HS256F - Healthcare Data Analytics and Data Mining

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Homework 2

INSURANCE MARKET DATA AND ANALYTICS

Group 4

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INTRODUCTION

The Centers for Medicare and Medicaid Services, commonly known as CMS, is the agency within the United States' Health and Human Services(HHS) department responsible for overseeing the nation's major healthcare programs including Medicare, Medicaid, CHIP (Children's Health Insurance Program), as well as some state and federal health insurance marketplaces (KAGAN, n.d.).

The Medicare program, which this paper focuses on is a program designed to cater to the health insurance needs of people in the United States over the age of 65 years (Medicare.gov, n.d.). Offering a variety of plans for this select subset of the United States population, Medicare is largely funded by two specific trust funds of the country's treasury - the Hospital Insurance (HI) Trust Fund, and the Supplementary Medical Insurance (SMI) Trust Fund (Medicare.gov, n.d.). There are different parts of the Medicare program - Part A, which is basically hospital insurance, Part B, which is medical insurance for outpatient care, and Part D which is coverage for prescription medication (CMS.gov, 2021). Part C of the Medicare program, largely called Medicare Advantage (MA) Plans, are the plans where the CMS contracts insurance benefits of its beneficiaries to private insurance companies (Razavi, 2022).

This report aims to analyse the data collated by the CMS on the Part C model of its services for Hawaii, Michigan, Minnesota, Mississippi, New York, Oklahoma, South Dakota and Tennessee, and equip Congress with the necessary details to make informed decisions regarding moving to a private quasi single-payer model in these states. This report also contains information beneficial to certain sub-committees on the benefit packages offered in these states, dental packages, as well as efforts by insurance companies contributing to the mitigation of the opoid crisis.

A combination of statistical packages were used in this analysis including STATA/SE 17.0, Python, and Microsoft Excel, and subsets of the main dataset were created as necessary.

PART 1

This portion of the report seeks to analyse the data provided by the CMS on enrollment across the eight states mentioned previously and provide recommendations using the Herfindal-Hirschman Index as the yardstick for understanding the market concentration and making recommendations regarding possible partners for Congress in the consideration for a move to a private quasi single-payer model in the states in question.

METHOD: Using STATA/SE 17.0, the enrollment data for the eight states in question were filtered and cropped out to create a sub database. Data for contracts with less than 11 enrollments were also filtered out of the sub-dataset and then Microsoft Excel was used to carry out further analysis to arrive at the market share and Herfindal-Hirschman Index for each state. Additional data sets detailing the plans and organizations responsible were used to aid the analysis process.

RESULT & ANALYSIS: The result obtained from this process showed as seen in Table 1 that South Dakota had the highest HHI, with Oklahoma, Mississippi and Michigan following closely behind. This indicates how highly concentrated the insurance market in these four states are with some organizations taking the lion share of the enrollment in those states.

State	HHI	Company with lion share	Market Share of company
South Dakota	4635	UnitedHealthcare	62.91
Oklahoma	3052	UnitedHealthcare	46.9
Mississippi	2604	Humana	42.55
Michigan	2602	BlueCrossBlueShield	45.09

Table 1 : Data showing the states with the highest HHI of the eight and the companies with the largest market share.

Figure 1: Chart showing the market share of the insurance companies in South Dakota

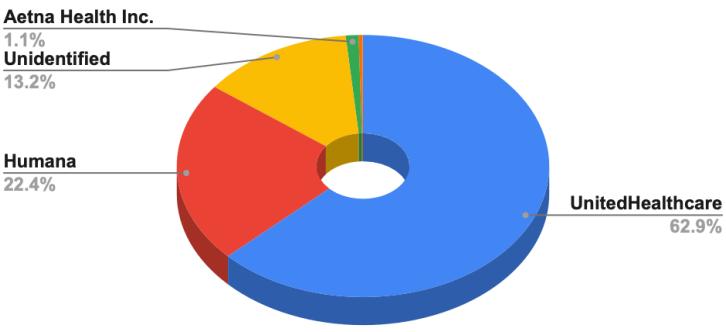


Figure 2: Chart showing the market share of insurance companies in Oklahoma

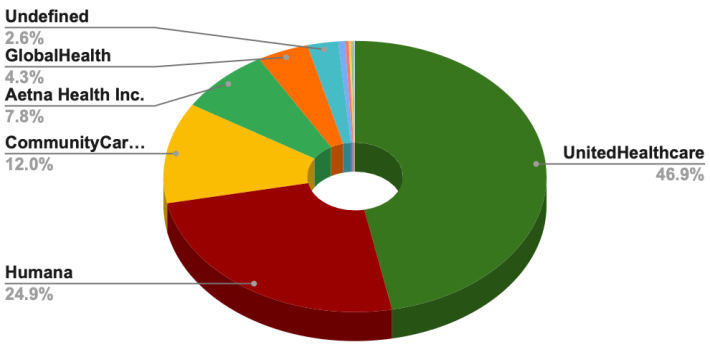


Figure 3: Chart showing the market shares of insurance companies in Mississippi

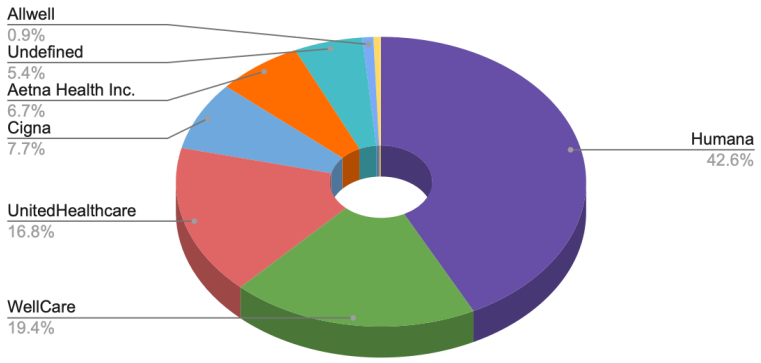
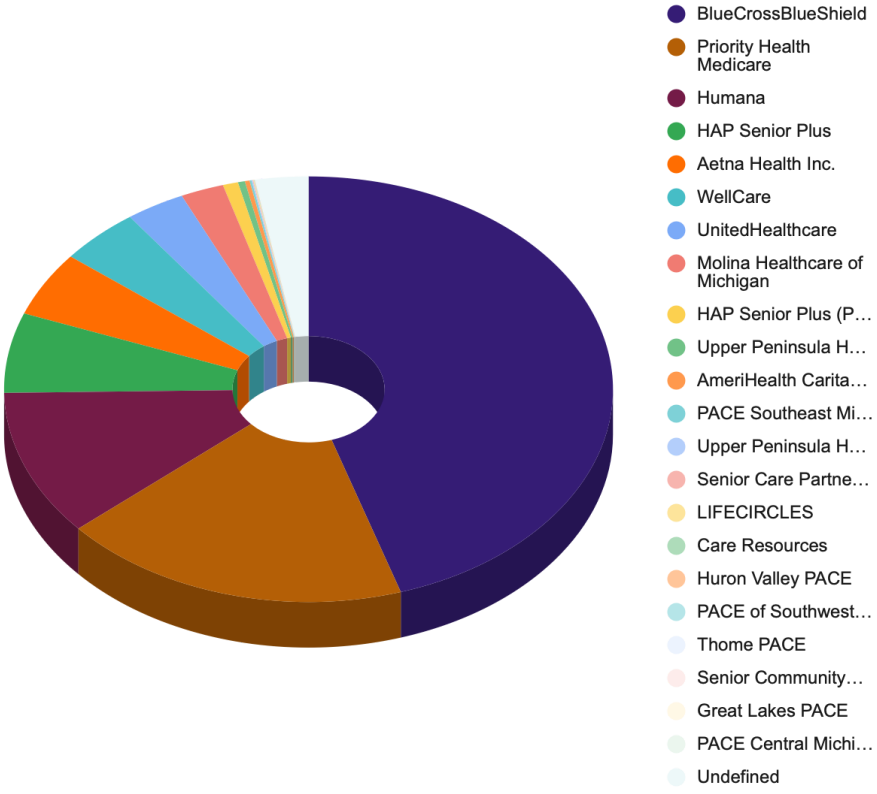


Figure 4: Chart showing the market shares of insurance companies in Michigan



PART 2

This portion of the report seeks to detail the benefit packages as it relates to dental coverage across the eight states.

