Analyzing US Insurance Claim Data

Introduction

In this project, we analyze the US insurance market using Insurance Claim data - All-Payer Claim Data (APCDs) for the year 2016 in this case. APCDs are databases that include medical claims, pharmacy claims, dental claims, and eligibility and provider files collected from private and public payers. For this assignment, we used four databases. These databases are inpatient file reports, outpatient reports, emergency room reports, and revenue reports.

In our analysis, we start by following the journey of seven patients and their interaction with the healthcare system. For each patient, we identify their demographics, type of illness, doctor diagnosis, services/drugs provided, and the costs associated with each diagnosis. We also supplement this analysis with relevant additional information.

We proceed by analyzing the services and costs provided by the major insurance providers for inpatient hospitalizations. The major insurance providers are Medicare, Medicaid, and Commercial Payers (Blue Cross and Commercial Insurance). Here we calculate the total costs for these major insurance providers across the 25 Major Diagnostic Categories (MDC).

Lastly, we analyze the severity of illicit drugs and prescription drugs overdose in the US using the emergency room data. We calculate the size of ED visits related to drug abuse and the associated type of diagnosis. We also analyze the distribution opioid and drug abuse across gender and location in the US.

Results and Discussions

Patient vignettes / Understanding Data

- **ID: 507033**

This is a female patient within the age of 25-29 who lives in a city/town in Vermont. She voluntarily left her home and went to Northwestern Medical Center in the state. This patient went to the hospital as she was in labor. She was diagnosed with a 40 week pregnancy due delivery. The doctors at the hospital rendered to her two services namely *"Delivery of Products of Conception, External Approach"* and *"Drainage of Amniotic Fluid, Therapeutic from Products of Conception, Via Natural or Artificial Opening"*. The patient successfully conceived a baby while admitted at the hospital. Her delivery proceeded without any complications and she was discharged home the following day. The costs associated with this trip came up to $3,233.29 with

labor room charges accounting for the most at 39.4% ($1273.76). Here is a detailed breakdown of the costs that she incurred.

Room & Board -Semi-Private 2 beds ($1002.13); Clinical Diagnostic ($341.00); Medical/Surgical Supplies: Sterile supplies ($334.33); Pharmacy: IV solutions ($92.10), Pharmacy ($83.44); Medical/Surgical Supplies ($75.22); and Pharmacy: Other ($31.31). Her principal payment source for this hospital visit is Blue Cross Insurance Company. Across the US, a baby delivery without complications costs $2,600 for those with health insurance. This brief exercise suggests that the cost of having a baby in Vermont might be higher than in other states.

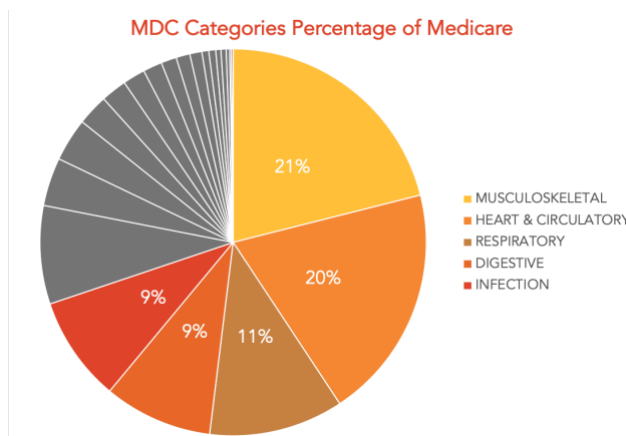## Service and Cost Profile Of major insurances

