired individuals [15].

2.3 Procedure

The research population in this survey consists of individuals only working in the IT Sector and living in various provinces of India. There was no specific location or zone wise selection of the participants because our prime focus was to study the mental state of IT Sector workers irrespective of the geographical locations. The data were collected through an online questionnaire between 10th and 14th June 2020, using Google Forms. The AD8 Screening Questionnaire along with some basic queries about their gender, age, and the number of employees in their organization, were included in the form. The AD8 Dementia Screening Interview is used to detect dementia. It consists of 8 questions, each of which is scored 1. The state of cognition is evaluated on the basis of the response of the eight questions. The lowest possible scores for dementia are 0 and 1, and the highest possible scores are from 2-8. Higher scores indicate increased severity of dementia. In order to analyse and evaluate data, we need to modify the dataset according to the expected format and structure as per the requirement of the tool. After creating the database in an excel sheet, we converted it into a comma-separated value (.csv) file format and pre-processed the data sample. The converted data file has been processed by using some basic concepts of Python. Further, the data has been analysed and visualized through the Orange Data Mining Software [17] which is an open-source software used for the task of explorative data analysis and interactive data visualization. The results generated are in the form of scatter plots. It has the regression line, which helps us to evaluate the risk factors.

AD8 Dementia Screening Interview

Patient ID#: _____

CS ID#: _____

Date: _____

Remember, "Yes, a change" indicates that there has been a change in the last several years caused by cognitive (thinking and memory) problems.	YES, A change	NO, No change	N/A, Don't know
1. Problems with judgment (e.g., problems making decisions, bad financial decisions, problems with thinking)			
2. Less interest in hobbies/activities			
3. Repeats the same things over and over (questions, stories, or statements)			
4. Trouble learning how to use a tool, appliance, or gadget (e.g., VCR, computer, microwave, remote control)			
5. Forgets correct month or year			
6. Trouble handling complicated financial affairs (e.g., balancing checkbook, income taxes, paying bills)			
7. Trouble remembering appointments			
8. Daily problems with thinking and/or memory			
TOTAL AD8 SCORE			

Figure 1: The AD8, is a brief informant interview to detect dementia. (Reprinted with permission. Copyright 2005. The Eight-item Informant Interview to Differentiate Aging and Dementia is a copyrighted instrument of Washington University, St. Louis, Missouri. All Rights Reserve)

III. RESULTS

A total of 116 individuals completed the online questionnaire, 41 of whom are 'female', 74 of whom are 'male' and 1 belongs to the 'prefer not to say' class. 95 people are from the age group 18-29, 17 people are from the age group 30-50, and 4 people are aged above 50. Overall, 93 (80.1%) participants are from Technical Background, out of whom 44 stated that they are currently in stress. 23 (19.8%) participants are from Non-Technical Background, out of whom 16 stated that they are currently stressed. In this study, we also established an association of dementia with various factors affecting it. The following subsections describe these findings in more detail.

3.1 Association between Number of Employees in the organization and dementia

In this era of globalization and modern technology, various industries are trying their best to become "Labour Independent" due to various reasons like reducing the turnover hassle, reducing the acquisition and training time, reducing the costs, et cetera [18]. The reduced number of employees might be profitable for numerous industries, but it may lead to some serious issues regarding the mental wellbeing of an individual [19]. The information about the total number of workers in an organization is important for this study because it plays an important role in determining the mental wellbeing of a person [20]. In this paper, we showed how the "number of employees" in an organization is associated with dementia. The questionnaire filled by IT Sector Workers also gathered details about the total number of employees in their respective organizations, along with eight AD8 dementia screening questions. After collecting the data samples of each individual participant, we pre-processed the data by using some basic concepts of python in order to obtain the optimum output in our desired format. We used Orange Data Mining software [17] to study the relation about how the number of employees can be related to dementia and to plot the result so that we can get a better insight. The visual representation of the relation between the number of employees and dementia is shown in Figure 2. As shown in Figure 2, the x-axis represents the total number of employees working in the respective organizations of the participants. The y-axis represents the final scores of the participants i.e. "0, 1, 2, 3, 4, 5, 6, 7, 8" on the basis of which we have identified whether the person has normal cognition or not. The legend in the scatter