METHOD: The dataset was loaded and filtered for the states that this report focuses on. The dental benefit database was then merged with the enrollment database and information per state and top insurers were reported. Notably, to keep the data format consistent, all the leading zeros in the 'Plan ID' variable were filtered out.

The datasets used for this include:

- enrollment: CPSC_Enrollment_Info_2022_01.csv
- plan: Monthly_Report_By_Plan_2022_01.xlsx
- dental: pbp_b16_dental.txt

And then, we filter out group 4 States.

In the next step, we merge the dental benefit database with enrollment database on both Contract Number and Plan ID to retrieve the dental benefit information in columns 'pbp_b16a_bendesc_yn' and 'pbp_b16b_bendesc_yn'.

After that, we merge the temporary dataframe with the plan database to fetch the insurer info.

Now, the head of the dataframe could be shown as:

```
In [9]: df.head()
```

Out[9]:

	Contract Number	Plan ID	State	pbp_a_hnumber	pbp_a_plan_identifier	segment_id	pbp_b16a_bendesc_yn	pbp_b16b_bendesc_yn	Organization Name
0	H0022	1	HI	H0022	1	0	1.0	1.0	BUCKEYE COMMUNITY HEALTH PLAN, INC.
1	H0022	1	MI	H0022	1	0	1.0	1.0	BUCKEYE COMMUNITY HEALTH PLAN, INC.
2	H0022	1	MI	H0022	1	0	1.0	1.0	BUCKEYE COMMUNITY HEALTH PLAN, INC.
3	H0022	1	MI	H0022	1	0	1.0	1.0	BUCKEYE COMMUNITY HEALTH PLAN, INC.
4	H0022	1	MI	H0022	1	0	1.0	1.0	BUCKEYE COMMUNITY HEALTH PLAN, INC.

After that, we report the dental benefit by the States. We used the groupby function followed by the count function to figure out how many records in an individual state do enjoy the dental benefit. (with value 1 in column 'pbp_b16a_bendesc_yn' or 'pbp_b16b_bendesc_yn')

By dividing the number by the total number of records in an individual state, we are able to get the percentage of enrollees enjoying the dental benefit. The summary table could be shown below.

State	p_dental_perc	c_dental_perc
HI	11.77%	10.33%
MI	15.95%	15.14%
MN	8.17%	7.95%
MS	5.80%	5.64%
NY	14.06%	12.53%
OK	5.78%	5.20%
SD	3.30%	3.22%
TN	9.87%	9.51%

Note: Column 'p_dental_perc' is the percentage of enrollees enjoy the 'Preventive Dental Items as a supplemental benefit under Part C'; column 'c_dental_perc' is the percentage of enrollees enjoy the 'Comprehensive Dental Items as a supplemental benefit under Part C'

Finally, we came up with the dental benefit by the top-5 major insurance companies. We used the groupby function followed by the count function and sort_values function to determine the top-5 insurance companies with the most enrollees, respectively 'Care Improvement Plus South Central Insurance Co.', 'Sierra Health And Life Insurance Company, Inc.', 'Anthem Insurance Companies, Inc', 'Human Insurance Company', 'Aetna Life Insurance Company'.

And then, we repeated the process undertaken in the last step to come up with the percentage of enrollees enjoying the dental benefit by the insurance company.

Organization Name	p_dental_perc	c_dental_perc
AETNA LIFE INSURANCE COMPANY	20.31%	20.29%
ANTHEM INSURANCE COMPANIES, INC.	0.44%	0.15%
CARE IMPROVEMENT PLUS SOUTH CENTRAL INSURANCE CO.	1.36%	1.11%
HUMANA INSURANCE COMPANY	39.66%	39.15%
SIERRA HEALTH AND LIFE INSURANCE COMPANY, INC.	0.11%	0.10%

PART 3 - Quality of care and performance of the plans

Drug addiction has become a national crisis in the US. Research suggests that prescription opioids play an essential role in addition in the US. This section explores the weighted rate of drug use, which is reported by the variable name UOD (Use of Opioids at High Dosage and the Measure Code) Rate in the following report, for all top-10 insurance companies in each state and ranks their performances.

Method: Using Python, there are 5 steps here. Four datasets are imported are:

- CPSC_Enrollment_Info_2022_01.csv: detailed information from contract level goes down to plan level.
- Monthly_Report_By_Plan_2022_01.xlsx: local/ regional subsidiary and the contract they offered
- MajorInsuranceOrgs.xlsx: the major insurance company behind the smaller entities
- HEDIS2021.xlsx: UOD rate of each contract

Step 1: Creat sub-dataset based on conditions

The data for the eight states for our group was filtered and cropped out. Based on the 8 states dataset, all the Hxxx, Rxxx, and Exxx contracts were kept and all Sxxx contracts were excluded because we focus only on health products. Additionally, all row were dropped if the number of enrolled beneficiaries is missing or marked with *, finally a new enroll information dataset were created.

Step 2: Merge datasets to show the whole image of every contract

Enroll information dataset was left joined with monthly report dataset on the variable Contract Number. The return is every contract information and matched entity. And then the new dataset was left joined with the MajorInsuranceOrgs dataset to find out the big insurance company behind subsidiaries for each contract. Now the final dataset details the information of every contracts from the big company behind them to the number of enrollees.

Step 3: Find out top-10 biggest market share insurance company in each state

The final dataset was grouped by variable State and MajorInsuranceOrgName, number of enrollees in each group was calculated so that we got the total number of enrollment of each company in each state. These data were divided by the total number of enrollment of all companies to figure out the market share of each company within each state. The top-10 biggest share company can be seen in the picture below:

State		MajorInsuranceOrgName	market_share
HI	0	UnitedHealthcare	80.70%
	1	Humana	7.97%
	2	Kaiser	7.74%
	3	Lasso Healthcare	0.00%
MI	0	Priority Health Medicare	40.91%
	1	UnitedHealthcare	30.11%
	2	HAP Senior Plus	21.53%
	3	Aetna Health Inc.	4.10%
	4	HAP Senior Plus (PPO)	1.57%
	5	Upper Peninsula Health Plan (UPHP) MI Health Link	0.12%
	6	AmeriHealth Caritas VIP Care Plus	0.08%
	7	PACE Southeast Michigan	0.07%
	8	Upper Peninsula Health Plan	0.03%
	9	Senior Care Partners P.A.C.E.	0.03%
MN	0	UCare	38.26%
	1	UnitedHealthcare	38.09%
	2	BlueCrossBlueShield	7.87%
	3	Aetna Health Inc.	3.26%
	4	HealthPartners	0.49%
	5	UCare's MSHO	0.41%
	6	PrimeWest Health	0.05%
	7	South Country Health Alliance	0.04%
	8	Itasca Medical Care/IMCare Classic	0.01%
	9	Lasso Healthcare	0.01%
MS	0	Humana	63.58%
	1	UnitedHealthcare	6.19%
	2	Aetna Health Inc.	0.36%
	3	Lasso Healthcare	0.00%

NY	0	UnitedHealthcare	67.11%
	1	Aetna Health Inc.	6.30%
	2	MVP HEALTH CARE	6.15%
	3	BlueCrossBlueShield	2.50%
	4	MetroPlus Health Plan	0.45%
	5	VillageCareMAX	0.11%
	6	Bright Health	0.05%
	7	ArchCare Advantage	0.02%
	8	Healthfirst Medicare Plan	0.01%
	9	Catholic Health LIFE	0.01%
OK	0	UnitedHealthcare	63.20%
	1	Aetna Health Inc.	36.50%
	2	BlueCrossBlueShield	0.20%
	3	Humana	0.10%
SD	0	UnitedHealthcare	14.80%
	1	Aetna Health Inc.	7.37%
	2	Humana	5.95%
	3	HealthPartners	0.17%
	4	Lasso Healthcare	0.01%
TN	0	UnitedHealthcare	60.48%
	1	BlueCrossBlueShield	1.99%
	2	Aetna Health Inc.	0.42%

From the table above we can see that UnitedHealthcare is the most popular insurance company in the 8 states because it accounts for a large portion market share in each state.

