

PROFESSIONAL TRAINING REPORT

AT

Sathyabama Institute of Science and Technology

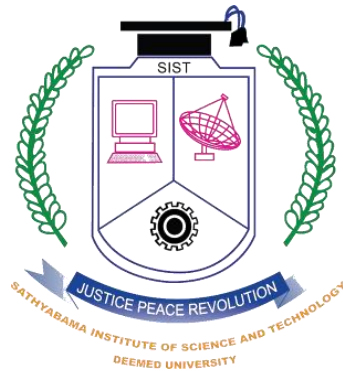
(Deemed to be University)

Submitted in partial fulfillment of the requirements for the award
Of Bachelor of Technology Degree in Information Technology

BY

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DEPARTMENT OF INFORMATION TECHNOLOGY

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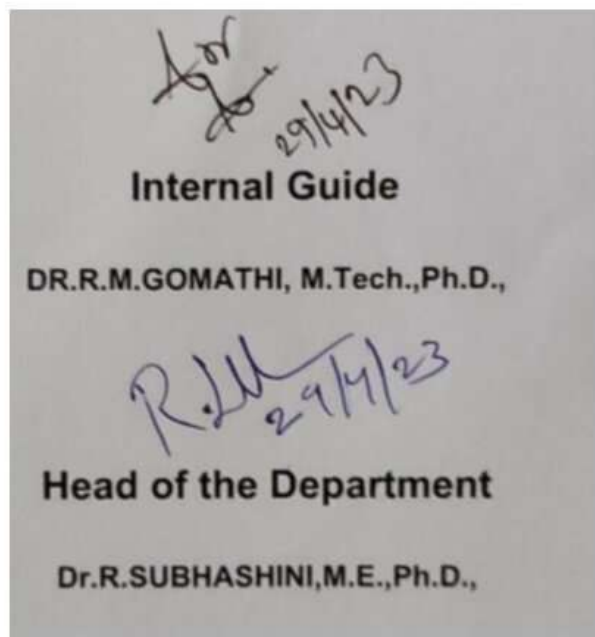
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APRIL - 2023



BONAFIDE CERTIFICATE

This is to certify that this Project Report is the Bonafide work of **SUDHARSAN P 40120094** who carried out the project entitled "**COVID VACCINATION ANALYSIS**" under my supervision from January 2023 to April 2023.



Submitted for Viva voce Examination held on



DECLARATION

I SUDHRANSAN P hereby declare that the Project Report entitled **“COVID VACCINATION ANALYSIS”** done by me under the guidance of **DR.R.M. GOMATHI, M.Tech.,PH.D.**, is submitted in partial fulfillment of the requirements for the award of Bachelor of Technology degree in Information Technology

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I am pleased to acknowledge my sincere thanks to **Board of Management of SATHYABAMA** for their kind encouragement in doing this project and for completing it successfully. I am grateful to them.

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TRAINING CERTIFICATE

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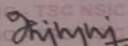

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us for a period of one week (30 Hours) from
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HEAD OF TRAINING


HEAD OF CENTRE

ABSTRACT

The long-term solution to the coronavirus disease 2019 (COVID-19) pandemic, hopefully, will be a globally implemented, safe vaccination program that has broad clinical and socioeconomic benefits. Dozens of vaccines are in development, with 8 currently in phase 1 trials. Some scenarios predict the earliest, widespread availability of a COVID-19 vaccine to be in 2021.¹ As launches of prior mass vaccination programs have demonstrated, careful planning to ensure readiness of both the general public and the health community for a COVID-19 vaccine should begin now.

To substantially reduce morbidity and mortality from COVID-19, an efficacious and safe vaccine must be delivered swiftly and broadly to the public as soon as it is available. However, the mere availability of a vaccine is insufficient to guarantee broad immunological protection; the vaccine must also be acceptable to both the health community and general public. Vaccine hesitancy is a major barrier to vaccine uptake and the achievement of herd immunity, which is required to protect the most vulnerable populations. Depending on varying biological, environmental, and sociobehavioral factors, the threshold for COVID-19 herd immunity may be between 55% and 82% of the population.

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CHAPTER 1

1.INTRODUCTION

Global equitable access to a COVID-19 vaccine, particularly for health workers and other most-at-risk populations, is the only way to mitigate the public health and economic impact of the pandemic. More than 12 billion vaccine doses have been administered globally, and now, with a predictable supply of COVID-19 vaccines, more must be done to deliver them to those most in need.

Recognizing the urgency of turning vaccine doses into vaccinated, protected communities, WHO, UNICEF and Gavi, the Vaccine Alliance **launched** the COVID-19 Vaccine Delivery Partnership (CoVDP). The Delivery Partnership builds on existing resources to support the AMC 92 and focuses foremost on the 34 countries that were at or below 10% coverage in January 2022. Working closely with countries to understand bottlenecks to vaccination, the Delivery Partnership offers access to urgent operational funding, technical assistance and political engagement to rapidly scale up vaccination and monitor progress towards targets.

The Delivery Partnership builds on the substantial body of work realized by the **Country Readiness and Delivery (CRD) workstream** that was part of COVAX since early 2020, and which made available global guidance and coordinated technical support for the implementation of COVID-19 vaccines. Now that COVID-19 vaccines have been developed, the next major milestone will be ensuring people around the world are vaccinated, starting with the most vulnerable.

The rollout of COVID-19 vaccines presents fresh challenges, such as working to rapid timelines and reaching older populations that normally would not be a major focus of vaccination.

Addressing the operational challenges that arise from these developments is vital to ensuring vaccines are valued, trusted, easily available.

CHAPTER 2

2. AIM AND SCOPE

2.1 AIM

The pace and breadth of the global rollout of COVID-19 vaccines to date is unprecedented. Prior to the COVID-19 pandemic, manufacturers produced an estimated total of five billion vaccines doses per year – across all diseases. 65% of the world's population has now received at least one dose of a COVID-19 vaccine and over 11 billion doses have been administered globally. The COVID-19 vaccine rollout has been achieved at global level faster than any other vaccine in history (see figure 2), saving millions of lives. Less than 12 months after the first vaccine was authorised every country in the world, except two,¹⁰ had introduced new COVID-19 vaccine programs – an unprecedented achievement. The growth in vaccine trade was also accompanied by increasing trade in related or intermediate inputs underpinning their global manufacturing and distribution. Across high income countries, 877 million people (73.6% of the population) have now been fully vaccinated.¹² In upper-middle income countries that number rises to 1.6 billion (73.9%). Most of these countries also have active booster programs for their vulnerable populations reflecting the latest WHO guidance, and in many cases for all adults. In general, these countries were able to strike individual bilateral deals with COVID-19 vaccine manufactures to secure relatively early deliveries of COVID-19 vaccines. When combined with strong and well-funded health systems this allowed higher income countries to plan in advance and introduce successful mass vaccination strategies that were rolled out over the course of 2021. Upper-middle income countries were not able to move as fast as higher income countries but have gradually caught up. 70% of the population of G20 countries have now been fully vaccinated.

2.2 SCOPE

For the first time since the pandemic was declared two years ago, there is currently sufficient supply in the global vaccine market – which means countries can secure the vaccines they need, on a timescale that works for them, and better plan their vaccination strategies. Over the past two years a significant amount of work has been done across lower income countries to prepare for large-scale vaccination deployment, in many cases supported by the country readiness and delivery work of

international partners, and for many it is only in recent months that those plans could be operationalised at scale. As supply constraints have eased, it has become clear that a group of countries could benefit from concerted support to accelerate COVID-19 vaccination. Recognising the urgency of turning vaccine doses into vaccinated, protected, people and communities, Gavi, UNICEF and WHO, launched the COVID-19 Vaccine Delivery Partnership (CoVDP) in January 2021, an interagency initiative building on existing resources and partnerships at country, regional, and global level to accelerate vaccination coverage in countries that face the biggest challenges to reaching their vaccination targets. The work of the CoVDP has been supported by and coordinated with members of the Multilateral Leaders Task Force, as well as donor partners and the ACT-A Health Systems and Response Connector.

CHAPTER 3

3. SYSTEM REQUIREMENTS

Windows

- Microsoft® Windows® 7/8/10 64-bit
- 4 GB RAM minimum, 8 GB RAM recommended
- 2 GB of available disk space minimum,
- 4 GB Recommended 500 MB for IDE + 1.5 GB for Android SDK and emulator system image
- 1280 x 800 minimum screen resolution

Mac

- Mac® OS X® 10.10 Yosemite or higher, up to 10.14 macOS Mojave
- 4 GB RAM minimum, 8 GB RAM recommended
- 2 GB of available disk space minimum,
- 4 GB Recommended 500 MB for IDE + 1.5 GB for Android SDK and emulator system image
- 1280 x 800 minimum screen resolution

Linux

- GNOME or KDE desktop - Tested on gLinux based on Debian.
- 64-bit distribution capable of running 32-bit applications

CHAPTER 4

4. METHODOLOGY

4.1 DATA COLLECTION

SMART Vaccines is a data-intensive tool and compilation of pertinent, high-quality data can be burdensome. At its core, SMART Vaccines relies on three types of data for producing final scores:

Readily available “known-knowns.” Some examples of this type of data would include population data for most nations of the world (and sometimes for smaller areas within nations such as states and counties in the United States). These data are available from several sources such as the World Health Organization and provide the lowest level of challenge for future users of SMART Vaccines. In high-income countries, economic and epidemiologic data resources are also available. These types of data include disease burden, typical patterns and cost of treating these diseases, productivity loss arising from these diseases, and similar data needed as inputs into SMART Vaccines. However, these types of data may be available only sporadically or not at all in low-income countries with less investment in data gathering infrastructures.

