Hult DATA Global

HULT HUSTLE

R & TABLEAU HACKATHON

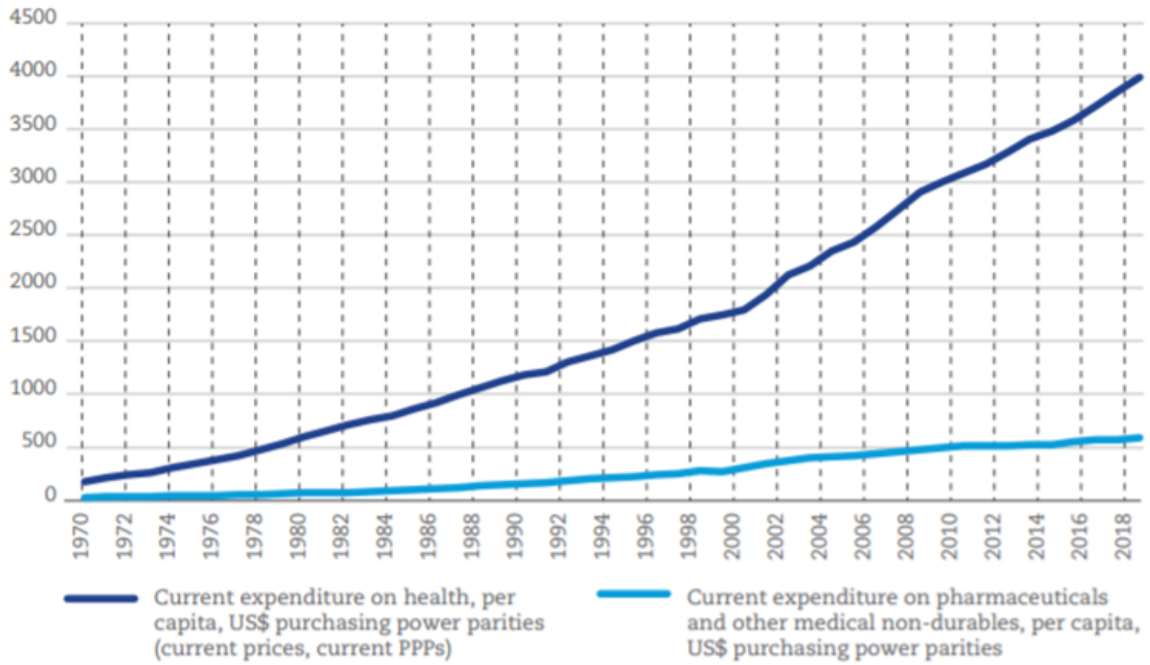
January 24 - 30, 2022

PharmaCo Business Case - The Hult Hustle 2022

1. The pharmaceutical industry

The United States is the worldwide leader in per capita prescription drug spending, representing between 30% to 40% of the world market. Many global pharmaceutical companies also have a presence in the U.S. Further, 40% of the worldwide total of approximately 6,500 drugs in clinical development originated in the U.S (Ellis, 2016).

