# ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM

**AFFILIATED TO MAHATMA GANDHI UNIVERSITY**



# THE COVID-ARTHRITIS NEXUS AMONG YOUNG WOMEN

# PROJECT REPORT

In the partial fulfilment of the requirements for the award of the degree of

## BACHELOR OF SCIENCE IN
## COMPUTER APPLICATIONS [TRIPLE MAIN]

**Submitted by**

**S B MITAALI**

**III B.Sc. Computer Applications [Triple Main]**

**Register No:SB21CA022**

Under the guidance of

**Ms. Mary Andrews**

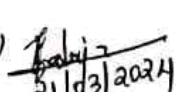**DEPARTMENT OF COMPUTER APPLICATIONS**
**2021-2024**

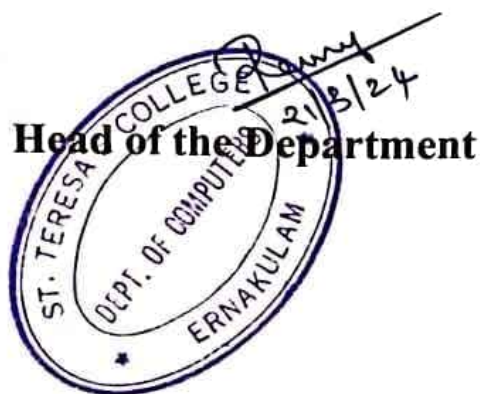# ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM

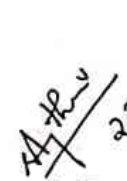## AFFILIATED TO MAHATMA GANDHI UNIVERSITY



# CERTIFICATE

This is to certify that the project report entitled **"THE COVID-ARTHRITIS NEXUS AMONG YOUNG WOMEN"** is a bonafide record of the work done by **S B MITAALI** (Register no : **SB21CA022**) during the year 2023-24 and submitted in the partial fulfilment of the requirements of the degree of Bachelor in Science in Computer Applications (Triple Main) under Mahatma Gandhi University.

Head of the Department

for,
21/03/2024
**Internal Examiner**

22.3.24
**External Examiner**

**Date:** 21/03/2024

# DECLARATION

I, **S B MITAALI** (Register no : **SB21CA022**), B.Sc. Computer Applications (Triple Main) final year student of St. Teresa's College (Autonomous), Ernakulam, hereby declare that the project submitted named **"THE COVID ARTHRITIS NEXUS AMONG YOUNG WOMEN"** for Bachelor's Degree in Computer Applications (Triple Main) is my original work. I further declare that the said work has not previously been submitted to any other university or academic body.

Place: ERNAKULAM

Date: 21|03|2024

S B MITAALI

# ACKNOWLEDGMENT

First and foremost, I express my profound gratitude to the divine for the blessings bestowed upon me. I extend my heartfelt appreciation to all those who contributed to the successful completion of this project. I am sincerely thankful to the **Provincial Superior and Manager**, **Rev. Dr. Sr. Vinitha CSST, Director Rev. Sr. Emeline CSST, and Principal Dr. Alphonsa Vijaya Joseph** for their generoussupport and provision of necessary resources.

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<div align="right">S B MITAALI</div>

# ABSTRACT

In Kerala, more than half of people have been affected by COVID-19. However, many individuals are still unaware of the post COVID impact on various aspect of life. One such aspect was arthritis which was seen more in women. The goal of the study was to compare pre and post arthritis symptoms data of women in the age group 14 to 35 in order to examine the COVID-19 influence in residents of Kerala, India. The study discovered that women affected by COVID-19 in the age group of 14 to 35 showed a positive correlation from post COVID-19 towards arthritis symptoms and the type of vaccination and the number of doses also played a significant effect towards arthritis. By using Chi square test and Pearson's correlation coefficient, to examine the data, we were able to determine the correlation for Arthritis Symptoms both before and after COVID-19. This study seeks to offer insights that can help improve how arthritis is managed and treated during the COVID-19 pandemic, benefiting individuals in Kerala and beyond.