Theoretically knowable “unknown knowns.” Some data that are available readily in high-income countries would be in theory be available in low-income countries as well, but do not exist. In these cases, potential users of SMART Vaccines will have to decide whether to make new investments in data gathering infrastructures or to rely on low-cost approximations for initial priority setting exercises using SMART Vaccines.

In many settings, the most useful way to get sufficient data to begin the priority setting process is to obtain best expert estimates, often relying on different individuals for different types of estimates. This could be done in a more formalized structure using group consultation techniques such as the Delphi methods or its variations for estimating unknown data.

The sensitivity analysis capabilities of SMART Vaccines provide another way to help users understand the importance of improving the quality of various types of data. If the user finds that within their context—and using their own weights—and across a wide range of possible data levels that the priority rankings do not change, then it is an indication that further investments to improve those data elements is not necessary. Alternatively, if the priority rankings are sensitive to the levels of certain data elements, then it signals the importance of investing resources to improve those data.

Currently unknowable “known unknowns.” These are data whose nature is well known but they do not exist, including the vaccines that do not yet exist, and the nature and hence the dangers of diseases that do not yet exist. The primary sources for SMART Vaccines data were publications reporting primary epidemiologic and economic data or else reporting sufficient information to derive estimates of the primary data. Studies reporting data on a national scale were given precedence over those that analyzed populations on a state, county, or provincial basis. In some instances when national estimates were unavailable, estimates from a smaller subset of a population were extrapolated to the entire population. Indirect estimates from mathematical modeling studies were consulted when firsthand data were unavailable. Specific source references are embedded in the data spreadsheets.

4.2 DATA MINING

In this section, there is an overview of the process of data mining and data modeling, collecting the data, through the data preparation and finally the data modeling. Data cleaning and formatting can be considered as the most critical part of the whole project according to several data scientists. Figure shows how the process of data mining works to extract knowledge using algorithms.

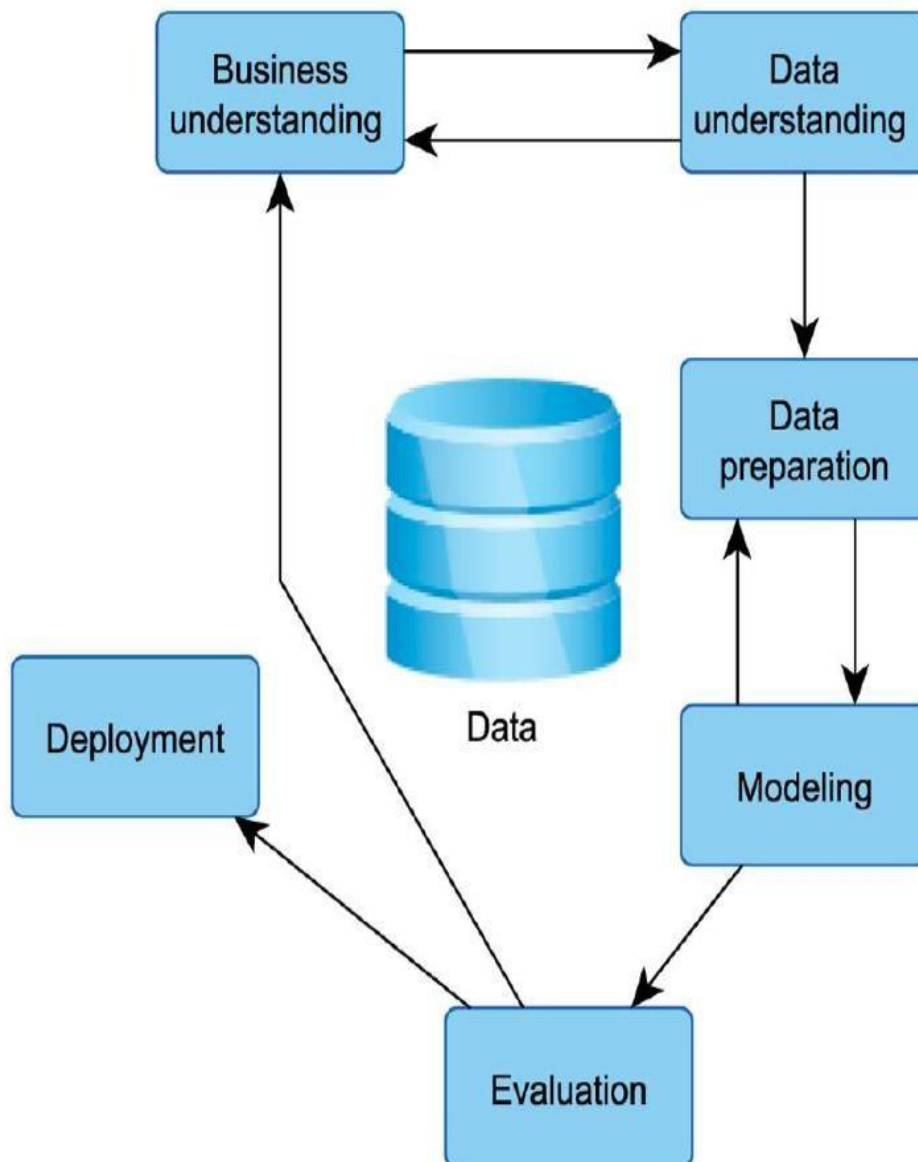


FIGURE 4.1 : DATA MINING

4.3 DATA ANALYSIS

The process of data analysis, or alternately, data analysis steps, involves gathering all the information, processing it, exploring the data, and using it to find patterns and other insights. The process of data analysis consists of:

Data Requirement Gathering: Ask yourself why you're doing this analysis, what type of data you want to use, and what data you plan to analyze.

Data Collection: Guided by your identified requirements, it's time to collect the data from your sources. Sources include case studies, surveys, interviews, questionnaires, direct observation, and focus groups. Make sure to organize the collected data for analysis. **Data Cleaning:** Not all the data you collect will be useful, so it's time to clean it up. This process is where you remove white spaces, duplicate records, and basic errors. Data cleaning is mandatory before sending the information on for analysis.

Data Analysis: Here is where you use data analysis software and other tools to help you interpret and understand the data and arrive at conclusions. Data analysis tools include Excel, Python, R, Looker, Rapid Miner, Charito, Meta base, Rehash, and Microsoft Power BI. **Data Interpretation:** Now that you have your results, you need to interpret them and come up with the best courses of action based on your findings.

Data Visualization: Data visualization is a fancy way of saying, "graphically show your information in a way that people can read and understand it." You can use charts, graphs, maps, bullet points, or a host of other methods. Visualization helps you derive valuable insights by helping you compare datasets and observe relationships.

If you want to make informed decisions, you need data, but there's more to it. The data in question must be accurate. Data analysis helps businesses acquire relevant, accurate information, suitable for developing future marketing strategies, business plans, and realigning the company's vision or mission. A simple example of data analysis can be seen whenever we make a decision in our daily lives by evaluating what has happened in the past or what will happen if we make that decision.

Basically, this is the process of analyzing the past or future and making a decision based on that analysis.

4.4 TYPES OF DATA ANALYSIS

The four types of data analysis are:

- Descriptive Analysis
- Diagnostic Analysis
- Predictive Analysis
- Prescriptive Analysis

4.4.1 DESCRIPTIVE ANALYSIS

Descriptive analytics answer the question, “What happened?”. This type of analytics is by far the most commonly used by customers, providing reporting and analysis centered on past events. It helps companies understand things such as:

- How much did we sell as a company?
- What was our overall productivity?
- How many customers churned in the last quarter?

Descriptive analytics is used to understand the overall performance at an aggregate level and is by far the easiest place for a company to start as data tends to be readily available to build reports and applications. It’s extremely important to build core competencies first in descriptive analytics before attempting to advance upward in the data analytics maturity model. Core competencies include things such as data modeling fundamentals, communicating data with right visualization and basic dashboard skills.

It’s likely you’ve adopted some form of descriptive analytics internally, whether that be static P&L statements, PDF reports, or reporting within an analytics tool. For a true descriptive analytics program to be implemented, the concepts of repeatability and automation of tasks must be top of mind. Repeatability in that a data process is standardized and can be regularly applied with minimal effort (think a weekly sales

report), and automation in that complex tasks (VLOOKUPS, merging of excel spreadsheets, etc.) are automated—requiring little to no manual intervention.

4.4.2 DIAGNOSTIC ANALYSIS

Diagnostic analytics, just like descriptive analytics, uses historical data to answer a question. But instead of focusing on “what”, diagnostic analytics addresses the critical question of why an occurrence or anomaly occurred within your data. Diagnostic analytics also happens to be the most overlooked and skipped step within the analytics maturity model. Anecdotally, I see most customers attempting to go from “what happened” to “what will happen” without ever taking the time to address the “why did it happen” step. This type of analytics helps companies answer questions such as:

- Why did our company sales decrease in the previous quarter?
- Why are we seeing an increase in customer churn?
- Why is a specific basket of products vastly outperforming their prior year sales figures?

Diagnostic analytics tends to be more accessible and fit a wider range of use cases than machine learning/predictive analytics. You might even find that it solves some business problems you earmarked for predictive analytics use cases. Being at the diagnostic analytics phase likely means you’ve adopted a modern analytics tool. Most modern analytics tools contain a variety of search-based, or lightweight artificial intelligence capabilities.

These features allow for detailed insights a layer deeper (for example: the Key Drivers visualization in Power BI, or Qlik’s search-based insight functionality). To be clear, these are an effective lightweight means to address diagnostic analytics use cases but are not a means to a full-scale implementation. Software vendors like Sisu have built their core business around addressing diagnostic analytics use cases (what they call “augmented analytics”) and are a great bet. Diagnostic analytics is an important step in the maturity model that unfortunately tends to get skipped or obscured. If you cannot infer why your sales decreased 20% in 2020, then jumping to predictive analytics and trying to answer “what will happen to sales in 2021” is a stretch in advancing upward in the analytics maturity model.

