PROJECT NAME:-

MONKEYPOX ANALYSIS WORLDWIDE

BY: -

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TECHNOLOGY: -

SYSTEM REQUIREMENT: -

SOFTWARE REQUIREMENT: -

- PYTHON
- JUPYTER NOTEBOOK

HARDWARE REQUIREMENT: -

- PROCESSOR: - i5 or Ryzen 5
- SSD: - 256GB
- MEMORY: - 8GB RAM

ABSTRACT

Human monkeypox is a zoonotic Orthopoxvirus with a presentation similar to smallpox. Clinical differentiation of the disease from smallpox and varicella is difficult. Laboratory diagnostics are principal components to identification and surveillance of disease, and new tests are needed for a more precise and rapid diagnosis. The majority of human infections occur in Central Africa, where surveillance in rural areas with poor infrastructure is difficult but can be accomplished with evidence-guided tools and educational materials to inform public health workers of important principles. Contemporary epidemiological studies are needed now that populations do not receive routine smallpox vaccination. New therapeutics and vaccines offer hope for the treatment and prevention of monkeypox; however, more research must be done before they are ready to be deployed in an endemic setting. There is a need for more research in the epidemiology, ecology, and biology of the virus in endemic areas to better understand and prevent human infections.

Main aim of this project is to perform Exploratory Data Analysis and help identify the main features and symptoms identified so that it helps countries take needful action and develop vaccines so that spread of this disease could be stopped.

LITERATURE

CLINICAL PICTURE

Human monkeypox was not recognized as a distinct infection in humans until 1970 during efforts to eradicate smallpox, when the virus was isolated from a patient with suspected smallpox infection in The Democratic Republic of the Congo. The majority of the clinical characteristics of human monkeypox infection mirror those of smallpox (discrete ordinary type or modified type). An initial febrile prodrome is accompanied by generalized headache and fatigue. Prior to, and concomitant with, rash development is the presence of maxillary, cervical, or inguinal lymphadenopathy (1– 4 cm in diameter) in many patients. Enlarged lymph nodes are firm, tender, and sometimes painful. Lymphadenopathy was not characteristic of smallpox. The presence of lymphadenopathy may be an indication that there is a more effective immune recognition and response to infection by monkeypox virus vs variola virus, but this hypothesis requires further study. Fever often declines on the day of or up to 3 days after rash onset. Often, the rash first appears on the face and quickly appears in a centrifugal distribution on the body. The distinctive lesions often present as first macular, then papular, then vesicular and pustular. The number of lesions on a given patient may range from a few to thousands. Lesions are often noted in the oral cavity and can cause difficulties with drinking and eating.
Given the distinctive presentation of lesions, digital photographs and the Internet are 21st-century tools for clinical consultation.

The extensive perturbation of the skin raises concerns about secondary bacterial infections of the skin, and this has been observed to be present in 19% of unvaccinated monkeypox patients. The skin of patients has been noted being swollen, stiff, and painful until crusts appeared. The occurrence of a second febrile period occurring when skin lesions become pustular has been associated with deterioration in the patient's general condition. Severe complications and sequelae were found to be more common among unvaccinated (74%) than vaccinated patients (39.5%). Patients have been observed with pulmonary distress or bronchopneumonia, often late in the course of illness, suggestive of secondary infection of the lungs. Vomiting or diarrhoea can occur by the second week of illness and can contribute to severe dehydration. Encephalitis was observed in one patient and septicaemia in another patient with > 4500 lesions.

Ocular infections can occur and may result in corneal scarring and permanent vision loss. Pitted scarring is the most classic lesions, lesions in the same stage of development) and minor criteria could be modified for monkeypox and used for diagnostic management. Namely, the inclusion of lymphadenopathy as a major criteria would allow for the addition of monkeypox in the algorithm, retaining smallpox in the differential. This will be an important consideration in the light of biosecurity concerns and the need to consistently rule out suspect smallpox disease. The implementation of such a protocol will be possible with the analysis of clinical and surveillance data from an endemic area. Public health officials should be contacted immediately upon clinical suspicion of an Orthopoxvirus infection.

State health departments and the US Centres for Disease Control and Prevention offer consultation and diagnostic testing.

THE CHANGING FACE OF MONKEYPOX EPIDEMIOLOGY

Historically, there have been reports of human monkeypox infections in West Africa, but since 1981 most reported infections have occurred in the Congo Basin of Central Africa. DRC continues to report the majority of human monkeypox cases each year. Recently, infections also were noted in the Central African Republic, ROC, and Sudan, but it is unclear if these infections were the result of movement across the DRC border or the occurrence of indigenous disease. Improved phylogeography and georeferencing of human cases will aid in a better understanding of the distribution of cases, and these data can be used to develop more accurate ecological models of monkeypox distribution. Domestically, the United States experienced a monkeypox outbreak among humans and captive prairie dogs in 2003, and traceback studies identified a shipment of wild rodents from Ghana as the probable source.

Monkeypox can infect a taxonomically wide variety of mammalian species; however, the virus has only been isolated once from a wild animal, a Funisciurus squirrel in DRC. The extent of viral circulation in animal populations and the precise species that may harbour the virus is not entirely known, although several lines of evidence point to rodents as a likely reservoir. Human infections have been linked to contact with animals, but the precise exposure of a human case can be difficult to pinpoint in areas where contact with animals via household rodent infestations and the hunting or preparation of bushmeat from a variety of species is common. Transmission is believed to occur via saliva/respiratory excretions or contact with lesion exudate or crust material. Viral shedding via faeces may represent another exposure source. Although human-to-human transmission of monkeypox is apparently less efficient than that observed in smallpox, it did occur in up to 11.7% of household contacts of patients who did not have prior smallpox vaccination; evidence indicates that household members or those who care for a monkeypox patient are at increased risk for acquiring an infection. The longest uninterrupted chain or sequential transmission events of human to- human spread is posited to be 6 individuals, and clusters of patients have been commonly noted. Transmission in hospital settings has also been documented, and may be prevented with standard precautions, as well as vaccination of those at risk, including healthcare workers. In the United States, vaccination is recommended for any persons who are at risk of exposure to an Orthopoxvirus species, including occupational exposures.
Surveillance for human monkeypox infections in endemic areas is a challenge. Poor infrastructure, scarce resources, inappropriate diagnostic specimens and/or lack of specimen collection, and clinical difficulties in recognizing monkeypox illness are some of the challenges encountered by surveillance systems. As more information is gained from contemporary monkeypox cases, together with the data from past efforts, it will be important to reassess the characteristics of the disease that help identify monkeypox from other rash illnesses. Current case definitions may be sensitive and broadly identify rash illnesses, but the refinement and use of a more specific case definition will provide better detection of actual monkeypox cases, aiding in patient care and isolation to prevent human-to-human transmission. Continued training of healthcare workers is needed to maintain knowledge, vigilance, and support for monkeypox surveillance. Ultimately, a broader laboratory-based surveillance network will augment our knowledge of disease burden.

Smallpox vaccination (using vaccinia virus) provides protection against Orthopoxvirus infections, including monkeypox. Smallpox vaccination ended around 1982 in DRC. As a result,
(1) there is waning vaccine immunity in the individuals who were vaccinated by 1982, and
(2) there are large numbers of people who have never been vaccinated and,

in the absence of a previous exposure and development of immunity, are susceptible to an Orthopoxvirus infection. The question of how this changing Orthopoxvirus immunity via the absence of a vaccination will alter the incidence of human monkeypox is one that is difficult to answer but is nevertheless concerning based on the available data. There is a wealth of human monkeypox epidemiological data from patients and their contacts in Equateur Province of DRC from 1981 to 1986, in the days following smallpox eradication. The attack rate of household members was significantly lower among those who had prior vaccination than those without vaccination. At the time of these studies, approximately 70% of all case contacts were vaccinated (3–19 years previously), and prior vaccination conferred 85% protection against monkeypox. The average annual incidence of monkeypox in the Bumba Health Zone was 0.63 per 10 000 persons. A more recent assessment of a cohort of patients from Sankuru District, DRC, showed a dramatic increase in average annual incidence to 5.53 per 10 000. An obvious hypothesized factor affecting this increase in incidence is the lack of vaccination; indeed, only 24% of the local population and 4% of the monkeypox patients had prior vaccination. These recent data suggest that vaccination >25 years prior may still protect individuals against an Orthopoxvirus infection and, also, that the lack of vaccination in these populations may contribute to an increased incidence of infection. In the US outbreak, however, 24% (6/29) of the cases had received prior childhood smallpox vaccination, indicating that childhood vaccination was not entirely protective against disease. These observations deserve further study, accounting for additional virologic, anthropologic, and ecological variables to more effectively parse the factors affecting this increase in incidence and the role of vaccination, or lack thereof.