# CONTENTS

# 1. INTRODUCTION

## 1.1 About Project

This project investigates the relationship between COVID-19 and arthritis symptoms among young women aged 14 to 35 in Kerala, India. The study aims on comparing pre and post-arthritis symptom data, to understand the impact of COVID-19 infection on arthritis development. Furthermore, the study examine how variables such as the type of vaccine received and the number of doses influence the severity of arthritis symptoms post-COVID-19. Through comprehensive analysis, the goal is to provide insights that can aid in improving the management and treatment of arthritis in the context of the COVID-19 pandemic.

## 1.2 Objective of Project

The objective of this project is to assess the impact of post-COVID-19 on young women's arthritis symptoms in Kerala, India, by comparing pre and post-arthritis symptom data. Additionally, the study aims to explore the influence of vaccination status, including the type of vaccine received and the number of doses, on arthritis symptoms. By analyzing these factors, the project seeks to inform Keralites about the implications of post-COVID-19 on arthritis symptoms . The findings of this study are intended to have important implications for healthcare professionals and policymakers, particularly in the development of effective targeted immunization programs tailored to the specific needs and characteristics of Keralites.

# 2. LITERATURE REVIEW

Investigating the relationship between COVID-19 and rheumatoid arthritis, the study "Exploring the Link Between COVID-19 and Rheumatoid Arthritis" (Tripathy et al., 2021) sheds light on the risks that individuals with rheumatoid arthritis may face during the COVID-19 pandemic, offering valuable insights into this intersection of health concerns. This study provides valuable insights into how individuals managing rheumatoid arthritis may be affected by COVID-19, offering a clear understanding of the challenges posed to this particular demographic during the ongoing pandemic.

In the study " Flare of Rheumatoid Arthritis after COVID-19 Vaccination" (Terracina et al., 2021), the authors focus on investigating the potential exacerbation of rheumatoid arthritis (RA) following COVID- 19 vaccination. The aim is to comprehend the prevalence and factors associated with RA flares post- vaccination. This research contributes significant insights, offering valuable information for a better understanding of the impact of COVID-19 vaccination on individuals with rheumatoid arthritis.

In the study "Post-COVID-19 Arthritis: Is it Hyperinflammation or Autoimmunity?" (Taha et al., 2021), the authors explore the dynamics surrounding the development of post-COVID-19 arthritis. Addressing whether hyperinflammation or autoimmunity primarily drives this condition, the study thoroughly examines the underlying mechanisms, delving into the interplay between inflammatory processes and autoimmune responses. It provides an understanding of the factors influencing arthritis in individuals recovering from COVID-19, contributing valuable insights to the evolving understanding of post COVID-19 complications.

The research, titled "Impact of the COVID-19 Pandemic on the Employment of Canadian Young Adults with Rheumatic Disease: Findings from a Longitudinal Survey" (Jetha et al., 2021), meticulously examines the socio-economic implications of the COVID-19 pandemic on the younger demographic with rheumatic disease. It offers a comprehensive exploration of effects, delving into employment status, mental health, quality of life, medication challenges, and access to crucial rheumatology care.

The researchers provide an examination, shedding light on challenges faced during the global health crisis, contributing valuable insights to our understanding of the broader impact of the pandemic on vulnerable communities.

The study titled "Respiratory Viral Infections and the Risk of Rheumatoid Arthritis"(Young Bin Joo et al.,2019) conducted at the Catholic University of Korea in Seoul offers a thorough examination of the potential connection between ambient respiratory viral infections and the development of Rheumatoid Arthritis (RA).With a specific emphasis on gender disparities, the research contributes valuable insights into how respiratory viral infections may influence the risk of RA. The study's meticulous approach provides a nuanced understanding of the complex relationship between respiratory viral infections and RA, offering a foundation for further exploration in this critical area of research.

Examining the emergence of new-onset inflammatory arthritis post-COVID-19 vaccination, the study "New-onset Inflammatory Arthritis after COVID-19 Vaccination: A Systematic Review" (Chen et al., 2023) presents their findings. The research systematically reviews case reports, offering a comprehensive analysis of the occurrence of inflammatory arthritis following vaccination. The study brings to light the potential connection between COVID-19 vaccination and the development of inflammatory arthritis, providing crucial insights into this evolving realm of research.