4.4.3 PREDICTIVE ANALYSIS

Predictive analytics is a form of advanced analytics that determines what is likely to happen based on historical data using machine learning. Historical data that comprises the bulk of descriptive and diagnostic analytics is used as the basis of building predictive analytics models. Predictive analytics helps companies address use cases such as:

- Predicting maintenance issues and part breakdown in machines.
- Determining credit risk and identifying potential fraud.
- Predict and avoid customer churn by identifying signs of customer dissatisfaction.

At the outset of any predictive analytics build, three core elements need to be established:

- Identify a problem to solve,
- Define what is you want to predict, and
- State what you will achieve by doing so.

To start you should collect existing data, organize data in a useful way to allow for data modeling, cleanse your data and review overall quality, and finally determine your modeling objective.

While modeling takes up the spotlight in predictive analytics, data prep is a crucial step that needs to happen first. This is why organizations with a rock-solid foundation in descriptive and diagnostic analytics are better equipped to handle predictive analytics. Simply put, the time and effort to prep, transform, and ensure data quality for retrospective reporting has already taken place. The groundwork should be relatively well laid to quickly identify and leverage data for the modeling phase. I always encourage customers with well-defined KPIs and business logic in a specific business reporting area (think sales reporting for example) to use that as the first predictive

analytics use case. The goal is to derive value quickly, and there is no better place to start than an area where you know data is well defined and of high quality.

4.4.4 PRESCRIPTIVE ANALYSIS

Prescriptive analytics is the fourth and final pillar of modern analytics. Prescriptive analytics pertains to true guided analytics where your analytics is prescribing or guiding you toward a specific action to take. It is effectively the merging of descriptive, diagnostic, and predictive analytics to drive decision making. Existing scenarios or conditions (think your current fleet of freight trains) and the ramifications of a decision or occurrence (parts breakdown on the freight trains) are applied to create a guided decision or action for the user to take (proactively buy more parts for preventative maintenance).

Prescriptive analytics requires strong competencies in descriptive, diagnostic, and predictive analytics which is why it tends to be found in highly specialized industries (oil and gas, clinical healthcare, finance, and insurance to name a few) where use cases are well defined. Prescriptive analytics help to address use cases such as:

- Automatic adjustment of product pricing based on anticipated customer demand and external factors.
- Flagging select employees for additional training based on incident reports in the field.

Prescriptive analytics' primary aim is to take the educated guess or assessment out of data analytics and streamline the decision-making process. Prescriptive analytics is commonly considered the merging of descriptive, diagnostic, and predictive analytics. Getting started isn't so much a step-by-step list but rather the time and effort up front to build your competencies within the analytics maturity curve.

Simply put, there is no starting point in prescriptive analytics without the requisite first three pillars of modern analytics being established first. If you're ready for prescriptive analytics, then quantifying your call to action and the underlying criteria will be the first requirement. For example: if the use case is to call corrective action for an employee (i.e. – additional training based on poor performance) then the factors

that necessitate this action must be firmly established and the action itself must be clearly defined. Knowing how each kind of analytics helps you better understand your data and how to use it.

4.5 POWER BI

Microsoft Power BI is a business intelligence (BI) platform that provides nontechnical business users with tools for aggregating, analyzing, visualizing and sharing data. Power BI's user interface is fairly intuitive for users familiar with Excel, and its deep integration with other Microsoft products makes it a versatile self-service tool that requires little upfront training.

Users can download an application for Windows 10, called Power BI Desktop, and native mobile apps for Windows, Android and iOS devices. There is also Power BI Report Server for companies that must maintain their data and reports on premises. That version of Power BI requires a special version of the desktop app -- aptly called Power BI Desktop for Power BI Report Server.

4.5.1 USES OF POWER BI

Microsoft Power BI is used to find insights within an organization's data. Power BI can help connect disparate data sets, transform and clean the data into a data model and create charts or graphs to provide visuals of the data. All of this can be shared with other Power BI users within the organization.

The data models created from Power BI can be used in several ways for organizations, including the following:

- telling stories through charts and data visualizations;
- examining "what if" scenarios within the data; and
- creating reports that can answer questions in real time and help with forecasting to make sure departments meet business metrics.

Power BI can also provide executive dashboards for administrators or managers, giving management more insight into how departments are doing.

4.5.2 FEATURES OF POWER BI

Microsoft has added a number of data analytics features to Power BI since its inception and continues to do so. Some of the most important features are the following:

Artificial intelligence. Users can access image recognition and text analytics in Power BI, create machine learning models using automated ML capabilities and integrate with Azure Machine Learning.

Hybrid deployment support. This feature provides built-in connectors that allow Power BI tools to connect with a number of different data sources from Microsoft, Salesforce and other vendors.

Quick Insights. This feature allows users to create subsets of data and automatically apply analytics to that information.

Common data model support. Power BI's support for the common data model allows the use of a standardized and extensible collection of data schemas (entities, attributes and relationships).

Cortana integration. This feature, which is especially popular on mobile devices, allows users to verbally query data using natural language and access results using Cortana, Microsoft's digital assistant.

Customization. This feature allows developers to change the appearance of default visualization and reporting tools and import new tools into the platform.

APIs for integration. This feature provides developers with sample code and application program interfaces (APIs) for embedding the Power BI dashboard in other software products.

CHAPTER 5

5. PROJECT OVERVIEW

5.5.1 CONCEPT OF VACCINE

- Different types of vaccines work in different ways to offer protection
- None of the COVID 19 vaccines can give you COVID 19
- COVID 19 vaccines help our bodies develop immunity to the virus that cause COVID 19 without us having to get the illness

5.5.2 How COVID-19 Vaccines Work

Different types of vaccines work in different ways to offer protection. But with all types of vaccines, the body is left with a supply of “memory” T-lymphocytes as well as B-lymphocytes that will remember how to fight that virus in the future. It typically takes a few weeks after vaccination for the body to produce T-lymphocytes and B-lymphocytes. Therefore, it is possible that a person could be infected with the virus that causes COVID-19 just before or just after vaccination and then get sick because the vaccine did not have enough time to provide protection.

Sometimes after vaccination, the process of building immunity can cause symptoms, such as fever. These symptoms are normal signs the body is building immunity.

5.5.3 Types of Vaccines:

There are three main approaches to designing a vaccine. Their differences lie in whether they use a whole virus or bacterium; just the parts of the germ that triggers the immune system; or just the genetic material that provides the instructions for making specific proteins and not the whole virus.

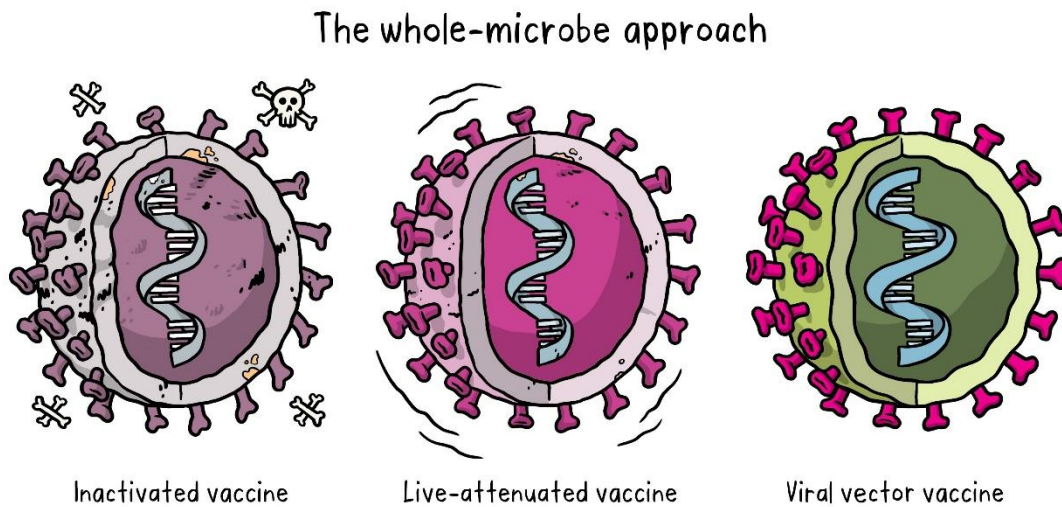


FIGURE 5.1

Inactivated vaccine

The first way to make a vaccine is to take the disease-carrying virus or bacterium, or one very similar to it, and inactivate or kill it using chemicals, heat or radiation. This approach uses technology that's been proven to work in people – this is the way the flu and polio vaccines are made – and vaccines can be manufactured on a reasonable scale.

However, it requires special laboratory facilities to grow the virus or bacterium safely, can have a relatively long production time, and will likely require two or three doses to be administered.

Live-attenuated vaccine

A live-attenuated vaccine uses a living but weakened version of the virus or one that's very similar. The measles, mumps and rubella (MMR) vaccine and the chickenpox and shingles vaccine are examples of this type of vaccine. This approach uses similar

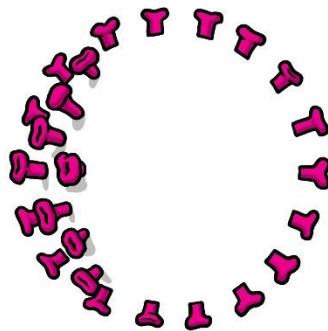
technology to the inactivated vaccine and can be manufactured at scale. However, vaccines like this may not be suitable for people with compromised immune systems.