VIRUS DIFFERENCES: WEST VS CENTRAL AFRICAN MONKEYPOX

There are 2 distinct phylogenetic clades of monkeypox viruses:
those that exist in West Africa and those in Central Africa. Experience during the 2003 US outbreak with the West African clade suggested that disease severity also differed across clades. There are very few documented cases of West African monkeypox: Liberia, Sierra Leone, Nigeria, and Côte d'Ivoire have each reported <10 cases between 1970 and 2005, and the US outbreak had 47 cases. Generally, West African monkeypox infections exhibit a less severe illness in humans and nonhuman primates. The US outbreak had a number of hospitalized patients and severe disease, but no fatalities.

Genome comparisons of West and Central African strains yielded a set of candidate genes that may be involved in the differentiating clade virulence. These open reading frames are predicted to be involved in alterations to the viral life cycle, host range, or immune evasion, or are virulence factors. Central African monkeypox prevents T-cell receptor–mediated T-cell activation, prohibiting inflammatory cytokine production in human cells derived from previously infected monkeypox patients. These results suggest that monkeypox may produce a modulator that suppresses host T-cell responses. Several immune evasion candidates have been identified in Central African monkeypox virus. The monkeypox virus inhibitor of complement enzymes, a gene that inhibits complement enzymes and is absent in West African strains, has been implicated as an important immunomodulating factor contributing to the increased virulence of Central African strains. Additionally, Central African monkeypox strains selectively downregulate host responses compared to West African strains, specifically apoptosis in the host. Multiple loci may be involved in the observed pathogenicity differences. Furthermore, transcriptional studies have shown that Central African monkeypox appears to selectively silence transcription of genes involved in host immunity during an infection. Determining the range of effects produced with these different viruses will require a multifaceted effort.

THERAPEUTICS AND VACCINES

Several compounds have shown promise as antiviral therapeutics against Orthopoxvirus species. Cidofovir has antiviral activity against a variety of viruses by inhibiting viral DNA polymerase. CMX-001 is a modified cidofovir compound that lacks the extent of nephrotoxicity seen with cidofovir. Antiviral activity of CMX-001 has been demonstrated with a variety of Orthopoxvirus species. The drug ST-246 blocks the release of the intracellular virus from the cell, and has shown promising results against a variety of Orthopoxvirus species, including variola virus. These compounds have been used in varying combinations, also with vaccinia immune globulin, investigation ally, to treat severe vaccine-associated adverse events. Development of strategies to use these drugs in endemic areas to treat disease will need to be considered.

Smallpox vaccines, comprised of fully replicative vaccinia virus, are currently not in use in monkeypox-endemic areas given concerns about severe adverse events in a population with an uncertain immunocompromised profile. The risk of pathogenic monkeypox disease must be balanced with the risk of adverse events from replicative vaccines such as ACAM2000. An ideal vaccine for use in monkeypox-endemic areas would be one that does not have these risk groups and could be administered readily to children, as well. There is no vaccination that meets all of these criteria, but some next-generation vaccines take one step closer to reaching that goal. Modified vaccinia Ankara (MVA) is an attenuated vaccinia virus that cannot achieve complete replication in mammalian cells. MVA has shown protection in primate models challenged with lethal doses of monkeypox virus. However, this vaccine has not conferred protection in primates with severely diminished T-cell function. LC16m8 is another vaccine that has been altered to prevent viral replication and has shown protection against severe monkeypox illness in nonhuman primates. LC16m8 was used to vaccinate >50 000 schoolchildren in Japan with few reported adverse events.

CONCLUSION

Human monkeypox has the potential for spread via zoonotic reservoirs, as was demonstrated by the US outbreak. Civil conflict and displacements cause concerns for movement of the virus into an area without monkeypox, or movement of individuals to more heavily forested areas more prone for interaction with wildlife and a range of zoonoses. The documented rise in incidence of human disease needs further evaluation and consideration with additional studies to better understand the range of factors involved in disease transmission and spread. There are still many unanswered questions about human disease, animal reservoirs, and the virus itself—advances in our understanding of this important zoonosis will help better guide prevention strategies and mitigate human disease.

Tables Depicting Data:

Table 1. Key Clinical Characteristics of Smallpox, Monkeypox, and Varicella

Characteristic	Smallpox	Monkeypox	Varicella
Time period			
Incubation period	7–17 d	7–17 d	10–21 d
Prodromal period	1–4 d	1–4 d	0–2 d
Rash period (from the appearance of lesions to desquamation)	14–28 d	14–28 d	10–21 d
Symptoms			
Prodromal fever	Yes	Yes	Uncommon, mild fever if present
Fever	Yes, often >40°C	Yes, often between 38.5°C and 40.5°C	Yes, up to 38.8°C
Malaise	Yes	Yes	Yes
Headache	Yes	Yes	Yes
Lymphadenopathy	No	Yes	No
Lesions on palms or soles	Yes	Yes	Rare
Lesion distribution	Centrifugal	Centrifugal[a]	Centripetal
Lesion appearance	Hard and deep, well-circumscribed, umbilicated	Hard and deep, well-circumscribed, umbilicated[a]	Superficial, irregular borders, "dew drop on a rose petal"
Lesion progression	Lesions are often in one stage of development on the body; slow progression with each stage lasting 1–2 d	Lesions are often in one stage of development on the body; slow progression with each stage lasting 1–2 d[a]	Lesions are often in multiple stages of development on the body; fast progression

[a] Differences in the appearance of rash have been noted in vaccinated (vaccination <20 years prior to illness) vs unvaccinated individuals. Vaccinated individuals were noted to have fewer lesions, smaller lesions, and better presentation of regional monomorphism and centrifugal distribution of rash.

Table 2. Diagnostic Tests for Monkeypox or *Orthopoxvirus*

Test	Pros	Cons
Viral culture/isolation: Live virus is grown and characterized from a patient specimen.	Can yield a pure, live culture of virus for definitive classification of the species. *Orthopoxviruses* produce distinctive "pocks" on chorioallantoic membranes; and other cell-based viral culture methods can be used. Patient specimens from lesions are the most reliable for this method, as viremia is not present the entire duration of illness.	The assay takes several days to complete. Patient specimens may contain bacteria, hampering culture attempts. Further characterization must be done for viral identification. Must be performed at a major laboratory with skilled technicians.
Electron microscopy: Negative staining produces a clear image of a brick-shaped particle, allowing for visual classification of a poxvirus, other than *Parapoxvirus*	Can be used to identify viral particles in a biopsy specimen, scab material, vesicular fluid, or viral culture. Can differentiate an *Orthopoxvirus* from Herpesviridae.	*Orthopoxviruses* are morphologically indistinguishable from each other. Must be performed at a major laboratory with skilled technicians and an electron microscope.
Immunohistochemistry: Tests for the presence of *Orthopoxvirus*-specific antigens.	Can be used to identify antigens in biopsy specimens. This technique can be used to rule out or identify other suspect agents.	Not specific for monkeypox virus. Must be performed at a major laboratory with skilled technicians.
PCR, including real-time PCR: Tests for the presence of monkeypox-specific DNA signatures.	Can diagnose an active case using lesion material from a patient. The assay uses viral DNA, which is stable if a specimen is kept in dark, cool conditions. Designed to be specific for monkeypox virus.	Highly sensitive assays where concerns about contamination are warranted. These assays require expensive equipment and reagents. Must be performed at a major laboratory with skilled technicians.
Anti-*Orthopoxvirus* IgG: Tests for the presence of *Orthopoxvirus* antibodies.	Can be used to assess a previous exposure to an *Orthopoxvirus*, including a pathogen or smallpox vaccination.	Requires the collection of blood (serum) and a cold chain. This assay is not specific for monkeypox virus. Results will be affected by prior smallpox vaccination. The duration of response is variable. Must be performed at a major laboratory with skilled technicians.
Anti-*Orthopoxvirus* IgM: Tests for the presence of *Orthopoxvirus* antibodies.	Can be used to assess a recent exposure to an *Orthopoxvirus*, including a pathogen or smallpox vaccination. This assay could be used as a diagnostic for suspect *Orthopoxvirus* patients with prior smallpox vaccination.	Requires the collection of blood (serum) and a cold chain. This assay is not specific for monkeypox virus. Must be performed at a major laboratory with skilled technicians.
Tetracore Orthopox BioThreat Alert: Tests for the presence of *Orthopoxvirus* antigens.	Can rapidly diagnose an active case using lesion material from a patient; a point-of-care diagnostic test. Can be performed at ambient temperature with little expertise.	This assay is not specific for monkeypox virus. Needs to be tested in endemic settings. Less sensitive than PCR.