Figure 1: Per Capita Expenditure on Health and Pharmaceuticals, OECD Countries



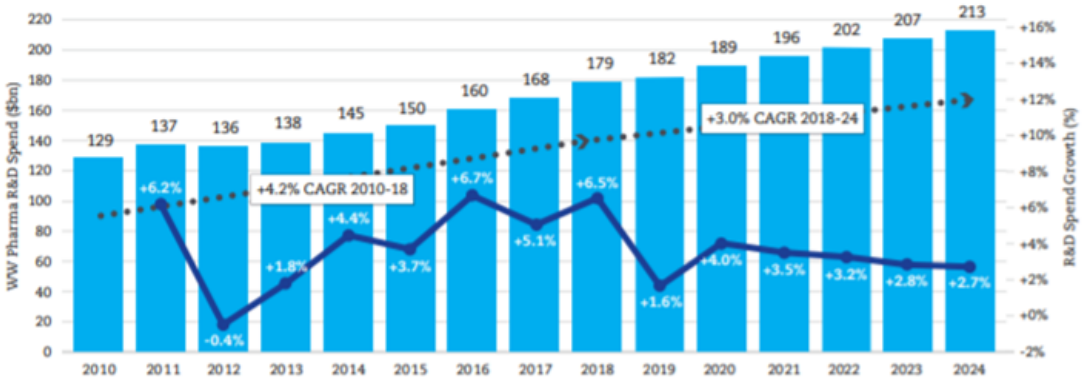
Source: ifpma.org

Pharmaceutical publicly-funded innovation is decreasing. The rate of research funding growth in the U.S. has slowed, and research for new treatments has declined recently. Additionally, a majority of transformative pharmaceutical innovation emerges directly from publicly-funded science (Ellis, 2016).

On the other hand, pharmaceutical manufacturers in the U.S. spend nearly twice as much on marketing their products than they do on research and development. In addition, much research and development investment from large manufacturers are spent on incremental

improvements to existing products rather than the development of new drugs. Estimates from industry-funded economists suggest that drug development may cost as much as $2.5 billion per drug, but these estimates are based on non-transparent data and use assumptions highly favorable to the industry, so the actual number is probably much smaller (Ellis, 2016).

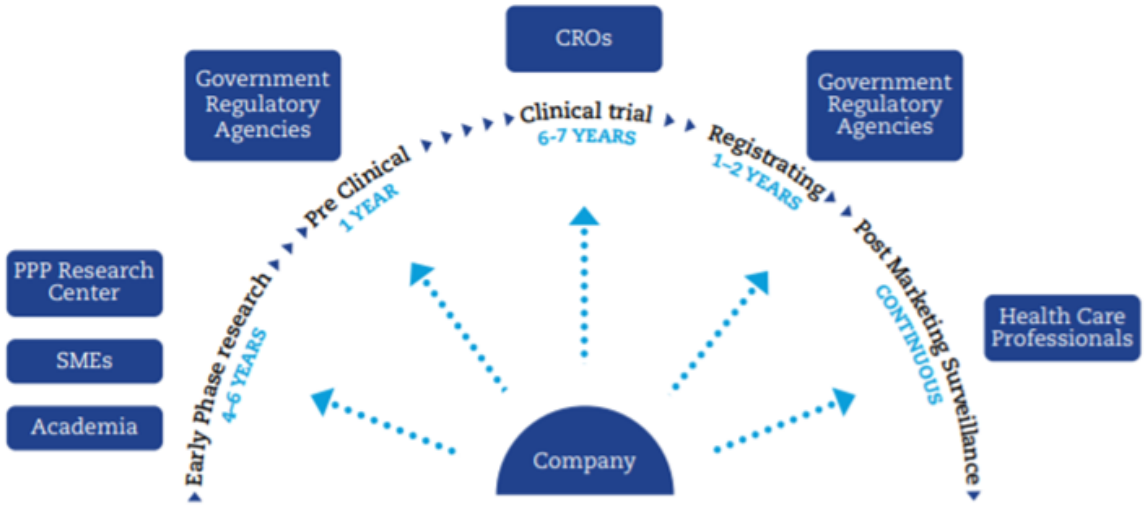
Figure 2: Biopharmaceutical R&D Spending



Source: ifpma.org

Moreover, in the U.S., most of the pharmaceutical wholesaler business is concentrated in a few companies that hold the majority of the market share (Ellis, 2016).

