**Group 4**

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**Selected Dataset Name**: Census Demographic ACS

**ACS (American Community Survey) Demographic and Housing Estimates**

**About Dataset:**

This is American Community Survey (ACS) produces population, demographic and housing unit estimates for 2020. The 2020 Census provides the official counts of the population and housing units for the counties

**Source**:

[U.S. Census Bureau, 2016-2020 American Community Survey 5-Year Estimates](https://data.census.gov/table/ACSDP5Y2020.DP05?q=dp&g=010XX00US$0500000)

**Executive Summary:**

This report documents the process of cleaning, merging, and analyzing COVID-19 and demographic data from U.S. counties. The main focus is on the COVID-19 pandemic trends for 2020, particularly in Arizona, as well as enriching the COVID-19 data with demographic information from the American Community Survey (ACS) to better understand the spread of the virus. The steps outlined include data preparation, cleaning, and merging to create a comprehensive dataset. The enriched dataset helps explore various social, economic, and demographic factors that may have influenced the virus's transmission. This analysis allows us to pose key hypotheses regarding the relationship between demographic variables and the spread of COVID-19.

**Introduction:**

The COVID-19 pandemic has had profound effects on public health, the economy, and society worldwide. To understand its spread and impact, it is essential to analyze not only the reported cases and deaths but also the demographic context of the affected areas. This project aims to clean and merge COVID-19 case and death data with demographic data from the ACS. By analyzing trends in different regions, particularly in Arizona, and enriching the data with demographic information, this report seeks to gain deeper insights into how factors such as population density, age, and socioeconomic status might have influenced the spread and severity of the virus.