Viral vector vaccine

This type of vaccine uses a safe virus to deliver specific sub-parts – called proteins – of the germ of interest so that it can trigger an immune response without causing disease. To do this, the instructions for making particular parts of the pathogen of interest are inserted into a safe virus. The safe virus then serves as a platform or vector to deliver the protein into the body. The protein triggers the immune response. The Ebola vaccine is a viral vector vaccine and this type can be developed rapidly.

The subunit approach

The subunit approach



Only uses the very specific parts
(the subunits) of a virus or bacterium that
the immune system needs to recognize.

FIGURE 5.2

A subunit vaccine is one that only uses the very specific parts (the subunits) of a virus or bacterium that the immune system needs to recognize. It doesn't contain the whole microbe or use a safe virus as a

vector. The subunits may be proteins or sugars. Most of the vaccines on the childhood schedule are subunit vaccines, protecting people from diseases such as whooping cough, tetanus, diphtheria and meningococcal meningitis.

The genetic approach (nucleic acid vaccine)

The genetic approach (nucleic acid vaccine)



Uses the genetic material for specific proteins - the DNA or RNA.

FIGURE 5.3

Unlike vaccine approaches that use either a weakened or dead whole microbe or parts of one, a nucleic acid vaccine just uses a section of genetic material that provides the instructions for specific proteins, not the whole microbe. DNA and RNA are the instructions our cells use to make proteins. In our cells, DNA is first turned into messenger RNA, which is then used as the blueprint to make specific proteins.

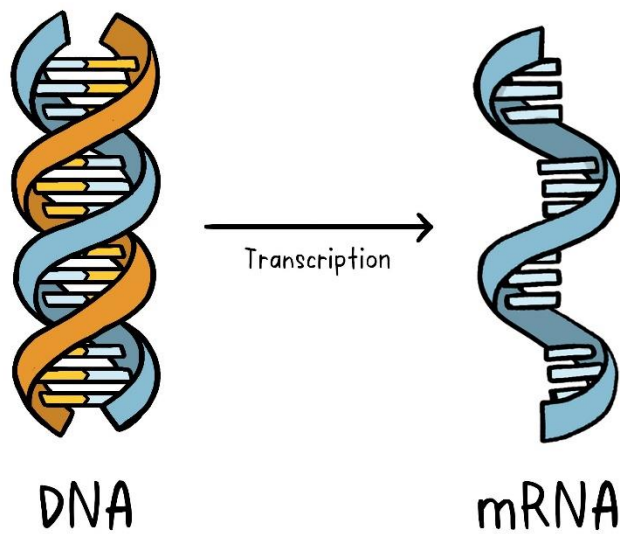


FIGURE 5.4

A nucleic acid vaccine delivers a specific set of instructions to our cells, either as DNA or mRNA, for them to make the specific protein that we want our immune system to recognize and respond to.

The nucleic acid approach is a new way of developing vaccines. Before the COVID-19 pandemic, none had yet been through the full approvals process for use in humans, though some DNA vaccines, including for particular cancers, were undergoing human trials. Because of the pandemic, research in this area has progressed very fast and some mRNA vaccines for COVID-19 are getting emergency use authorization, which means they can now be given to people beyond using them only in clinical trials.

CHAPTER 6

6.VACCINATION DRIVE ACROSS THE GLOBE

There are four COVID-19 vaccines approved for use in the U.S. The Pfizer, Moderna, Novavax, and Johnson & Johnson vaccines are all highly effective in protecting you from the virus that causes COVID-19.

The CDC says there's a preference for the mRNA (Pfizer and Moderna) COVID-19 vaccines over the Novavax or Johnson & Johnson vaccines. This is based on data from the Advisory Committee on Immunization Practices (ACIP). It discussed vaccine safety, vaccine effectiveness, rare negative side effects, and the U.S. vaccine supply.

The CDC recommends that if you are ages 5 years and up that you get one updated (bivalent) booster if it has been at least 2 months since your last COVID-19 vaccine dose. This last dose can be your final primary series dose or an original (monovalent) booster. If you have received more than one original (monovalent) booster, the CDC still recommends that you get an updated (bivalent) booster.

More than thirty vaccines have been approved for general or emergency use in countries around the world. By the end of 2022, over thirteen billion doses had been administered worldwide. In dozens of countries, at least three-quarters of the population has been fully vaccinated; Qatar, Singapore, and the United Arab Emirates are among those with the highest immunization rates. However, many others—mostly in Africa—have vaccinated only small fractions of their populations. Close to three years after COVID-19 emerged, nearly one-third of the global population is yet to receive a vaccine dose.

6.1 LEADING COVID-19 VACCINES

Morningstar has estimated the size of the COVID-19 market sinking to \$8 billion annually starting in 2023 in the best of three scenarios or “bull case” laid out by the firm, but dropping further to \$2 billion in the middle or “base case,” and to \$500 million in the worst or “bear case.” The number will depend on how frequently, and in how widespread of a population, will booster shots be needed.

GEN lists eight of the best-selling COVID-19 vaccines and drugs for which sales figures have been disclosed (or in the case of one company, suggested in a regulatory filing). Each drug or vaccine is listed by its name(s), sponsor(s), first-quarter 2021 sales as disclosed by sponsor(s), and the sponsors' 2021 sales guidance to investors, with a comparison to forecasts earlier this year.

This list does not include numerous additional COVID-19 vaccines and drugs that are well into clinical development but have yet to win any approvals or emergency authorizations from regulators.

Country	Developer	Clinical phase	Efficacy	Doses
China	CanSino	3	58%–92%	1
China	Sinopharm	3	78%	2
China	Sinovac	3	51%–84%	2
India	Bharat Biotech	3	78.0%	2
Russia	Gamaleya	3	75%–92%	2
United Kingdom, Sweden	Oxford-AstraZeneca	2 and 3	74%–100%	2
United States, Germany	Pfizer-BioNTech	3	91.0%	2
United States, India	Baylor, Biological E	3	90%+	2
United States	Johnson & Johnson	3	64%–72%	1

6.2 CHALLENGES IN VACCINATION PROGRAMS

On 13th January 2021, the African Union reported the procurement of nearly 300 million vaccine doses against COVID-19 for countries in the continent.¹¹ This massive deal was a separate effort of the COVID-19 vaccine Global Access (COVAX) who also planned on getting millions of COVID-19 vaccines for underdeveloped and developing nations of the world.¹¹ In spite of these vaccines procurement deals, and vaccines availability in Africa, the continent is the least vaccinated in the world despite having a combined COVID-19 case count of over 7 million as of 24th August, 2021.¹²

Over the years, various immunization programmes have been beneficial to public health in Africa.⁷ For example, the control, elimination, and eradication of some communicable disease such as diphtheria, pertussis, tetanus, measles, and polio have been achieved through different levels of immunization programmes in the continent.¹³⁻¹⁵

The current COVID-19 vaccination programme in Africa is the continent's biggest-ever immunization campaign, and part of a worldwide effort to abate and get under control the rampaging COVID-19. So far, the majority of countries in Africa have begun the administration of COVID-19 vaccines for its populations and a combined figure of over 24 million shots have been administered in Africa, which is just 1.7% of the continent's population having received their full doses as of 25th August, 2021.¹⁶

Despite the landmark achievements in the procurement of COVID-19 vaccines, and the initial progress made at the beginning of the vaccination exercise, the vaccination momentum is subsiding presently in Africa. For instance, because of numerous factors, less than 1% of the total COVID-19 shots administered in the world have been given in the continent.¹⁷ Highlighted below are some of the challenges hindering the successful implementation of the immunization programme against COVID-19 in Africa.

6.2.1 LIMITED FUNDS

Large amounts of funds are usually required before any immunization program can be implemented. For instance, the cost for a full immunization for just a child in Africa for the DTap vaccine (diphtheria, tetanus and pertussis) ranges between 25 to 45 US dollars, this excluding other immunization logistics requirements and costs.¹⁹ Most times, limited funds are allotted for immunization campaigns by African leaders in their respective countries despite the proven overall beneficial effects. For example, some percentages of the overall cost of the immunization programmes in Zambia in 2014 were provided by the Global Alliance for Vaccines and Immunization, while in many African countries, significant costs for immunization programmes are usually covered by external donors and bodies.^{20,21}

Presently over \$12 billion are needed by the continent for the COVID-19 vaccination exercise; this includes the funds needed to purchase over 1.4 billion doses to

vaccinate 60% of the African population that is needed to attain herd immunity.¹⁷ The financial capabilities of most countries in the continent are seriously affected by the pandemic situation, and a significant portion of the funds needed for the vaccination exercise could not be met by individual countries.

COVAX is helping with the procurement of COVID-19 vaccines for underdeveloped and developing countries; however, 60% of the amount of money expended on vaccination represent operational costs such as storage facilities, movement of vaccines, training of vaccinators, protective equipment for vaccinators and other supporting staff, and vaccination materials.¹⁷ Eight African countries have finished their first batch of vaccines, but over twenty countries which include Mauritius, Rwanda, Egypt, Seychelles and Morocco have used less than 50% of their shots.²² In addition, the Governments of Uganda, Kenya, and Nigeria needed supplementary budgets to kick start their vaccination campaign, while countries like Benin republic, Botswana, Burundi, Cabo Verde, Central African Republic, Comoros, Chad, Djibouti, Eritrea, Eswatini, Guinea-Bissau, Madagascar, Niger, Sao Tome and Principe, Somalia, South Sudan, and Sudan are having difficulties and struggling to raise funds to sustain their COVID-19 vaccination programs.