Abbreviations: IgG, immunoglobulin G; IgM, immunoglobulin M; PCR, polymerase chain reaction.

Table 3. Promising Therapeutics for the Treatment of *Orthopoxvirus* Infections

Antiviral Therapeutic	Mechanism of Action	Clinical Considerations	Stage of Development or Use
Cidofovir	Inhibits DNA polymerase	Intravenous administration with hydration and probenecid; nephrotoxicity has been seen	Licensed for the use of cytomegalovirus retinitis in AIDS patients. Has been used to treat other poxvirus infections (molluscum contagiosum and orf virus).
CMX-001	Modified cidofovir compound; inhibits DNA polymerase	Lacks nephrotoxicity seen with cidofovir; oral administration	In development
ST-246	Inhibits release of intracellular virus	Oral administration	Is maintained in the United States in the Strategic National Stockpile. Available for other *Orthopoxvirus* infections under an investigational protocol.

Table 4. Smallpox Vaccines

Vaccine	Pros	Cons	Stage of Development or Use
ACAM2000: Live vaccinia virus	Single-dose administration. A successful take is noted by observation of a lesion at the vaccination site. Lyophilized preparation for long-term storage.	Live viral vaccine that replicates in mammalian cells; autoinoculation and contact transmission are risks. In low-disease-risk situations, should not be used for individuals with immunocompromising conditions, history of eczema or atopic dermatitis, or pregnant females. Cardiac events postvaccination have been noted to occur.	Licensed vaccination in the United States. Currently available to specific populations from the Strategic National Stockpile.
Modified vaccinia Ankara; IMVAMUNE (US); IMVANEX (Europe): Attenuated vaccinia virus	The virus has limited replication in mammalian cells. No lesion produced at the vaccination site.	Two-dose administration by injection.	European Commission has authorized marketing for immunization of the general adult population, including those who are immunocompromised. Maintained in the United States' Strategic National Stockpile.
LC16m8: Attenuated vaccinia virus	Single-dose administration. Exhibits a safer profile and less adverse events than ACAM2000 in human and animal vaccinations.	Attenuated virus that can still replicate in mammalian cells.	Licensed for use in Japan.

Introduction of technologies used

1. Python

Python is a high-level, general-purpose and a very popular programming language. Python programming language (latest Python 3) is being used in web development, Machine Learning applications, along with all cutting-edge technology in Software Industry. Python Programming Language is very well suited for Beginners, also for experienced programmers with other programming languages like C++ and Java. It is a widely used general-purpose, high level programming language. It was created by Guido van Rossum in 1991 and further developed by the Python Software Foundation. It was designed with an emphasis on code readability, and its syntax allows programmers to express their concepts in fewer lines of code. Python is a programming language that lets you work quickly and integrate systems more efficiently.

Below are some facts about Python Programming Language:

1. Python is currently the most widely used multi-purpose, high-level programming language.
2. Python allows programming in Object-Oriented and Procedural paradigms.
3. Python programs generally are smaller than other programming languages like Java. Programmers have to type relatively less and indentation requirement of the language, makes them readable all the time.
4. Python language is being used by almost all tech-giant companies like – Google, Amazon, Facebook, Instagram, Dropbox, Uber… etc.
5. The biggest strength of Python is huge collection of standard libraries which can be used for the following:
    - Machine Learning
    - GUI Applications (like Kivy, Tkinter, PyQt etc.)
    - Web frameworks like Django (used by YouTube, Instagram, Dropbox)
    - Image processing (like OpenCV, Pillow)
    - Web scraping (like Scrapy, Beautiful Soup, Selenium)
    - Test frameworks
    - Multimedia
    - Scientific computing
    - Text processing and many more...

Reason for increasing popularity

1. Emphasis on **code readability, shorter codes**, ease of writing
2. Programmers can express logical concepts in **fewer lines** of code in comparison to languages such as C++ or Java.
3. Python supports **multiple** programming paradigms, like object-oriented, imperative and functional programming or procedural.
4. There exists inbuilt functions for almost all of the frequently used concepts.
5. Philosophy is "Simplicity is the best".

LANGUAGE FEATURES

- **Interpreted**
    - There are no separate compilation and execution steps like C and C++.
    - Directly *run* the program from the source code.
    - Internally, Python converts the source code into an intermediate form called bytecodes which is then translated into native language of specific computer to run it.
    - No need to worry about linking and loading with libraries, etc.
- **Platform Independent**
    - Python programs can be developed and executed on multiple operating system platforms.
    - Python can be used on Linux, Windows, Macintosh, Solaris and many more.
- **Free and Open Source;** Redistributable
- **High-level Language**
    - In Python, no need to take care about low-level details such as managing the memory used by the program.
- **Simple**
    - Closer to English language;Easy to Learn
    - More emphasis on the solution to the problem rather than the syntax
- **Embeddable**
    - Python can be used within C/C++ program to give scripting capabilities for the program's users.

- **Robust**:
    - Exceptional handling features
    - Memory management techniques in built

- **Rich Library Support**
    - The Python Standard Library is very vast.
    - Known as the **“batteries included”** philosophy of Python ;It can help do various things involving regular expressions, documentation generation, unit testing, threading, databases, web browsers, CGI, email, XML, HTML, WAV files, cryptography, GUI and many more.
    - Besides the standard library, there are various other high-quality libraries such as the Python Imaging Library which is an amazingly simple image manipulation library.

Python vs JAVA

Python	Java
Dynamically Typed • No need to declare anything. An assignment statement binds a name to an object, and the object can be of any type. • No type casting is required when using container objects	**Statically Typed** • All variable names (along with their types) must be explicitly declared. Attempting to assign an object of the wrong type to a variable name triggers a type exception. • Type casting is required when using container objects.
Concise Express much in limited words	**Verbose** Contains more words
Compact	**Less Compact**
Uses Indentation for structuring code	**Uses braces for structuring code**

The classical **Hello World program** illustrating the **relative verbosity** of a Java Program and Python Program

Java Code

```
public class HelloWorld
{
  public static void main (String[] args)
  {
    System.out.println("Hello, world!");
```

```
    }
  }
```

Python Code

```python
print("Hello, world!")
```

Similarity with Java

- Require some form of runtime on your system (JVM/Python runtime)
- Can probably be compiled to executables without the runtime (this is situational, none of them are designed to work this way)

Softwares making use of Python

Python has been successfully embedded in a number of software products as a scripting language.

1. GNU Debugger uses Python as a **pretty printer** to show complex structures such as C++ containers.
2. Python has also been used in artificial intelligence
3. Python is often used for **natural language processing** tasks.

Current Applications of Python

1. A number of Linux distributions use installers written in Python example in Ubuntu we have the **Ubiquity**
2. Python has seen extensive use in the **information security industry**, including in exploit development.
3. Raspberry Pi– single board computer uses Python as its principal user-programming language.
4. Python is now being used **Game Development** areas also.

Pros:

1. Ease of use
2. Multi-paradigm Approach

Cons:

1. Slow speed of execution compared to C,C++
2. Absence from mobile computing and browsers
3. For the C,C++ programmers switching to python can be irritating as the language requires proper indentation of code. Certain variable

names commonly used like sum are functions in python. So C, C++ programmers have to look out for these.

Industrial Importance

Python is a high-level, interpreted, and general-purpose dynamic programming language that focuses on code readability. It has fewer steps when compared to Java and C. It was founded in 1991 by developer Guido Van Rossum. Python ranks among the most popular and fastest-growing languages in the world. Python is a powerful, flexible, and easy-to-use language. In addition, the community is very active there. It is used in many organizations as it supports multiple programming paradigms. It also performs automatic memory management.

Advantages :

1. Presence of third-party modules
2. Extensive support libraries(NumPy for numerical calculations, Pandas for data analytics etc)
3. Open source and community development
4. Versatile, Easy to read, learn and write
5. User-friendly data structures
6. High-level language
7. Dynamically typed language(No need to mention data type based on the value assigned, it takes data type)
8. Object-oriented language
9. Portable and Interactive
10. Ideal for prototypes – provide more functionality with less coding
11. Highly Efficient(Python’s clean object-oriented design provides enhanced process control, and the language is equipped with excellent text processing and integration capabilities, as well as its own unit testing framework, which makes it more efficient.)
12. (IoT)Internet of Things Opportunities
13. Interpreted Language
14. Portable across Operating systems

Applications :

1. GUI based desktop applications
2. Graphic design, image processing applications, Games, and Scientific/ computational Applications
3. Web frameworks and applications
4. Enterprise and Business applications

5. Operating Systems
6. Education
7. Database Access
8. Language Development
9. Prototyping
10. SoftwareDevelopment

Organizations using Python :

1. Google(Components of Google spider and Search Engine)
2. Yahoo(Maps)
3. YouTube
4. Mozilla
5. Dropbox
6. Microsoft
7. Cisco
8. Spotify
9. Quora

2.JUPYTER

The Jupyter Notebook is an open source web application that you can use to create and share documents that contain live code, equations, visualizations, and text. Jupyter Notebook is maintained by the people at Project Jupyter.