1. Medicare

Figure 2.1

Medicare is primarily known as the United States federal health insurance program that is available to the senior US citizen who is 65-year-old or older. On top of this, Medicare also offers health coverage to people who have a disability, regardless of their income. Bearing those thoughts in mind, we hypothesize that the most common MDC's covered by Medicare reflect the most prevalent diseases among the elder. It comes as no surprise that, as is shown in the pie chart, Musculoskeletal and Heart & Circulatory relevant diseases are the two major problems, together accounting for more than 40% of all major diagnostic categories. Brain & Central Nervous System related diseases come in third place. According to MedlinePlus, as we age, our brains and spinal cord lose nerve cells and weight, and this can cause abnormal changes in the brain called plaques and tangles to form. The fact that aging can affect your senses and possibly lead to diseases further validates our assumption that the major components in the charts are diseases the elder tend to suffer.
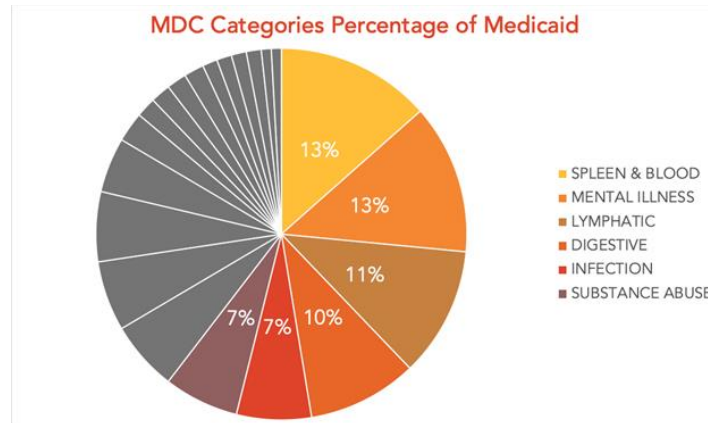
2.   Medicaid

Figure 2.2

Medicaid is different from Medicare, which is a state and federal program that provides health coverage if you have a very low income. From this pie chart, we can notice that SPLEEN & BLOOD and MENTAL ILLNESS have the highest proportion. Our assumption is that low income people may drink more often and not have a particularly stable life, which may lead to spleen & blood problems. Meanwhile, low-income people face huge life pressure compared with middle or high income groups, thus they are more likely to suffer from mental illness. For example,depression is a very common psychological disease, people may suffer from it because of various life shocks, and the poor are more likely to suffer from it than the rich. Lymphatic and digestive diagnoses account for more than 10% of Medicaid services portfolio, which also supports our assumption that the low-income group is more likely to suffer from digestive diseases because it would be more difficult for them to keep a healthy and hygienic eating habits due to poverty. Another MDC category we cannot ignore is substance abuse, which presents 7% of Medicaid services portfolio. Our assumption is that low-income people are more likely to abuse drugs, such as addiction to some dependent or hallucinogenic drugs.
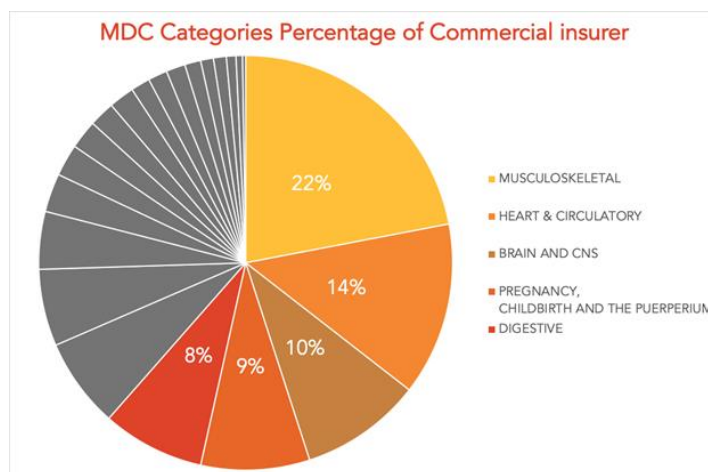
3. Commercial insurers

