# Gender Specific Study in Subjects at Risk of Developing Dementia, Anxiety and Depression After Covid-19 Exposure

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**Abstract**

**Introduction:** Dementia, anxiety and depression are brain conditions that affects several upper cortical processes, including memory, thinking, direction, comprehension, calculation, learning capacity, language, and judgement. **Objectives:** The objective of this study is to study the effect of demographic factor on dementia, anxiety and depression in patients recovered from COVID-19 infection. **Methods:** This study is designed to observe subjects at risk of developing dementia, anxiety and depression after Covid-19 exposure patient data were collected from the hospital with help of hospital staff. Eligible patients were involved in the study based on the inclusion and exclusion criteria. Patients who meet the eligibility criteria was required to fill the questionnaire. So based on responses from the subject, the data was analyzed. Clinical Dementia Rating scale (CDL) was used for the study. **Results:** We have performed statistical analyses with the categorization of patient i. E. Gender and disease condition. The total number of patients (1000, Post Covid-19) enrolled in the study. Based on the response received from post-Covid-19patients, the data were analyzed by SAS Program. The responses, which were resulted in "YES" against each question of the questionnaire, were calculated as proportion. **Conclusion:** while the long-term impact of COVID-19 on dementia, anxiety and depression risk is still uncertain, it is essential to prioritize the health and well-being of older adults, especially those with pre-existing dementia, during and after the pandemic. Maintaining social connections, providing accessible healthcare services, and implementing preventive measures

**Keywords**: Alzheimer's disease, Cognitive disorder, Diabetes

## 1. Introduction

Covid-19was firstly identified in Jan-2020. This virus is quickly spreading among humans, resulting in a covid-19 pandemic [1-2]. Patients over the age of 65 and those with cardiovascular disease are more likely to develop acute respiratory syndrome, multiple organ failure, pneumonia and mortality [3-5]. Due to limited availability of vaccine and logistical challenges, the only method to control the outbreak was to enforce isolation, quarantine, and physical separation [6-7]. Vaccines were desperately required to combat the load of mortality and morbidity associated with covid-19 infection [8-10]. A total of 195 vaccine candidates are in line for clinical trial and approval. Currently, 36 vaccines are approved by world health organization (WHO), and 68 candidates are in phase III of the clinical trial. Worldwide 197 countries have approved vaccines available for vaccination [11-13].

Due to cognitive impairment in dementia, the patient's ability to obey with covid-19 infection preventive actions such as, cover face, community distancing and nostrils with mask and frequent sanitizing the hand may be hampered. The loss of one's sense of taste and smell is a warning indication of illness. In addition, the brain can

be affected by organ failure in a different place and hypoxia is an assurance of severe infection, leading to malfunction of brain cerebral edema [14-16.]

Covid-19 has been shown to complicate dementia in several ways. Firstly, the covid-19 pandemic has led to significant disruptions in routine care for individuals with dementia, including delays in diagnosis and treatment, and reduced access to care. This can lead to a worsening of symptoms and an overall decline in quality of life for those with dementia.Secondly, individuals with dementia may have difficulty following public health guidelines related to covid-19, such as wearing masks, social distancing, and washing hands regularly[17-19]. This may increase their risk of contracting covid-19, which can have severe and potentially life-threatening consequences, especially for older adults with underlying health conditions like dementia.Thirdly, covid-19 can also directly impact the brain and nervous system, leading to neurological complications such as confusion, delirium, and cognitive impairment. This can further exacerbate the symptoms of dementia and lead to a more rapid decline in cognitive function.Finally, covid-19 has also been associated with long-term neurological effects, such as persistent fatigue, headaches, and cognitive impairment, which can worsen the symptoms of dementia and impact overall quality of life.Anxiety during covid-19 refers to the heightened state of fear, worry, and unease experienced by individuals as they navigate the uncertainties and potential threats associated with the pandemic. The constant barrage of distressing news, the fear of contracting the virus, or witnessing its effects on loved ones can take a toll on mental well-being[20-25].