Step 4: calculate the rate for every contract offered by the top-10 biggest companies in each state

In this part, each state dataset was filter out and then group by contract number and insurance company. For each contract within companies, the number of contract was divided by the total number of contracts in that state, then the rate was calculated and can be seen in the tables below:

- HI - Hawaii

	MajorInsuranceOrgName	Contract Number	num_contrct	rate_contract
0	Humana	H0028	369	0.49%

1	Humana	H1036	2093	2.76%
2	Humana	H2944	39	0.05%
3	Kaiser	H1230	150	0.20%
4	Lasso Healthcare	H1924	24	0.03%
5	UnitedHealthcare	H0251	354	0.47%
6	UnitedHealthcare	H0271	1650	2.17%
7	UnitedHealthcare	H0294	450	0.59%
8	UnitedHealthcare	H0710	603	0.79%
9	UnitedHealthcare	H1278	294	0.39%
10	UnitedHealthcare	H1537	248	0.33%
11	UnitedHealthcare	H2001	66048	86.94%
12	UnitedHealthcare	H2196	138	0.18%
13	UnitedHealthcare	H2228	1089	1.43%
14	UnitedHealthcare	H2247	51	0.07%
15	UnitedHealthcare	H2292	114	0.15%
16	UnitedHealthcare	H2577	1950	2.57%
17	UnitedHealthcare	H3307	306	0.40%

- MI - Michigan

	MajorInsuranceOrgName	**Contract Number**	**num_contrct**	**rate_contract**
0	Aetna Health Inc.	H1608	980	1.15%
1	Aetna Health Inc.	H2663	84	0.10%
2	Aetna Health Inc.	H3146	320	0.38%
3	Aetna Health Inc.	H3192	297	0.35%
4	Aetna Health Inc.	H3219	560	0.66%
5	Aetna Health Inc.	H3239	105	0.12%
6	Aetna Health Inc.	H3288	3339	3.93%
7	Aetna Health Inc.	H3312	1265	1.49%
8	AmeriHealth Caritas VIP Care Plus	H0192	3	0.00%
9	HAP Senior Plus	H2354	1408	1.66%

10	HAP Senior Plus (PPO)	H2322	324	0.38%
11	PACE Southeast Michigan	H2318	6	0.01%
12	Priority Health Medicare	H2320	2871	3.38%
13	Senior Care Partners P.A.C.E.	H1310	6	0.01%
14	UnitedHealthcare	H0251	354	0.42%
15	UnitedHealthcare	H0271	1650	1.94%
16	UnitedHealthcare	H0294	450	0.53%
17	UnitedHealthcare	H0710	603	0.71%
18	UnitedHealthcare	H1278	294	0.35%
19	UnitedHealthcare	H1537	248	0.29%
20	UnitedHealthcare	H2001	66048	77.78%
21	UnitedHealthcare	H2196	138	0.16%
22	UnitedHealthcare	H2228	1089	1.28%
23	UnitedHealthcare	H2247	51	0.06%
24	UnitedHealthcare	H2292	114	0.13%
25	UnitedHealthcare	H2577	1950	2.30%
26	UnitedHealthcare	H3307	306	0.36%
27	Upper Peninsula Health Plan	H2161	34	0.04%
28	Upper Peninsula Health Plan (UPHP) MI Health Link	H1977	15	0.02%

- MN - Minnesota

	MajorInsuranceOrgName	**Contract Number**	**num_contrct**	**rate_contract**
0	Aetna Health Inc.	H1608	980	1.13%
1	Aetna Health Inc.	H2663	84	0.10%
2	Aetna Health Inc.	H3146	320	0.37%
3	Aetna Health Inc.	H3192	297	0.34%
4	Aetna Health Inc.	H3219	560	0.64%
5	Aetna Health Inc.	H3239	105	0.12%
6	Aetna Health Inc.	H3288	3339	3.84%
7	Aetna Health Inc.	H3312	1265	1.46%

8	BlueCrossBlueShield	H0107	66	0.08%
9	BlueCrossBlueShield	H1732	186	0.21%
10	BlueCrossBlueShield	H2425	62	0.07%
11	BlueCrossBlueShield	H2461	720	0.83%
12	BlueCrossBlueShield	H3259	212	0.24%
13	HealthPartners	H2422	12	0.01%
14	HealthPartners	H2462	403	0.46%
15	Itasca Medical Care/IMCare Classic	H2417	1	0.00%
16	Lasso Healthcare	H1924	24	0.03%
17	PrimeWest Health	H2416	13	0.02%
18	PrimeWest Health	H2926	2	0.00%
19	South Country Health Alliance	H2419	9	0.01%
20	UCare	H0422	16	0.02%
21	UCare	H2459	4908	5.65%
22	UCare's MSHO	H2456	63	0.07%
23	UnitedHealthcare	H0251	354	0.41%
24	UnitedHealthcare	H0271	1650	1.90%
25	UnitedHealthcare	H0294	450	0.52%
26	UnitedHealthcare	H0710	603	0.69%
27	UnitedHealthcare	H1278	294	0.34%
28	UnitedHealthcare	H1537	248	0.29%
29	UnitedHealthcare	H2001	66048	75.97%
30	UnitedHealthcare	H2196	138	0.16%
31	UnitedHealthcare	H2228	1089	1.25%
32	UnitedHealthcare	H2247	51	0.06%
33	UnitedHealthcare	H2292	114	0.13%
34	UnitedHealthcare	H2577	1950	2.24%
35	UnitedHealthcare	H3307	306	0.35%

- MS - Mississippi

	MajorInsuranceOrgName	**Contract Number**	**num_contrct**	**rate_contract**

0	Aetna Health Inc.	H1608	980	1.18%
1	Aetna Health Inc.	H2663	84	0.10%
2	Aetna Health Inc.	H3146	320	0.39%
3	Aetna Health Inc.	H3192	297	0.36%
4	Aetna Health Inc.	H3219	560	0.68%
5	Aetna Health Inc.	H3239	105	0.13%
6	Aetna Health Inc.	H3288	3339	4.03%
7	Aetna Health Inc.	H3312	1265	1.53%
8	Humana	H0028	369	0.45%
9	Humana	H1036	2093	2.53%
10	Humana	H2944	39	0.05%
11	Lasso Healthcare	H1924	24	0.03%
12	UnitedHealthcare	H0251	354	0.43%
13	UnitedHealthcare	H0271	1650	1.99%
14	UnitedHealthcare	H0294	450	0.54%
15	UnitedHealthcare	H0710	603	0.73%
16	UnitedHealthcare	H1278	294	0.36%
17	UnitedHealthcare	H1537	248	0.30%
18	UnitedHealthcare	H2001	66048	79.80%
19	UnitedHealthcare	H2196	138	0.17%
20	UnitedHealthcare	H2228	1089	1.32%
21	UnitedHealthcare	H2247	51	0.06%
22	UnitedHealthcare	H2292	114	0.14%
23	UnitedHealthcare	H2577	1950	2.36%
24	UnitedHealthcare	H3307	306	0.37%

