INSURANCE MARKET DATA & ANALYTICS

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Best candidates of private single player

Single-payer national health insurance, also known as "Medicare for all," is a system in which a single public or quasi-public agency organizes health care financing, but the delivery of care remains largely in private hands. Based on recent rhetoric and emerging plans, it appears increasingly likely that a single-payer health care system would be the solution to America's health care challenge.

In order to figure out which insurance companies serve as best candidates of private single player, we calculate the market share of each of the major insurance companies in each state and mark the company with the largest market share using the databases from Centers for Medicare & Medicaid Services. We focus only on heath products and put the drug plans aside for now, so we exclude all small size plans from the database.

Table 1 shows the market share of each of the major insurance companies in each state, and the company with the largest market share in each state is highlighted.

Table 1 Market Share of Major Insurance Companies in Each State

State	MajorInsuranceOrgName	Share
WA	UnitedHealthcare	34.82%
WA	Kaiser	27.43%
WA	BlueCrossBlueShield	14.23%
WA	Humana	11.75%
WA	Aetna Health Inc.	5.50%
WA	Health Alliance Northwest	2.40%
WA	Molina Healthcare of Washington, Inc.	2.09%
WA	Health Net Life Insurance Company	0.77%
WA	AMERIGROUP	0.49%
WA	Asuris Northwest Health	0.19%
WA	PacificSource Medicare	0.16%
WA	Providence Health System	0.16%
WA	Providence ElderPlace Portland	0.01%
OH	Aetna Health Inc.	25.57%
OH	BlueCrossBlueShield	23.92%
OH	UnitedHealthcare	16.24%
OH	Humana	15.67%
OH	MediGold	4.61%
OH	Medical Mutual of Ohio	3.38%
OH	SummaCare Medicare Advantage Plans	2.27%
OH	PrimeTime Health Plan	1.96%
OH	CareSource MyCare Ohio	1.94%
OH	Molina Healthcare of Ohio	1.39%
OH	Buckeye Health Plan - MyCare Ohio	1.31%
OH	The Health Plan	0.83%
OH	CareSource	0.37%
OH	Allwell	0.27%
OH	Gateway Health Medicare Assured	0.08%

State	MajorInsuranceOrgName	Share
OH	Mutual of Omaha Medicare Advantage	0.05%
OH	McGregor PACE	0.05%
OH	WellCare	0.04%
OH	Valor Health Plan	0.03%
OH	Bright Health	0.03%
OH	UPMC for Life	0.01%
OH	Health Alliance Medicare	0.00%
NM	UnitedHealthcare	33.18%
NM	Presbyterian Health Plan	25.82%
NM	Humana	19.98%
NM	BlueCrossBlueShield	13.83%
NM	Molina Healthcare of New Mexico, Inc.	2.06%
NM	Aetna Health Inc.	1.83%
NM	Presbyterian Insurance Company, Inc.	1.67%
NM	Amerigroup Community Care of New Mexico	0.90%
NM	CHRISTUS Health Plan Generations	0.47%
NM	InnovAge New Mexico PACE	0.24%
ME	Martin's Point Generations Advantage	38.50%
ME	UnitedHealthcare	21.02%
ME	Aetna Health Inc.	18.49%
ME	WellCare	9.80%
ME	Humana	5.99%
ME	BlueCrossBlueShield	4.87%
ME	Harvard Pilgrim Health Care, Inc.	1.31%
MD	Kaiser	40.21%
MD	UnitedHealthcare	15.83%
MD	Johns Hopkins HealthCare	15.63%
MD	Aetna Health Inc.	10.83%
MD	Cigna	10.08%
MD	University of Maryland Health Advantage	3.97%
MD	Humana	2.65%
MD	Provider Partners Maryland Advantage Plan	0.38%
MD	Lasso Healthcare	0.15%
MD	BlueCrossBlueShield	0.15%
MD	Hopkins ElderPlus	0.11%
LA	Humana	55.00%
LA	Peoples Health	23.84%
LA	UnitedHealthcare	6.86%
LA	Vantage Health Plan, Inc.	5.51%
LA	WellCare	4.19%
LA	Aetna Health Inc.	4.14%
LA	BlueCrossBlueShield	0.26%
LA	PACE Baton Rouge	0.09%