Jupyter Notebooks are a spin-off project from the IPython project, which used to have an IPython Notebook project itself. The name, Jupyter, comes from the core supported programming languages that it supports: Julia, Python, and R. Jupyter ships with the IPython kernel, which allows you to write your programs in Python, but there are currently over 100 other kernels that you can also use.

3.EDA: EXPLORATORY DATA ANALYSIS

Exploratory Data Analysis is a process of examining or understanding the data and extracting insights or main characteristics of the data. EDA is generally classified into two methods, i.e. graphical analysis and non-graphical analysis.
Exploratory data analysis was promoted by John Tukey to encourage statisticians to explore data, and possibly formulate hypotheses that might cause new data collection and experiments. EDA focuses more narrowly on checking assumptions required for model fitting and hypothesis testing. It also checks while handling missing values and making transformations of variables as needed. Filling the counts with EDA build a robust understanding of the data,

issues associated with either the info or process. it's a scientific approach to get the story of the data.

TYPES OF EXPLORATORY DATA ANALYSIS:

1. Univariate Non-graphical
2. Multivariate Non-graphical
3. Univariate graphical
4. Multivariate graphical

1. Univariate Non-graphical: this is the simplest form of data analysis as during this we use just one variable to research the info. The standard goal of univariate non-graphical EDA is to know the underlying sample distribution/ data and make observations about the population. Outlier detection is additionally part of the analysis. The characteristics of population distribution include:

- **Central tendency:** The central tendency or location of distribution has got to do with typical or middle values. The commonly useful measures of central tendency are statistics called mean, median, and sometimes mode during which the foremost common is mean. For skewed distribution or when there's concern about outliers, the median may be preferred.
- **Spread:** Spread is an indicator of what proportion distant from the middle we are to seek out the find the info values. the quality deviation and variance are two useful measures of spread. The variance is that the mean of the square of the individual deviations and therefore the variance is the root of the variance
- **Skewness and kurtosis:** Two more useful univariates descriptors are the skewness and kurtosis of the distribution. Skewness is that the measure of asymmetry and kurtosis may be a more subtle measure of peakedness compared to a normal distribution.

2. Multivariate Non-graphical: Multivariate non-graphical EDA technique is usually wont to show the connection between two or more variables within the sort of either cross-tabulation or statistics.

- For categorical data, an extension of tabulation called cross-tabulation is extremely useful. For 2 variables, cross-tabulation is preferred by making a two-way table with column headings that match the amount of one-variable and row headings that match the amount of the opposite two variables, then filling the counts with all subjects that share an equivalent pair of levels.

- For each categorical variable and one quantitative variable, we create statistics for quantitative variables separately for every level of the specific variable then compare the statistics across the amount of categorical variable.
- Comparing the means is an off-the-cuff version of ANOVA and comparing medians may be a robust version of one-way ANOVA.

3. Univariate graphical: Non-graphical methods are quantitative and objective, they are doing not give the complete picture of the data; therefore, graphical methods are more involve a degree of subjective analysis, also are required. Common sorts of univariate graphics are:

- **Histogram:** The foremost basic graph is a histogram, which may be a barplot during which each bar represents the frequency (count) or proportion (count/total count) of cases for a variety of values. Histograms are one of the simplest ways to quickly learn a lot about your data, including central tendency, spread, modality, shape and outliers.
- **Stem-and-leaf plots:** An easy substitute for a histogram may be stem-and-leaf plots. It shows all data values and therefore the shape of the distribution.
- **Boxplots:** Another very useful univariate graphical technique is that the boxplot. Boxplots are excellent at presenting information about central tendency and show robust measures of location and spread also as providing information about symmetry and outliers, although they will be misleading about aspects like multimodality. One among the simplest uses of boxplots is within the sort of side-by-side boxplots.
- **Quantile-normal plots:** The ultimate univariate graphical EDA technique is that the most intricate. it’s called the quantile-normal or QN plot or more generally the quantile-quantile or QQ plot. it’s wont to see how well a specific sample follows a specific theoretical distribution. It allows detection of non-normality and diagnosis of skewness and kurtosis.

4. Multivariate graphical: Multivariate graphical data uses graphics to display relationships between two or more sets of knowledge. The sole one used commonly may be a grouped barplot with each group representing one level of 1 of the variables and every bar within a gaggle representing the amount of the opposite variable.
Other common sorts of multivariate graphics are:

- **Scatterplot:** For 2 quantitative variables, the essential graphical EDA technique is that the scatterplot , sohas one variable on the x-axis and one on the y-axis and therefore the point for every case in your dataset.

- **Run chart:** It's a line graph of data plotted over time.
- **Heat map:** It's a graphical representation of data where values are depicted by color.
- **Multivariate chart:** It's a graphical representation of the relationships between factors and response.
- **Bubble chart:** It's a data visualization that displays multiple circles (bubbles) in two-dimensional plot.

In a nutshell: We ought to always perform appropriate EDA before further analysis of your data. Perform whatever steps are necessary to become more conversant in your data, check for obvious mistakes, learn about variable distributions, and study about relationships between variables.

TOOLS REQUIRED FOR EXPLORATORY DATA ANALYSIS:

Some of the most common tools used to create an EDA are:

1. R: An open-source programming language and free software environment for statistical computing and graphics supported by the R foundation for statistical computing. The R language is widely used among statisticians in developing statistical observations and data analysis.

2. Python: An interpreted, object-oriented programming language with dynamic semantics. Its high level, built-in data structures, combined with dynamic binding, make it very attractive for rapid application development, also as to be used as a scripting or glue language to attach existing components together. Python and EDA are often used together to spot missing values in the data set, which is vital so you'll decide the way to handle missing values for machine learning.

Apart from these functions described above, EDA can also:

- **Perform k-means clustering:** Perform k-means clustering: it's an unsupervised learning algorithm where the info points are assigned to clusters, also referred to as k-groups, k-means clustering is usually utilized in market segmentation, image compression, and pattern recognition
- EDA is often utilized in predictive models like linear regression, where it's wont to predict outcomes.
- It is also utilized in univariate, bivariate, and multivariate visualization for summary statistics, establishing relationships between each variable, and understanding how different fields within the data interact with one another.

Exploratory Data Analysis

Technically, The primary motive of EDA is to

- Examine the data distribution
- Handling missing values of the dataset(a most common issue with every dataset)
- Handling the outliers
- Removing duplicate data
- Encoding the categorical variables
- Normalizing and Scaling

Understanding EDA

To understand the steps involved in EDA, we will use Python as the programming language and Jupyter Notebooks because it's open-source, and not only it's an excellent IDE but also very good for visualization and presentation.

Step 1

First, we will import all the python libraries that are required for this, which include **NumPy** for numerical calculations and scientific computing, **Pandas** for handling data, and **Matplotlib** and **Seaborn** for visualization.

Step 2

Then we will load the data into the **Pandas** data frame.

Step 3

We can observe the dataset by checking a few of the rows using the **head()** method, which returns the first five records from the dataset.

Step 4

Using **shape**, we can observe the dimensions of the data.

Step 5

info() method shows some of the characteristics of the data such as Column Name, No. of non-null values of our columns, Dtype of the data, and Memory Usage. From this, we can observe, that the data which we have doesn't have any missing values. We are very lucky in this case, but in real-life scenarios, the data usually has missing values which we need to handle for our model to work accurately. (Note – Later on, I'll show you how to handle the data if it has missing values in it)

Step 6

We will use **describe()** method, which shows basic statistical characteristics of each numerical feature (int64 and float64 types): number of non-missing values, mean, standard deviation, range, median, 0.25, 0.50, 0.75 quartiles.

Step 7

Handling missing values in the dataset. Luckily, this dataset doesn't have any missing values, but the real world is not so naive as our case. So I have removed a few values intentionally just to depict how to handle this particular case.We can check if our data contains a null value or not by the following command So, now we can handle the missing values by using a few techniques, which are

- **Drop the missing values** – If the dataset is huge and missing values are very few then we can directly drop the values because it will not have much impact.
- **Replace with mean values** – We can replace the missing values with mean values, but this is not advisable in case if the data has outliers.
- **Replace with median values** – We can replace the missing values with median values, and it is recommended in case if the data has outliers.
- **Replace with mode values** – We can do this in the case of a Categorical feature.
- **Regression** – It can be used to predict the null value using other details from the dataset.