plot indicates the different ranges of the total number of employees. The scatter plot has 116 data points, which represent 116 participants who participated in our survey. As depicted in Figure 2, if the number of workers/employees is higher, i.e. above the range of 200000–300000, 300000–400000, or above 500000, then the majority of the participant's score is not much higher than 2 or 3. This indicates mild cognitive impairment. Few of them have scored 7, which indicates that a person is suffering from severe dementia. In the region with the employee range between 0-100000, we can see that there are multiple data points that form clusters. The majority of these employees have been marked with higher scores like 6, 7, or 8. This indicates severe dementia. This study clearly shows that the total number of employees in an organization is inversely proportional to the risk of dementia. It means that the risk of dementia becomes higher when the number of co-workers is less and vice versa. One of the reasons for this might be because when the number of workers is larger, the work burden can be easily distributed amongst them leading to less mental stress and risk of dementia. On the other hand, when the number of workers is less, although the work might be equally distributed amongst all, the workload increases leading to stress, which might accompany the risk of dementia. Moreover, the adage that “no man is an island”, also justifies the fundamental idea that human beings do badly when isolated from others and they need to be part of a community to thrive [22].

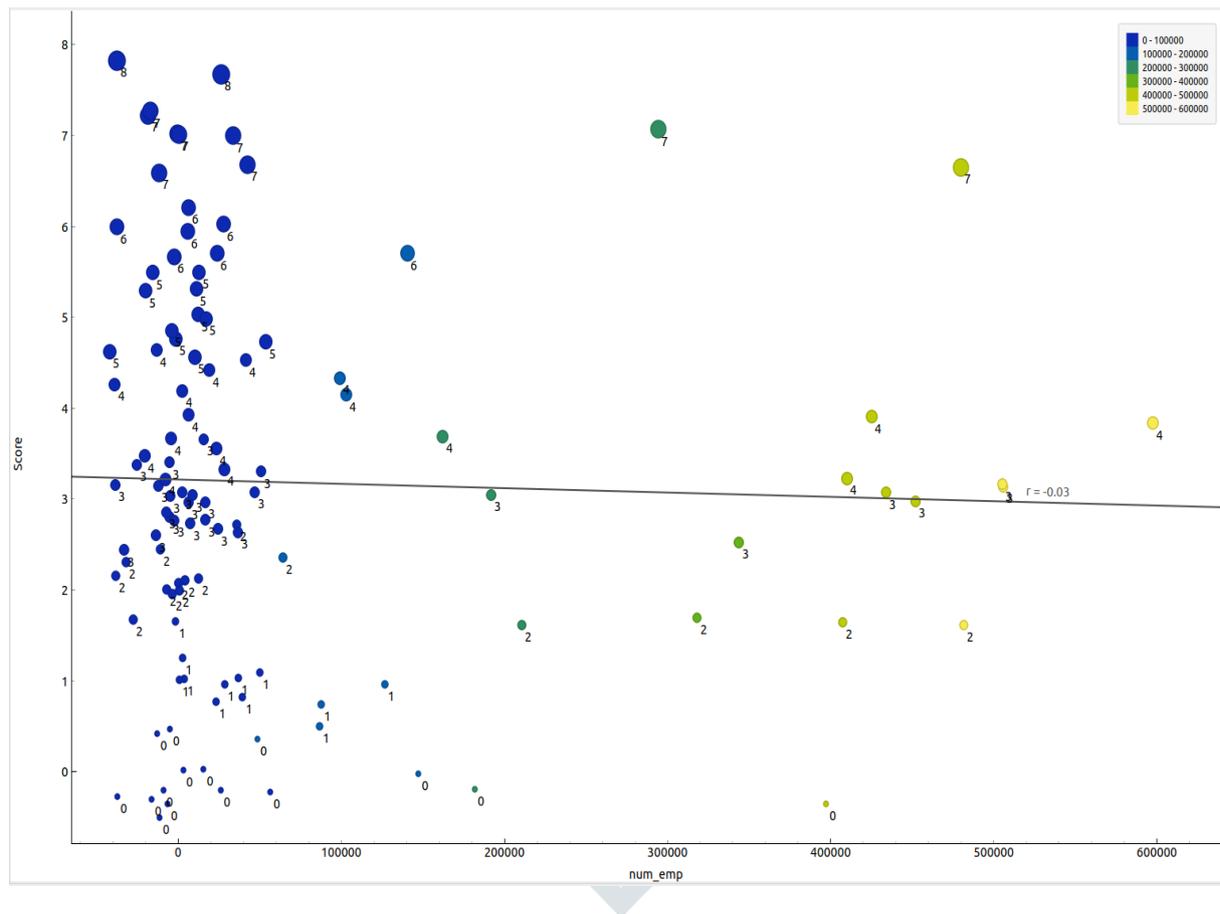


Figure 2: Scatter Plot of No. of Employee Vs Score (Showing the Association Between Number of Employees and Dementia)