6.2.2 Concerns around vaccine safety and uncertainties

Malawi, Sierra Leone, Chad, Zimbabwe and some other African countries were skeptical about vaccinating their citizens with the Oxford/AstraZeneca COVID-19 vaccines due to safety concerns, which was fueled by reports of blood clots, and associated deaths among people in the United States and some European countries such as Denmark, Iceland, Norway, Estonia, Austria, Lithuania, Italy, Luxembourg, and Latvia.²³ This also resulted in low uptake of the vaccines by medical workers and some educated vulnerable people in some African countries that initiated the vaccination programme despite the WHO advising its usage.²⁴

In addition, numerous countries in Africa lacked the system and capabilities to track and monitor reports of unusual and rare side effects in people after being vaccinated, this is also raising the issues of safety concerns, and deterring people from getting the vaccines. For example, findings from a large study conducted by the Africa Center for Disease Control on COVID-19 vaccine perceptions in Burkina Faso, Côte d'Ivoire, Democratic Republic of the Congo, Ethiopia, Gabon, Kenya, Malawi, Morocco, Niger, Nigeria, Senegal, South Africa, Sudan, Tunisia, and Uganda revealed that the majority of the respondents had doubts about vaccine safety, while the majority of respondents from Ethiopia, Niger, Tunisia and the Democratic Republic of Congo outright rejected taking a vaccine.²⁵

Also, issues regarding misinformation and superstitious beliefs that have emerged from the beginning of the pandemic in some African countries and the world generally, and unfounded theories surrounding the production of the COVID-19 vaccines, which are spreading via the social media, are threatening the uptake of the vaccines in the world and Africa, especially in rural communities.

6.2.3 ACCESSING THE MOST VULNERABLE PEOPLE

Vaccinating the essential workforce, for example medical workers, security personnel, workers in elderly homes, transportation and food industry workers, and international students and personnel in the first phase of the immunization exercise is recommended to prevent economic shutdown and sustain important services to the public.³⁸ The vulnerable population, for example, elderly people with or without medical conditions, should be vaccinated. Also, pregnant women and the general population should be vaccinated in subsequent phases in order to reduce infection rates.³⁸ In addition, children should be prioritized for COVID-19 vaccination, and presently, the health authorities in the US have granted authorization for the administration of the Pfizer, Johnson & Johnson and Moderna vaccines for children of over 12 years of age, and individuals who are over the age of 18 respectively, while the health authorities in Europe have granted permission for the use of the Pfizer/BioNTech's vaccine for use in children between the age of 12 to 16 in European countries. For now, no vaccine is authorized for use in children below 12 years of age.^{39,40}

In most countries in Africa, the plan is to first vaccinate medical personnel, essential workers, elderly people with or without existing medical conditions, and the general population. Medical personnel are easily accessible in health facilities, and the administration of the vaccine would be easier on them compared to the elderly people with existing medical conditions whose identification would be hard to get, especially those living in rural villages and communities. The appropriate documentation and records of the individual's health status in respective countries is essential for any successful immunization programmes.⁴¹ Nigeria, Angola and Ghana made use of ad hoc staff who visited the respective communities and villages asking for elderly individuals with existing medical conditions to ensure proper profiling and documentation prior to the start of the vaccination program.

Most countries in Africa lacked the access to updated basic medical information of their citizens such as socio-demographic characteristics, and medical conditions, while the resources needed to get this vital information for the immunization exercise in a limited time duration were inadequate. Because of these difficulties, significant numbers of people in most African countries who were planned for vaccination in the first phase have not been vaccinated. By comparison, 13% of elderly individuals have gotten a first shot of COVID-19 vaccine in the world, compared to just 1% in Africa.¹⁷ Zambia, Uganda, Gambia and Somalia are struggling in the vaccination of

their elderly citizens due to inappropriate documentation and problems getting to the most vulnerable people.

6.2.4 THE USE OF DIFFERENT VACCINES

Presently, different COVID-19 vaccines such as the ones produced by Oxford/AstraZeneca, Johnson and Johnson, Moderna, Pfizer/BioNTech and Sinopharm are some of the vaccines that have been granted approval and certified for global usage by the WHO, and other different regulatory health authorities in the world. In Africa, Botswana, Rwanda and numerous other countries in Africa are using different types of vaccines in the ongoing COVID-19 vaccination exercise. For example, South Africa has vaccinated some medical personnel with the Johnson & Johnson vaccines in a phase 3B open label implementation study among 500,000 healthcare workers after it discontinued the use of the Oxford/AstraZeneca shots,⁴² while Egypt has been making use of both the Sinopharm and Oxford-AstraZeneca vaccines to vaccinate its citizens.¹⁷

There are some benefits with this method such as individuals getting protected quickly if managed well, but due to the particular problems of poor record keeping, which is evident in most African countries, it can cause challenges such as keeping track of the specific vaccine types used for different individuals, different logistics for vaccines and cold chain necessities and additional training of health personnel to give different vaccines. With diverse and different information on safety and efficacy for different vaccines, respective authorities might find it difficult to provide adequate information, and encourage the benefits of COVID-19 vaccination to their citizens. Hence, there is the need for pharmacovigilance post emergency use authorization (EUA) and the need to manage safety events during vaccines rollout, as well as the need to monitor field effectiveness during the vaccination exercise.

6.2.5 MEASURES TO MITIGATE THIS CHALLENGES

Continuous planning and timely execution of such plans is imperative to achieve a successful vaccination programme in Africa. Adequate planning for a vaccination programme incorporates a national strategy that enables an undisrupted vaccine procurement, storage, movement, distribution, and administration to intending populations.⁴⁵ Before the commencement of the vaccination programme for COVID-19 in Africa, most countries on the continent revealed pre-planned outlines of how and when the vaccinations would take place; this was impressive and yielded positive results early in the vaccination exercise as evident in Ghana and Angola who vaccinated their targeted populations very early.

As the vaccination exercise progresses, planning ahead for the next phases is imperative to repeat the impressive results that were gained early in the first phase, and to correct the mistakes recorded in the ongoing first phase. Some of the major problems for the achievement of the set goals in an immunization exercise are inadequate vaccines at vaccination centers and the standard storage facilities for

vaccines to ensure safety and to preserve efficacy.⁴⁶ African countries should invest more in cold chain facilities that would preserve larger vaccines for the vaccination programme in the second phase in order to maintain the potency and safety of the vaccine doses before usage. The second phase of the vaccination exercise will involve larger populations compared to the first phase; there should be enough cold chain logistics in place that will preserve the vaccines that will serve the target and intended populations.

Countries and areas with interrupted electricity supply of <8 hours daily should make use of solar refrigerators to preserve the safety and efficacy of their vaccines.⁴⁷ Solar refrigerators are effective ways for vaccines preservation, and may provide commensurable fund savings for vaccine doses administered over electricity powered cold chain equipment when electricity supply is inadequate.⁴⁷ The procurement and movement of vaccines without disruption to the cold-chain storage is imperative and should be maintained, while vaccine doses should readily be available in vaccination centers, especially in the rural areas.

A robust and well-coordinated preparation was important to reaching individuals in rural areas in the ongoing first phase of the vaccination programme in Ghana, Rwanda and Mauritius. For instance, mobile vaccination personnel in conjunction with community volunteers were able to reach older people in remote villages and communities for the vaccination exercise, and this yielded positive results through high turnout. This method should be maintained in the second phase, while the numbers of community volunteers and mobilizers should be increased in order to ensure large coverage. In addition, pre-listing and early registration of target population for the next phase should be ongoing simultaneously, and when this is completed, routine mobile messages should be sent to each individual detailing their vaccination centers and time to be around for the vaccines so as to improve vaccination uptakes, reduce discontinuance rates, and prevent delays during the inoculation exercise.⁴⁸

The ongoing COVID-19 immunization exercise of this large magnitude that needs all the general population to be vaccinated requires enormous funds. As stated earlier, over \$12 billion are needed by African countries to purchase over 1.4 billion doses that will vaccinate 60% of the African population needed to attain herd immunity, while around \$70 billion are required for the continent to fund the whole vaccination programme.¹⁷ The majority of African countries have struggled to raise these funds, while Uganda, Kenya, and Nigeria needed to pass series of supplementary budgets to get the funds needed for the commencement of the first phase of the vaccination exercise. Potential vaccination funds could be raised through internal revenues such as the passage of special intervention budgets and specific taxes. Also, funding for vaccination programmes could be sought by underdeveloped and developing countries through various external sources and platforms such as the World Bank International Development Association for eligible countries, International Monetary Fund, the Global Fund, and special grants and donations from non-governmental national and international organizations. Importantly, COVID-19 vaccination is a health intervention that will benefit all sectors, and effectively financing the vaccine exercise will indicate economy getting back-up globally.

It is evident that most African countries are faced with challenges of inadequate medical facilities and infrastructures.⁴⁹ The use of conventional facilities has been employed in the past to cushion the effects of inadequate medical facilities in most African countries to battle various public health problem, for example the Ebola disease epidemics.⁵⁰ As African countries prepare ahead for the second phase rollout of the vaccination exercise, which will involve a larger population, makeshift facilities such as large fields, open spaces with the provision of tents and seating equipment and various public venues, e.g. churches and mosques, could be used as vaccination centers. In addition, existing facilities and resources which have been used previously to fight numerous public health problems in the continent such as the Ebola outbreak in West Africa, yellow fever in Angola, and wild polio virus in Ghana and northern part of Nigeria could also be used in the current vaccination exercise, e.g. the existing storage facilities, vaccinators and other medical workers. These systems are readily available, faster to use, and with little financial commitments.

The safety of vaccinators and other medical workers is paramount and should be taken into consideration and planning before the second phase commences among countries in the continent. The availability of protective materials together with guidelines on usage is important to ensuring that vaccines are administered safely to people.⁵¹ Protective masks, medical gloves, and hygiene materials for example soap, detergent and clean running water should be made available in all the vaccination centers prior to the commencement of the second phase, while physical distancing between the vaccinators and the receivers should be maintained.