Step 8

We can check for duplicate values in our dataset as the presence of duplicate values will hamper the accuracy of our ML model. We can remove duplicate values using **drop_duplicates()**

Step 9

Normalizing and Scaling – Data Normalization or **feature scaling** is a process to standardize the range of features of the data as the range may vary a lot. So we can pre-process the data using ML algorithms. So for this, we will use **StandardScaler** for the numerical values, which uses the formula as **x-mean/std deviation**.

Step 10

Now, using Seaborn, we will visualize the relationships using LINE plot.

INSIGHTS

Insights from daily cases dataset as on 9th June 2022
England being the leader in number of active cases and the number being 43
Germany has recorded the second highest number of cases; 30.

Some General comparative insights which we can get from above plots is:
1. England having most number of confirmed cases(183), have very less number of suspected cases(5) which is weird as being near to the most contaminated area increases the risk of suspection of the disease, but here there is not more than 5 suspected case. On the other hand Spain being 2nd on the highest number of confirmed cases has the most number of suspected cases recorded(68).
#
2. Also Canada have the second most number of suspected cases i.e. 35, but is on 5th number when it comes to Confirmed cases. So this is probably a good sign as the cases with suspection can take precautions and have a early cure, also it can be said that people there are more aware and are one more positive side of treatment as if they had seen any sign on MonkeyPox they went to the Hospital to report it.
#
3. There is a less need for hospitalization of the MonkeyPox cases in England, the most affected country, as only 5 cases have been hospitalized till now. On the other hand Gremany and Italy are seeing the most number of hospitalized cases as it has 13 and 14 respectively patients in hospital out of 38 and 20 confirmed cases respectively.
#
4. Italy and USA have most number of cases with travel history 9 and 9 each, approximately 50% of cases have travel history in their records and similar number of patients have been hospitalized; Italy, 12 and USA, 10; confirmed cases being 20 in Italy and 19 in USA. So condition in Italy is a bit severe as more than 50% of patients are in hospitals. (12 out of 20).

SCREENSHOTS OF PROGRAM AND FIGURES

localhost:8889/edit/Downloads/MonkeypoxAnalysis_Final%20Project%20by%20Priya/MonkeyPox_Analysis%20Final.py

jupyter MonkeyPox_Analysis Final.py 06/24/2022

File Edit View Language

```
#!/usr/bin/env python
# coding: utf-8

# # Monkey_pox EDA Analysis
#
# By:- PRIYA KUMARI

# Problem Statement:
# Monkey pox is a newly spreading virus that threatens for a outbreak.
# Our job as Data Scientist is to analyse the given dataset by performing exploratory data analysis.

# # EDA:-
# Is a method of Descriptive Statistics, to evaluate and comprehend data in order to derive insights.
# EDA has 2 categories:-
# 1. Graphical Analysis
# 2. Non Graphical Analysis
#
# Here we will perform Graphical Analysis, identify the key variables, their correlation with various other variables and gather meaningful insights out of the given datasets.

# # Monkey Pox

# Monkeypox is a viral zoonotic disease(a virus that is transmitted to humans from animals) that occurs primarily in tropical rainforest areas of Central and West Africa and is occasionally exported to other regions.

# # Import ALL Important Libraries

# In[1]:


import pandas as pd
```

jupyter MonkeyPox_Analysis Final.py 06/24/2022

File Edit View Language

```
# In[1]:


import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import plotly.express as px
import warnings
warnings.filterwarnings("ignore")
get_ipython().run_line_magic('matplotlib', 'inline')
import plotly.graph_objects as go


# # Data Collection Source:-
# 1. kaggle.com

# # Loading Monkey_Pox_Cases_Worldwide dataset.
#

# In[2]:


monkeypox_data = pd.read_csv(r'C:\Users\badal\Downloads\monkeypox\Monkey_Pox_Cases_Worldwide.csv')
monkeypox_data1 = pd.read_csv(r'C:\Users\badal\Downloads\monkeypox new\monkeypox-main\latest.csv')


# In[3]:


monkeypox_data
```

```
# # find insights from Monkey_Pox_Cases_Worldwide dataset.

# # Data Cleaning

# In[4]:


monkeypox_data.head(10)


# In[5]:


monkeypox_data.tail(10)


# In[6]:


monkeypox_data.shape


# In[7]:


monkeypox_data1


# In[8]:
```

```
monkeypox_data1.shape


# In[9]:


monkeypox_data1.columns


# In[10]:


monkeypox_data.columns


# In[11]:


monkeypox_data1.info()


# In[12]:


monkeypox_data.info()


# # Description of the datasets

# In[13]:
```

```
monkeypox_data.describe()


# In[14]:


monkeypox_data1.describe()


# # Missing Values

# In[15]:


monkeypox_data.isnull().sum()


# In[16]:


monkeypox_data1.isnull().sum()


# # Symptoms

# # Symptoms being the most important feature of the Dataset

# In[17]:


# shows the column indicating all the symptoms as an array
# Array:- is a collection of items that are stored at contiguous memory locations;
```

```
# In[18]:


# shows the number of patients having the respective symptom
monkeypox_data1['Symptoms'].value_counts()


# In[19]:


temp_monkeypoxdata = pd.DataFrame(monkeypox_data1['Symptoms'].value_counts()).reset_index()
temp_monkeypoxdata = temp_monkeypoxdata.append(pd.DataFrame({'index':'multiple or other',
'Symptoms':temp_monkeypoxdata.loc[temp_monkeypoxdata['Symptoms'] < 2]['Symptoms'].sum()},index = [0]))
temp_monkeypoxdata = temp_monkeypoxdata.loc[temp_monkeypoxdata['Symptoms'] > 1]


fig = go.Figure(data = [go.Pie(labels = temp_monkeypoxdata['index'],
                               values = temp_monkeypoxdata['Symptoms'],
                               hole = .75,
                               #title = '% of Symptoms',
                               marker_colors = px.colors.sequential.algae_r,
                              )
                       ])



fig.update_layout(
    title_text = "Distribution of Symptoms",
    template = 'ggplot2',
    height = 600,
    annotations = [dict(text = 'Symptoms',
                        x = 0.5
```

```
fig.update_layout(
    title_text = "Distribution of Symptoms",
    template = 'ggplot2',
    height = 600,
    annotations = [dict(text = 'Symptoms',
                        x = 0.5,
                        y = 0.5,
                        font_size = 20,
                        showarrow = False
                       )])



fig.show()


# # Insights
# From above pie chart we can see that genital ulcer lesions is the top symtom for monkey pox.

# # Bar Plot of Country vs Date of Confirmation and Confirmed cases with all other data for overview.
#
# Other Data considered here are Suspected cases, Hospitalised, Travel History Yes and Travel History No.

# In[20]:


px.bar(monkeypox_data1, x='Date_confirmation', y='Country',text_auto=True, color= 'Country', height=1500,width=1000,
                 hover_data=monkeypox_data1.columns)

```

```
# In[21]:


px.bar(monkeypox_data, x='Country', y='Confirmed_Cases',text_auto=True, color= 'Country', height=1000,width=1000,
                 hover_data=monkeypox_data.columns)


# In[22]:


px.line(monkeypox_data, x='Country', y='Confirmed_Cases', markers=True, title="Country with Confirmed Cases of Monkeypox")


# # Insights
# From above bar plot we conclude that how a particular Country is getting Confirmed cases; ie it shows the velocity of spreading of monkey pox virus.
#
# From the line plot we conclude that
# England has the most number of confirmed cases, which is 180.
#
# there are no confirmed cases in in countries like Sudan, Iran, Malta, Brazil, Pakistan,Ecuador, Malaysia,Peru.

# In[23]:


px.line(monkeypox_data, x='Country', y='Suspected_Cases', markers=True, title="Country with Suspected Cases of Monkeypox")


# # Insights:
# Fromthe above line plot Spain has the maximum number of Suspected cases ie. 68.
```