3.2 Association between Stress and Dementia

We always are curious about knowing whether there is a link between stress and dementia or not. Moreover, if there is a link between the both, then how to prevent it, and if not, then up to what extent it affects us. The researchers of the Alzheimer's Society of England went for the search for an answer for these questions [23]. According to their findings, all the evidence indicates that prolonged stress may play a certain role in the development of dementia, but having chronic stress does not necessarily cause dementia. However, if stress plays any role in a person's risk of progressing dementia, then to uncover this delusion and to study in-depth about what role stress plays in the development of dementia, further research can be done. In order to analyse this, we decided to examine the relationship between both the attributes with respect to various factors specifically in such a target population which handles stress on a daily basis, i.e. the IT Sector. The following two subsections elaborate the findings of our study which consists of the relationship between dementia and stress with respect to the factors age and gender.

3.2.1 On the basis of Age:

As we all know that Dementia is more common in people who are aged above 65 [24], but it can also affect younger people as well. As per a research, people who are in their 30s, 40s, or 50s, are also prone to dementia and may start developing symptoms even before reaching 65 years of age. Here, we have analysed the role played by age

in the development of stress along with dementia. Figure 3 represents the visualization of our study which shows that age definitely affects the relation between stress and dementia. As depicted in Figure 3, we can see that the x-axis represents the final scores of the participants i.e. “0, 1, 2, 3, 4, 5, 6, 7, 8” on the basis of which we identify whether an individual has normal cognition or is suffering from cognitive impairment. The y-axis represents the binary classification of whether the participant is currently in stress or not. Here “1” represents the person is in stress and “0” represents the person is not in stress. The legend in the plot indicates the age-ranges of the participants. The scatter plot consists of multiple data points that represent the age of the participants, along with the regression line.

As shown in Figure 3, the data points have formed two clusters in the plot where the data points above the regression line denote the participants with stress, and the data points below the regression line denote the participants with no stress. Our focus is on the right-hand side of the plot i.e. the region above the x-axis where the score ranges between 2-8. This region denotes that the participant possesses cognitive impairment. The size of the data points is fixed in ascending order of age. If we closely examine the data points marked against scores in the x-axis between the range 2–8 and count the number of elderly participants, then the majority of participants whose age ranges fall between 40–60, are plotted above the regression line that represents the stress zone. The data points above the regression line which is yellow and green in colour signify the participants whose age is above 30.