Myths and misinformation discouraging vaccine uptake are spreading very fast; dispelling these wrong information and misconceptions will enable efficient rollout to achieve massive uptake by the targeted population in Africa.⁵² While having in place mechanisms that ensure a rapid and unhindered allocation of COVID-19 vaccines the moment they are available is imperative, the role of a holistic community sensitization is paramount and should not be overlooked. African nations must design and implement methods on the most effective ways to improve community trust, understanding and to prevent wrong information about the COVID-19 vaccines.⁵³

Early and continuous community engagements involving vaccine promotion, community sensitization and messages that dispel myths and misconceptions should be intensified in all communities and villages in order to increase vaccine uptake. Vaccination promoting messages could be relayed to the general public via the radio and television programs and routine announcements, daily newspapers, posters, pamphlets, short mobile messages, and various social media channels making use of all spoken languages in the respective countries. In rural and remote areas with limited access to internet and frequent electricity, messages promoting COVID-19 vaccine uptake should be relayed in churches, mosques, traditional functions, and large gatherings, while sensitization efforts making use of house-house methods with the help of trained community messengers and volunteered workers should be conducted as well.

In addition, making use of local champions, respected figures, and celebrities in the dissemination of vaccine promoting messages might result in higher vaccine acceptance rate in the public. Also, the provision and promotion of a robust intra- and inter-sectoral partnership would help to improve the acceptance and uptake of the COVID-19 vaccines via the provision of more human and material resources needed to tackle COVID-19 vaccine hesitancy in African countries.⁵⁴ Likewise, the integration of the COVID-19 vaccine into the regular vaccination framework, and as a requirement, might help to fortify the public care system, promoting and increasing the acceptance of the COVID-19 vaccine, and improving the overall wellbeing of all individuals dwelling in Africa.⁵⁴

Getting COVID-19 vaccines across to conflict and war-torn areas, and vaccinating the people in these areas is important to achieve herd immunity on the continent, and a moral obligation. Sub-standard health capacities because of the breakdown or destruction of health services, inadequate medical workers, depleted medical facilities, equipment and materials, and disputed borders might hamper vaccination programmes in conflict situations. Getting to areas not controlled by constituted authorities or the government brings problems such as logistic issues, the need to get a travel pass which is usually complicated and time consuming, and reduced access to electricity and standard storage facilities. Over 160 million individuals are faced with an increased risk of exclusion from the ongoing COVID-19 immunization exercise due to reasons of internal conflicts, unrests and wars in most African countries, including in Nigeria, South Sudan, Mali, Somalia, Chad, Libya, Ethiopia, and Mozambique.⁴⁴

Brokering local ceasefires is needed and important to enable life-saving vaccination exercise to take place in these disturbed areas, as well as important to ensure the safety of courageous medical personnel and other charity workers working and providing care in a highly complex situations in conflict environments. In addition, members of the community, international humanitarian organizations such as the Red Cross, religious, traditional, and community or village figures should be drafted to assist in the planning and designing of vaccination frameworks in disturbed places or areas. Community partnership and providing communities with the right information and data would be crucial to achieve an impressive outcome or results during the COVID-19 immunization campaign, and to ensure the safety of medical care workers.

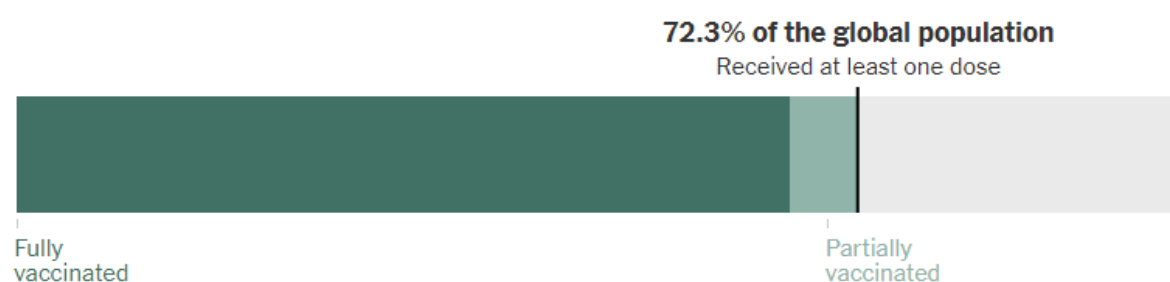
A big national intervention program such as the COVID-19 vaccination campaign needs a broader society partnership and approaches prior to, and during the rollout exercise. Strong leadership and coordination from the Health Ministry, partnerships across and beyond the government for example the private sectors will prove crucial for the success of the vaccination program. For example, a multi-sectoral partnership which involves the government and private organizations should be in place at the international, regional, national, district and community levels.

Due to Africa's inability to produce vaccines for COVID-19 and other vaccination materials, the international and regional partnerships with COVAX, Coalition for Epidemic Preparedness Innovations, World Bank, Bill Gates foundation, and WHO is imperative to procure vaccines and other medical materials at lesser rates and with

limited time. Once the vaccines are procured, national authorities with partnerships with private sectors will help with the plan layout and standard logistics for the safe, equal and timely distribution of vaccines into intending districts and communities.

Individuals in the community are the end receivers of vaccines in the vaccination chain. To ensure high uptake, communities need to understand the importance of the vaccines to them, their safety, and the method of administration, and that their social and traditional norms will be upheld and respected at all times during the vaccination process.

6.3 PROGRESS IN VACCINATION DRIVE SO FAR



More than 5.55 billion people worldwide have received a dose of a Covid-19 vaccine, equal to about 72.3 percent of the world population. This map shows the stark gap between vaccination programs in different countries.

FIRGURE 6.1

Vaccination rates by region

As a share of total population. The height of each bar is proportional to the region's population.

● Partially vaccinated ● Fully vaccinated

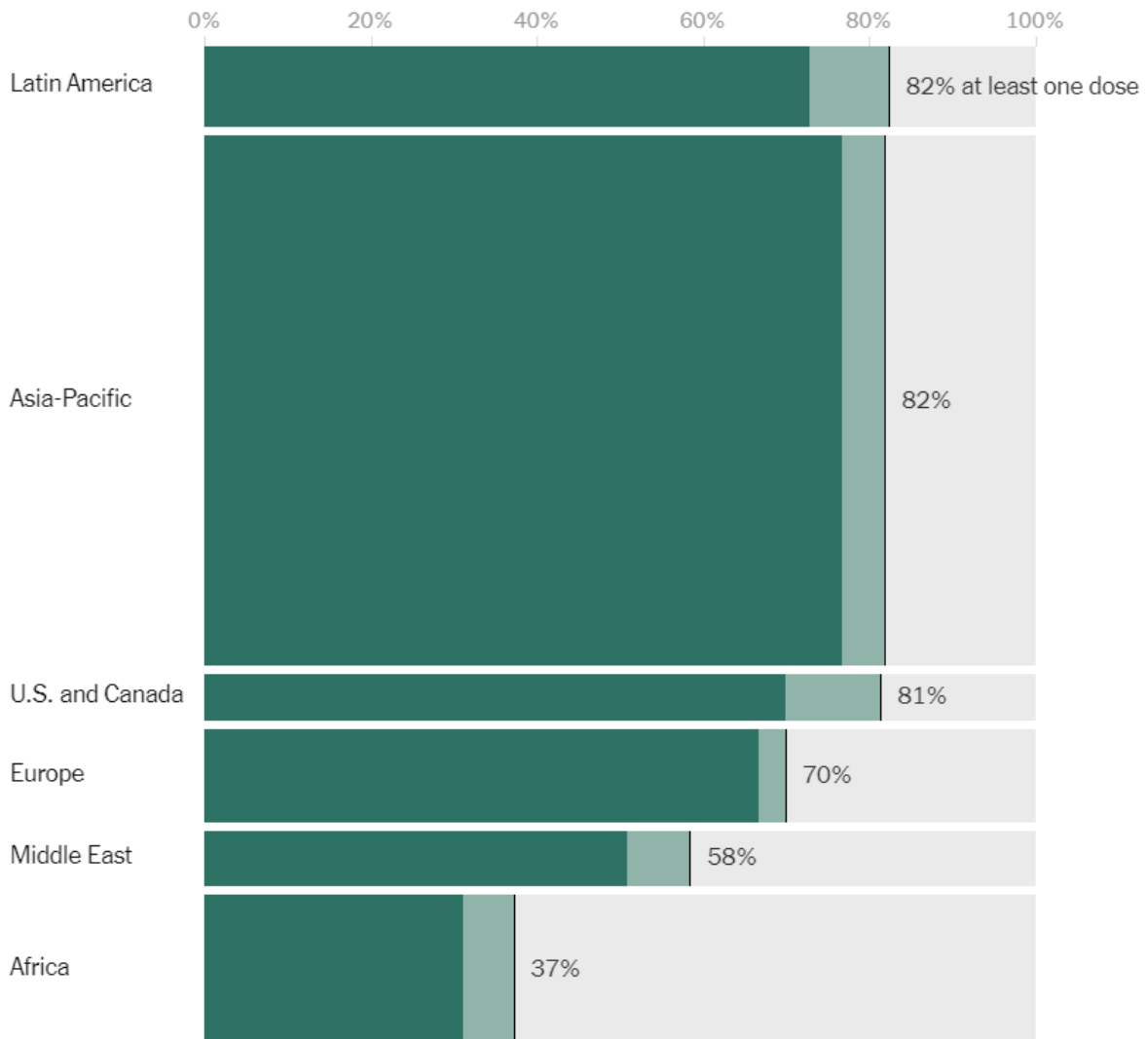
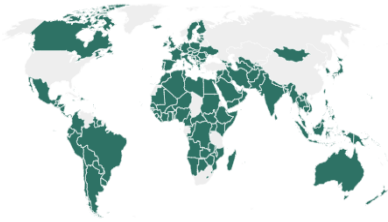


FIGURE 6.2

Where each vaccine has been used

These maps are no longer being updated. Data is as of November 30, 2022.