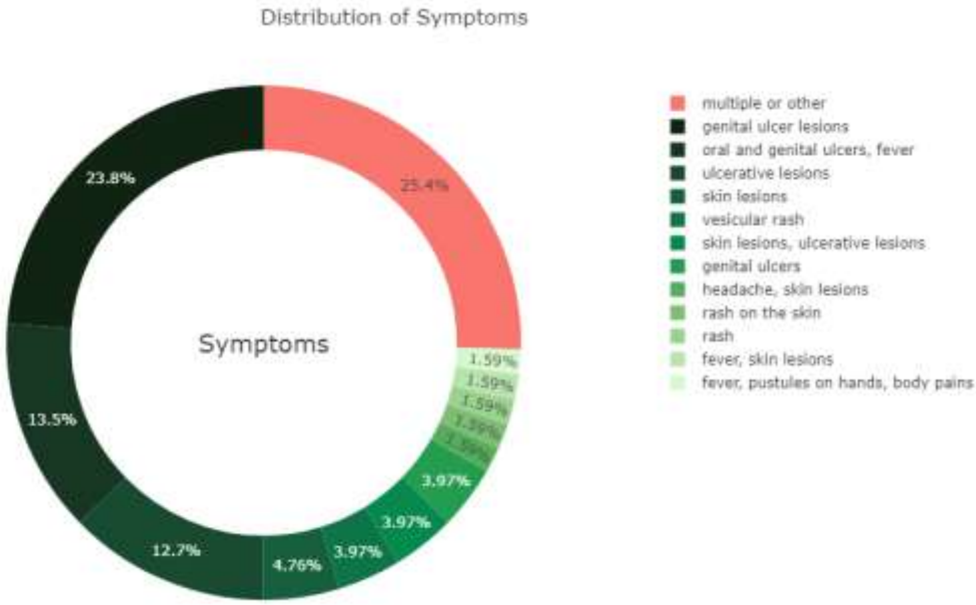
```
# In[24]:


monkeypox_data1['Hospitalised (Y/N/NA)'].unique()


# In[25]:


monkeypox_data1['Hospitalised (Y/N/NA)'].value_counts()


# In[26]:


plt.figure(figsize=(15,6))
sns.countplot('Hospitalised (Y/N/NA)', data = monkeypox_data1, palette='hls')
plt.xticks(rotation = 90)
plt.show()


# In[27]:


px.line(monkeypox_data, x='Country', y='Hospitalized', markers=True, title="Country with Hospitalised Patients of Monkeypox")


# # Insights:
# The Graph shows that out of the people showing symptoms of monkeypox only 79 were hospitlised and rest 72 were not.
#
# Line plot shows Germany and Italy have maximum number of hospitalised patients.

```

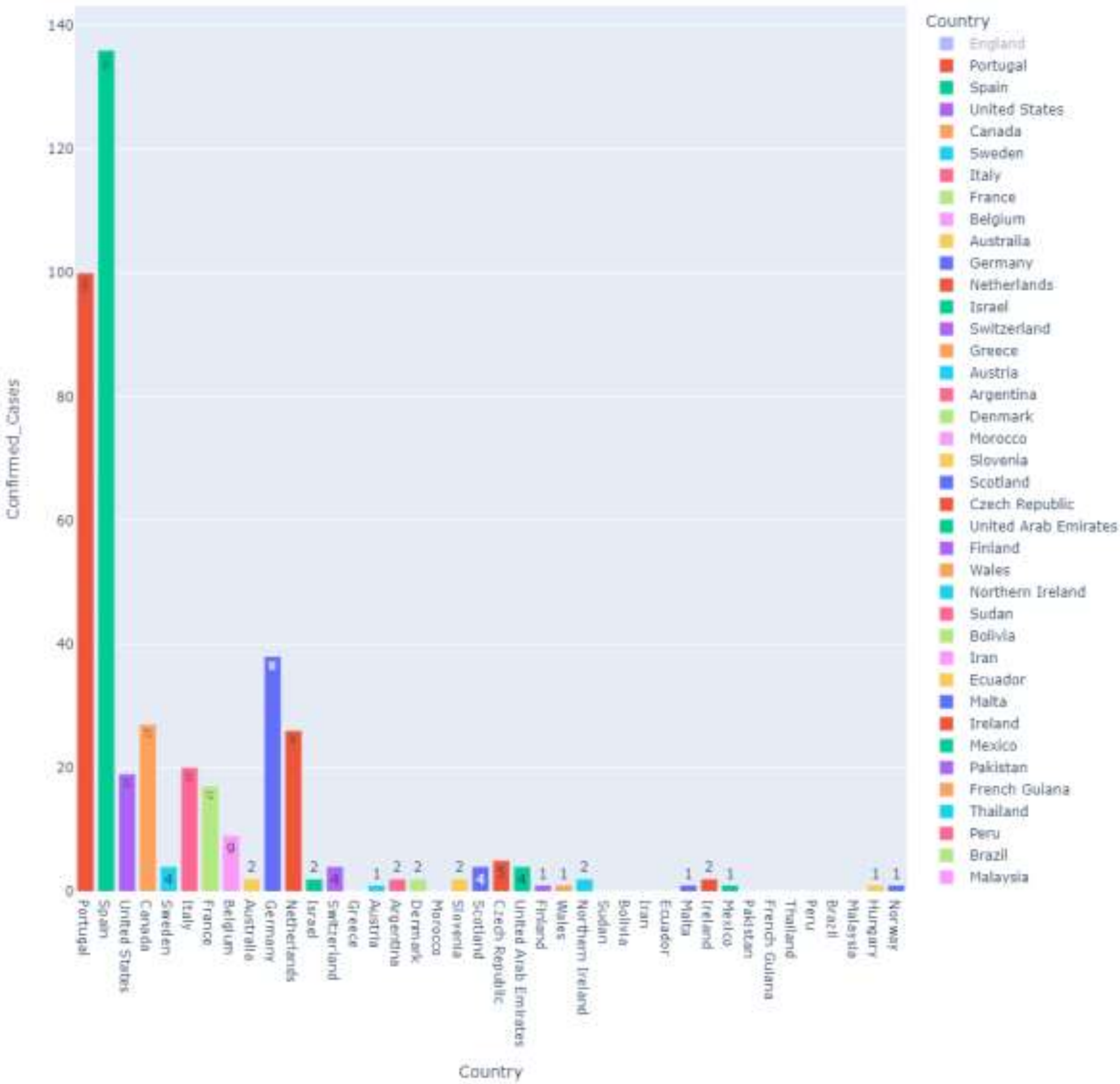
```
# In[28]:


px.line(monkeypox_data, x='Country', y='Travel_History_Yes', markers=True, title="Country with Travel History")


# # Insights:-
# Italy,US and Germany have maximum people with a travel history, number being 9, 9 and 8 respectively.

# In[29]:


px.line(monkeypox_data, x='Country', y='Travel_History_No', markers=True, title="Country with No Travel History")


# # Insights
# Portugal has 34 patients with no travel history.

# # presenting First 10 countries having
# 1. Confirmed Cases
# 2. Suspected Cases

# In[30]:


plt.figure(figsize=(25,10))
sns.barplot(x = 'Country', y = 'Confirmed_Cases',
            data = monkeypox_data.nlargest(10, 'Confirmed_Cases'))
plt.xticks(rotation = 90)
plt.show()

```

```
# In[31]:


plt.figure(figsize=(25,10))
sns.barplot(x = 'Country', y = 'Suspected_Cases',
            data = monkeypox_data.nlargest(10, 'Suspected_Cases'))
plt.xticks(rotation = 90)
plt.show()


# # Dataset loaded countrywise updated on 14th june, 2022

# In[32]:


monkeypox_data_cases = pd.read_csv(r'C:\Users\badal\Downloads\monkeypox new\Daily_Country_Wise_Confirmed_Cases.csv')


# In[33]:


monkeypox_data_cases


# In[34]:


monkeypox_data_cases.head(10)


# In[35]:


monkeypox_data_cases.tail(10)


# In[36]:


monkeypox_data_cases.shape


# In[37]:


monkeypox_data_cases.columns


# In[38]:


monkeypox_data_cases.info()


# In[39]:


monkeypox_data_cases.describe()


# In[40]:


monkeypox_data.nunique()
```