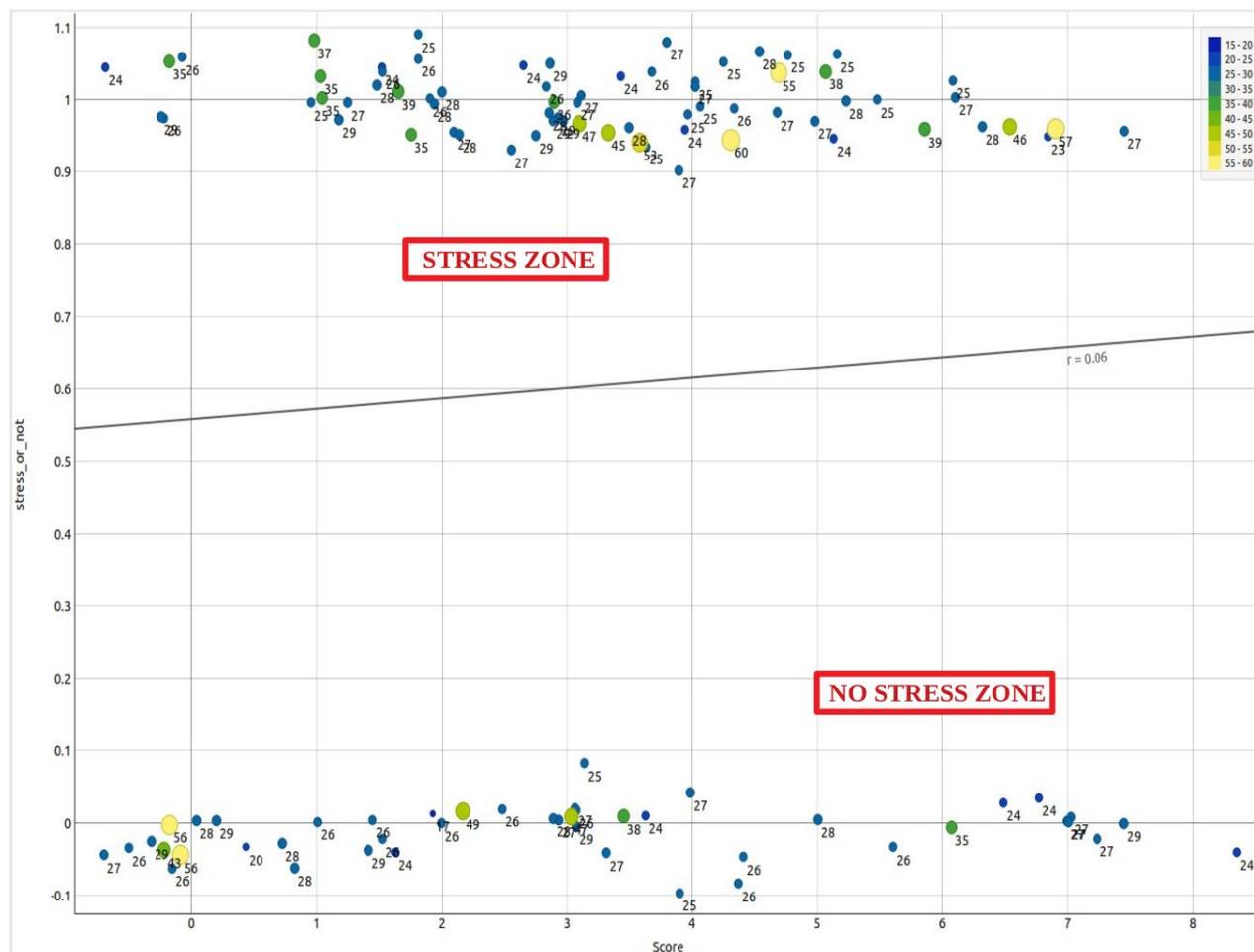


Figure 3: Scatter Plot of Stress Vs Score (Showing the Association Between Stress and Dementia with respect to Age)

This tells us that the majority of people who are above 30-40 years might develop the risk of dementia and stress is one of the main factors causing their risk of developing dementia. With these findings, we can pay more attention to the ways of dealing with stress, especially in the cases where the first signs of aging are apparent.

3.2.2 On the basis of Gender:

Several pieces of research have been done to investigate the problem if gender has a role in developing risk of dementia. Many studies have suggested that women are at higher risk of dementia than men [7]. In our study, we investigated the possible gender differences in the development of dementia in the IT Sector. As illustrated in Figure 4, we have plotted the x-axis with the final scores of the participants. The y-axis is the binary representation of whether the participant is currently in stress or not. Here “1” represents the person is in stress and “0” represents the person is not in stress. The legend in the plot indicates the gender representation of the participants, where “0” indicates a female, “1” represents a male and “2” indicates prefer not to say category. The scatter plot consists of multiple data points that represent the gender of the participants, along with the regression line. As shown in Figure 4, we can see that the data points have formed two clusters. Our focus is on the right-hand side of the plot i.e. the region above the x-axis where the score ranges between 2–8, which denotes that the participants are suffering from cognitive

impairment. The size of the data points is fixed in the ascending order of the score. The area above the regression line represents the stress zone, whereas that below represents no stress zone. We closely examined the data points and compared the number of female participants, in both the zones i.e. Stress Zone and No Stress Zone. According to our study, out of all the female participants who are at the risk of dementia, 82.1% of them have work stress as well. Out of all the male participants who are at the risk of dementia, 64.5% of them have work stress. This tells us that- “The probability of females developing the risk of dementia due to “work related stress” is higher than that of males. The probability of males who are at the risk of dementia “not due to stress” is higher than that of females.”