- NY - New York

	MajorInsuranceOrgName	**Contract Number**	**num_contrct**	**rate_contract**
0	Aetna Health Inc.	H1608	980	1.17%
1	Aetna Health Inc.	H2663	84	0.10%
2	Aetna Health Inc.	H3146	320	0.38%

3	Aetna Health Inc.	H3192	297	0.36%
4	Aetna Health Inc.	H3219	560	0.67%
5	Aetna Health Inc.	H3239	105	0.13%
6	Aetna Health Inc.	H3288	3339	4.00%
7	Aetna Health Inc.	H3312	1265	1.51%
8	ArchCare Advantage	H1777	10	0.01%
9	BlueCrossBlueShield	H0107	66	0.08%
10	BlueCrossBlueShield	H1732	186	0.22%
11	BlueCrossBlueShield	H2425	62	0.07%
12	BlueCrossBlueShield	H2461	720	0.86%
13	BlueCrossBlueShield	H3259	212	0.25%
14	Bright Health	H2288	45	0.05%
15	Catholic Health LIFE	H1518	2	0.00%
16	Healthfirst Medicare Plan	H1722	3	0.00%
17	MVP HEALTH CARE	H3305	1963	2.35%
18	MetroPlus Health Plan	H0423	27	0.03%
19	UnitedHealthcare	H0251	354	0.42%
20	UnitedHealthcare	H0271	1650	1.97%
21	UnitedHealthcare	H0294	450	0.54%
22	UnitedHealthcare	H0710	603	0.72%
23	UnitedHealthcare	H1278	294	0.35%
24	UnitedHealthcare	H1537	248	0.30%
25	UnitedHealthcare	H2001	66048	79.05%
26	UnitedHealthcare	H2196	138	0.17%
27	UnitedHealthcare	H2228	1089	1.30%
28	UnitedHealthcare	H2247	51	0.06%
29	UnitedHealthcare	H2292	114	0.14%
30	UnitedHealthcare	H2577	1950	2.33%
31	UnitedHealthcare	H3307	306	0.37%
32	VillageCareMAX	H2168	16	0.02%

- OK - Oklahoma

	MajorInsuranceOrgName	Contract Number	num_contrct	rate_contract
0	Aetna Health Inc.	H1608	980	1.17%
1	Aetna Health Inc.	H2663	84	0.10%
2	Aetna Health Inc.	H3146	320	0.38%
3	Aetna Health Inc.	H3192	297	0.35%
4	Aetna Health Inc.	H3219	560	0.67%
5	Aetna Health Inc.	H3239	105	0.13%
6	Aetna Health Inc.	H3288	3339	3.98%
7	Aetna Health Inc.	H3312	1265	1.51%
8	BlueCrossBlueShield	H0107	66	0.08%
9	BlueCrossBlueShield	H1732	186	0.22%
10	BlueCrossBlueShield	H2425	62	0.07%
11	BlueCrossBlueShield	H2461	720	0.86%
12	BlueCrossBlueShield	H3259	212	0.25%
13	Humana	H0028	369	0.44%
14	Humana	H1036	2093	2.49%
15	Humana	H2944	39	0.05%
16	UnitedHealthcare	H0251	354	0.42%
17	UnitedHealthcare	H0271	1650	1.96%
18	UnitedHealthcare	H0294	450	0.54%
19	UnitedHealthcare	H0710	603	0.72%
20	UnitedHealthcare	H1278	294	0.35%
21	UnitedHealthcare	H1537	248	0.30%
22	UnitedHealthcare	H2001	66048	78.64%
23	UnitedHealthcare	H2196	138	0.16%
24	UnitedHealthcare	H2228	1089	1.30%
25	UnitedHealthcare	H2247	51	0.06%
26	UnitedHealthcare	H2292	114	0.14%
27	UnitedHealthcare	H2577	1950	2.32%
28	UnitedHealthcare	H3307	306	0.36%

- SD - South Dakota

	MajorInsuranceOrgName	Contract Number	num_contrct	rate_contract
0	Aetna Health Inc.	H1608	980	1.18%
1	Aetna Health Inc.	H2663	84	0.10%
2	Aetna Health Inc.	H3146	320	0.38%
3	Aetna Health Inc.	H3192	297	0.36%
4	Aetna Health Inc.	H3219	560	0.67%
5	Aetna Health Inc.	H3239	105	0.13%
6	Aetna Health Inc.	H3288	3339	4.01%
7	Aetna Health Inc.	H3312	1265	1.52%
8	HealthPartners	H2422	12	0.01%
9	HealthPartners	H2462	403	0.48%
10	Humana	H0028	369	0.44%
11	Humana	H1036	2093	2.52%
12	Humana	H2944	39	0.05%
13	Lasso Healthcare	H1924	24	0.03%
14	UnitedHealthcare	H0251	354	0.43%
15	UnitedHealthcare	H0271	1650	1.98%
16	UnitedHealthcare	H0294	450	0.54%
17	UnitedHealthcare	H0710	603	0.72%
18	UnitedHealthcare	H1278	294	0.35%
19	UnitedHealthcare	H1537	248	0.30%
20	UnitedHealthcare	H2001	66048	79.40%
21	UnitedHealthcare	H2196	138	0.17%
22	UnitedHealthcare	H2228	1089	1.31%
23	UnitedHealthcare	H2247	51	0.06%
24	UnitedHealthcare	H2292	114	0.14%
25	UnitedHealthcare	H2577	1950	2.34%
26	UnitedHealthcare	H3307	306	0.37%

- TN - Tennessee

	MajorInsuranceOrgName	Contract Number	num_contrct	rate_contract
0	Aetna Health Inc.	H1608	980	1.20%
1	Aetna Health Inc.	H2663	84	0.10%
2	Aetna Health Inc.	H3146	320	0.39%
3	Aetna Health Inc.	H3192	297	0.36%
4	Aetna Health Inc.	H3219	560	0.69%
5	Aetna Health Inc.	H3239	105	0.13%
6	Aetna Health Inc.	H3288	3339	4.10%
7	Aetna Health Inc.	H3312	1265	1.55%
8	BlueCrossBlueShield	H0107	66	0.08%
9	BlueCrossBlueShield	H1732	186	0.23%
10	BlueCrossBlueShield	H2425	62	0.08%
11	BlueCrossBlueShield	H2461	720	0.88%
12	BlueCrossBlueShield	H3259	212	0.26%
13	UnitedHealthcare	H0251	354	0.43%
14	UnitedHealthcare	H0271	1650	2.02%
15	UnitedHealthcare	H0294	450	0.55%
16	UnitedHealthcare	H0710	603	0.74%
17	UnitedHealthcare	H1278	294	0.36%
18	UnitedHealthcare	H1537	248	0.30%
19	UnitedHealthcare	H2001	66048	81.05%
20	UnitedHealthcare	H2196	138	0.17%
21	UnitedHealthcare	H2228	1089	1.34%
22	UnitedHealthcare	H2247	51	0.06%
23	UnitedHealthcare	H2292	114	0.14%
24	UnitedHealthcare	H2577	1950	2.39%
25	UnitedHealthcare	H3307	306	0.38%

Contract 2001 offered by UnitedHealthcare is the contract most individuals choose. The rates of this contract are the largest ones in all 8 states.