Figure 3: Biopharmaceutical R&D Network



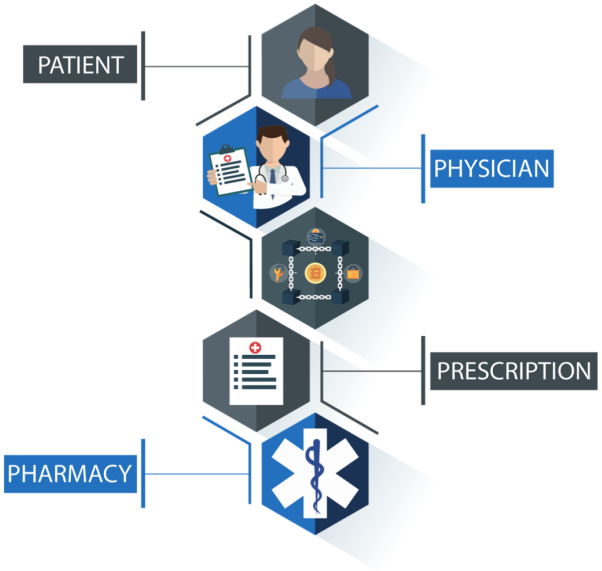
Source: ifpma.org

Many people from democrats and republican parties today seem to agree on this issue: more price regulation or innovations in pharmaceutical payment will be important for the future of the healthcare field and for the well-being of patients (Ellis, 2016).

2. PharmaCo

PharmaCo was founded in 2018 as a way to "create and develop the world's first Decentralized Pharmacy Platform" (PharmaCo, 2021). Its success has become such that the company started to administrate the patient records through an encrypted system. This was driven by the vision of the founders who were permanently searching to provide a safer storage of verified clients through data privacy. The system of PharmaCo works as follow:

Figure 4: How PharmaCo works



Source: pharmaco.com

The patient will be able to choose from a worldwide registry of certified physicians. In case they feel they need to, they will be able to ask for second opinions. Once the physician will realize its diagnosis, a prescription will be given to the pharmacy for the patient to go and pick up the drugs.

Using its existing network of doctors, pharmacists and patients, PharmaCo has been able to implement this innovation worldwide as well as a constant growth worldwide. The use of

blockchain technology enables the platform to reduce the risk of buying counterfeited drugs while providing alternative solutions to uninsured, elderly, or handicapped people. Nowadays, PharmaCo is offering a range of products but is outstanding in one particular field. Indeed, ***PharmaCo is becoming one of the global market leaders in Type 2 Diabetes*** and has already sold it in a huge number of countries. While seeing this success, PharmaCo has started to invest money in other drug research to serve the community the best it can (PharmaCo, 2021).

3. Diabetes

Diabetes is a disease that occurs when your blood glucose is too high (NIH,). These high levels of sugar are due to a dysfunctioning of the pancreas which doesn't produce enough insulin to process the glucose from the food eaten. Big amounts of glucose in the blood can cause critical health problems, therefore it is important to manage it and be careful of what is eaten. In 2016, an estimated value of 1.6 million deaths was caused by diabetes. Increasingly, 2.2 million deaths were related to high blood glucose levels in 2012 (International Federation of Pharmaceutical Manufacturers & Associations, 2021). Diabetes can be distinguished into two types:

- ***Diabetes Type 1:***

In this type of diabetes, the patient is not able to produce insulin, and the immune system attacks and destroys the cells of the pancreas that make that insulin. People falling into this type of diabetes will have to take insulin every day to stay alive (NIH, 2021).