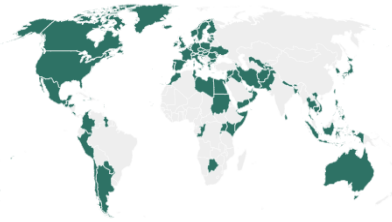
Oxford-AstraZeneca
185 COUNTRIES



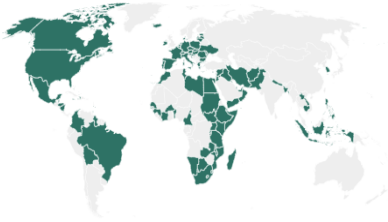
Pfizer-BioNTech
165 COUNTRIES



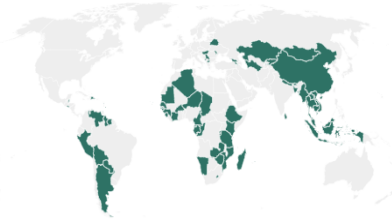
Moderna
114 COUNTRIES



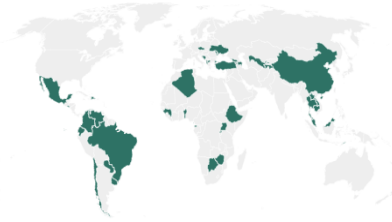
Johnson & Johnson
103 COUNTRIES



Sinopharm-Beijing
72 COUNTRIES



Sinovac
41 COUNTRIES



Gamaleya (Sputnik V)
35 COUNTRIES



Novavax
33 COUNTRIES



Bharat Biotech (Covaxin)
31 COUNTRIES



FIGURE 6.3 vaccines in world

CHAPTER 7

7.COVID VACCINATION DRIVE IN INDIA

India's vaccination programme against COVID-19 has been one of the most successful and largest in the world, the Union health ministry said on Sunday and termed as misleading some media reports that claimed the country has missed its COVID-19 inoculation targets.

Since the start of the national COVID-19 vaccination drive on January 16 last year, India has administered to over 90 per cent of its eligible citizens first doses and 65 per cent second doses.

In the vaccination drive, so far, the country has achieved several milestones, which have no precedent in the world, including administering over 100 crore doses in less than nine months, administering 2.51 crore doses in a single day and several times administering one crore doses in a day, the ministry said.

"Compared with other developed nations, India has done a better job in administering Covid vaccination to its eligible adult citizen of 93.7 crore as per the RGI (Registrar General)

In case of first dose coverage to the eligible population, the US has covered only 73.2 per cent of its population, the UK has covered 75.9 per cent of its population, France has covered 78.3 per cent of its population and Spain has covered 84.7 per cent of its population, the ministry said.

India has already covered 90 per cent of its eligible population with first dose of vaccine against COVID-19, it said in the statement.

CHAPTER 8

8.PROJECT IMPLEMENTATION

The project is implemented in Microsoft excel and Microsoft power Bi. The Microsoft excel is used to collect the data and form the data's into the table. Microsoft power bi is used to analyze and transform the raw data into an analyzable format.

We need to collect the datasets for price of various countries. We need to collect the Total population vaccine used total doses administered and several other things.

The dataset includes;

- Countries and their vaccination program
- How effectively they have done by per 100 people

Now enter the dataset in Microsoft excel sheet as per the data The main objective of the project that the analysis of vaccination program.

The vaccination drive analysis depends on various factor namely:

- Total population
- Availability of vaccines
- Number of doses
- Fully vaccinated population
- Penetration of vaccines in rural areas

Now collect the dataset of these values . Import to the excel sheet. These data's are taken from several countries and their population etc.,

Then import the excel sheet into the Microsoft power bi.

The following diagram shows the datasets taken

project 9 covid vaccination report - Excel									
File Home Insert Page Layout Formulas Data Review View Help Tell me what you want to do									
Clipboard Font Alignment Number Styles Cells Editing									
B1 X ✓ fx PLACE OF ORIGIN									
	A	B	C	D	E	F	G	H	I
1	VACCINE BRAND	PLACE	COUNTRY WISE USAGE	COUNTRY WISE VACCINATION PROGRAMM	VACCINES USED	TOTAL POPULATION	VACCINATED POPULATION PERCENTAG	FULLY VACCINATED PERCENTAGE	DOSES ADMINISTER
2	PFIZER	USA	165 USA		PFIZER,MODERNA,J	33,10,02,651	80%	68%	63,29,05
3	MODERNA	USA	114 INDIA		COVAXIN	1,38,00,04,385	75%	70%	2,20,63,48
4	NOVAVAX	USA	33 CHINA		SINOVAC,SINOPHA	1,43,93,23,776	94%	91%	3,49,10,7
5	JOHNSON & JOHNS	USA	103 RUSSIA		SPUTNIK-V	14,59,34,462	61%	55%	18,56,72
6	ASTRAZENECA	EUROPE	185 JAPAN		ASTRAZENECA,PFIZ	12,64,76,461	83%	82%	38,16,75
7	SINOVAC	CHINA	41 FRANCE		ASTRAZENECA,PFIZ	6,52,73,511	82%	79%	15,42,95
8	COVAXIN	INDIA	31 UK		ASTRAZENECA,PFIZ	6,78,86,001	81%	76%	15,12,4
9	SPUTNIK-V	RUSSIA	35 GERMANY		ASTRAZENECA,PFIZ	8,37,83,942	78%	76%	19,21,02
10	SINOPHARM	CHINA	72 CANADA		ASTRAZENECA,PFIZ	3,77,42,154	92%	84%	9,63,9

FIGURE 8.1 Data set

8.2 REPRESENTATION OF DATA IN VISUALS USING KPI

8.2.1 PIE CHART

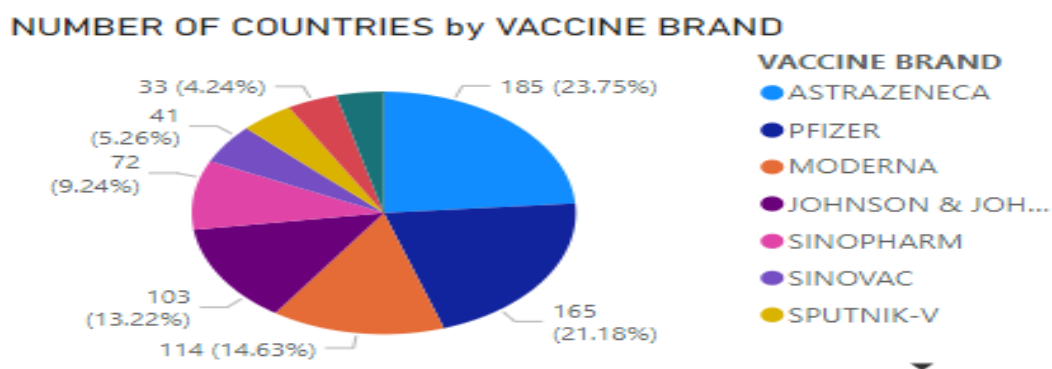


FIGURE 8.2 pie chart

Pie charts can be used to show percentages of a whole, and represents percentages at a set point in time. Unlike bar graphs and line graphs, pie charts do not show changes over time. The following pages describe the different parts of a pie chart. The title offers a short explanation of what is in your graph.

The above pie chart shows usage of different vaccines across the world accordance to the above data set.

8.2.2 COLUMN CHART

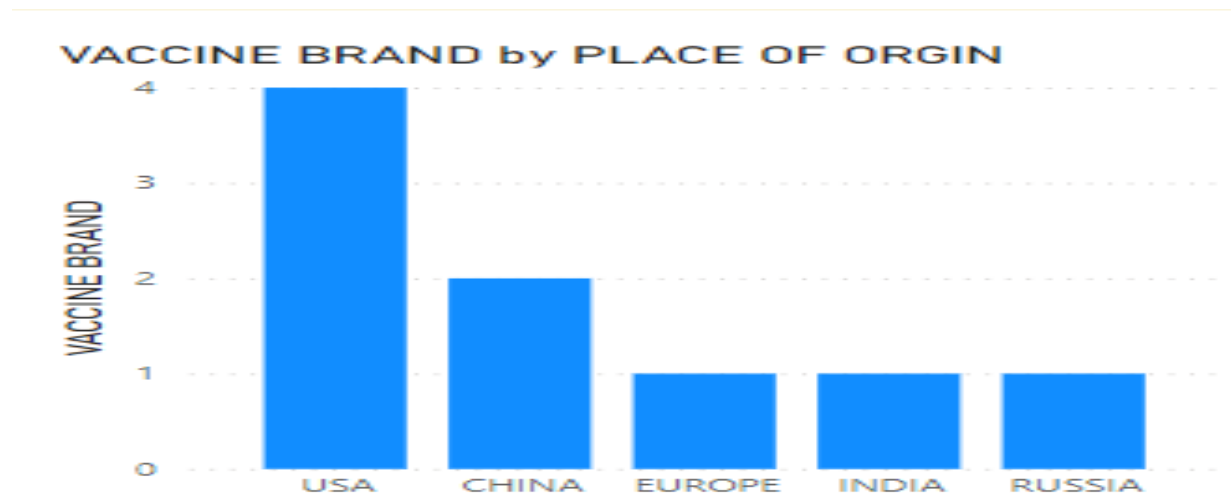


FIGURE 8.3

Bar and Column charts are two of the most frequently used chart types in Power BI. They are a very simple and uncomplicated way to show comparison or ranking in a range of values. The bars in a bar chart are displayed horizontally across the axis and in a column chart they are displayed vertically. Both these chart types represent data with rectangular bars, where the size of the bar is proportional to the magnitude of data values.