The rationale behind the study on the effect of covid-19 on dementia, anxiety and depression is that there is a growing concern that the covid-19 pandemic may have significant impacts on the health and well-being of individuals with dementia. The covid-19 pandemic has disrupted healthcare systems around the world and has led to significant changes in the way that care is provided to patients, including those with dementia. Additionally, covid-19 can directly impact the brain and nervous system, potentially exacerbating the symptoms of dementia. Anxiety during covid-19 refers to the heightened state of fear, worry, and unease experienced by individuals as they navigate the uncertainties and potential threats associated with the pandemic. The constant barrage of distressing news, the fear of contracting the virus, or witnessing its effects on loved ones can take a toll on mental well-being[26-28].

We hypothesized that pre-existing dementia predisposes individuals to increased risks of morbidity and mortality from covid-19 as a result of these common brain problems and autopsy findings. Once infected, dementia sufferers are more likely to suffer negative consequences [11]. Alzheimer's disease is challenging not just for people who have it, but also for those who care for them and their families. It is leading causes of disability and dependency among the elderly across the world. Dementia can no longer be ignored; it must now be included in all countries' public health agendas[29-31].

The objective of the study is to identify the specific impacts of the covid-19 pandemic on individuals with dementia, including changes in access to care, worsening of symptoms, and increased risk of infection.To examine the potential direct impact of covid-19 on the brain and nervous system in individuals with dementia, and to understand the potential long-term neurological effects of covid-19 on this population[32-34]. To investigate the factors that may exacerbate the impact of covid-19 on individuals with dementia, such as social isolation, comorbidities, and access to resources and support.To identify strategies for mitigating the negative impacts of covid-19 on individuals with dementia, including interventions to address social isolation, access to care and support, and management of comorbidities.To understand the broader societal impacts of the covid-19 pandemic on individuals with dementia and their caregivers, including changes in healthcare systems, social policies, and economic factors. Anxiety, as a natural response to perceived threats, can serve as a protective mechanism, enabling individuals to stay alert and focused during uncertain situations[35-37]. However, the prolonged and intense nature of the pandemic has pushed many people into chronic anxiety, disrupting their daily lives and overall well-being. The multifaceted impact of COVID-19 on mental health calls for a comprehensive understanding of the factors contributing to anxiety and the various coping mechanisms that can help individuals navigate these challenging times[38-40]. Anxiety, as a natural response to perceived threats, can serve as a protective mechanism, enabling individuals to stay alert and focused during uncertain situations. However, the prolonged and intense nature of the pandemic has pushed many people into chronic anxiety, disrupting their daily lives and overall well-being[41-45].

## 2. Material and Method

This study is design to observe Subjects at Risk of Developing Dementia, Anxiety and Depression after Covid-19 exposure theCovid patient data are collected from the covid hospital (Unique hospital multispecialty & research institute, Surat, India). Patients who meet the eligible criteria was required to fill the questionnaire. So based on responses from the subject, the data was analyzed.Clinical dementia rating scale (CDL) was used for the study so data as per CDL scale was collected[46].

**2.1. Enrollment:** Patient those who were considered to have severe illness and required prolonged hospitalization (≥ 4 days or transferred to ICU) was enrolled in the study.

### 2.2. Study design and procedure

This was an observational study to analysis subjects at risk of developing dementia, anxiety and depression after covid-19 exposure. This study included total 1000 patients. The covid patient data were collected from the covid hospital with help of hospital staff. Eligible patients wereenrolled in the study based on the inclusion and exclusion criteria. Those patients admitted in intense care unit (ICU) in the hospital with more ≥ 4 days. Patients with no history of dementia in past but have any neurological problem or any other condition were involved in study. Patients with mild severity or asymptomatic covid-19 but admitted to hospital for ≥ 4 days or transferred to ICU will be enrolled. Patients who meet the eligible criteria was required to fill the questionnaire (Figure 1). Questionnaire contain total 11 questions these questions will be fill by the patients. So based on responses from the subject, the data will be analyzed.CDL will be used for the study so data as per CDL scale will be collected.

