Open Payments is a national disclosure program that gives insight into the financial relationships of drug and medical device companies with physicians and teaching hospitals. It makes payment transactions between the two different types of entities available to the general public in an effort to increase transparency between patients and their healthcare providers. I carried out my exploration of the Open Payment datasets by looking into the 2020 Research Payments and the 2017 and 2020 Ownership Payments datasets. Below is a description of how I filtered each dataset before downloading the filtered dataset:

2020 Research Payments: The original dataset had 588,942 rows containing the payments received by physicians and teaching hospitals for research purposes from January 1, 2020 - Dec 31, 2020. In order to conduct a more focused research, I added two filters to this dataset, filtering it by state (to include only Illinois (IL)) and by recipient type (to include only teaching hospitals). This then reduced the dataset to 3,406 rows, creating a more niche and focused dataset, which I then downloaded to use in Jupyter. Since many of my friends are medical students who intend on coming to the US to complete their medical school journey, I was curious in examining the most popular research areas in Illinois during the Covid era and the teaching hospitals involved in these research fields and the amount of funding allocated to them.

2017 and 2020 Ownership Payments: I filtered both these datasets based on state (to include only Illinois (IL)). These datasets give me more insight into individual physician practices and physician specialties which receive the most funding and how these investments change over the years from 2017 to 2020. This reduced the size of the 2020 dataset from 3,238 rows to 112 rows and the size of the 2017 dataset from 3,218 rows to 119 rows. This would also help my friends in med school come to a more concrete conclusion about their field of study within medicine.

Analysis of 2020 Research Payments

After analyzing the dataset, the top 5 most popular research fields according to the highest number of occurrences in the dataset were as follows:

Using this information, I wanted to analyze which teaching hospitals partake in each research field, how much funding is allocated to each, and which entity is allocating the funding:

1) A phase 2, open-label, non-comparative, multicenter study to evaluate the safety and tolerability, efficacy and pharmacokinetics of Isavuconazonium Sulfate for the treatment of invasive aspergillosis (IA) or invasive mucormycosis (IM) in pediatric subjects:

Hospitals conducting this research	Number of Payments made to each hospital	Entity making payments	Total Funding received by the hospital
Ann & Robert H. Lurie Children's Hospital	98 payments, of equal value (315.39 USD)	Astellas US Technologies and Astellas Pharma Global Development	76405.83 USD
Total amount of payment made towards this research field:			76405.83 USD

2) TRuE AD2-An Efficacy and Safety Study of Ruxolitinib Cream in Adolescents and Adults With Atopic Dermatitis:

Hospitals conducting this research	Number of Payments made to each hospital	Entity making payments	Total Funding received by the hospital
Advocate Lutheran General Hospital	41	Incyte Corporation	119858.92 USD
Rush University Medical Center	17	Incyte Corporation	26889.04 USD
Loyola University Medical Center	14	Incyte Corporation	29055.06 USD
Total amount of payment made towards this research field:			175803.02 USD

3) NN9535-4321:

Hospitals conducting this research	Number of Payments made to each hospital	Entity making payments	Total Funding received by the hospital
Northshore University Healthsystem	63	Novo Nordisk Inc.	25515.27 USD
Total amount of payment made towards this research field:			25515.27 USD

4) Pallaspalbociclib collaborative adjuvant studya randomized phase iii trial of palbociclib with standard adjuvant endocrine therapy versus standard adjuvant endocrine therapy alone for HR or HER2 early breast cancer:

Hospitals conducting this research	Number of Payments made to each hospital	Entity making payments	Total Funding received by the hospital
Saint Anthony Medical Center	40	Pfizer Inc.	31900.0 USD
Carle Foundation Hospital	17	Pfizer Inc.	13300.0 USD
Board of Trustees of the University	5	Pfizer Inc.	3400.0 USD
Total amount of payment made towards this research field:			48600.0 USD

5) Abbott RealTime SARS-CoV-2 Reproducibility and Clinical Testing Study

Hospitals conducting this research	Number of Payments made to each hospital	Entity making payments	Total Funding received by the hospital
Northshore University Healthsystem	62	Abbott Laboratories	294479.75 USD
Total amount of payment made towards this research field:			294479.75 USD