The study on "Does post–COVID Reactive Arthritis Exist? Experience of a Tertiary Care Centre with a Review of the Literature" (Pal et al., 2023) provides a comprehensive exploration into the potential existence of post-COVID reactive arthritis. Conducted at a prominent tertiary care center in India, this research adopts a retrospective and observational approach. The study centers its attention on patients with post-COVID-19 arthritis, aiming to meticulously analyze their clinical profiles, treatment outcomes, and the broader implications of reactive arthritis subsequent to COVID-19 infection. By delving into this multifaceted investigation, the research contributes valuable insights to our understanding of the complex interplay between COVID-19 and rheumatological manifestations

# 3. METHODOLOGY

The method consisted of collecting data, selecting an appropriate method for data cleaning, data wrangling, analyzing our obtained data, and finally visualizing it.

## 3.1. Data Collection :

Data collection through questionnaires is a common practice in social and healthcare research. In this study focusing on the health of individuals in Kerala, a questionnaire was distributed to 176 participants. The questionnaire, developed in collaboration with a specialized doctor, aimed to gather information on COVID-19 status, arthritis symptoms, vaccination details, and experiences before and after COVID-19. This method allows for comprehensive data collection and insights into the health status of the population under study.

The process of data collection through a questionnaire involves the following steps:

*Design the Questionnaire:* The questionnaire is designed based on the research objectives and the information required from the participants. In this case, a specialized doctor was involved in the preparation of the questionnaire to ensure that the questions were relevant and accurately reflected the health concerns of the people of Kerala.

*Select the Sample:* The sample of participants is selected based on the research objectives and the population of interest. In this case, the sample consisted of 180 individuals from Kerala. The sampling method used is Snowball Sampling.

*Distribute the Questionnaire:* The questionnaire was circulated among the participants through google forms via email, WhatsApp, and other platforms.

*Collect the Responses:* The responses from the participants were collected and recorded. In the case of a google form survey, the responses were automatically recorded in a database as an excel/CSV file.

*Data Cleaning and Analysis:* The collected data were cleaned to remove any inconsistencies or errors useful in the form to analyze our data with the help of filter tool in Excel. The cleaned data were analyzed using appropriate statistical tools.

In the case of obtaining data on the health of people in Kerala after receiving the vaccine, the questionnaire was designed to collect information on various aspects such as the type of vaccine received, the date of vaccination, precautions taken, and any symptoms or side effects experienced after vaccination. The data collected through the questionnaire can provide valuable insights into the safety and effectiveness of the vaccine and help healthcare professionals in managing any post-vaccination symptoms.

## 3.2. Method Used:

The methodology involved comparison of pre and post-arthritis conditions statuses as well as vaccination details and arthritis condition. To analyze these comparisons, we utilized statistical methods such as the Pearson correlation coefficient and the chi- square test.

### 3.2.1. Pearson Correlation Coefficient:

The Pearson correlation coefficient is a statistical measure used to determine the strength and direction of the linear relationship between two continuous variables. It's represented by the symbol "r" and ranges from -1 to +1. The formula for calculating "r" involves Computing the covariance between the two variables Normalizing it by dividing by the product of their standard deviations

where p is the probability of the dependent variable taking a value of 1, X1 to Xk are the independent variables, β0 is the intercept and β1 to βk are the coefficients of the independent variables.

$$r = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2}\sqrt{\sum_{i=1}^{n}(y_i - \bar{y})^2}}$$

where n is the number of data, x and y are the variables to be analyzed.

***Strength of relationship*** : The closer the value of "r" is to +1 or -1, the stronger the relationship between the two variables.

- If "r" is close to +1, it indicates a strong positive linear relationship. This means that as one variable increases, the other variable tends to increase as well.

- If "r" is close to -1, it indicates a strong negative linear relationship. This means that as one variable increases, the other variable tends to decrease.

*Direction of relationship :* The sign of "r" (+ or -) indicates the direction of the relationship.

- A positive "r" value indicates a positive relationship, where both variables tend to increase together.
- A negative "r" value indicates a negative relationship, where one variable tends to decrease as the other variable increases.

*No relationship :* If "r" is close to 0, it suggests that there's no linear relationship between the two variables.