Step 5: calculate the weighted average of the UOD

In this part, the dataset of each state generated in step 4 was left joined with HEDIS.2021 dataset. The outcome is every contract and its related UOD rate. All contracts without UOD rates were then dropped. For each company, the UOD rate of every contract multiplied by the total number of enrollees of the contract in a specif state, sums them up, and then the data was divided by the total number of enrollees of that company in the same state. The result is the averaged UOD rate and can be seen in the following tables:

- HI - Hawaii

MajorInsuranceOrgName	Weighted Avg UOD Rate(%)
UnitedHealthcare	6.62
Humana	5.21
Kaiser	3.12

- MI - Michigan

MajorInsuranceOrgName	Weighted Avg UOD Rate(%)
HAP Senior Plus (PPO)	8.08
UnitedHealthcare	5.68
Priority Health Medicare	5.3
Aetna Health Inc.	4.03
HAP Senior Plus	4.01
Upper Peninsula Health Plan	3.23

- MN - MInnesota

MajorInsuranceOrgName	Weighted Avg UOD Rate(%)
HealthPartners	7.42
PrimeWest Health	7.38
South Country Health Alliance	5.38
UCare's MSHO	5.36
Aetna Health Inc.	5.34
UnitedHealthcare	4.72
UCare	4.43
BlueCrossBlueShield	4.05

- MS - Mississippi

MajorInsuranceOrgName	Weighted Avg UOD Rate(%)
Aetna Health Inc.	5.34
UnitedHealthcare	4.72

- NY - New York

MajorInsuranceOrgName	Weighted Avg UOD Rate(%)
VillageCareMAX	11.9
MetroPlus Health Plan	11.69
Aetna Health Inc.	9.94
UnitedHealthcare	6.95
MVP HEALTH CARE	6.78
ArchCare Advantage	4

- OK - Oklahoma

MajorInsuranceOrgName	Weighted Avg UOD Rate(%)
BlueCrossBlueShield	6.08
Aetna Health Inc.	5.91
Humana	5.61
UnitedHealthcare	4.72

- SD - South Dakota

MajorInsuranceOrgName	Weighted Avg UOD Rate(%)
Aetna Health Inc.	6.09
Humana	5.21
HealthPartners	4.62
UnitedHealthcare	4.5

- TN - Tennessee

MajorInsuranceOrgName	Weighted Avg UOD Rate(%)
Aetna Health Inc.	7.89
UnitedHealthcare	7.47

BlueCrossBlueShield	5.89

Results and Analysis:

From the tables that show the weighted average UOD rate of the top 10 companies in each state, we can rank the quality of care and performance of each company from worst (highest rate of UOD) to best (lowest rate of the UOD). With lower UOD rate means that the companies are more proactive in making sure their members are not on an unsafe does prescription opioids for a prolonged period and reward and support their goodwill. The worst performing companies are on the left and the best one is on the far right in the rank below.

- HI - Hawaii

  UnitedHealthcare < Humana < Kaiser
- MI - Michigan

  HAP Senior Plus (PPO) < UnitedHealthcare < Priority Health Medicare < Aetna Health Inc. < HAP Senior Plus < Upper Peninsula Health Plan
- MN - Minnesota

  HealthPartners < PrimeWest Health < South Country Health Alliance < UCare's MSHO < Aetna Health Inc. < UnitedHealthcare < UCare < BlueCrossBlueShield
- MS - Mississippi

  Aetna Health Inc. < UnitedHealthcare
- NY - New York

  VillageCareMAX < MetroPlus Health Plan < Aetna Health Inc. < UnitedHealthcare < MVP HEALTH CARE < ArchCare Advantage
- OK - Oklahoma

  BlueCrossBlueShield < Aetna Health Inc. < Humana < UnitedHealthcare
- SD - South Dakota

  Aetna Health Inc. < Humana < HealthPartners < UnitedHealthcare
- TN - Tennessee

  Aetna Health Inc. < UnitedHealthcare < BlueCrossBlueShield

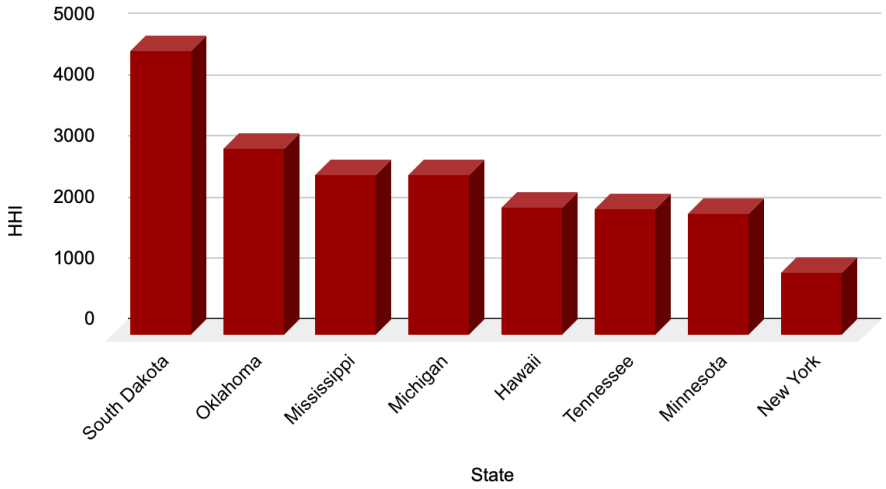
The same company has different performances in different states. From the ranks above, it is noticeable that United Healthcare is the best performing company in 3 states, New York, Oklahoma, and South Dakota respectively, but it is the worst one in Hawaii. Aetna Health Inc. is the company that ranks lowest twice. The same company has different performances in different states. Companied with the market share of each company, there is no apparent relationship between market share and the UOD rate. In some

states, companies with the biggest market share have the lowest UOD rate, but in others, they may be performance worst in terms of UOD rate. It seems that the UOD rate is not an extremely critical factor when people choose an insurance company.

DISCUSSION AND LIMITATIONS

From the series of analyses carried out on the subset of the data relevant to this report, i.e., for the eight states, Hawaii, Michigan, Minnesota, Mississippi, New York, Oklahoma, South Dakota, and Tennessee, the following observations were made.

Figure 5: Visual representation of the Herfindahl–Hirschman Index across all eight states



Going by the Herfindahl–Hirschman Index (HHI), it was observed that South Dakota had the highest index indicating it to be the state with the highest market concentration with a value of 4,635. All four states referenced in Table 1 had HHI values above the 2,500 threshold which indicates there is a significant disparity in the market shares of the companies in the health insurance sector. Using this metric as a yardstick, we find the companies with the largest market shares as shown in Table 1 to be the greatest contenders to partner with Congress in a private quasi single-payer model. The market share distribution of the companies in the four states can be seen in Figures 1 through 4.

Worthy of note, however, is the fact that due to a lack of updated information, there were a significant number of unidentified major providers owing to the source data not being recently updated. Also worth mentioning is the fact that a number of smaller organizations have since been bought over by even larger organizations such as Centene, which is responsible for a vast number of the smaller companies seen offering Part C Medicare services. A number of these mergers and buy-overs were not reflected in the source document, and as such were not reflected in the results obtained in this paper. Finally, in terms of limitations, while the Herfindahl–Hirschman Index is commonly accepted as an indicator for measuring market concentration, one major drawback lies in the fact that it does not take into consideration the complexities of the various markets it is often applied to (Investopedia, n.d.).

CONCLUSION

From the analysis carried out using various subsets of the most recently updated Enrollment and Plan data provided by CMS, this report has been able to sufficiently identify possible partners for the Government for a private quasi single-payer model based on their market shares in States with High Herfindahl–Hirschman Indices. The report has also been able to outline the details of dental coverage, showing the extent of both preventative and comprehensive dental benefit packages, as well as the trend of activities as it relates to the opioid crisis.