State	MajorInsuranceOrgName	Share
LA	Allwell	0.06%
LA	Pace Greater New Orleans	0.05%
IA	UnitedHealthcare	42.46%
IA	Aetna Health Inc.	33.00%
IA	Humana	15.17%
IA	Medical Associates Health Plan, Inc.	7.52%
IA	Health Alliance Medicare	0.68%
IA	HealthPartners UnityPoint Health	0.67%
IA	Immanuel Pathways Iowa	0.22%
IA	SIOUXLAND PACE, INC.	0.12%
IA	Senior Preferred	0.11%
IA	BlueCrossBlueShield	0.04%
IA	Medical Associates Clinic Health Plan of Wisconsin	0.01%
CA	Kaiser	43.75%
CA	UnitedHealthcare	16.70%
CA	BlueCrossBlueShield	11.23%
CA	SCAN Health Plan	7.31%
CA	Health Net of California	4.04%
CA	Humana	3.05%
CA	Alignment Health Plan	1.76%
CA	Central Health Medicare Plan	1.55%
CA	Brand New Day	1.46%
CA	Aetna Health Inc.	1.27%
CA	WellCare	1.18%
CA	IEHP DualChoice	1.01%
CA	Inter Valley Health Plan	0.71%
CA	HEALTH NET COMMUNITY SOLUTIONS, INC.	0.65%
CA	L.A. Care Cal MediConnect Plan	0.58%
CA	OneCare Connect	0.51%
CA	Molina Healthcare of California	0.41%
CA	Health Net Cal MediConnect Medicare Medicaid Plan	0.35%
CA	Vitality Health Plan of California	0.35%
CA	Health Plan of San Mateo	0.32%
CA	Santa Clara Family Health Plan Cal MediConnect	0.29%
CA	Community Health Group	0.23%
CA	Golden State	0.22%
CA	Chinese Community Health Plan	0.18%
CA	Aspire Health Plan	0.16%
CA	Stanford Health Care Advantage	0.15%
CA	Sharp Health Plan	0.14%
CA	AltaMed Health Services Corporation	0.07%
CA	OneCare	0.06%
CA	VillageHealth	0.05%

State	MajorInsuranceOrgName	Share
CA	On Lok Lifeways	0.05%
CA	St. Paul's PACE	0.03%
CA	AHF	0.02%
CA	Center For Elders' Independence	0.02%
CA	InnovAge California PACE	0.02%
CA	Imperial Health Plan of California, Inc.	0.02%
CA	San Diego PACE	0.01%
CA	Fresno PACE	0.01%
CA	Sutter SeniorCare PACE	0.01%
CA	Brandman Centers for Senior Care	0.01%
CA	CalOptima PACE	0.01%
CA	Redwood Coast PACE	0.01%
CA	Stockton PACE	0.00%
CA	Cigna	0.00%
AK	Aetna Health Inc.	75.45%
AK	UnitedHealthcare	19.52%
AK	Humana	3.47%
AK	BlueCrossBlueShield	1.56%

Moreover, we want to find the market that is highly "concentrated" in hands of one big player and that player could be the company with enough of economy of scale and scope that can be relied on to delegate the mission of "private single payer" to.

We calculate the Herfindahl-Hirschman Index (HHI) to measure each state's concentration of market power and pick the top-4 states in terms of market concentration (four highest HHIs) and for those states list the company with the "lion share" of the market. The results are shown in **Table 2**, ordered (descending) by the HHI column.