Pearson Correlation Coefficient helps researchers understand how strongly and in what direction two variables are related, providing valuable insights into their relationship in various fields of study.

### 3.2.2. Chi-Square Test

The chi-square test is a hypothesis test that evaluates whether there is a significant association between two categorical variables in a population. The null hypothesis $(H_0)$ states that there is no association between the variables, while the alternative hypothesis $(H_1)$ states that there is an association.

*Calculate Expected Frequencies:* First, we calculate the expected frequencies for each category under the assumption of no association between the variables.

$$X^2 = \sum \frac{(O - E)^2}{E}$$

where $X^2$ is the chi-square test statistic, $O$ is the observed frequency, $E$ is the expected frequency

*Degrees of Freedom:* The degrees of freedom for the chi-square test depend on the number of categories in each variable. For a contingency table with R rows and C columns, the degrees of freedom is calculated as (R - 1) * (C - 1).

*Critical Value or P-value:* Finally, we compare the chi-square test statistic to a critical value from the chi-square distribution or calculate a p-value. If the test statistic is greater than the critical value or if the p-value is less than a predetermined significance level (usually 0.05), we reject the null hypothesis and conclude that there is a significant association between the variables.

### 3.3. Data Wrangling:

Data wrangling is the process of cleaning, transforming, and preparing raw data for analysis.

In this study there were different categorical data. To analyze this data, the categorical variables were converted to numeric values with the help of Label Encoder too in the sci-kit learn library in python using Python Jupyter Notebook.

### 3.4. Data Analysis:

The Data Analysis was done with the help of Python. There are mainly two objective.

The primary objective was to analyze the dependency of Covid 19 with arthritis symptoms. This was done with the help of Pearson Correlation Coefficient and Chi Square test.

Secondly, to identify any kind of possible relationship between type of vaccine and number of doses by assigning all the arthritis symptoms to a single variable and taking the counts of data where the value in the single variable is greater than 1 and grouping them based on type of vaccine and number of doses.

The data visualization have been dine using Python. Data visualization can effectively communicate insights from analyzing Covid – Arthritis data in Kerala. Python has powerful libraries like Matplotlib and Seaborn for users to explore the data and gain valuable insights.

# 4. RESULTS

### 4.1 Analyzing the pre/post arthritis data

#### 4.1.1 Comparison using Pearson's Correlation Coefficient

```
Pearson Correlation Coefficients for HCP before covid:
      HCP      JPBC     SASBC     LJBC      WBC       ABC      PSBC
HCP   1.0   0.130646  0.095202  0.002668 -0.111663  0.166577  0.143775


Pearson Correlation Coefficients for HCP after covid:
      HCP      JPAC     SASAC     LJAC      WAC       AAC      PSAC
HCP   1.0   0.32273   0.391122  0.359561  0.291151  0.254196  0.440298
```

- **HCP** is Have Covid Positive
- **JPBC/JPAC** is Joint Pain Before Covid/Joint Pain After Covid
- **SASBC/SASAC** is difficulty in movement after long time of Standing And Sitting Before Covid/After Covid
- **LJBC/LJAC** is Limitation in Joint movements Before Covid/After Covid
- **WBC/WAC** is Weight loss Before Covid/ After Covid
- **ABC/AAC** is Arthritis Before Covid/After Covid
- **PSBC/PSAC** is lack of Physical Stability Before Covid/ After Covid

**Here we can see an increase in correlation of COVID-19 and arthritis from before COVID situation to after COVID situation**

**4.1.2** Comparison using Chi- Square Test

## HCP * JPBC Crosstabulation

Count

| | | JPBC | | |
|---|---|---|---|---|
| No | | | Yes | Total |
| HCP | No | 74 | 3 | 77 |
| | Yes | 67 | 8 | 75 |
| Total | | 141 | 11 | 152 |

## HCP * JPAC Crosstabulation

Count

| | | JPAC | | |
|---|---|---|---|---|
| No | | | Yes | Total |
| HCP | No | 77 | 0 | 77 |
| | Yes | 61 | 14 | 75 |
| Total | | 138 | 14 | 152 |

## HCP * SASBC Crosstabulation

Count

| | | SASBC | | |
|---|---|---|---|---|
| No | | | Yes | Total |
| HCP | No | 72 | 5 | 77 |
| | Yes | 66 | 9 | 75 |
| Total | | 138 | 14 | 152 |