**Visualization of dataset for one county:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Label (Grouping) | Estimate | Margin of Error | Percent | Percent Margin of Error |
| SEX AND AGE |  |  |  |  |
| Total population | 65432 |  |  |  |
| Male | 32379 |  |  |  |
| Female | 33053 |  |  |  |
| Sex ratio (males per 100 females) | 98.0 |  |  |  |
| Under 5 years | 3776 |  |  |  |
| 5 to 9 years | 4581 |  |  |  |
| 10 to 14 years | 5598 |  |  |  |
| 15 to 19 years | 4966 |  |  |  |
| 20 to 24 years | 4632 |  |  |  |
| 25 to 34 years | 8411 |  |  |  |
| 35 to 44 years | 7934 |  |  |  |
| 45 to 54 years | 6257 |  |  |  |
| 55 to 59 years | 3501 |  |  |  |
| 60 to 64 years | 4754 |  |  |  |
| 65 to 74 years | 6913 |  |  |  |
| 75 to 84 years | 3166 |  |  |  |
| 85 years and over | 943 |  |  |  |
| Median age (years) | 35.8 |  |  |  |
| Under 18 years | 16961 |  |  |  |
| 16 years and over | 50686 |  |  |  |
| 18 years and over | 48471 |  |  |  |
| 21 years and over | 45281 |  |  |  |
| 62 years and over | 13911 |  |  |  |
| 65 years and over | 11022 |  |  |  |
| 18 years and over | 48471 |  |  |  |
| Male | 23902 |  |  |  |
| Female | 24569 |  |  |  |
| Sex ratio (males per 100 females) | 97.3 |  |  |  |
| 65 years and over | 11022 |  |  |  |
| Male | 4945 |  |  |  |
| Female | 6077 |  |  |  |
| Sex ratio (males per 100 females) | 81.4 |  |  |  |
| RACE |  |  |  |  |
| Total population | 65432 |  |  |  |
| One race | 61959 |  |  |  |
| Two or more races | 3473 |  |  |  |
| One race | 61959 |  |  |  |
| White | 12705 |  |  |  |
| Black or African American | 320 |  |  |  |
| American Indian and Alaska Native | 48041 |  |  |  |
| Cherokee tribal grouping | N |  |  |  |
| Chippewa tribal grouping | N |  |  |  |
| Navajo tribal grouping | N |  |  |  |
| Sioux tribal grouping | N |  |  |  |
| Asian | 368 |  |  |  |
| Asian Indian | N |  |  |  |
| Chinese | N |  |  |  |
| Filipino | N |  |  |  |
| Japanese | N |  |  |  |
| Korean | N |  |  |  |
| Vietnamese | N |  |  |  |
| Other Asian | N |  |  |  |
| Native Hawaiian and Other Pacific Islander | 13 |  |  |  |
| Native Hawaiian | N |  |  |  |
| Guamanian or Chamorro | N |  |  |  |
| Samoan | N |  |  |  |
| Other Pacific Islander | N |  |  |  |
| Some other race | 512 |  |  |  |
| Two or more races | 3473 |  |  |  |
| White and Black or African American | 161 |  |  |  |
| White and American Indian and Alaska Native | 295 |  |  |  |
| White and Asian | 60 |  |  |  |
| Black or African American and American Indian and Alaska Native | 85 |  |  |  |
| Black or African American and Some Other Race | 0 |  |  |  |
| Race alone or in combination with one or more other races |  |  |  |  |
| Total population | 65432 |  |  |  |
| White | 15587 |  |  |  |
| Black or African American | 566 |  |  |  |
| American Indian and Alaska Native | 49031 |  |  |  |
| Asian | 445 |  |  |  |
| Native Hawaiian and Other Pacific Islander | N |  |  |  |
| Some other race | 3367 |  |  |  |
| HISPANIC OR LATINO AND RACE |  |  |  |  |
| Total population | 65432 |  |  |  |
| Hispanic or Latino (of any race) | 4728 |  |  |  |
| Mexican | 3288 |  |  |  |
| Puerto Rican | 144 |  |  |  |
| Cuban | 0 |  |  |  |
| Other Hispanic or Latino | 1296 |  |  |  |
| Not Hispanic or Latino | 60704 |  |  |  |
| White alone | 12328 |  |  |  |
| Black or African American alone | 318 |  |  |  |
| American Indian and Alaska Native alone | 47177 |  |  |  |
| Asian alone | 368 |  |  |  |
| Native Hawaiian and Other Pacific Islander alone | 13 |  |  |  |
| Some other race alone | 0 |  |  |  |
| Two or more races | 500 |  |  |  |
| Two races including Some other race | 43 |  |  |  |
| Two races excluding Some other race, and Three or more races | 457 |  |  |  |
| Total housing units | 29042 |  |  |  |
| CITIZEN, VOTING AGE POPULATION |  |  |  |  |
| Citizen, 18 and over population | 23738 |  |  |  |
| Male | 23738 |  |  |  |
| Female | 24358 |  |  |  |

**In Dataset column name format example:**  
Percent Margin of Error!!RACE!!Total population!!One race!!Asian!!Other Asian

**Enrichment data and datatype - variable dictionary:**

You can find the variable dictionary as file name **ACS Demographic and Housing Estimates\_Variable dictionary.csv** where we can see the each column name with it’s datatype value.

**Work:**

**1. Preparing the Dataset for Cleaning**

Before initiating the data cleaning process, three essential datasets were uploaded:

1. covid\_deaths\_usafacts.csv – Data on COVID-19 deaths by county.
2. covid\_confirmed\_usafacts.csv – Confirmed COVID-19 cases by county.
3. covid\_county\_population\_usafacts.csv – Population data for U.S. counties.

**2. Data Cleaning**

For the COVID-19 deaths, confirmed cases, and population datasets, the following data cleaning steps were carried out:

* **Removal of Invalid Rows**: Rows where countyFIPS had a value of 0 were removed, as these are not valid county codes and represent areas with a population of 0. This step was crucial for ensuring data consistency and relevance.
  + *COVID Deaths*: 3142 rows, 1269 columns.
  + *COVID Cases*: 3142 rows, 1269 columns.
  + *Population*: 3144 rows, 4 columns.