In terms of market concentration, Alaska, Louisiana, Iowa, Maine are the top-4 states. In Alaska, Aetna Health Inc. is the largest company with 75.45% share, while in Louisiana, Humana has "lion share" of the market with 55.00% share. In Iowa, UnitedHealthCare occupies the major market with 42.46% share in total. As for Maine, Martin's Point Generations Advantage has the largest market share, which is 38.50%.

Table 2 Herfindahl-Hirschman Index (HHI) of Each State

State	HHI
AK	6088.12
LA	3705.81
IA	3179.64
ME	2423.75
CA	2412.12
NM	2369.98
MD	2353.94
WA	2346.67
OH	1785.17

The generosity of Insurance Benefit Packages for Dental Services

In this part, we examine the generosity of the insurance benefit packages for dental services offered by the major insurance companies in each state.

Using benefit package detailed databases from Centers for Medicare & Medicaid Services, we calculate the percentage of enrollees who enjoy Preventive Dental Items as a supplemental benefit under Part C (Pct_Preventive), as well as the percentage of enrollees who enjoy the "Comprehensive Dental Items as a supplemental benefit under Part C (Pct_Comprehensive). The results are shown in **Table 3**.

The results show the generosity of the insurance coverage for dental services regarding whether the insurance plans offer dental care benefit or a more comprehensive plan that covers most of the dental services or only offer basic care. As the results shown, a majority of major insurance companies offer supplemental benefit. Comparing the results by states, we see that in average the insurers in Ohio and Maine are more generous, while the insurers in Iowa and Alaska are the least generous.

Table 3 Percentages of Supplemental Benefit for Dental Services

State	Rank	MajorInsuranceOrgName	Pct_Preventive	Pct_Comprehensive
OH	1	Health Alliance Medicare	100.00%	100.00%
OH	2	UPMC for Life	100.00%	48.44%
OH	3	Bright Health	100.00%	100.00%
OH	4	Valor Health Plan	0.00%	0.00%
OH	5	WellCare	100.00%	35.83%
OH Average			**80.00%**	**56.85%**
ME	1	Harvard Pilgrim Health Care, Inc.	100.00%	100.00%
ME	2	BlueCrossBlueShield	21.74%	0.00%
ME	3	Humana	99.54%	93.92%
ME	4	WellCare	100.00%	100.00%
ME	5	Aetna Health Inc.	47.08%	47.08%
ME Average			**73.67%**	**68.20%**
NM	1	InnovAge New Mexico PACE	0.00%	0.00%
NM	2	CHRISTUS Health Plan Generations	100.00%	26.48%
NM	3	Amerigroup Community Care of New Mexico	100.00%	100.00%
NM	4	Presbyterian Insurance Company, Inc.	0.00%	0.00%
NM	5	Aetna Health Inc.	60.81%	60.81%
NM Average			**52.16%**	**37.46%**
LA	1	Pace Greater New Orleans	0.00%	0.00%
LA	2	Allwell	100.00%	100.00%
LA	3	PACE Baton Rouge	0.00%	0.00%
LA	4	BlueCrossBlueShield	53.67%	53.67%
LA	5	Aetna Health Inc.	67.26%	67.26%
LA Average			**44.19%**	**44.19%**