Prior Conduct of Study below listed approvals were taken:

1. University Research Ethics Committee from Dehradun Institute of Technology University, Dehradun, India (DITU/UREC/2022/04/6)
2. Ethics Committee Approval from hospital (Ethics Committee-Unique Hospital, Surat, India)

**Fig 1: Questionnaire for the post COVID treatment**

| DIT UNIVERSITY IMAGINE ASPIRE ACHIEVE | **Questionnaire** | Strictly confidential |
|---|---|---|
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**Questionnaire for the post COVID treatment**

Patient Name:

DOB: Age:

Last day of Discharge:

Responded Name: Relationship:

3. Please answer following questions by circling the appropriate response

| Sr .no | Questionnaire of subject | Yes | No |
|---|---|---|---|
| 1 | He/she talks and asks about the same thing repeatedly | Yes | No |
| 2 | He/she has become unable to understand the context of facts | Yes | No |
| 3 | He/she has become indifferent about clothing and other personal concerns | Yes | No |
| 4 | He/she has begun to forget to turn off the faucet and/or close the door and/or has become unable to clean up properly | Yes | No |
| 5 | When doing two thing at the same time he/she forget one of them | Yes | No |
| 6 | He/she has become unable to take medication under proper management | Yes | No |
| 7 | He/ she has begun to take a longer time to do work (e.g. Household chores), which could be done quickly before | Yes | No |
| 8 | He/ She has become unable to make plan | Yes | No |
| 9 | He /She cannot understand complex topic | Yes | No |
| 10 | He/ she become less interested and willing and stopped hobbies etc. | Yes | No |
| 11 | He/She has become more irrotable and suspicious than before | Yes | No |
| Totoal SED – 11Q Score | | | |

Patient with Depression: Yes / No Patient with Anxiety: Yes / No

| Declaration by Participant | | Subject Initial |
|---|---|---|
| 1 | I confirm that I have read and understood the information Sheet dated TBD for the above study and have had the opportunity to ask questions. | [ ] |
| 2 | I understand that my participation in the study is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected. | [ ] |
| 3 | I agree not to restrict the use of any data or results that arise from this study provided such a use is only for scientific purposes | [ ] |
| 4 | I agree to take part in the above study without seeking any financial benefits considering academic nature off this study. | [ ] |

Following activities will be performed during Study Research.

1. Informed consent.
2. Demographic details including sex, height, weight and BMI
3. Medical history, Vital signs and Clinical examination

All subjects will be strictly required to follow the instructions given to them as per protocol**.**

**2.3. Method of administration of study tools:**

**Objective 1**: Patient data was obtained from hospital database (unique hospital, Surat, India) which were used to identify patient based on I/E criteria.

**Objective 2**: Quantitative- ICF; CRF and questionnaires was given to patients by research assistants and was filled by patient.

**Qualitative**: The Principal investigator (PI) will take the ICF and questionnaire will be filled in the presence of patient and based on the Questionnaire data will be analyzed and translated for analysis

**2.4. Data Collection and Management:**

Data was collected using paper-based forms and entered into Microsoft excel. Analysis of data will involve statistical software as appropriate.

1. ANOVA
2. Inclusion/Exclusion Checklist
3. Paper based crfs
4. Paper Based icfs
5. CDL Questionnaire

**2.5. Statistical Analysis:**

Analysis and statistics Data was extracted from the source database and was analyze using ANOVA test. The socio-demographic features was tabulated. Mean and standard deviations (SD) will be calculated.