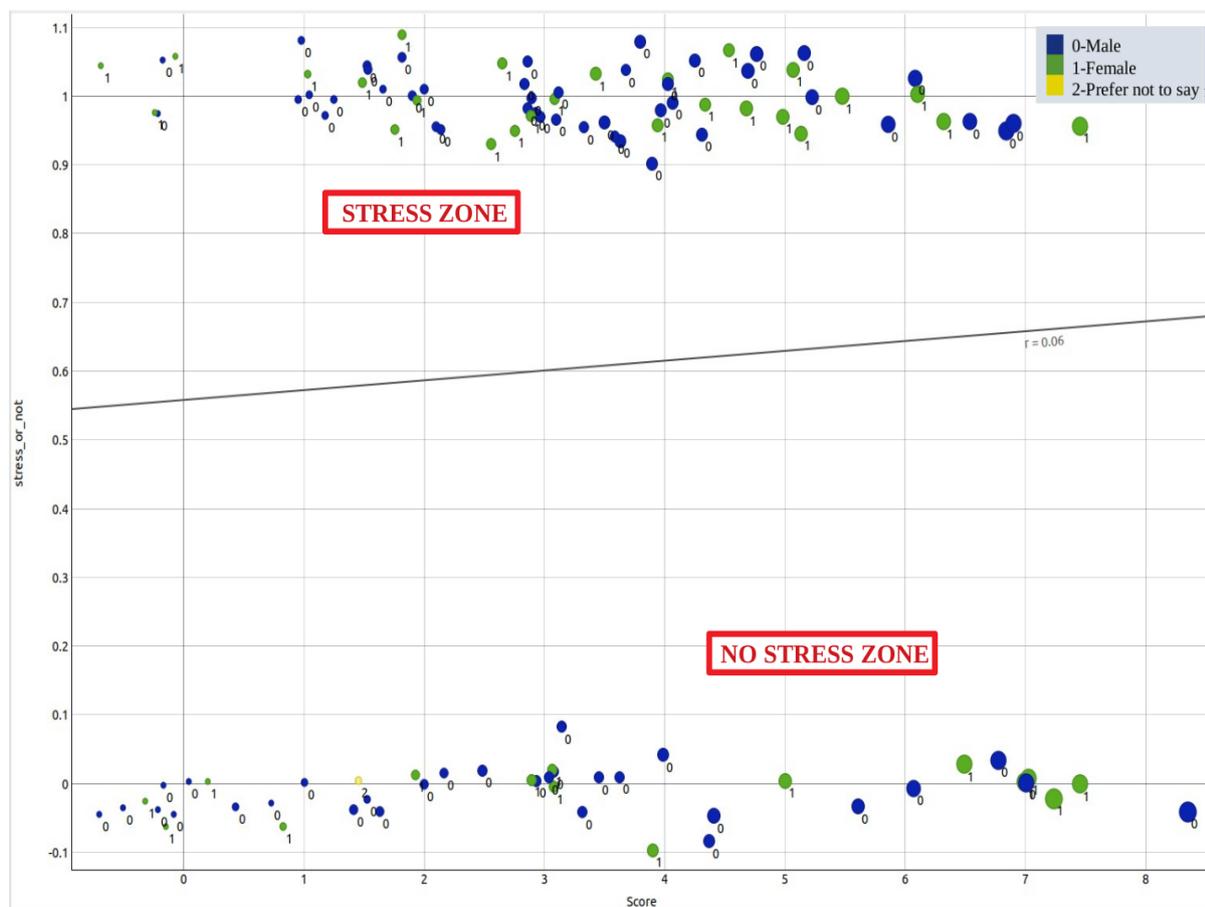


Figure 4: Scatter Plot of Stress Vs Score (Showing the Association Between Stress and Dementia with respect to Gender)