State	Rank	MajorInsuranceOrgName	Pct_Preventive	Pct_Comprehensive
MD	1	Hopkins ElderPlus	0.00%	0.00%
MD	2	BlueCrossBlueShield	0.00%	0.00%
MD	3	Lasso Healthcare	0.00%	0.00%
MD	4	Provider Partners Maryland Advantage Plan	100.00%	100.00%
MD	5	Humana	77.91%	77.91%
MD Average			**35.58%**	**35.58%**
WA	1	Providence ElderPlace Portland	0.00%	0.00%
WA	2	Providence Health System	0.00%	0.00%
WA	3	PacificSource Medicare	0.00%	0.00%
WA	4	Asuris Northwest Health	100.00%	100.00%
WA	5	AMERIGROUP	40.25%	40.25%
WA Average			**28.05%**	**28.05%**
CA	1	Cigna	100.00%	100.00%
CA	2	Stockton PACE	0.00%	0.00%
CA	3	Redwood Coast PACE	0.00%	0.00%
CA	4	CalOptima PACE	0.00%	0.00%
CA	5	Brandman Centers for Senior Care	0.00%	0.00%
CA Average			**20.00%**	**20.00%**
IA	1	Medical Associates Clinic Health Plan of Wisconsin	0.00%	0.00%
IA	2	BlueCrossBlueShield	0.00%	0.00%
IA	3	Senior Preferred	16.35%	0.00%
IA	4	SIOUXLAND PACE, INC.	0.00%	0.00%
IA	5	Immanuel Pathways Iowa	0.00%	0.00%
IA Average			**3.27%**	**0.00%**
AK	1	BlueCrossBlueShield	0.00%	0.00%
AK	2	Humana	0.00%	0.00%
AK	3	UnitedHealthcare	0.00%	0.00%
AK	4	Aetna Health Inc.	0.00%	0.00%
AK Average			**0.00%**	**0.00%**
Grand Average			**38.29%**	**32.99%**

Quality of care and performance of the plans

Drug addiction has become a serious issue in the US. According to the Substance Abuse and Mental Health Services Administration's (SAMHSA) National Survey on Drug Use and Health (NSDUH), in 2016, over 11 million Americans misused prescription opioids, and 2.1 million had an opioid use disorder due to prescription opioids or heroin.[1]

In order to see which insurance companies are more pro-active in making sure their members are not on an unsafe dose of prescription opioids for a prolong period, we use three steps to calculate the weighted

average of the UOD rate[1] for all top-10 companies within each state and rank the companies by the rate. The dataset of UOD is *EOC170 - Use of Opioids at High Dosage (UOD)*, downloaded from CMS.gov.

Firstly, we screen out the top-10 biggest market share insurance companies in each state. Then, we can get the UOD rate for every contract offered by these insurance companies. The results are shown in **Table 4**.

Table 4 UOD Rates for Contracts Offered by Top-10 Insurance Companies

Contract Number	MajorInsuranceOrgName	UOD Rate
H0028	Humana	6.09%
H0504	BlueCrossBlueShield	5.70%
H0523	Aetna Health Inc.	3.48%
H0524	Kaiser	2.93%
H0543	UnitedHealthcare	12.10%
H0544	BlueCrossBlueShield	2.64%
H0562	Health Net of California	5.81%
H0710	UnitedHealthcare	5.80%
H0838	Brand New Day	2.56%
H1286	UnitedHealthcare	6.17%
H1304	BlueCrossBlueShield	10.37%
H1365	Martin's Point Generations Advantage	5.98%
H1608	Aetna Health Inc.	5.54%
H1609	Aetna Health Inc.	6.83%
H1660	Harvard Pilgrim Health Care, Inc.	4.98%
H1737	Health Alliance Medicare	1.52%
H1846	MediGold	7.92%
H1894	AMERIGROUP	5.10%
H1951	Humana	4.59%
H1961	Peoples Health	3.43%
H1997	BlueCrossBlueShield	5.73%
H2001	UnitedHealthcare	4.01%
H2108	Cigna	6.77%
H2150	Kaiser	3.02%
H2228	UnitedHealthcare	9.56%
H2406	UnitedHealthcare	4.72%
H2491	WellCare	5.47%
H2775	WellCare	4.21%
H2802	UnitedHealthcare	5.04%
H2816	WellCare	4.90%
H3204	Presbyterian Health Plan	4.35%
H3206	Presbyterian Insurance Company, Inc.	6.19%

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[1] For members 18 years and older, the rate by contract of receiving prescription opioids for ≥15 days during the measurement year at a high dosage (average morphine equivalent dose [MED] >120 mg).