8.2.3 TABLE CHART

Difference between the two is that if the rectangles are stacked horizontally, it is called a bar chart. If the rectangles are vertically aligned, it is called a column chart. The above column chart has the visualized data about vaccines origin

COUNTRY	DOSES ADMINISTERED	PER 100 PEOPLE
CANADA	96956502	258
CHINA	3491077000	250
FRANCE	154295635	230
GERMANY	192102093	231
INDIA	2206348628	161
JAPAN	381675627	302
RUSSIA	185672750	129
UK	151248820	226
USA	632905664	191
Total	7492282719	1978

FIGURE 8.4

A table is a grid that contains related data in a logical series of rows and columns. It may also contain headers and a row for totals. Tables work well with quantitative comparisons where you're looking at many values for a single category. The above table shows a glimpse of vaccination programs across the globe.

8.2.5 MAP CHART

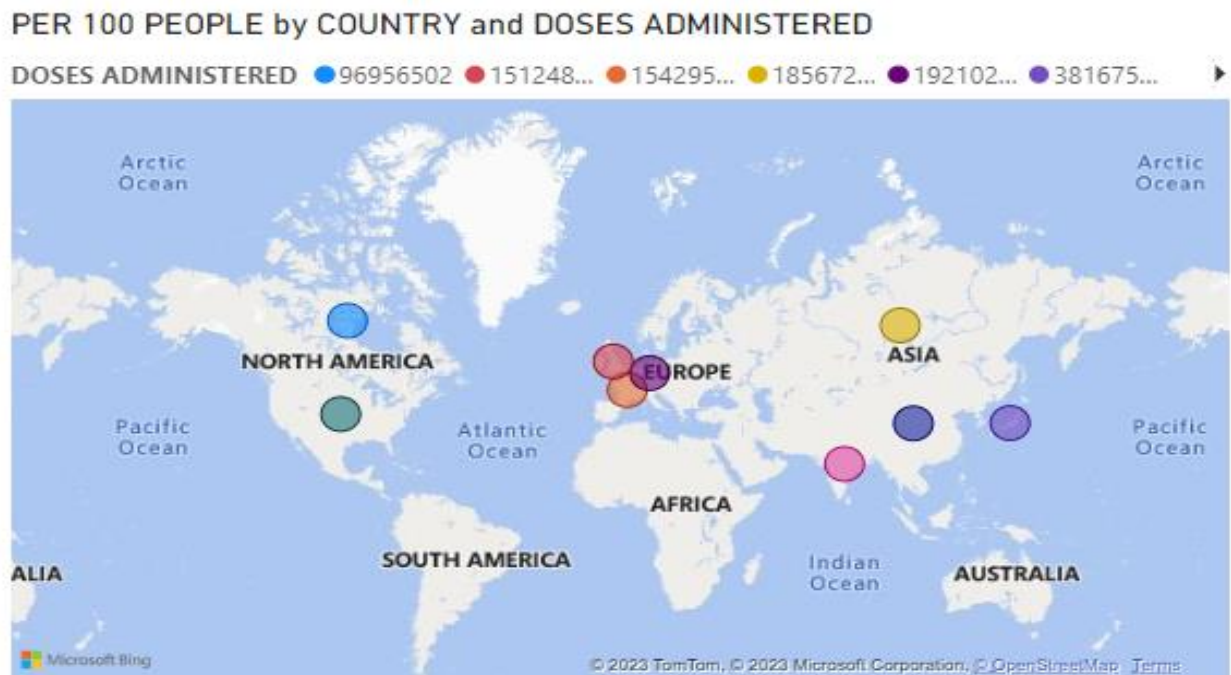


FIGURE 8.5

Using a Power BI map is a great way to visualize data that represent locations. With visually appealing maps and easy-to-understand content, your users will be able to gain more insight into your data.

8.3 INTERACTION AMONG VISUALS

Reports are embedded with slicers and filters, so if the summary table shows only monthly sales, then by adding the category field to the slicers, we can select each category individually and see how each category performs across months. Dashboards may not have this interactivity. We may see monthly and category-wise sales values in different tables or visuals. Users need to look at two different tables and find the differences.

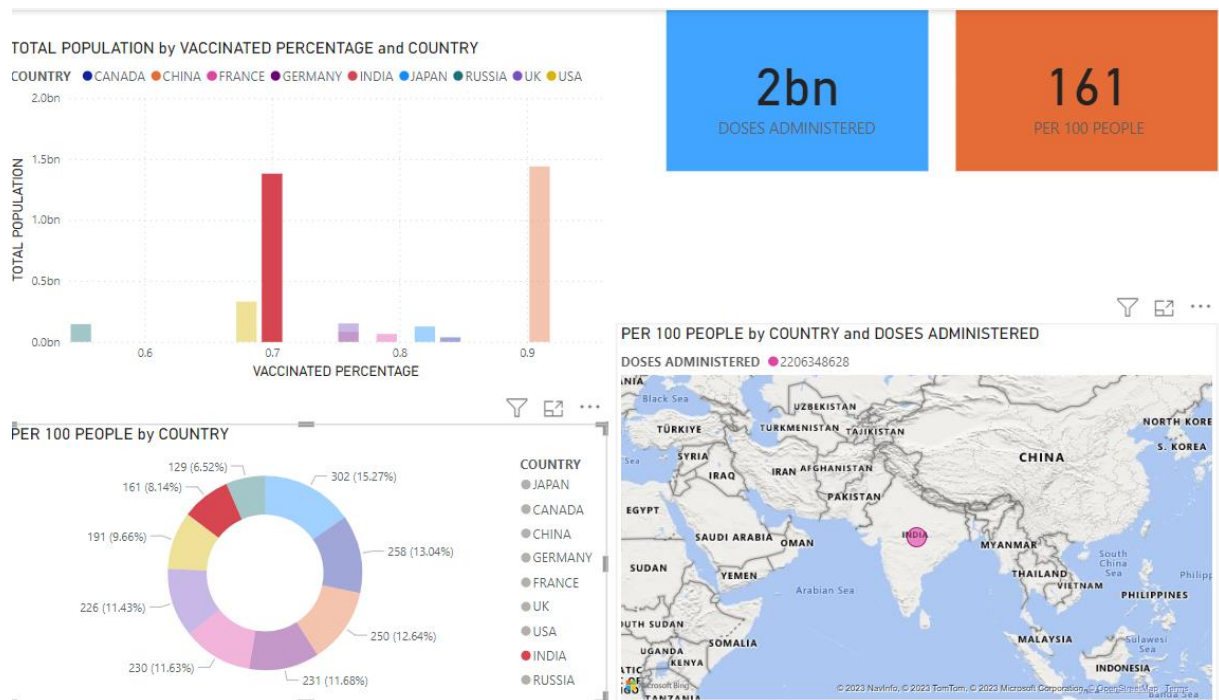


FIGURE 8.6

By clicking one visual we can make all the other visuals to interact clicking donut chart creates interaction among all the other visuals

8.3.1 SLICER

Slicers are visualizations on a Power BI canvas that allows users to refine the data for themselves easily. Filters are for developers to refine specific visuals, entire pages, or whole workbooks before sharing the dashboard(s) with end-users.



COUNTRIES, VACCINES USED

31	31
33	33
35	35
41	41
72	72
103	103
114	114

NUMBER OF COUNTRIES by VACCINE BRAND



FIGURE 8.7

CHAPTER 9

9.CONCLUSION

Can vaccines end the pandemic?

Even with a variety of vaccines with at least limited approval, there remains the tremendous challenge of making enough and distributing them to the global population. Though multilateral initiatives such as COVAX and individual governments are investing billions of dollars to [expand production plants](#), current global manufacturing capabilities remain far below what's needed. This task has not only motivated countries to scale up production, but also pitted them against one another amid a limited vaccine supply. Wealthy countries including Australia, Canada, and the United States [struck deals](#) with manufacturers early on to provide their own countries with more than enough doses, leaving lower-income countries unable to immunize but a small proportion of their citizens. China and India have large vaccine industries, which allowed them to reserve some of their vaccine supplies for their own populations. Experts including CFR's Thomas J. Bollyky have warned that [vaccine nationalism](#) leads to inequitable distribution and, ultimately, fails to eliminate the risk of new outbreaks. Beijing's decision to rely entirely on domestically made vaccines, for example, drew heightened criticism in 2022 as the government faced a record caseload, an underimmunized populace, and mass protests against its zero-COVID strategy.

CHAPTER 10

REFERENCE

- For *Nature*, CFR's Amy Maxmen looks at the [radical plan](#) for vaccine equity. With Think Global Health, Maxmen gives a [behind-the-scenes look](#) at her reporting on the mRNA vaccine technology transfer hub.
- This In Brief explains [how to tell](#) when COVID-19 becomes endemic.
- In [this report](#), Ginkgo Bioworks' Ryan Morhard outlines how global health security governance can keep pace in the DNA age.
- CFR's Thomas J. Bollyky, the Institute for Health Metrics and Evaluation's Olivia Angelino and Joseph L. Dieleman, and Bilkent University's Simon Wigley [write in the *Lancet*](#) that trust made the difference for democracies during the COVID-19 crisis.
- The WHO breaks down [how vaccines protect](#) against dozens of life-threatening diseases.
- This timeline [looks at major epidemics](#) since the start of the twentieth century.