Depicted below is a graph of the total amount of payment allocated towards each research field. From this graph, let us analyze the two greatest amount of payments made. The first one was made by Abbott Laboratories to Covid research. This makes sense since the presence and surge of Covid in the US began in 2020, which would explain the huge sum of money allocated to the Clinical Testing study. According to Statista, Abbott's revenue reached a record high of 34.6B USD in 2020 since 2011, which explains its ability to invest large amounts into Covid research. The second greatest amount of payment was made towards the testing of the Ruxolitinib cream as a treatment for Atopic Dermatitis, which was recently approved by the FDA in September 2021 (AJMC). The constant success of the various phases of this research in 2020, as is evident in the press releases from Incyte, explains why Incyte was compelled to continually invest large sums of money in 2020.

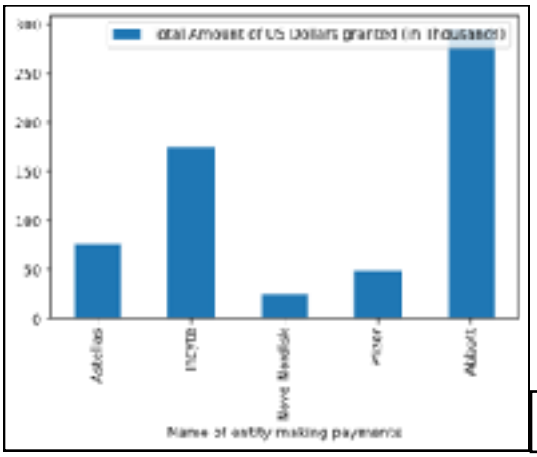

Figure 1: Amount of US Dollars granted to each field of study

Analysis of 2017 and 2020 Ownership Payments

This next part of the study gives more insight into investments made for physicians with varying specialties. In order to analyze and compare the frequency of each physician specialty and the amount of investment that each one received in 2020, I created two horizontal bar plots shown below:

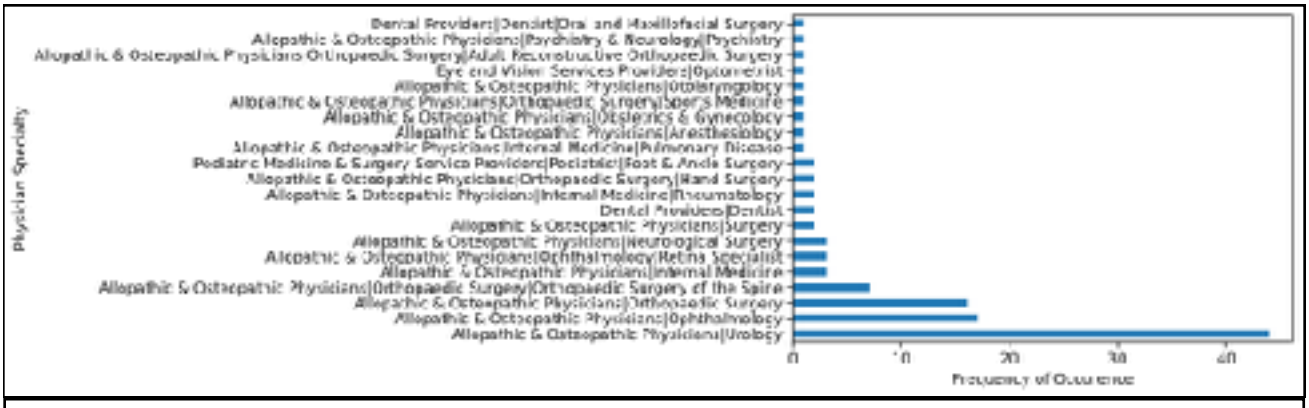

Figure 2: Frequency of each physician specialty

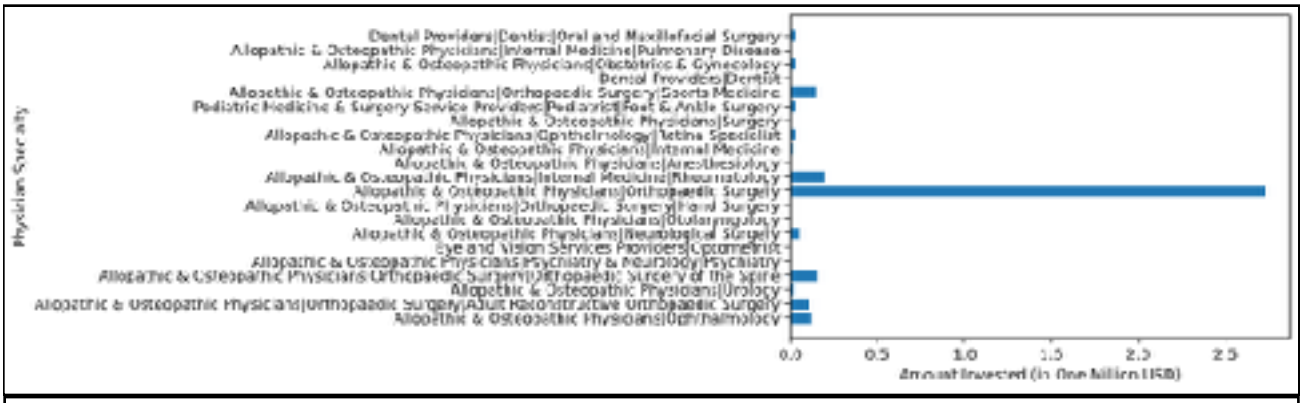

Figure 3: The amount invested in each physician specialty

As can be seen from the above graphs, the highest number of investments was made to Urology physicians. However, the amount of the total investment into Urology specialists is still far less than the highest amount of investment, which was to Orthopaedic Surgery specialists in 2020, the frequency of which is much less than that of Urology specialists. As calculated in my Jupiter Notebook, the percent increase in the frequency from Orthopaedics to Urology was 175%, and the percent increase in the investment amount from Urology to Orthopaedics was around 21017%. This observation is important because a greater number of investments made in smaller amounts signals less confidence in the investment than smaller amount of investments made in much larger amounts. Thus, from this observation, we can deduce that investors saw greater, better opportunity in the field of Orthopaedic

Surgery than in that of Urology. According to an article in the *Journal of Orthopaedic Experience and Innovation*, the demand for orthopedic care in the US is very high, but the supply of orthopedic surgeons is relatively low. So this imbalance in supply-demand is what makes this market very attractive since it has a lot of potential for growth. This could help explain why the total amount of investment made towards Orthopaedic Surgery specialists is the highest in the dataset.

Focusing on the investments of the Orthopaedic Surgery field, let us now compare the total amount of investment as well as the investors (the sources of the payments) in 2017 and in 2020. As I compared edited versions of the two datasets, I noticed something very interesting: although the total amount of investment more than doubled from 2017 to 2020 from 16,619,775.8 USD in 2017 to 2,731,856.5 USD in 2020, the number of investors decreased. My findings are summarized in the tables below:

Investors	Number of investments made	Investment made in 2017	Investment made in 2020
Vertebral Technologies, Inc.	6	Yes	Yes
United Rheumatology	2	Yes	No
Consensus Orthopedics, Inc.	2	No	Yes
Joint Active Systems, Inc.	2	Yes	Yes
Arthrosurface Incorporated	1	Yes	No
Innovation Technologies Inc	1	Yes	Yes
Catalyst OrthoScience	1	Yes	Yes
Spinal Simplicity, LLC	1	Yes	No
ORTHOSENSOR INC	1	Yes	No
CROSSROADS EXTREMITY SYSTEMS, LLC	1	No	Yes
4WEB, INC.	1	Yes	Yes
Nanovis LLC	1	Yes	Yes
SI-BONE, Inc.	1	Yes	No
Romark Laboratories, LC	1	Yes	Yes
Number of Investments made		19	16

Since the value of investments increased, but the number of investments decreased, this aligns with the logic explained earlier, wherein greater investment amounts in smaller quantities reveal greater confidence in the investments. Since the Orthopaedics industry is constantly growing, we can notice this increasing positive investor sentiment due to the increasing growth and sustained potential of this industry. We can deduce from the table above that this field lost 5 investors from 2017 to 2020: United Rheumatology, Arthrosurface Incorporated, Spinal Simplicity LLC, Orthosensor Inc, and SI-Bone Inc., and gained 2 new investors: Consensus Orthopedics, Inc., and Crossroads Extremity Systems, LLC.

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