Figure 2.3

Commercial Insurers provide insurance to everyone who is ineligible for Medicare and Medicaid. These would predominantly be adults below the age of 65 with relatively healthy lifestyles. The proportion of men in this coverage might also be higher since some adult women(pregnant women) are eligible for Medicaid. Consequently, our hypothesis would be that the most common MDC's covered by Commercial Insurers reflect the most common diseases among adults. The pie chart above supports this assumption with *Musculoskeletal* diagnoses being the highest at 13% of Commercial Insurers' inpatient services portfolio. The incidence rate for these ailments such as accidents, falls, fractures, and dislocations is higher since most people in this age group are more likely to live an active lifestyle. *Brain & Central Nervous System* diseases and *Heart & Circulatory* diseases are also common in this age group. More importantly, adults in the group are in the child-bearing stage of their lives. Therefore it is not surprising that *Pregnancy, Childbirth, and Puerperium* hospitalizations are in the top five with 9% of all charges for Commercial Insurers.

Illicit drugs and prescription opioids use/abuse/overdose

Drug use/abuse situation:
Drug overdose has become a severe problem in the US causing many unnecessary cost and losses. Therefore, we were curious about how many ED patients in our data set had been drug abuse. After processing the data, we found 2151 ED visits have been diagnosed as drug user/abuser.

Gender bias:
We also want to check if men and women have significant differences in drug using/abusing. In our case, all the N/A values in "sex" column had been dropped. After aggregation, we got the data as below and applied Fisher Exact test:

	Male	**Female**	*Total*
Not drug use/abuse	123149	140553	**263702**
% within	46.3%	52.9%	**99.2%**
Drug use/abuse	1009	1141	**2150**
% within	0.38%	0.42%	**0.8%**
Total	**124158**	**141694**	**265852**
% total	**46.7%**	**53.3%**	**100.0%**

Table 3.1 Fisher Exact test results

Odds ratio = 0.99, P-value = 0.84

Analysis:

According to the cross table above, there are small differences in drug use/abuse between male and female patients. After Fisher Exact testing, we found no statistically significant gender bias on drug use/abuse as the p-value was greater than 0.05, which means women have no better protection measures to stay away from drug use/abuse than men.

Payment on drug overdose:

There are tens of millions of dollars reportedly spent on drug use related cases the year alone. Below listed the exact dollar amount for identified patients and the share of each of the total payment of Medicare, Medicaid and Commercial Payers.

Type of Insurance Company	Amount
Medicare	**17237917.63**
Medicaid	6713846.42
Commercial Payers	5777497.88
Total Payment	**30741219.53**

Table 3.4

Medicare companies take up more than half of the payment and Medicaid has slightly more than Commercial companies.
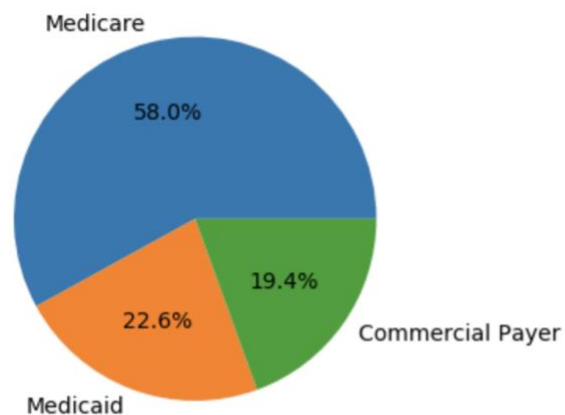

Figure 3.1 Amount share across Medicaid, Medicare and commercial players

Synthetic Narcotics Related Issue:

The use of synthetic narcotics is rising alarmingly in part due to the marketing campaign for such meds. There were **156** cases on record that patients were brought to ED for diagnosis related to synthetic narcotics or amphetamines.