3.2.3 On the basis of Work Background:

In this section, our focus is to investigate the question that what role does the work background of an employee plays in the onset of dementia. As illustrated in Figure 5, we have plotted the x-axis with the final scores of the participants and the y-axis with the classification of whether the participant belonging to Technical or Non-Technical background is currently under stress or not. The size of the data points is fixed in the ascending order of the score. The legend in the scatter plot indicates the work background of participants, where “0” represents employees with Non-Technical background that have no work stress, “1” represents employees with Non-Technical background that have work stress, “10” indicates employees with Technical background that have no work stress and “11” indicates employees with Technical background having work stress. The scatter plot consists of 116 data points that represent the work background of 116 participants. It also shows the regression line. As shown in Figure 5, our focus is on the right-hand side of the plot i.e. the region above the x-axis where the score ranges between 2–8, which denotes that the participants are suffering from cognitive impairment. According to our study, 60.8% of Non-Technical background employees and 66.6% of Technical background employees are at the risk of dementia as they scored more than 2. This tells us that the probability of Technical background employees developing the risk of dementia is high as compared to the Non-Technical background workers. Among all the 66.6% of Technical background employees who are at the risk of dementia, 62.9% of them have stress. According to which we can state that - “The risk of dementia is directly proportional to the number of Technical background employees in an organisation having stress. It means, higher the number of technical people in the organization, higher would be the risk of onset of dementia in employees.