## HCP * SASAC Crosstabulation

Count

| | | SASAC | | |
|---|---|---|---|---|
| No | | | Yes | Total |
| HCP | No | 76 | 1 | 77 |
| | Yes | 53 | 22 | 75 |
| Total | | 129 | 23 | 152 |

**HCP * LJBC Crosstabulation**

Count

| | | LJBC No | Yes | Total |
|---|---|---|---|---|
| HCP | No | 74 | 3 | 77 |
| | Yes | 72 | 3 | 75 |
| Total | | 146 | 6 | 152 |

**HCP * LJAC Crosstabulation**

Count

| | | LJAC No | Yes | Total |
|---|---|---|---|---|
| HCP | No | 77 | 0 | 77 |
| | Yes | 58 | 17 | 75 |
| Total | | 135 | 17 | 152 |

**HCP * ABC Crosstabulation**

Count

| | | ABC No | Yes | Total |
|---|---|---|---|---|
| HCP | No | 77 | 0 | 77 |
| | Yes | 71 | 4 | 75 |
| Total | | 148 | 4 | 152 |

**HCP * AAC Crosstabulation**

Count

| | | AAC No | Yes | Total |
|---|---|---|---|---|
| HCP | No | 77 | 0 | 77 |
| | Yes | 66 | 9 | 75 |
| Total | | 143 | 9 | 152 |

**HCP \* WBC Crosstabulation**

Count

| | | WBC | | Total |
|---|---|---|---|---|
| | | No | Yes | |
| HCP | No | 64 | 13 | 77 |
| | Yes | 68 | 7 | 75 |
| Total | | 132 | 20 | 152 |

**HCP \* WAC Crosstabulation**

Count

| | | WAC | | Total |
|---|---|---|---|---|
| | | No | Yes | |
| HCP | No | 76 | 1 | 77 |
| | Yes | 61 | 14 | 75 |
| Total | | 137 | 15 | 152 |

**HCP \* PSBC Crosstabulation**

Count

| | | PSBC | | Total |
|---|---|---|---|---|
| | | No | Yes | |
| HCP | No | 77 | 0 | 77 |
| | Yes | 72 | 3 | 75 |
| Total | | 149 | 3 | 152 |

**HCP \* PSAC Crosstabulation**

Count

| | | PSAC | | Total |
|---|---|---|---|---|
| | | No | Yes | |
| HCP | No | 76 | 1 | 77 |
| | Yes | 49 | 26 | 75 |
| Total | | 125 | 27 | 152 |

**Here we can see an increase in the number of people affected by each arthritis symptoms from before COVID -19 to after COVID-19.**

### 4.1.3 Comparison with vaccine type

**TV * JPBV Crosstabulation**

Count

| JPBV | | No | Yes | Total |
|---|---|---|---|---|
| TV | Covaxin | 44 | 0 | 44 |
| | Covishield | 103 | 2 | 105 |
| | Sputnik-V | 1 | 0 | 1 |
| Total | | 148 | 2 | 150 |

**TV * JPAV Crosstabulation**

Count

| JPAV | | No | Yes | Total |
|---|---|---|---|---|
| TV | Covaxin | 41 | 3 | 44 |
| | Covishield | 91 | 14 | 105 |
| | Sputnik-V | 1 | 0 | 1 |
| Total | | 133 | 17 | 150 |

**TV * SASBV Crosstabulation**

Count

| SASBV | | No | Yes | Total |
|---|---|---|---|---|
| TV | Covaxin | 41 | 3 | 44 |
| | Covishield | 97 | 8 | 105 |
| | Sputnik-V | 1 | 0 | 1 |
| Total | | 139 | 11 | 150 |

**TV * SASAV Crosstabulation**

Count

| SASAV | | No | Yes | Total |
|---|---|---|---|---|
| TV | Covaxin | 39 | 5 | 44 |
| | Covishield | 89 | 16 | 105 |
| | Sputnik-V | 0 | 1 | 1 |
| Total | | 128 | 22 | 150 |