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APPENDIX 1

Define directory
cd "/Users/bloomn/Library/Mobile Documents/com~apple~CloudDocs/Personal Documents/Heller GHPM/Classes & Reading Resources/Spring '22/HS 256f - Healthcare Data Analytics & Data Mining/Class 3/CPSC_Enrollment_2022_01/"

Create log file
log using "HW2 rough work.log", replace

Import the data set
import delimited "/Users/bloomn/Library/Mobile Documents/com~apple~CloudDocs/Personal Documents/Heller GHPM/Classes & Reading Resources/Spring '22/HS 256f - Healthcare Data Analytics & Data Mining/Class 3/CPSC_Enrollment_2022_01/CPSC_Enrollment_Info_2022_01.csv"

Extract data for group 4's states
keep if state=="HI" | state == "MI" | state == "MN" | state == "MS" | state == "NY" | state == "OK" | state == "SD" | state == "TN"

Save new data subset
save "/Users/bloomn/Library/Mobile Documents/com~apple~CloudDocs/Personal Documents/Heller GHPM/Classes & Reading Resources/Spring '22/HS 256f - Healthcare Data Analytics & Data Mining/Class 3/CPSC_Enrollment_2022_01/Grp4_CPSC_Enrollment_2022_01.dta"

**Drop observations with enrollment = "*" **
drop if enrollment=="*"

Export to an excel file to continue data manipulation
export excel using "/Users/bloomn/Library/Mobile Documents/com~apple~CloudDocs/Personal Documents/Heller GHPM/Classes & Reading Resources/Spring '22/HS 256f - Healthcare Data Analytics & Data Mining/Class 3/CPSC_Enrollment_2022_01/Grp4Tidy_CPSC_Enrollment.xls", firstrow(variables)

```
log close
```

APPENDIX 2

```
# ## Question 2
# ### Steps
# 1. Load the datasets
# 2. Filter out group 4 States
# 3. Merge the dental benefit database with enrollment database
# 4. Report by States
# 5. Report by top-5 insurers

# #### 1. Load the datasets
# keep the leading zeros in column `Plan ID`
import pandas as pd
enrollment = pd.read_csv('/Users/cynding/Desktop/Brandeis 2022 Spring/HS 256F - Healthcare Data Analytics/HW2/CPSC_Enrollment_2022_01/CPSC_Enrollment_Info_2022_01.csv')
plan = pd.read_excel('/Users/cynding/Desktop/Brandeis 2022 Spring/HS 256F - Healthcare Data Analytics/HW2/Monthly_Report_By_Plan_2022_01/Monthly_Report_By_Plan_2022_01.xlsx',header=5, skipfooter=3,)
plan.head()
# keep the necessary columns
plan = plan[['Contract Number','Plan ID','Organization Name']]
# keep the leading zeros in column `pbp_a_plan_identifier`
dental = pd.read_table('/Users/cynding/Desktop/Brandeis 2022 Spring/HS 256F - Healthcare Data Analytics/HW2/PBP_Benefits_2021 07_01_2021/pbp_b16_dental.txt')

# #### 2. Filter out group 4 States
State_list = ['HI','MI','MN','MS','NY','OK','SD','TN']
enrollment = enrollment[enrollment['State'].isin(State_list)]

# #### 3. Merge the dental benefit database with enrollment database
# only keep the necessary columns
dental =
dental[['pbp_a_hnumber','pbp_a_plan_identifier','segment_id','pbp_b16a_bendesc_yn','pbp_b16b_bendesc_yn']]
```

```
temp = pd.merge(enrollment[['Contract Number','Plan ID','State']],dental,how='inner',left_on=['Plan ID','Contract Number'], right_on=['pbp_a_plan_identifier','pbp_a_hnumber'])
temp.head()
# #### Then merge our temporary database with plan database to retrieve the insurer info.
df = pd.merge(temp,plan,how='inner',on=['Contract Number','Plan ID'])
df.head()
# the overall percentage of enrollees enjoying the “Preventive Dental Items as a supplemental benefit under Part C”?
df[df['pbp_b16a_bendesc_yn']==1.0].shape[0]/df.shape[0]
# the overall percentage of enrollees enjoying the “Comprehensive Dental Items as a supplemental benefit under Part C”?
df[df['pbp_b16b_bendesc_yn']==1.0].shape[0]/df.shape[0]



# #### 4. Report by States
p_dental = df.groupby([df['State'],df['pbp_b16a_bendesc_yn']])['Contract Number'].count().unstack(level=1)
p_dental_perc = p_dental[1.0].div(p_dental.sum(axis=1),axis=0)
c_dental = df.groupby([df['State'],df['pbp_b16b_bendesc_yn']])['Contract Number'].count().unstack(level=1)
c_dental_perc = c_dental[1.0].div(c_dental.sum(axis=1),axis=0)
by_states = pd.DataFrame(dict(p_dental_perc = p_dental_perc, c_dental_perc = c_dental_perc))
by_states.style.format({
    'p_dental_perc': '{:,.2%}'.format,
    'c_dental_perc': '{:,.2%}'.format,
})

# #### 5. Report by top-5 insurers
# #### Find the top-5 insurers
temp = df.groupby(df['Organization Name']).count().sort_values(by='Contract Number',ascending=False)
top_5 = temp.iloc[:5,:]
top_5 = top_5.index.to_list()
df = df[df['Organization Name'].isin(top_5)]
```

```
p_dental = df.groupby([df['Organization Name'],df['pbp_b16a_bendesc_yn']])['Contract
Number'].count().unstack(level=1)
p_dental_perc = p_dental[1.0].div(p_dental.sum(axis=1),axis=0)
c_dental = df.groupby([df['Organization Name'],df['pbp_b16b_bendesc_yn']])['Contract
Number'].count().unstack(level=1)
c_dental_perc = c_dental[1.0].div(c_dental.sum(axis=1),axis=0)
by_insurers = pd.DataFrame(dict(p_dental_perc = p_dental_perc, c_dental_perc = c_dental_perc))
by_insurers.style.format({
    'p_dental_perc': '{:,.2%}'.format,
    'c_dental_perc': '{:,.2%}'.format,
})
```