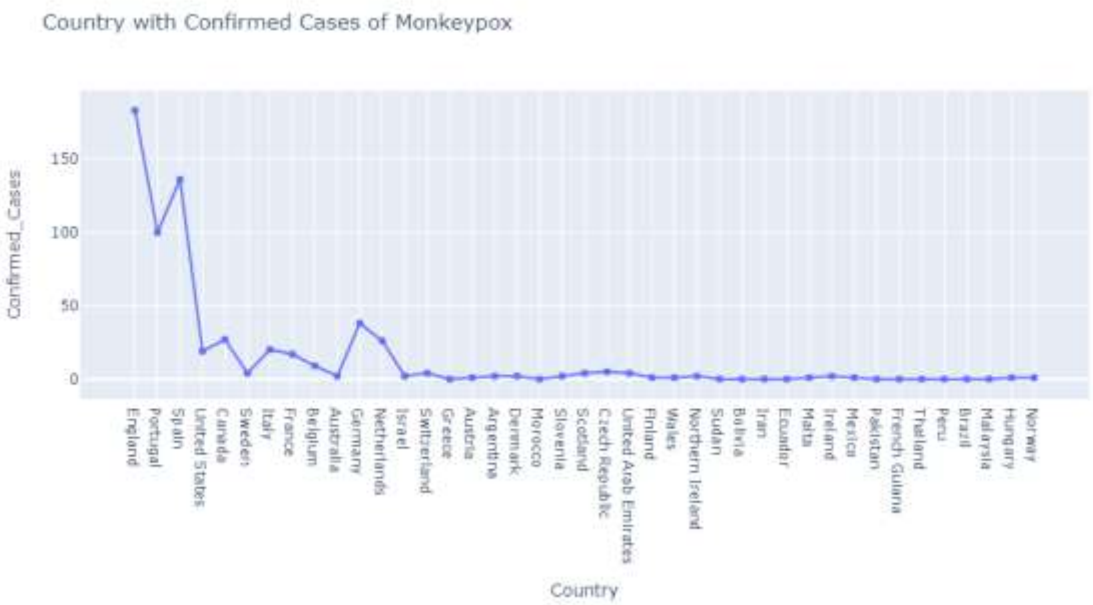
```python
# # Insights showing cases throughout the world as on 2022-06-09.

# In[41]:


monkeypox_data_cases.isnull().sum()


# In[42]:


monkeypox_data_cases.nunique()


# In[43]:


monkeypox_data_cases['2022-06-09'].unique()


# In[44]:


monkeypox_data_cases['2022-06-09'].value_counts()


# In[45]:


plt.figure(figsize=(15,6))
sns.countplot(x = '2022-06-09', data = monkeypox_data_cases)
```

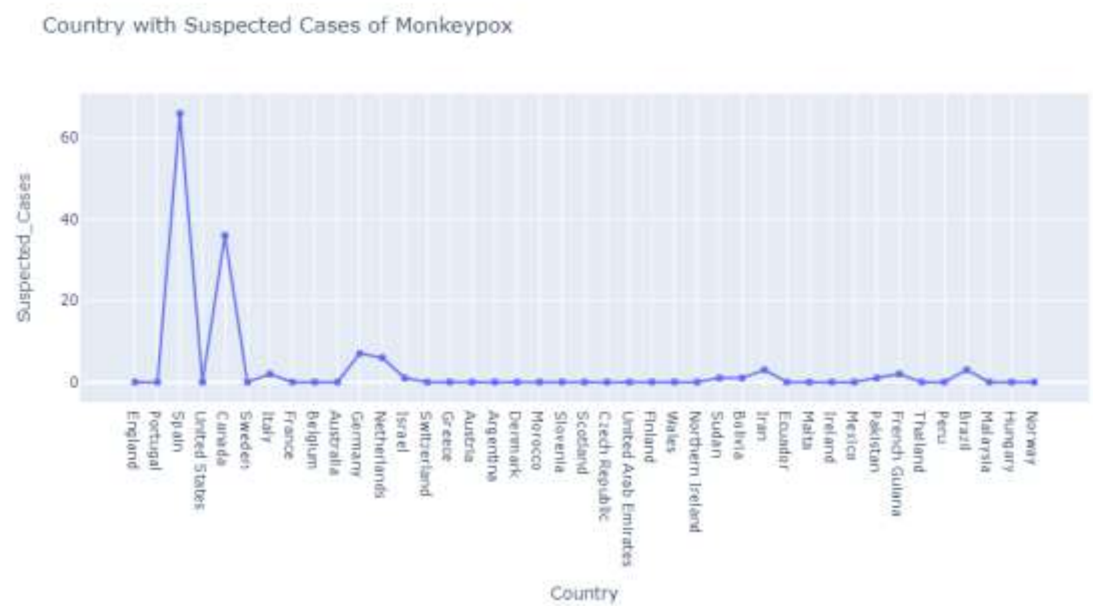
```python

# In[46]:


plt.figure(figsize=(15,6))
sns.barplot(y = '2022-06-09', x = 'Country', data = monkeypox_data_cases)
plt.xticks(rotation = 90)
plt.show()


# # Insights from daily cases dataset as on 9th June 2022
# England being the leader in number of active cases and the number being 43
# Germany has recorded the second highest number of cases; 38.

# # Some General comparitive insights which we can get from above plots is:
# 1. England having most number of confirmed cases(183), have very less number of suspected cases(5) which is weird as being near to the most contaminated area increases the risk of suspection of the disease, but here there is not more than 5 suspected case. On the other hand Spain being 2nd on the highest number of confirmed cases has the most number of suspected cases recorded(68).
#
# 2. Also Canada have the second most number of suspected cases i.e. 35, but is on 5th number when it comes to Confirmed cases. So this is probably a good sign as the cases with suspection can take precautions and have a early cure, also it can be said that people there are more aware and are one more positive side of treatment as if they had seen any sign on MonkeyPox they went to the Hospital to report it.
#
# 3. There is a less need for hospitalization of the MonkeyPox cases in England, the most affected country, as only 5 cases have been hospitalized till now. On the other hand Gremany and Italy are seeing the most number of hospitalized cases as it has 13 and 14 respectively patients in hospital out of 38 and 20 confirmed cases respectively.
#
# 4. Italy and USA have most number of cases with travel history 9 and 9 each, approximately 50% of cases have travel history in their records and similar number of patients have been hospitalized; Italy, 12 and USA, 10; confirmed cases being 20 in Italy and 19 in USA. So condition in Italy is a bit severe as more than 50% of patients are in hospitals. (12 out of 20).

```


Distribution of Symptoms
Symptoms
25.4%
23.8%
13.5%
12.7%
4.76%
3.97%
3.97%
3.97%
1.59%
1.59%
1.59%
multiple or other
genital ulcer lesions
oral and genital ulcers, fever
ulcerative lesions
skin lesions
vesicular rash
skin lesions, ulcerative lesions
genital ulcers
headache, skin lesions
rash on the skin
rash
fever, skin lesions
fever, pustules on hands, body pains

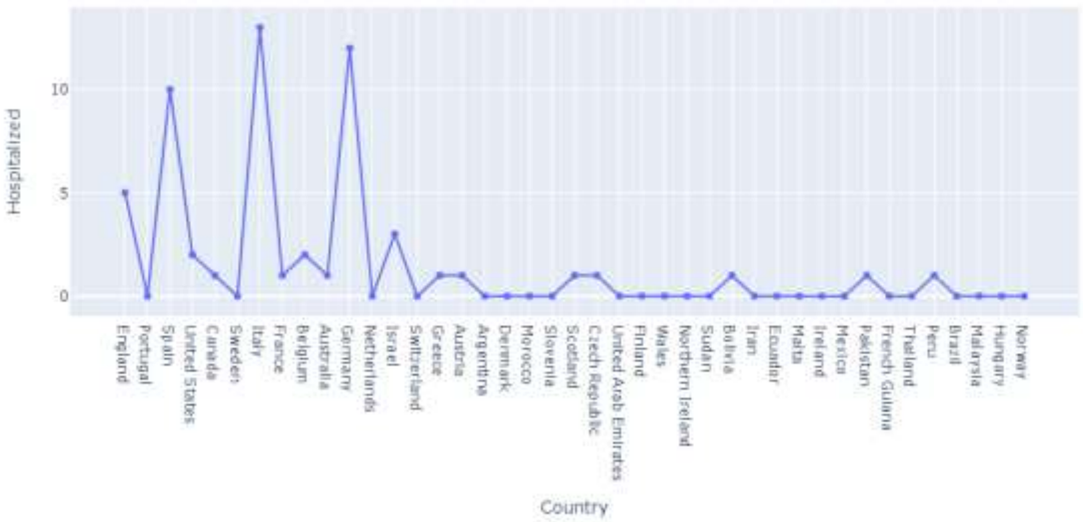


Confirmed_Cases
Country
0
20
40
60
80
100
120
140
Country
England
Portugal
Spain
United States
Canada
Sweden
Italy
France
Belgium
Australia
Germany
Netherlands
Israel
Switzerland
Greece
Austria
Argentina
Denmark
Morocco
Slovenia
Scotland
Czech Republic
United Arab Emirates
Finland
Wales
Northern Ireland
Sudan
Bolivia
Iran
Ecuador
Malta
Ireland
Mexico
Pakistan
French Guiana
Thailand
Peru
Brazil
Malaysia
Hungary
Norway