### TV * LJBV Crosstabulation

Count

| | | LJBV No | Yes | Total |
|---|---|---|---|---|
| TV | Covaxin | 40 | 4 | 44 |
| | Covishield | 102 | 3 | 105 |
| | Sputnik-V | 1 | 0 | 1 |
| Total | | 143 | 7 | 150 |

### TV * LJAV Crosstabulation

Count

| | | LJAV No | Yes | Total |
|---|---|---|---|---|
| TV | Covaxin | 38 | 6 | 44 |
| | Covishield | 98 | 7 | 105 |
| | Sputnik-V | 0 | 1 | 1 |
| Total | | 136 | 14 | 150 |

### TV * ABV Crosstabulation

Count

| | | ABV No | Yes | Total |
|---|---|---|---|---|
| TV | Covaxin | 43 | 1 | 44 |
| | Covishield | 102 | 3 | 105 |
| | Sputnik-V | 1 | 0 | 1 |
| Total | | 146 | 4 | 150 |

### TV * AAV Crosstabulation

Count

| | | AAV No | Yes | Total |
|---|---|---|---|---|
| TV | Covaxin | 43 | 1 | 44 |
| | Covishield | 98 | 7 | 105 |
| | Sputnik-V | 1 | 0 | 1 |
| Total | | 142 | 8 | 150 |

**TV \* WBV Crosstabulation**

Count

| WBV | | No | Yes | Total |
|---|---|---|---|---|
| TV | Covaxin | 43 | 1 | 44 |
| | Covishield | 103 | 2 | 105 |
| | Sputnik-V | 1 | 0 | 1 |
| Total | | 147 | 3 | 150 |

**TV \* WAV Crosstabulation**

Count

| WAV | | No | Yes | Total |
|---|---|---|---|---|
| TV | Covaxin | 42 | 2 | 44 |
| | Covishield | 98 | 7 | 105 |
| | Sputnik-V | 1 | 0 | 1 |
| Total | | 141 | 9 | 150 |

**TV \* PSBV Crosstabulation**

Count

| PSBV | | No | Yes | Total |
|---|---|---|---|---|
| TV | Covaxin | 43 | 1 | 44 |
| | Covishield | 103 | 2 | 105 |
| | Sputnik-V | 1 | 0 | 1 |
| Total | | 147 | 3 | 150 |

**TV \* PSAV Crosstabulation**

Count

| PSAV | | No | Yes | Total |
|---|---|---|---|---|
| TV | Covaxin | 38 | 6 | 44 |
| | Covishield | 89 | 16 | 105 |
| | Sputnik-V | 0 | 1 | 1 |
| Total | | 127 | 23 | 150 |

Here TV is Type of Vaccine and No is Number of doses

- Here we can see an increase in the number of people affected by each arthritis symptoms from pre vaccination period to post vaccination period.

- The maximum increase is observed with people having two doses of vaccine for Covaxin and Covishield.

## 4.2. Data Visualization

Data visualization is a crucial step in analyzing and interpreting data. It helps to identify patterns, trends, and relationships within the data, and it is an essential tool in decision-making processes. In this article, we will discuss data visualization conducted on data collected about the COVID and Arthritis details of people in Kerala, using SPSS and Python

The data collected for this study included information on individuals covid status, arthritis details and vaccine details in Kerala. The data included details such as the age, arthritis symptoms, type of vaccine and number of doses.

SPSS is a popular statistical software used for data analysis, and it was used in this study to perform descriptive statistics and create charts and graphs. The data was imported into SPSS. Charts and graphs were then created to visualize the data, such as bar charts to show the distribution of vaccine types, arthritis symptoms to show the trend of arthritis symptoms overtime.

Python is another programming language widely used in data analysis and visualization. In this study, Python was used to create interactive visualizations using the Matplotlib and Seaborn libraries.