Top 3 Zip code regions in drug abuse:

Zip	Detail	Number of cases
054	Zip in 05400-05499 range, excluding Burlington to Saint Albans	326
057	Zip in 05700-05799 range, excluding 05701	214
05701	Rutland	181

Table 3.2 Top 3 Zip code regions in drug abuse

10 most common diagnoses of drug abuse:

Diagnosis code	Detail	Number of cases
T401X1A	Poisoning by heroin, accidental (unintentional), initial encounter	258
T402X5A	Adverse effect of other opioids, initial encounter	256
T424X2A	Poisoning by benzodiazepines, intentional self-harm, initial encounter	123
T424X5A	Adverse effect of benzodiazepines, initial encounter	114
T40605A	Adverse effect of unspecified narcotics, initial encounter	112
T43222A	Poisoning by selective serotonin reuptake inhibitors, intentional self-harm, initial encounter	82
T402X1A	Poisoning by other opioids, accidental (unintentional), initial encounter	81
T424X1A	Poisoning by benzodiazepines, accidental (unintentional), initial encounter	80
T426X5A	Adverse effect of other antiepileptic and sedative-hypnotic drugs	75
T426X2A	Poisoning by other antiepileptic and sedative-hypnotic drugs, intentional self-harm	74

Table 3.3 Top 10 most common diagnoses of drug abuse

Analysis:

After summarizing the drug abuse data, we found that the most zip code regions where most drug abuse cases happen are zip codes starts with 054 and 057 (Burlington and Rutland). The

most common diagnoses of drug abuse in the emergency department include heroin, opioids and benzodiazepines.

Conclusion

The analysis on patient vignettes has enlightened us on the reason patients visit a hospital. We have learned how healthcare providers capture and manage information associated with each patient visit. More importantly, we have discovered some of the most expensive one-time services/products that hospitals can provide to a patient. These include cardiology ($23,275), body implants ($10,696) and psychiatric services ($10,666).

Our analysis also shows that there is variation in the inpatient services portfolio among Medicare, Medicaid, and Commercial insurers. Our results show that Spleen and Blood illnesses are the most common MDC for Medicaid. On the contrary, Musculoskeletal illnesses are the most common MDC for both Medicaid and Commercial insurers with a share of 22% and 21% respectively. This variation in the top five MDCs is mostly attributed to the demographics of patients under coverage in each insurance type. Medicare has more MDCs associated with older people, Medicaid has more MDCs common among lower income individuals, and Commercial insurers have more MDCs common among healthy adults.

The Emergency Department data shows 2151 ED visits have been diagnosed as drug overdose. Our analysis presents no statistical evidence on gender bias on drug abuse. After summarizing the drug abuse data, we found that 156 patients were brought to ED for diagnosis related to synthetic narcotics or amphetamines. Also, most drug abuse cases happened in Burlington and Rutland and the most common diagnoses of drug abuse in emergency department include heroin, opioids and benzodiazepines. Besides, it is presented that Medicare companies take up more than half of the payment in emergency department, and Medicaid takes over one fifth and has slightly more than Commercial companies.

Recommendation

ACPDs collect and store patient and provider claims data including the amount charged to patients and paid by payers. "You can't manage what you can't measure." Based on the current database, we recommend policymakers and hospital admissions make ACPDs more transparent tools and provide patients and healthcare service researchers with critical information in a timely manner.

According to our analysis, the top 3 MDC categories, Musculoskeletal, Heart & Circulatory and Respiratory, charged by Medicare insurance companies are not covered by any of the major categories of Medicaid insurance, while commercial payers share some common major services with both Medicare and Medicaid but still have their own focus. Different insurance companies have their own target services. In this case, on the patients' behalf, it is important to understand

the insurance options, rights, and protections and learn how to get a fast appeal for Medicare-covered services needed, especially for those elders in our family. For the payers, there are also some takeaways from the data. Stockholders can find services that are most demanded and design insurance packages that are more customized for their target market.

Drug overdose causes too many costs and losses. There are more than 2000 cases reported with drug use/abuse issues. Both government and payers should keep an eye on the providers' records of drugs overdose while choosing hospital or health service facility they cooperate with. Also, there should be penalty for providers that are involved with this issue frequently.

Reference

- https://dexur.com/icd10/T401X1A/ -ICD 10 Diagnosis Codes
- https://www.findacode.com/cpt-code-set.html -CPT Procedure Codes

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