Contract Number	MajorInsuranceOrgName	UOD Rate
H3251	BlueCrossBlueShield	6.62%
H3471	Health Alliance Northwest	3.34%
H3597	Aetna Health Inc.	6.32%
H3655	BlueCrossBlueShield	2.44%
H3660	SummaCare Medicare Advantage Plans	3.16%
H3664	PrimeTime Health Plan	2.17%
H3668	MediGold	2.74%
H3805	UnitedHealthcare	13.85%
H3815	Alignment Health Plan	37.08%
H3817	BlueCrossBlueShield	4.85%
H3822	BlueCrossBlueShield	5.76%
H3890	Johns Hopkins HealthCare	8.89%
H3928	Aetna Health Inc.	4.26%
H3931	Aetna Health Inc.	6.21%
H4036	BlueCrossBlueShield	3.79%
H4497	Medical Mutual of Ohio	6.60%
H4909	BlueCrossBlueShield	8.81%
H5008	UnitedHealthcare	9.97%
H5009	BlueCrossBlueShield	8.47%
H5010	Asuris Northwest Health	14.02%
H5050	Kaiser	3.81%
H5216	Humana	5.80%
H5253	UnitedHealthcare	6.08%
H5262	Senior Preferred	3.17%
H5322	UnitedHealthcare	6.10%
H5425	SCAN Health Plan	3.90%
H5521	Aetna Health Inc.	5.57%
H5522	Aetna Health Inc.	6.12%
H5525	Humana	4.89%
H5526	BlueCrossBlueShield	4.79%
H5576	Vantage Health Plan, Inc.	3.84%
H5591	Martin's Point Generations Advantage	3.54%
H5619	Humana	4.66%
H5649	Central Health Medicare Plan	1.28%
H5652	UnitedHealthcare	1.40%
H5746	Amerigroup Community Care of New Mexico	7.03%
H5823	Molina Healthcare of Washington, Inc.	6.95%
H5928	BlueCrossBlueShield	0.00%
H6237	BlueCrossBlueShield	5.52%
H6622	Humana	4.20%
H6723	Medical Mutual of Ohio	5.84%

Contract Number	MajorInsuranceOrgName	UOD Rate
H7245	BlueCrossBlueShield	6.48%
H7728	BlueCrossBlueShield	5.75%
H8145	Humana	6.98%
H8432	BlueCrossBlueShield	5.94%
H8552	BlueCrossBlueShield	7.99%
H8634	BlueCrossBlueShield	6.22%
H8854	University of Maryland Health Advantage	6.68%
H9003	Kaiser	3.34%
H9082	Molina Healthcare of New Mexico, Inc.	5.39%
H9302	BlueCrossBlueShield	4.79%
H9572	BlueCrossBlueShield	4.58%
R5329	UnitedHealthcare	10.78%
R5941	BlueCrossBlueShield	5.25%
R6694	Aetna Health Inc.	9.48%

Later, by multiplying UOD rate of each contract by the enrollment size of the contract in the state, summing them up, and dividing them by the total enrollment of the company in the state, we calculate the weighted average of the UOD rate. After ranking this weighted average rate for all top-10 companies, we can know which insurance companies did best in controlling the usage of opioid. At last, we calculate the weighted average[2] of the Use of Opioids at High Dosage (UOD) rate based on the enrollment number of all top-10 companies within each state.

The results are shown in **Table 5**, ordered from the worst (highest rate of UOD) to the best (lowest rate of the UOD). We can see that the UOD rate of the two companies with highest UOD rate in California and Washington are higher than 10%, and the UOD rate of Alignment Health Plan in California is even up to 37.08%.