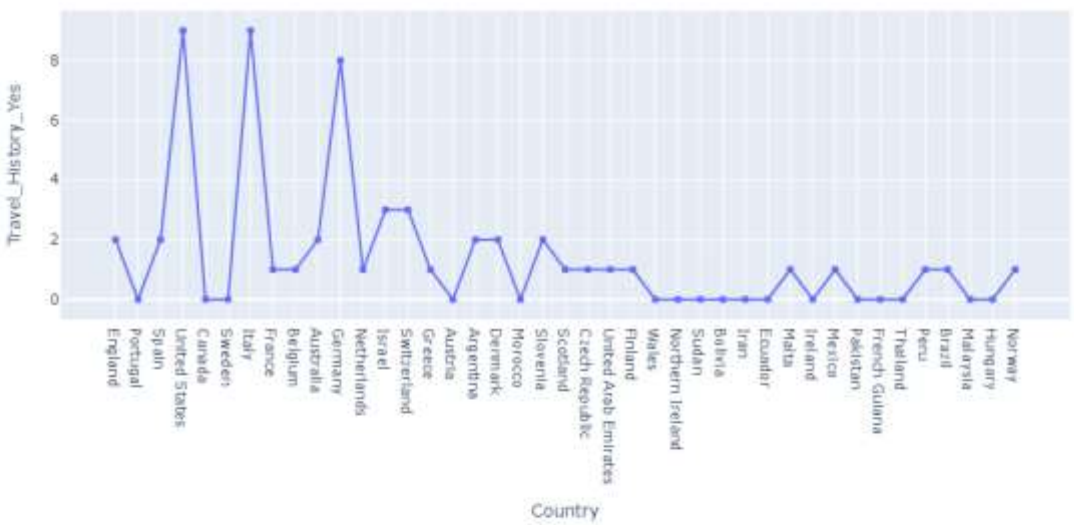

Country with Confirmed Cases of Monkeypox
Confirmed_Cases
150
100
50
0
England
Portugal
Spain
United States
Canada
Sweden
Italy
France
Belgium
Australia
Germany
Netherlands
Israel
Switzerland
Greece
Austria
Argentina
Denmark
Morocco
Slovenia
Scotland
Czech Republic
United Arab Emirates
Finland
Wales
Northern Ireland
Sudan
Bolivia
Iran
Ecuador
Malta
Ireland
Mexico
Pakistan
French Guiana
Thailand
Peru
Brazil
Malaysia
Hungary
Norway
Country

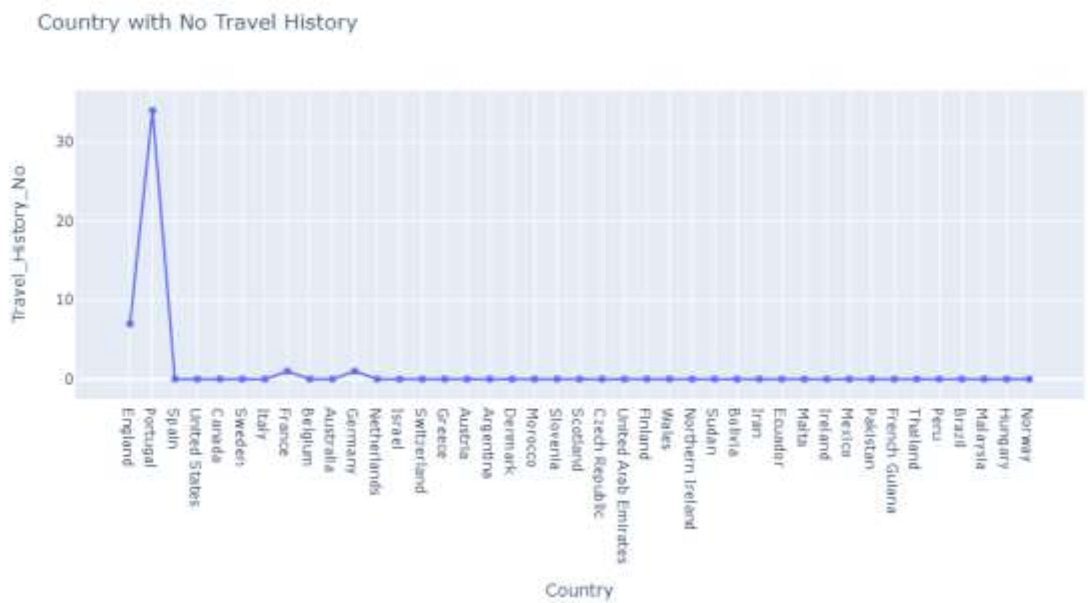

Country with Suspected Cases of Monkeypox
Suspected_Cases
60
40
20
0
England
Portugal
Spain
United States
Canada
Sweden
Italy
France
Belgium
Australia
Germany
Netherlands
Israel
Switzerland
Greece
Austria
Argentina
Denmark
Morocco
Slovenia
Scotland
Czech Republic
United Arab Emirates
Finland
Wales
Northern Ireland
Sudan
Bolivia
Iran
Ecuador
Malta
Ireland
Mexico
Pakistan
French Guiana
Thailand
Peru
Brazil
Malaysia
Hungary
Norway
Country

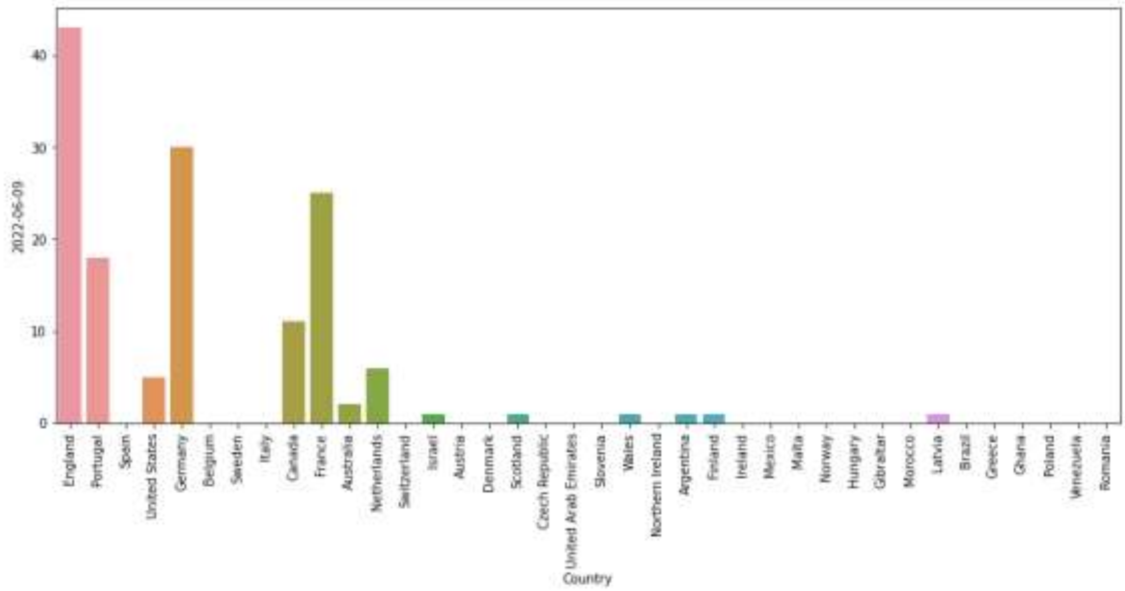
Country with Hospitalised Patients of Monkeypox



Country with Travel History




Country with No Travel History
Travel_History_No
Country
England
Portugal
Spain
United States
Canada
Sweden
Italy
France
Belgium
Australia
Germany
Netherlands
Israel
Switzerland
Greece
Austria
Argentina
Denmark
Morocco
Slovenia
Scotland
Czech Republic
United Arab Emirates
Finland
Wales
Northern Ireland
Sudan
Bolivia
Iran
Ecuador
Malta
Ireland
Mexico
Pakistan
French Guiana
Thailand
Peru
Brazil
Malaysia
Hungary
Norway


2022-06-09
Country
England
Portugal
Spain
United States
Germany
Belgium
Sweden
Italy
Canada
France
Australia
Netherlands
Switzerland
Israel
Austria
Denmark
Scotland
Czech Republic
United Arab Emirates
Slovenia
Wales
Northern Ireland
Argentina
Finland
Ireland
Mexico
Malta
Norway
Hungary
Gibraltar
Morocco
Latvia
Brazil
Greece
Ghana
Poland
Venezuela
Romania

CONCLUSION

- Improved surveillance and response, raise awareness of the disease and avoid contact with wild animals, especially monkeys.
- Any animals that might have come into contact with an infected animal should be quarantined, handled with standard precautions and observed for monkeypox symptoms for 30 days.
- It is important to refocus attention on other diseases. There is a drop in the number of reported cases of endemic diseases as people are not seeking care in health facilities, owing to **Covid-19**.

So to understand Monkeypox virus composition and develop vaccines and analyse the number of increasing cases EDA will be helpful.

REFRENCES

- https://academic.oup.com/cid/article/58/2/260/335791 on 15th June 2022
- www.drishtiias.com/monkeypox-data
- www.analyticsvidya.com
- Python.org
- www.kaggle.com (dataset on 14th June, 2022.)