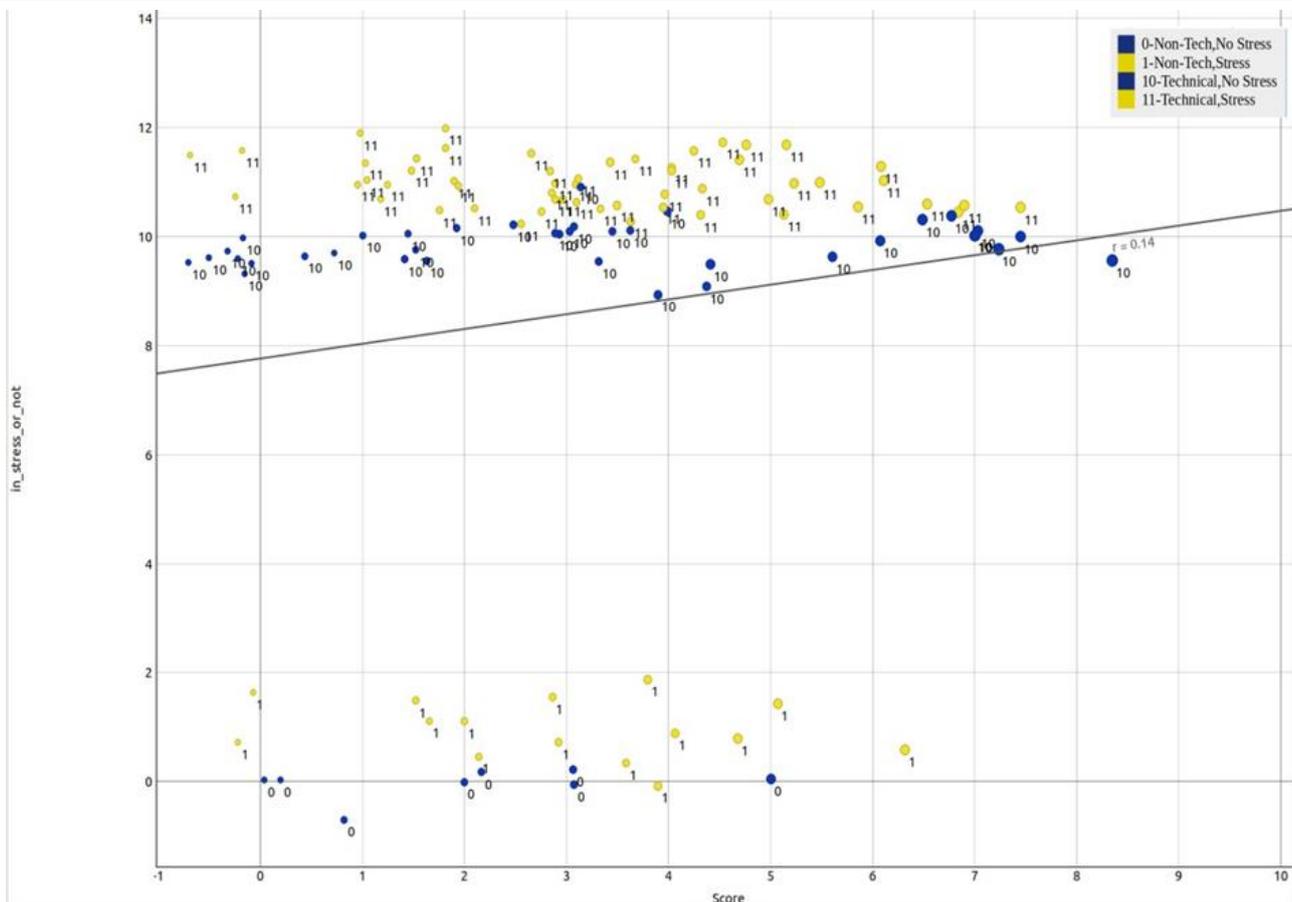


Figure 5: Scatter Plot of Stress Vs Score (Showing the Association Between Stress and Dementia with respect to Work Background)

3.3 Impact of Stress in Decision Making

In a stressful environment such as the IT work environment, decision making is of utmost importance in order to achieve work efficiency, effectiveness and productivity. In order to contribute to the organization with efficiency, commitment, and work satisfaction, numerous approaches such as the model of organizational choice [25], strategic decision-making [26], have been proposed. According to a research [25], there are few components across jobs like exhaustion which interfere with the decision-making capabilities of an employee. This ultimately affects the performance at the workplace. In this section, we attempted to determine that up to what extent stress affects the decision-making capabilities of an employee in an IT Sector. As illustrated in Figure 6, we have plotted the x-axis with the binary representation of whether the participant is facing any decision-making problem or not. Here “1” represents that the person has a decision-making problem and “0” represents no decision-making problem. The size of the data points is also fixed on the basis of decision-making capabilities i.e. small sized data points on the left side represent “No decision-making problems” and large sized data points on the right side represent “Problems in decision making”. The legend in the scatter plot indicates the work background of participants, where “0” indicates employees with Non-Technical background having no work stress, “1” represents employees with Non-Technical background having work stress, “10” indicates employees with Technical background having no work stress and “11” indicates employees with Technical background having work stress. The scatter plot consists of data points that represent the work background of 116 participants, along with the regression line. As shown in Figure 6, we can see that the data points have formed four clusters which helps us in determining which group is more affected by stress and decision-making issues.

Among all the 116 participants, 80.1% belong to Technical background and 19.8% belong to Non-Technical background. 59 out of 116 participants are having decision making problems, out of which 50 participants are from Technical backgrounds and 9 are from Non-Technical backgrounds. Among the 59 participants who are facing decision making problems, 84.7% of them belong to Technical background and 15.2% of them belong to Non-Technical background. Among the population, 19.8% belong to Non-Technical backgrounds out of which 60.8% of them don't have any Decision-Making problem. As shown in Figure 6, we can see that the “yellow” data points denote employees in “Stress” and “blue” data points denote employees having “No Stress”. Our focus in this section has been the Decision-Making Problem, and to find out which group is at the highest risk with respect to this problem. According to our study, Technical background employees are at higher risk, and surprisingly majority of the Technical background employees facing Decision-Making problems are also having work related stress. This shows that - “Stress is one of the major factors which affects the Decision-Making capabilities, especially of the Technical background employees in an organization.”