Table 5 UOD Rates for Contracts offered by Top-10 Insurance Companies by State

State	Rank	MajorInsuranceOrgName	UOD Rate
AK	1	BlueCrossBlueShield	8.81%
AK	2	Humana	5.80%
AK	3	Aetna Health Inc.	5.57%
AK	4	UnitedHealthcare	4.01%
CA	1	Alignment Health Plan	37.08%
CA	2	UnitedHealthcare	10.42%
CA	3	Health Net of California	5.81%
CA	4	Aetna Health Inc.	4.80%
CA	5	Humana	4.68%
CA	6	SCAN Health Plan	3.90%
CA	7	Blue Cross Blue Shield	3.81%
CA	8	Kaiser	2.93%

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[2] for each company, list all the Contracts in each state, multiply UOD rate of each Contract by the enrollment size of the Contract in the state, sum them up, divide them by the total enrollment of the Company in the state where the Contract has a UOD rate.

State	Rank	MajorInsuranceOrgName	UOD Rate
CA	9	Brand New Day	2.56%
CA	10	Central Health Medicare Plan	1.28%
IA	1	BlueCrossBlueShield	6.69%
IA	2	Humana	5.97%
IA	3	Aetna Health Inc.	5.66%
IA	4	UnitedHealthcare	5.15%
IA	5	Senior Preferred	3.17%
IA	6	Health Alliance Medicare	1.52%
LA	1	BlueCrossBlueShield	8.17%
LA	2	UnitedHealthcare	6.85%
LA	3	WellCare	5.47%
LA	4	Aetna Health Inc.	5.44%
LA	5	Humana	4.69%
LA	6	Vantage Health Plan, Inc.	3.84%
LA	7	Peoples Health	3.43%
MD	1	Johns Hopkins HealthCare	8.89%
MD	2	Cigna	6.77%
MD	3	University of Maryland Health Advantage	6.68%
MD	4	Blue Cross Blue Shield	6.50%
MD	5	Humana	5.80%
MD	6	Aetna Health Inc.	5.64%
MD	7	UnitedHealthcare	4.43%
MD	8	Kaiser	3.02%
ME	1	BlueCrossBlueShield	6.02%
ME	2	Aetna Health Inc.	5.86%
ME	3	Harvard Pilgrim Health Care, Inc.	4.98%
ME	4	Humana	4.90%
ME	5	UnitedHealthcare	4.43%
ME	6	WellCare	4.37%
ME	7	Martin's Point Generations Advantage	3.62%
NM	1	UnitedHealthcare	8.57%
NM	2	Amerigroup Community Care of New Mexico	7.03%
NM	3	BlueCrossBlueShield	6.22%
NM	4	Presbyterian Insurance Company, Inc.	6.19%
NM	5	Humana	5.93%
NM	6	Aetna Health Inc.	5.57%
NM	7	Molina Healthcare of New Mexico, Inc.	5.39%
NM	8	Presbyterian Health Plan	4.35%
OH	1	Medical Mutual of Ohio	6.03%
OH	2	UnitedHealthcare	5.72%
OH	3	Aetna Health Inc.	5.62%
OH	4	Humana	5.07%
OH	5	SummaCare Medicare Advantage Plans	3.16%

State	Rank	MajorInsuranceOrgName	UOD Rate
OH	6	MediGold	2.82%
OH	7	BlueCrossBlueShield	2.82%
OH	8	PrimeTime Health Plan	2.17%
WA	1	Asuris Northwest Health	14.02%
WA	2	UnitedHealthcare	11.31%
WA	3	Molina Healthcare of Washington, Inc.	6.95%
WA	4	BlueCrossBlueShield	6.46%
WA	5	Aetna Health Inc.	5.93%
WA	6	AMERIGROUP	5.10%
WA	7	Humana	4.87%
WA	8	Kaiser	3.70%
WA	9	Health Alliance Northwest	3.34%

According to the results shown in **Table 5**, we find the insurance companies most mindful of opioid crisis and doing their part to control it (shown in **Table 6**).