**3. Merging the COVID-19 Data**

Next, the datasets were merged based on the countyFIPS column using an inner join, ensuring that only rows with matching county codes across all datasets were retained. This resulted in the creation of the super\_covid19\_dataframe.csv, which combined COVID-19 cases, deaths, and population data:

* **Final Dataset**: 3142 rows and 2535 columns.

**4. Analyzing COVID-19 Data for 2020**

The merged dataset was then filtered to focus solely on COVID-19 data from the year 2020. This reduced the dataset to 3142 rows and 695 columns. The filtered data was essential for further trend analysis.

**5. COVID-19 Trends for the Last Week of 2020 (Arizona)**

Arizona’s data was analyzed to observe COVID-19 trends for the last week of 2020, broken down by county:

* **Counties with Increasing Cases**: Maricopa, Pima, Pinal, Yuma.
* **Counties with Stable Cases**: Apache, Cochise, Coconino, etc.

The data was visualized using line plots for each county to show the trends in COVID-19 cases.

**6. Enrichment Data: ACS Demographic and Housing Estimates:**  
To enhance the analysis, demographic data from the ACS Demographic and Housing Estimates dataset was included. This data provided information such as population estimates, sex ratios, and more.

**7. Cleaning ACS Data**

The ACS dataset was cleaned as follows:

* **Removal of Puerto Rico Data**: Rows where Geography column values began with 0500000US7 were excluded.
* **Prefix Removal**: The Geography column's prefix (0500000US) was removed to match the countyFIPS codes from the COVID-19 dataset.
* **Column Renaming**: The Geography column was renamed to countyFIPS.
* **Data Type Correction**: The countyFIPS column's data type was converted to an integer to ensure compatibility for merging with other datasets.
* **Dropping Unnecessary Columns**: An unnamed column containing NaN values was removed.

After cleaning, the ACS dataset had 3143 rows and 358 columns.

**8. Merging the Enriched Dataset**

Finally, the cleaned ACS demographic dataset was merged with the COVID-19 dataset using an outer join on column **countyFIPS** to ensure that all relevant records from both datasets were included:

* **Final Merged Dataset**: 3144 rows and 1052 columns.

This final dataset, merge\_Enrichment\_data.csv, combined COVID-19 data with demographic information, providing a comprehensive view of the pandemic's impact across U.S. counties.

**9. Enrichment Data's Role in COVID-19 Spread Analysis**

Demographic factors like population density, age distribution, and socioeconomic conditions can affect the transmission rate and mortality of COVID-19 in a region. For instance:

* **Population Density and Housing**: The number of housing units, particularly in relation to the population size, can provide insights into population density and crowding, both of which are factors that increase the likelihood of COVID-19 spread.
* **Age Distribution**: Areas with a higher elderly population might experience higher mortality rates since COVID-19 poses a greater risk to older adults.
* **Sex Ratios and COVID-19**: The dataset provides information about the sex ratio, which can be used to analyze if certain trends in the virus's transmission. For example, men were initially found to have a higher risk of severe outcomes from COVID-19.

**10. Initial Hypothesis Questions:**

The enriched dataset allows us to pose several hypothesis questions for future analysis:

1. **Does higher population density correlate with a higher rate of COVID-19 cases?**
2. **Are counties with a larger elderly population experiencing higher COVID-19 death rates?**
3. **Does sex ratio influence the COVID-19 death rate?**

**Conclusion**

This project successfully cleaned, merged, and analyzed COVID-19 data for 2020, focusing on Arizona while also enriching it with demographic data from the ACS. The merged dataset provides a comprehensive view of both COVID-19 trends and the demographic context, offering deeper insights into how factors such as population density and age may influence the spread of the virus. By posing relevant hypotheses, this analysis paves the way for more detailed studies on the role of demographics in the COVID-19 pandemic.