APPENDIX 3

Insurance Case Study -Zilin

Steps

1. Filter out the designed State
2. Drop rows based on conditions
3. Merge 3 datasets
4. Calculate top 10 market share insurance in each state
5. Report the rate for every contract offered by the top-10 biggest market share insurance companies in each state
6. Report the weighted average of the UOD rate of every contract offered by the top-10 biggest market share insurance companies in each state

```
import pandas as pd
import numpy as np
enroll_info = pd.read_csv("CPSC_Enrollment_Info_2022_01.csv")
monthly_report = pd.read_excel("Monthly_Report_By_Plan_2022_01.xlsx",header=5)
major_orgs = pd.read_excel("MajorInsuranceOrgs.xlsx")
### 1.Filter out the designed State
State_list = ['HI','MI','MN','MS','NY','OK','SD','TN']
enroll_info = enroll_info[enroll_info['State'].isin(State_list)]
### 2.Drop rows based on conditions
1. exclude all "Exxx" contracts
2. drop rows where value in enrollment column is missing or mared with *
enroll_info = enroll_info[enroll_info["Contract Number"].str[0] != 'S']
enroll_info = enroll_info.dropna(subset=['Enrollment'])
enroll_info = enroll_info[enroll_info.Enrollment != '*']
enroll_info_f = enroll_info[['Contract Number','State','Enrollment']]
enroll_info_f["Enrollment"] = pd.to_numeric(enroll_info_f["Enrollment"])
enroll_info_ff = enroll_info_f.groupby(["State","Contract
Number"])["Enrollment"].sum().reset_index(name ='total_enrollees')
### 3.Merge dataset to create the final dataset
monthly_report_f = monthly_report[['Contract Number','Organization Marketing Name']]
left_join_1 = pd.merge(enroll_info_f, monthly_report_f, on='Contract Number', how='left')
left_join_2 = pd.merge(left_join_1, major_orgs, on='Organization Marketing Name', how='left')
```

```
df = left_join_2
### 4.top-10 biggest market share insurance companies in each state
# calculate the total number of enrollees of each company in each state
df["Enrollment"] = pd.to_numeric(df["Enrollment"])
company_enroll = df.groupby(['State','MajorInsuranceOrgName'])['Enrollment'].sum().reset_index(name
='num_enrollees')
company_enroll
# calculate the total number of enrollees in the state
state_enroll = df.groupby(['State'])['Enrollment'].sum().reset_index(name ='total_enrollees')
state_enroll
#calculate the market share of each company in each state
company_enroll = pd.merge(company_enroll, state_enroll, on='State', how='inner')
company_enroll['market_share'] =
company_enroll['num_enrollees'].div(company_enroll['total_enrollees'])
df_top10 = company_enroll.groupby(['State']).apply(lambda x: x.sort_values(["market_share"],ascending
= False).reset_index(drop=True))
Company_enroll
##### Based on the the table above, we can figure out the top10 biggest market share insurance company
in each state. And I also drop those companies ranked after 10
df_top10 = company_enroll.drop(index=[8,9,11,14])
df_top10 = df_top10.groupby(['State']).apply(lambda x: x.sort_values(["market_share"],ascending =
False).reset_index(drop=True))
df_top10_docs = df_top10.iloc[:, [1,4]]
df_top10_docs.style.format({
   'market_share': '{:,.2%}'.format
})
df_top10.style.format({
   'market_share': '{:,.4%}'.format
})
df_top10.to_excel("Top 10 biggest mkt share company.xlsx")
### 5.Report the rate for every contract offered by the top-10 biggest market share insurance companies
in each state
states_HI = ['UnitedHealthcare','Humana','Kaiser','Lasso Healthcare']
df_HI = df[df['MajorInsuranceOrgName'].isin(states_HI)]
```

```
df_HI_1 = df_HI.groupby(['MajorInsuranceOrgName','Contract Number']).size().reset_index(name
='num_contrct')
df_HI_1['rate_contract'] = (df_HI_1['num_contrct']/len(df_HI.index)).round(6)
df_HI_1['State'] = 'HI'
df_HI_1.style.format({
   'rate_contract': '{:,.4%}'.format
})
states_MI = ['Priority Health Medicare','UnitedHealthcare','HAP Senior Plus','Aetna Health Inc.',
          'HAP Senior Plus (PPO)','Upper Peninsula Health Plan (UPHP) MI Health Link',
         'AmeriHealth Caritas VIP Care Plus','PACE Southeast Michigan','Upper Peninsula Health Plan',
         'Senior Care Partners P.A.C.E.']
df_MI = df[df['MajorInsuranceOrgName'].isin(states_MI)]
df_MI_1 = df_MI.groupby(['MajorInsuranceOrgName','Contract Number']).size().reset_index(name
='num_contrct')
df_MI_1['rate_contract'] = (df_MI_1['num_contrct']/len(df_MI.index)).round(6)
df_MI_1['State'] = 'MI'
df_MI_1.style.format({
   'rate_contract': '{:,.4%}'.format
})
states_MN = ['UCare','UnitedHealthcare','BlueCrossBlueShield','Aetna Health Inc.',
          'HealthPartners',"UCare's MSHO",'PrimeWest Health',
          'South Country Health Alliance','Itasca Medical Care/IMCare Classic',
         'Lasso Healthcare']
df_MN = df[df['MajorInsuranceOrgName'].isin(states_MN)]
df_MN_1 = df_MN.groupby(['MajorInsuranceOrgName','Contract Number']).size().reset_index(name
='num_contrct')
df_MN_1['rate_contract'] = (df_MN_1['num_contrct']/len(df_MN.index)).round(6)
df_MN_1['State'] = 'MN'
df_MN_1.style.format({
   'rate_contract': '{:,.4%}'.format
})
states_MS = ['Humana','UnitedHealthcare','Aetna Health Inc.','Lasso Healthcare']
df_MS = df[df['MajorInsuranceOrgName'].isin(states_MS)]
```

```
df_MS_1 = df_MS.groupby(['MajorInsuranceOrgName','Contract Number']).size().reset_index(name
='num_contrct')
df_MS_1['rate_contract'] = (df_MS_1['num_contrct']/len(df_MS.index)).round(6)
df_MS_1['State'] = 'MN'
df_MS_1.style.format({
   'rate_contract': '{:,.4%}'.format
})
states_NY = ['UnitedHealthcare','Aetna Health Inc.','MVP HEALTH CARE','BlueCrossBlueShield',
          'MetroPlus Health Plan','VillageCareMAX','Bright Health','ArchCare Advantage',
          'Healthfirst Medicare Plan','Catholic Health LIFE']
df_NY = df[df['MajorInsuranceOrgName'].isin(states_NY)]
df_NY_1 = df_NY.groupby(['MajorInsuranceOrgName','Contract Number']).size().reset_index(name
='num_contrct')
df_NY_1['rate_contract'] = (df_NY_1['num_contrct']/len(df_NY.index)).round(6)
df_NY_1['State'] = 'NY'
df_NY_1.style.format({
   'rate_contract': '{:,.4%}'.format
})
states_OK = ['UnitedHealthcare','Aetna Health Inc.','BlueCrossBlueShield','Humana']
df_OK = df[df['MajorInsuranceOrgName'].isin(states_OK)]
df_OK_1 = df_OK.groupby(['MajorInsuranceOrgName','Contract Number']).size().reset_index(name
='num_contrct')
df_OK_1['rate_contract'] = (df_OK_1['num_contrct']/len(df_OK.index)).round(6)
df_OK_1['State'] = 'OK'
df_OK_1.style.format({
   'rate_contract': '{:,.4%}'.format
})
states_SD = ['UnitedHealthcare','Aetna Health Inc.','Humana','HealthPartners',
          'Lasso Healthcare']
df_SD = df[df['MajorInsuranceOrgName'].isin(states_SD)]
df_SD_1 = df_SD.groupby(['MajorInsuranceOrgName','Contract Number']).size().reset_index(name