Table 6 Companies with Lowest UOD Rates in Each State

State	MajorInsuranceOrgName
AK	UnitedHealthcare
CA	Central Health Medicare Plan
IA	Health Alliance Medicare
LA	Peoples Health
MD	Kaiser
ME	Martin's Point Generations Advantage
NM	Presbyterian Health Plan
OH	PrimeTime Health Plan
WA	Health Alliance Northwest

Reference

[1] Asl. "Tracking Opioid and Substance Use Disorders in Medicare Medicaid." HHS.gov, 6 June 2018, https://www.hhs.gov/about/agencies/asl/testimony/2018-04/tracking-opioid-and-substance-use-disorders-medicare-medicaid-hhs-programs.html.

Appendix

```
1.  # Question 1 ####
2.  setwd("C:/Users/ytlau/Desktop/Brandeis/193HS-256F-1  Healthcare Data Analytics and Data
    Mining/HW2")
3.  library(data.table)
4.  library(stringr)
5.  ## geting the data
6.  enrollment  = fread('CPSC_Enrollment_Info_2019_10.csv')
7.  major_insurance = fread('MajorInsuranceOrgs.csv')
8.  monthly_report_by_plan = fread('Monthly_Report_By_Plan_2019_10.csv')
9.  ## removing the rows that contain '*'
10. enrollment= enrollment[Enrollment!='*']
11. ## keeping all keep all the Hxxxx and Rxxxx and Exxxx contracts
12. enrollment_new =  enrollment[substr(enrollment$`Contract Number`, 1, 1) != 'S']
13. monthly_report_by_plan_new =
    monthly_report_by_plan[substr(monthly_report_by_plan$`Contract Number`, 1, 1) != 'S']
14. ## merge table major_insurance with monthly_report_by_plan_new by 'Organization
    Marketing Name'
15. df_merge = merge(major_insurance, monthly_report_by_plan_new,
16.           by = 'Organization Marketing Name')
17. ## merge enrollment_new with newly merged table to get all the infomation by 'Contract
    Number' and 'Plan ID'
18. df_all_info = merge(x= enrollment_new, y=df_merge, by =c('Contract Number','Plan ID'), x.all
    = TRUE)
19. ## getting our group's assigned states
20. states_group1 = c('CA','OH','WA','MD','LA','IA','NM','ME','AK' )
21. ## aggregate enrollments by assigned states and MajorInsuranceOrgName
22. df_company_state = df_all_info[,.(company_total = sum(as.numeric(Enrollment.x))), by
    = .(State, MajorInsuranceOrgName)]
23. df_company_state_group1 =  df_company_state[(State %in% states_group1)]
24. ## aggregate enrollments by assigned states
25. df_state = df_all_info[,.(total = sum(as.numeric(Enrollment.x))), by = .(State)]
26. df_state_group1 = df_state[(State %in% states_group1)]
27. ## calculating the shares of different companies in different states
28. df_ratio = merge(df_company_state_group1, df_state_group1, by = 'State')
29. df_share = df_ratio[,.(MajorInsuranceOrgName,State,share= company_total/total)]
```

```
1.  # Question 2 ####
2.  dental = fread("pbp_b16_dental.csv")
3.  head(dental)
```

```r
4.  ## find the first Segment and assume its dental benefit to entire Plan
5.  dental_rank = dental[, rank := rank(segment_id), by =
      c("pbp_a_hnumber","pbp_a_plan_identifier")]
6.  dental_new = dental_rank[dental_rank$rank == 1,]
7.  ## subset data (top-5 major insurance companies in terms of market share in states)
8.  df_share_rank = df_share[, rank := rank(share), by = State]
9.  df_share_top5 = df_share_rank[df_share_rank$rank <= 5,]
10. df_share_new = df_share_top5[order(State, rank)]
11. ## merge dental data with enrollment data