- ***Diabetes Type 2:***

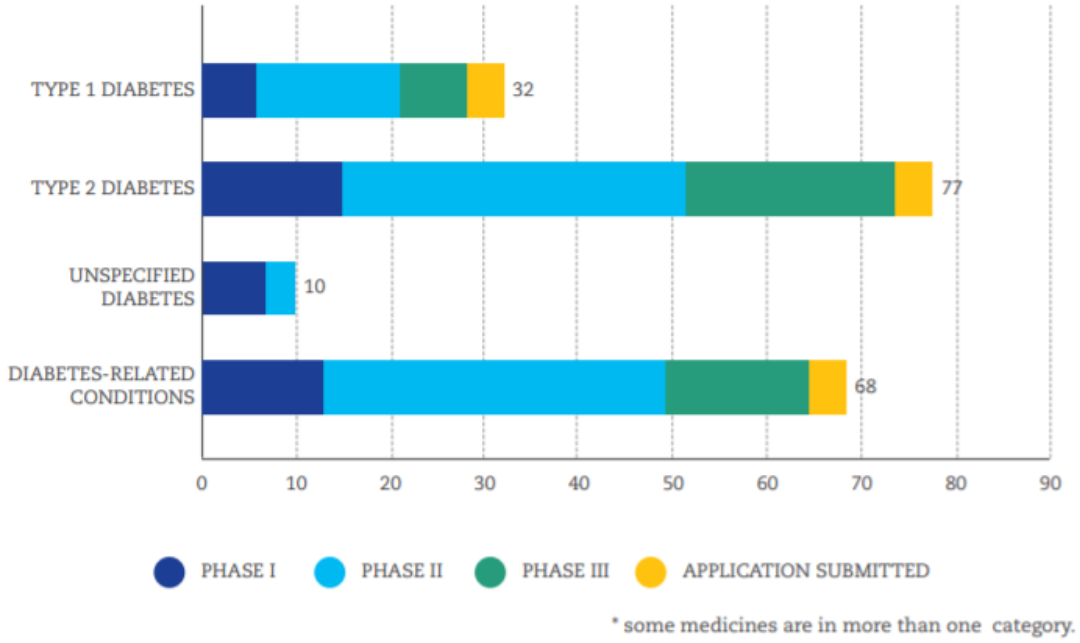
This type of diabetes can occur at any staging point of your life and it is due to improper usage of insulin by the body. Diabetes Type 2 is considered the most common type of diabetes (NIH, 2021). Advances in drugs also help lower blood sugar levels in Type 2 diabetes patients with less localized irritation but with faster and longer-lasting effects (International Federation of Pharmaceutical Manufacturers & Associations, 2021).

Figure 5: Medicines in Development

Source: ifpma.org

Many innovations in drug administration technology, alongside high-grade medication, are empowering patients to effectively manage their disease with confidence. We observe the different medicine development for diabetes in the following graph (International Federation of Pharmaceutical Manufacturers & Associations, 2021).

Figure 6: Medicines in Development for Diabetes and Related Conditions



Source: ifpma.org

Figure 6: Medicines in Development for Diabetes and Related Conditions (International Federation of Pharmaceutical Manufacturers & Associations, 2021)

4. **Blood glucose and A1C**

In order to verify if the patient has any type of prediabetes, type 1, type 2, or gestational diabetes; simple tests are available to get the result. For this section, a special emphasis on type 1 diabetes, type 2 diabetes, and prediabetes is made. Some of the most common tests to detect them are listed below:

- **A1C Test:**

The A1C measures the average blood sugar level over the past 2 or 3 months. An A1C below 5.7% is normal, between 5.7 and 6.4% indicates you have prediabetes, and 6.5% or higher indicates you have diabetes. (CDC, 2022)

- **Fasting Blood Sugar Test:**

Fasting Blood Sugar test verifies the level of blood glucose after overnight fasting. A fasting blood sugar level of 99 mg/dL or lower is normal, 100 to 125 mg/dL indicates you have prediabetes, and 126 mg/dL or higher indicates you have diabetes. (CDC, 2022)

- **Glucose Tolerance Test:**

Finally, this test analyzes the level of glucose before and after drinking a liquid containing sugar. To do it successfully, the person will have to fast overnight before the test. A first blood sample is taken out from the patient before drinking the liquid. The blood sugar level will be checked 1 hour; 2 hours and potentially 3 hours after drinking the beverage. At 2 hours, a blood sugar level of 140 mg/dL or lower is considered normal, 140 to 199 mg/dL indicates that the patient has prediabetes, and 200 mg/dL or higher indicates the presence of diabetes. (CDC, 2022)

In case of prediabetes, or any type of diabetes it is critical for the patient to talk with their doctor and nurse to get a detailed treatment plan to have a healthy and long life.