='num_contrct')
df_SD_1['rate_contract'] = (df_SD_1['num_contrct']/len(df_SD.index)).round(6)
df_SD_1['State'] = 'SD'
```

```
df_SD_1.style.format({
   'rate_contract': '{:,.4%}'.format
})
states_TN = ['UnitedHealthcare','BlueCrossBlueShield','Aetna Health Inc.']
df_TN = df[df['MajorInsuranceOrgName'].isin(states_TN)]
df_TN_1 = df_TN.groupby(['MajorInsuranceOrgName','Contract Number']).size().reset_index(name
='num_contrct')
df_TN_1['rate_contract'] = (df_TN_1['num_contrct']/len(df_TN.index)).round(6)
df_TN_1['State'] = 'TN'
df_TN_1.style.format({
   'rate_contract': '{:,.4%}'.format
})
### 6.Report the weighted average of the UOD rate in each state
df_UOD = pd.read_excel("UOD.xlsx")
df_HI_2= pd.merge(df_HI_1, enroll_info_ff, on=["State","Contract Number"], how = 'left')
df_UOD_HI = pd.merge(df_HI_2, df_UOD, on='Contract Number', how='left')
df_UOD_HI = df_UOD_HI.dropna()
df_UOD_HI['mul'] = df_UOD_HI['UOD Rate'].mul(df_UOD_HI['total_enrollees'])
a = df_UOD_HI.groupby(["MajorInsuranceOrgName"])["mul"].sum().reset_index(name ='sum')
b = df_UOD_HI.groupby(["MajorInsuranceOrgName"])["total_enrollees"].sum().reset_index(name
='sum_enroll')
df_avgUOD_HI = pd.merge(a, b, on='MajorInsuranceOrgName', how='left')
df_avgUOD_HI['Weighted Avg UOD Rate'] =
df_avgUOD_HI["sum"].div(df_avgUOD_HI["sum_enroll"])
df_avgUOD_HI.sort_values(by="Weighted Avg UOD Rate",ascending=False,inplace=True)
df_MI_2= pd.merge(df_MI_1, enroll_info_ff, on=["State","Contract Number"], how = 'left')
df_UOD_MI = pd.merge(df_MI_2, df_UOD, on='Contract Number', how='left')
df_UOD_MI = df_UOD_MI.dropna()
df_UOD_MI['mul'] = df_UOD_MI['UOD Rate'].mul(df_UOD_MI['total_enrollees'])
a = df_UOD_MI.groupby(["MajorInsuranceOrgName"])["mul"].sum().reset_index(name ='sum')
b = df_UOD_MI.groupby(["MajorInsuranceOrgName"])["total_enrollees"].sum().reset_index(name
='sum_enroll')
df_avgUOD_MI = pd.merge(a, b, on='MajorInsuranceOrgName', how='left')
```

```
df_avgUOD_MI['Weighted Avg UOD Rate'] =
df_avgUOD_MI["sum"].div(df_avgUOD_MI["sum_enroll"])
df_avgUOD_MI.sort_values(by="Weighted Avg UOD Rate",ascending=False,inplace=True)
df_avgUOD_MI
df_avgUOD_MI.to_excel("MI.xlsx")
df_MN_2= pd.merge(df_MN_1, enroll_info_ff, on=["State","Contract Number"], how = 'left')
df_UOD_MN = pd.merge(df_MN_2, df_UOD, on='Contract Number', how='left')
df_UOD_MN = df_UOD_MN.dropna()
df_UOD_MN['mul'] = df_UOD_MN['UOD Rate'].mul(df_UOD_MN['total_enrollees'])
a = df_UOD_MN.groupby(["MajorInsuranceOrgName"])["mul"].sum().reset_index(name ='sum')
b = df_UOD_MN.groupby(["MajorInsuranceOrgName"])["total_enrollees"].sum().reset_index(name
='sum_enroll')
df_avgUOD_MN = pd.merge(a, b, on='MajorInsuranceOrgName', how='left')
df_avgUOD_MN['Weighted Avg UOD Rate'] =
df_avgUOD_MN["sum"].div(df_avgUOD_MN["sum_enroll"])
df_avgUOD_MN.sort_values(by="Weighted Avg UOD Rate",ascending=False,inplace=True)
df_avgUOD_MN
df_avgUOD_MN.to_excel("MN.xlsx")
df_MS_2= pd.merge(df_MS_1, enroll_info_ff, on=["State","Contract Number"], how = 'left')
df_UOD_MS = pd.merge(df_MS_2, df_UOD, on='Contract Number', how='left')
df_UOD_MS = df_UOD_MS.dropna()
df_UOD_MS['mul'] = df_UOD_MS['UOD Rate'].mul(df_UOD_MS['total_enrollees'])
a = df_UOD_MS.groupby(["MajorInsuranceOrgName"])["mul"].sum().reset_index(name ='sum')
b = df_UOD_MS.groupby(["MajorInsuranceOrgName"])["total_enrollees"].sum().reset_index(name
='sum_enroll')
df_avgUOD_MS = pd.merge(a, b, on='MajorInsuranceOrgName', how='left')
df_avgUOD_MS['Weighted Avg UOD Rate'] =
df_avgUOD_MS["sum"].div(df_avgUOD_MS["sum_enroll"])
df_avgUOD_MS.sort_values(by="Weighted Avg UOD Rate",ascending=False,inplace=True)
df_avgUOD_MS
df_avgUOD_MS.to_excel("MS.xlsx")
df_NY_2= pd.merge(df_NY_1, enroll_info_ff, on=["State","Contract Number"], how = 'left')
df_UOD_NY = pd.merge(df_NY_2, df_UOD, on='Contract Number', how='left')
df_UOD_NY = df_UOD_NY.dropna()
```

```
df_UOD_NY['mul'] = df_UOD_NY['UOD Rate'].mul(df_UOD_NY['total_enrollees'])
a = df_UOD_NY.groupby(["MajorInsuranceOrgName"])["mul"].sum().reset_index(name ='sum')
b = df_UOD_NY.groupby(["MajorInsuranceOrgName"])["total_enrollees"].sum().reset_index(name
='sum_enroll')
df_avgUOD_NY = pd.merge(a, b, on='MajorInsuranceOrgName', how='left')
df_avgUOD_NY['Weighted Avg UOD Rate'] =
df_avgUOD_NY["sum"].div(df_avgUOD_NY["sum_enroll"])
df_avgUOD_NY.sort_values(by="Weighted Avg UOD Rate",ascending=False,inplace=True)
df_avgUOD_NY
df_avgUOD_NY.to_excel("NY.xlsx")
df_OK_2= pd.merge(df_OK_1, enroll_info_ff, on=["State","Contract Number"], how = 'left')
df_UOD_OK = pd.merge(df_OK_2, df_UOD, on='Contract Number', how='left')
df_UOD_OK = df_UOD_OK.dropna()
df_UOD_OK['mul'] = df_UOD_OK['UOD Rate'].mul(df_UOD_OK['total_enrollees'])
a = df_UOD_OK.groupby(["MajorInsuranceOrgName"])["mul"].sum().reset_index(name ='sum')
b = df_UOD_OK.groupby(["MajorInsuranceOrgName"])["total_enrollees"].sum().reset_index(name
='sum_enroll')
df_avgUOD_OK = pd.merge(a, b, on='MajorInsuranceOrgName', how='left')
df_avgUOD_OK['Weighted Avg UOD Rate'] =
df_avgUOD_OK["sum"].div(df_avgUOD_OK["sum_enroll"])
df_avgUOD_OK.sort_values(by="Weighted Avg UOD Rate",ascending=False,inplace=True)
df_avgUOD_OK
df_avgUOD_OK.to_excel("OK.xlsx")
df_SD_2= pd.merge(df_SD_1, enroll_info_ff, on=["State","Contract Number"], how = 'left')
df_UOD_SD = pd.merge(df_SD_2, df_UOD, on='Contract Number', how='left')
df_UOD_SD = df_UOD_SD.dropna()
df_UOD_SD['mul'] = df_UOD_SD['UOD Rate'].mul(df_UOD_SD['total_enrollees'])
a = df_UOD_SD.groupby(["MajorInsuranceOrgName"])["mul"].sum().reset_index(name ='sum')
b = df_UOD_SD.groupby(["MajorInsuranceOrgName"])["total_enrollees"].sum().reset_index(name
='sum_enroll')
df_avgUOD_SD = pd.merge(a, b, on='MajorInsuranceOrgName', how='left')
df_avgUOD_SD['Weighted Avg UOD Rate'] =
df_avgUOD_SD["sum"].div(df_avgUOD_SD["sum_enroll"])
df_avgUOD_SD.sort_values(by="Weighted Avg UOD Rate",ascending=False,inplace=True)
```

```
df_avgUOD_SD
df_avgUOD_SD.to_excel("SD.xlsx")
df_TN_2= pd.merge(df_TN_1, enroll_info_ff, on=["State","Contract Number"], how = 'left')
df_UOD_TN = pd.merge(df_TN_2, df_UOD, on='Contract Number', how='left')
df_UOD_TN = df_UOD_TN.dropna()
df_UOD_TN['mul'] = df_UOD_TN['UOD Rate'].mul(df_UOD_TN['total_enrollees'])
a = df_UOD_TN.groupby(["MajorInsuranceOrgName"])["mul"].sum().reset_index(name ='sum')
b = df_UOD_TN.groupby(["MajorInsuranceOrgName"])["total_enrollees"].sum().reset_index(name
='sum_enroll')
df_avgUOD_TN = pd.merge(a, b, on='MajorInsuranceOrgName', how='left')
df_avgUOD_TN['Weighted Avg UOD Rate'] =
df_avgUOD_TN["sum"].div(df_avgUOD_TN["sum_enroll"])
df_avgUOD_TN.sort_values(by="Weighted Avg UOD Rate",ascending=False,inplace=True)
df_avgUOD_TN
df_avgUOD_TN.to_excel("TN.xlsx")
```