12. dental_enroll = merge(x = dental_new, y = df_all_info, by.x =
      c("pbp_a_hnumber","pbp_a_plan_identifier"), by.y = c("Contract Number","Plan ID"))
13. dental_enroll_new = merge(x = dental_enroll, y = df_share_new, by =
      c("MajorInsuranceOrgName","State"))
14. setnames(dental_enroll_new, "Enrollment.x", "Enrollment")
15. ## calculate the number of enrollees for the top-5 major insurance companies in each state
16. dental_enroll_state_company =
      dental_enroll_new[, .(sum_enroll_t=sum(as.numeric(Enrollment))), by = .(State,
      MajorInsuranceOrgName)]
17. dental_enroll_preventive =  dental_enroll_new[, .(sum_enroll_p=sum((pbp_b16a_bendesc_yn
      == 1)*as.numeric(Enrollment),na.rm=TRUE)), by = .(State, MajorInsuranceOrgName)]
18. dental_enroll_comprehensive =
      dental_enroll_new[, .(sum_enroll_c=sum((pbp_b16b_bendesc_yn ==
      1)*as.numeric(Enrollment),na.rm=TRUE)), by = .(State, MajorInsuranceOrgName)]
19. ## merge the enrollment data tables
20. m1_dental_enroll_preventive = merge(x = dental_enroll_state_company, y =
      dental_enroll_preventive, by = c("MajorInsuranceOrgName","State"))
21. m2_dental_enroll_preventive = merge(m1_dental_enroll_preventive,
      dental_enroll_comprehensive, by = c("State", "MajorInsuranceOrgName"))
22. m3_dental_enroll_preventive = merge(m2_dental_enroll_preventive, df_share_top5, by =
      c("State", "MajorInsuranceOrgName"))
23. ## calculate percentages of the enrollees
24. dental_enroll_pct = m3_dental_enroll_preventive[order(State,rank)]
25. dental_enroll_pct$pct_preventive =
      round(dental_enroll_pct$sum_enroll_p/dental_enroll_pct$sum_enroll_t,4)
26. dental_enroll_pct$pct_comprehensive =
      round(dental_enroll_pct$sum_enroll_c/dental_enroll_pct$sum_enroll_t,4)
27. fwrite(dental_enroll_pct, file = "dental_enroll_pct.csv")
```

```r
1.  # Question 3  ####
2.  eoc_report = fread('EOC170.csv')
3.  head(eoc_report)
4.  ## cleaning data
5.  eoc_report = eoc_report[substr(`Contract Number`,1,1)!='S']
6.  eoc_report$`EOC170-0010`= as.numeric(eoc_report$`EOC170-0010`)
7.  eoc_report = na.omit(eoc_report)
8.  ## get the top-10 biggest market share insurance companies
9.  df_share_10 = df_share[,.(order = order(share),
10.                share, MajorInsuranceOrgName), by=State][order<=10]
```

```r
11. ## merge tables
12. df_all_share = merge(df_share_10, df_all_info,
13.                by = c('MajorInsuranceOrgName','State'))[,.(`Contract Number`,
14.                                     State, MajorInsuranceOrgName,Enrollment.x)]
15. df_eoc_all =merge(df_all_info, eoc_report,
16.           by = 'Contract Number')[,.(`Contract Number`,State,
    `MajorInsuranceOrgName`,`EOC170-0010`)]
17. df_eoc_all = unique(df_eoc_all)
18. df_uod = merge(df_eoc_all, df_all_share, by =c("Contract Number","State"))
19. ## calculating the average weight
20. df_weight  = df_uod[,.(weighted_avg = as.numeric(`EOC170-
    0010`)/100*as.numeric(Enrollment.x)/sum(as.numeric(Enrollment.x))),
21.              by =.(`Contract Number`,State, MajorInsuranceOrgName.y)]
22.
23. df_avg_weight= df_weight[,.(avg_weight = sum(weighted_avg)), by =.(`Contract
    Number`,State, MajorInsuranceOrgName.y)]
24. ## ranking
25. df_rank = df_avg_weight[with(df_avg_weight,order(State,avg_weight, decreasing = TRUE)),]
```