In conclusion, data visualization is an essential step in analyzing and interpreting data. In this study, we used SPSS and Python to visualize data collected. The visualizations created using these tools provided insights and allowed for deeper analysis and understanding of the data.
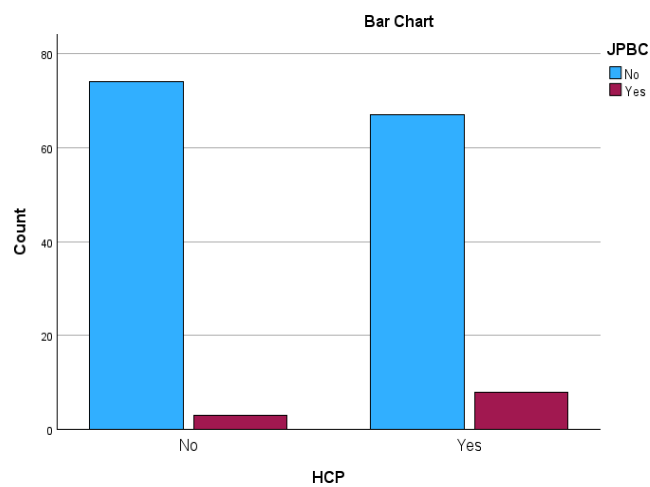
**Bar graph using SPSS showing the number of people showing positive and negative arthritis symptoms based on Covid Positive status**
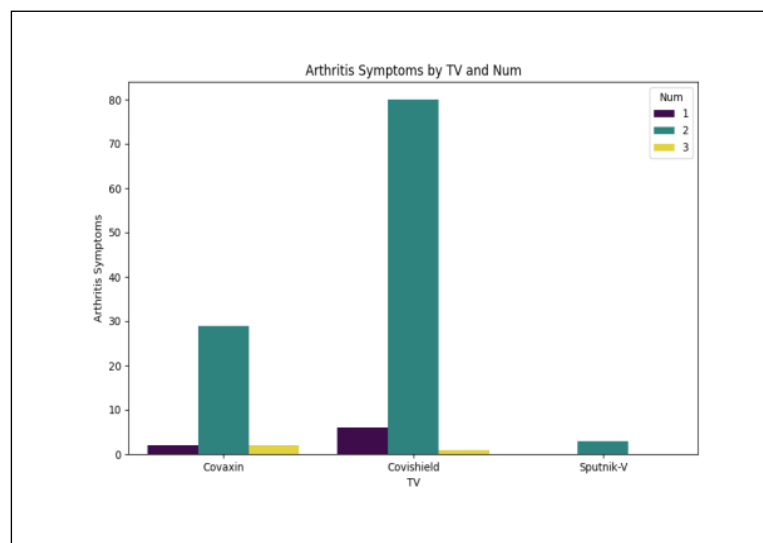


**Bar graph using python depicting count of people being affected with arthritis symptoms based on Type of Vaccine and Number of Doses**

# 5. CONCLUSION

The analysis conducted on the data collected about the covid positive status, pre /post arthritis details and vaccine details of people in Kerala revealed a significant improvement in the arthritis condition in the Post Covid Period.

- We observed a significant improvement in the correlation between arthritis symptoms among women from the age group 14 to 35 when comparing the analysis of before and after COVID-19.

- Notably, within this age group, individuals vaccinated with 2 doses of Covaxin and Covishield exhibited a positive correlation with arthritis symptoms compared to those vaccinated with others.

- These findings suggest that COVID-19 may contribute to an increased likelihood of developing arthritis.

- The project provides valuable insights into the potential impact of the covid virus on arthritis conditions, particularly among women aged from 14 to 35

This information is valuable for healthcare professionals and policymakers in designing targeted immunization plans that take into account the unique requirements and features of the people of Kerala.

Furthermore, the study's findings provide accurate information regarding the impact of the Covid-19 vaccine on Keralites, which is critical in promoting public confidence in the vaccine's efficacy. By providing accurate and reliable data, healthcare professionals and policymakers can ensure that the public has access to information that will help them make informed decisions about receiving the Covid-19 vaccine.

In conclusion, our study demonstrates the significant impact of Covid-19. This information can be used to develop targeted immunization plans that are effective in protecting the population against Covid-19 while taking into account the unique requirements and featuresof the people of Kerala.

# 6. FUTURE SCOPE

- While the study offers important insights into the relationship between COVID-19, arthritis, and vaccination, further investigation is warranted to establish causality and better understand the mechanisms behind these associations.

- Additional studies involving larger sample sizes and diverse populations would strengthen the conclusions drawn from this initial work.

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