**2.6. Qualitative Statistical Analysis**

Based on the response received from post-covid-19 patients, the data were analyzed by SAS Program. The responses which were resulted in "YES" against each question of the questionnaire were calculated as proportion. We have performed the statistical analysis in 1000 post-Covid-19 patients.

**3. Results:**

We have performed comparison of genders with diseases condition among covid-19 survivors developing dementia/anxiety/depression by SAS program. The total number of patients (1000, post covid-19) enrolled in the study.

Based on the response received from post-covid-19patients, the data were analyzed by SAS Program.Data were collected, each with a different number of observations for females and males. The means procedure was employed to calculate descriptive statistics for each study. The results from each study were aggregated and analyzed collectively to observe common patterns and trends across the samples.

**Table 1: Dementia Gender Statistical Analysis**

| Gender | N Obs | Mean | Median | Std Dev | Pr > \|t\| |
|---|---|---|---|---|---|
| F | 800 | 4.7637500 | 4.0000000 | 2.4300859 | <.0001 |
| M | 200 | 4.7850000 | 4.0000000 | 2.3911005 | <.0001 |

*F: Female; M: Male; N Obs: Number of Males and Females; Std Dev: Standard Deviation

Table 1 presents the summary statistics for dementia with females at 2.4300859 and males at 2.3911005. These results indicate that, on average, males tend to perform slightly better than females in this study. The summary statistics for dementia among female (N = 800) and male (N = 200) participants. The mean score for females was 4.7637500, while males had a slightly higher mean score of 4.7850000. Both genders had the same median score of 4.0000000, suggesting similar central tendencies. The results indicate a highly significant gender difference in dementia prevalence (Pr> |t| < .0001).

**Table 2: Anxiety Gender Statistical Analysis**

| Gender | N Obs | Mean | Median | Std Dev | Pr > \|t\| |
|---|---|---|---|---|---|
| F | 420 | 4.7119048 | 4.0000000 | 2.4378384 | <.0001 |
| M | 47 | 5.0851064 | 5.0000000 | 1.9204821 | <.0001 |

*F: Female; M: Male; N Obs: Number of Males and Females; Std Dev: Standard Deviation

Table 2 presents the summary statistics for anxiety, with 420 female and 47 male participants. Females had a mean score of 4.7119048, while males had a higher mean score of 5.0851064. The median scores were identical at 4.0000000. The standard deviations were 2.4378384 for females and 1.9204821 for males. The analysis revealed a highly significant gender difference in anxiety prevalence (Pr> |t| < .0001).

**Table 3: Depression Gender Statistical Analysis**

| Gender | N Obs | Mean | Median | Std Dev | Pr > \|t\| |
|---|---|---|---|---|---|
| F | 380 | 4.8210526 | 4.0000000 | 2.4234080 | <.0001 |
| M | 153 | 4.6928105 | 4.0000000 | 2.5164748 | <.0001 |

*F: Female; M: Male; N Obs: Number of Males and Females; Std Dev: Standard Deviation

Table 3, the summary statistics for depression among 380 female and 153 male participants.Females had a mean score of 4.8210526, and males had a slightly lower mean score of 4.6928105. Both genders had the same median score of 4.0000000. The standard deviations were 2.4234080 for females and 2.5164748 for males. The results indicate a highly significant gender difference in depression prevalence (Pr> |t| < .0001).

Overall, the results consistently show statistically significant gender differences in mean scores (Pr> |t| < .0001), indicating a consistent performance disparity.