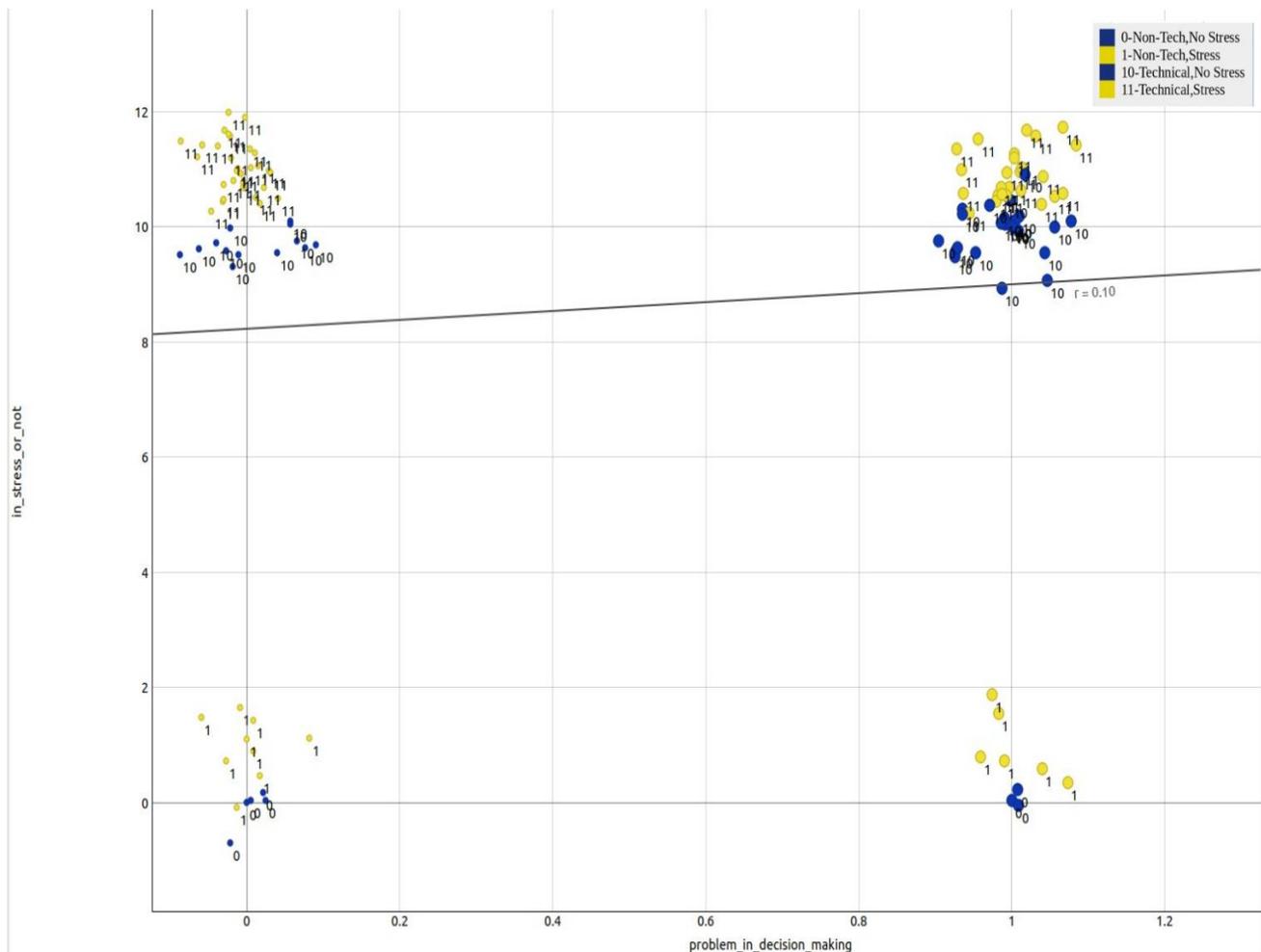


Figure 6: Scatter Plot of Stress Vs Problem in Decision Making (Showing the Impact of Stress in Decision Making)

IV. CONCLUSIONS

In this research paper, we tried to detect the onset of early dementia in the IT sector employees using AD8, the Dementia Screening questionnaire. We analysed the relationship between dementia and factors like the number of employees in the organization and stress. We also analysed that stress is affected by factors like age, gender, and work background. As per our research, we found that the probability of females who are at the risk of dementia due to stress is higher than that of males. The probability of males who are at the risk of dementia “not due to stress” is higher than that of females. It means that in the case of males, stress is not the major factor behind the onset of dementia. We also found that the probability of non-technical people facing Decision Making Problems is very low. On the other hand, the probability of technical people facing Decision Making Problems is very high. It shows that stress is one of the major factors that affects the decision-making capabilities of technical background employees. With the help of these findings we can pay more attention to the classes which are vulnerable to stress that might ultimately lead to the risk of onset of dementia.

V. ACKNOWLEDGMENT

This survey has been successfully accomplished due to all the participants who enthusiastically participated in our survey and helped us in data acquisition. This would have been impossible without the help and consent of all the IT Sector workers of India who became part of this and gave us their precious time out of their busy schedule and helped us out. We express our enormous gratitude to Washington University who granted us permission to use the AD8 Dementia Screening Questionnaire for our survey.

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