5. **The bias of data**

Algorithms are built around the premise of achieving a specific objective or task. Consistently in the pursuit for this, the nuances of the end user's well-being are overlooked and in the worst-case scenario exploited. This was showcased rather vividly in the Netflix documentary 'Coded Bias: Algorithm and Discrimination'. As these algorithms become more robust and scalable the importance of how they might affect society should be considered

proactively. Data is inherently biased as data is processed, analyzed, and interpreted by humans. Humans are traditionally trained in narrow-minded viewpoints, due to our cognitive biases that encourage 'shortcuts' to view any given situation. Therefore leveraging diverse viewpoints could be an effective way of broadening an individual's viewpoint. Learning the perspective of individuals with different backgrounds and walks of life can prove to be a valuable approach to programming. Encouragingly open source communities are already on the right track by being open to their challenges and success in coding.

It is highly recommended to take this route to accelerate your efforts as you approach this business challenge. Who knows which insights someone can find by paying attention to it.

6. The Business Problem and your role

Your journey as a business consultant just started. PharmaCo is hiring you to help them to increase their bottom line financial results. PharmaCo wants to know how the pharmaceutical industry is evolving. To do so PharmaCo understands the importance of Data Analytics and would like you to do some research on the most frequent medical treatments or diseases, to write business conclusions from it. You are free to choose the path you want for this problem. What PharmaCo should do as a next step to thrive in the industry?

To do your research, the consulting company INOVAlife kindly offers a repository of 200,000 files containing real-world data from PubMed medical knowledge base. Each of these files contains a summary of a science medical case report, about a given patient (or a small group of patients), their clinical diseases, treatments, and outcomes.

Do not forget that the data that is provided to you is general information; this means that it is your job as a Data Analyst to select the information that you need from the data set.

To access the repositories, you can connect directly on Github by clicking on the following link:
https://github.com/marcelotournier/case-report-dataset

During this hackathon, you will have three milestones to submit to your customer:

- **First delivery (Wednesday, 26th):** You will clean and structure the dataset and share with your customer the Motivation as well as a quick explanation on how you are going to attack the problem.
- **Second delivery (Friday, 28th):** By using R and Tableau, your team will have to create a report explaining all the insights they obtain from the dataset. Be **SMART** (Simple, Measurable, Achievable, Realistic, Trackable). Limit this report to 3 pages.
- **Third delivery (Saturday, 29th):** Pre-qualification presentation in front of a panel of judges; the presentation needs to be structured based on the 4M's (Motivation, Method, Mechanics, Message). ***Finalists will be chosen to participate in front of a professional panel the next day (Sunday, 30th)***!
- **Be creative!**

Resources

CDC, (2022). *All you need to know about A1C*. CDC. https://www.cdc.gov/diabetes/managing/managing-blood-sugar/a1c.html#:~:text=A%20normal%20A1C%20level%20is,for%20developing%20type%202%20diabetes

CDC, (2022). *Diabetes Tests*. CDC. https://www.cdc.gov/diabetes/basics/getting-tested.html

PharmaCo, (2021). *Pharmaco*. PharmaCo. https://pharmaco.com

National Institute of Diabetes and Digestive and Kidney Disease. (2021). *What is Diabetes?*. NIH. https://www.niddk.nih.gov/health-information/diabetes/overview/what-is-diabetes

Ellis, L. (2016).Snapshot of the American Pharmaceutical Industry. Harvard, T.h.Chan. https://www.hsph.harvard.edu/ecpe/snapshot-of-the-american-pharmaceutical-industry/

International Federation of Pharmaceutical Manufacturers & Associations. (2021, April). *The Pharmaceutical Industry and Global Health 2021.* Retrieved from ifpma.org: https://www.ifpma.org/wp-content/uploads/2021/04/IFPMA-Facts-And-Figures-2021.pdf