**Table 4: Other diseases among survivors who has dementia/anxiety/Depression**

| Disease | Male | | | Female | | |
|---|---|---|---|---|---|---|
| | Anxiety | Dementia | Depression | Anxiety | Dementia | Depression |
| Diabetes | 15 | 50 | 20 | 30 | 100 | 50 |
| Other diseases condition | 25 | 60 | 30 | 60 | 150 | 90 |

Table 4, suggest data appears to be presented in two different groups: Diabetes and Other diseases condition. This suggests that there are two categories of diseases being considered:

1. Diabetes: This group includes data on the occurrence of Anxiety, Dementia, and Depression specifically among survivors who also have diabetes. Under Male and Diabetes, there are 15 male survivors with anxiety, 50 male survivors with dementia, and 20 male survivors with depression. Similarly, under Female and Diabetes, there are 30 female survivors with anxiety, 100 female survivors with dementia, and 50 female survivors with depression.
2. Other diseases condition: This group includes data on the occurrence of Anxiety, Dementia, and Depression among survivors who do not have diabetes. For example, under Male and Other, there are 25 male survivors with anxiety, 60 male survivors with dementia, and 30 male survivors with depression. Similarly, under Female and Other, there are 60 female survivors with anxiety, 150 female survivors with dementia, and 90 female survivors with depression.

This type of table is often used to compare the prevalence of different diseases among specific groups, in this case, comparing gender and diabetes status. It provides a concise way to visualize and compare the data for different diseases and subgroups.

## 4. Discussion:

The observed differences in standard deviations between genders suggest that the score distributions may vary in spread, with males generally exhibiting more consistent performance. However, further research is needed to understand the underlying factors contributing to these disparities, as the small sample sizes in some studies may limit the generalizability of the results.The study's large sample size enhances the reliability of the findings and increases the generalizability of the results to the broader population. The highly significant p-values indicate that the observed gender differences are unlikely to occur by chance alone.

Understanding gender-based disparities in mental health conditions is essential for developing targeted interventions and support systems. This research contributes valuable insights that may aid healthcare professionals, policymakers, and researchers in tailoring strategies to address mental health challenges based on gender-specific needs. However, further research is necessary to explore the underlying factors contributing to these gender differences in dementia, anxiety, and depression prevalence.

For dementia and anxiety,males have a slightly higher mean score, suggesting a higher prevalence of dementia and anxiety among males. However, in case of depression females have a slightly higher mean score, suggesting a higher prevalence of depression among females.

It's important to note that the mean score differences are relatively small for all three conditions, indicating that the gender-based disparities are not substantial. However, the highly significant p-values suggest that these differences are statistically meaningful and should be considered when addressing mental health challenges in both genders. The research findings highlight the importance of considering gender-specific factors in mental health interventions and support systems, aiming to promote a more tailored and equitable approach to mental health care. Further research is warranted to explore the underlying factors contributing to these gender differences in the prevalence of dementia, anxiety, and depression. The comprehensive analysis of multiple studies provides robust evidence of gender differences in scores across diverse samples. Males consistently outperformed females in terms of mean scores, while median scores remained comparable for both genders. These findings support the existence of persistent gender-based disparities in academic performance.

The data might be part of a research study or survey that investigates the co-occurrence of mental health conditions and other medical conditions among survivors[46-47]. Such data can be useful for understanding potential associations or comorbidities between these conditions, which can help healthcare professionals in providing better care and support for patients with multiple health concerns[48-50].

## 5. Conclusion:

The comprehensive statistical analysis of gender differences in the prevalence of dementia, anxiety, and depression has yielded significant insights. The study found that males tend to have slightly higher mean scores and a higher prevalence of dementia and anxiety, while females exhibit a slightly higher mean score and a higher prevalence of depression. These differences are statistically significant, underscoring the importance of considering gender-specific factors in mental health research and interventions.

This study provides valuable insights into gender differences in dementia, anxiety, and depression. To advance our understanding, future research should investigate causal factors, conduct longitudinal studies, explore inter sectionality's influence, develop gender-specific interventions, consider cultural influences, and examine risk factors and resilience. Addressing these research gaps will contribute to more effective and equitable mental health policies and interventions, promoting better mental health outcomes for all, regardless of gender.

**Acknowledgement:** We would like to thanks to all authors, co-authors, and supportive staff to provide intimate support for this work.

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