HW2: US Insurance Market Data & Analytics

Team I - Zhiqi Chen, Nkosingiphile Shongwe, Salil Redkar,

Malavika Andavilli, Debarati Mazumdar

Introduction

Centers for Medicare and Medicaid Services (CMS) is a government agency in charge of government insurance programs such as Medicare and Medicaid. US citizens aged 65+ have the option to use traditional fee-for-service Medicare as their insurance or alternatively choose a private commercial insurance to insure them, which is a Part C model, also known as Medicare Advantage Plans. The CMS is required by law to keep and report Part C insurance statistics to the CMS such as dental health benefits package, opioid usage dosage, which we will investigate further (https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/MCRAdvPartDEnrolData/index.html). The CMS also has a record of the these insurance companies, which we can use to analyze market share and competitiveness in the industry using the Herfindahl-Hirschman index (HHI).

In this project, we are going to analyze that **whether states should move to a single private payer model, where the government could be a partner**. This can be done by understanding the market share of each company in each state as a measure of compatibility. In addition, we will study how concentrated or fragmented is the industry is in the nine states we are analyzing. For the government to learn more about each company and how attractive their benefit package is, we will also investigate the dental services each company offers in state. In this analysis, we want to determine the percentage of insurance companies offering a dental package as a supplement in terms of Preventive and Comprehensive Dental Items. Lastly, we will determine the companies that are mindful of the opioid crisis by controlling their prescription of such drugs to their customers, using the HEDIS Public Use Files 2018, developed by the National Committee for Quality Assurance (https://www.ncqa.org). We will use the Use of Opioids at High Dosage (UOD) as a measure to assess the rate of health plan members who receive long term-term opioids at high dosage for 90 consecutive days or more. With the increasing opioid epidemic, measures such as the UOD could be used to emphasize their importance and encourage action on them with incentives such as financial gain.

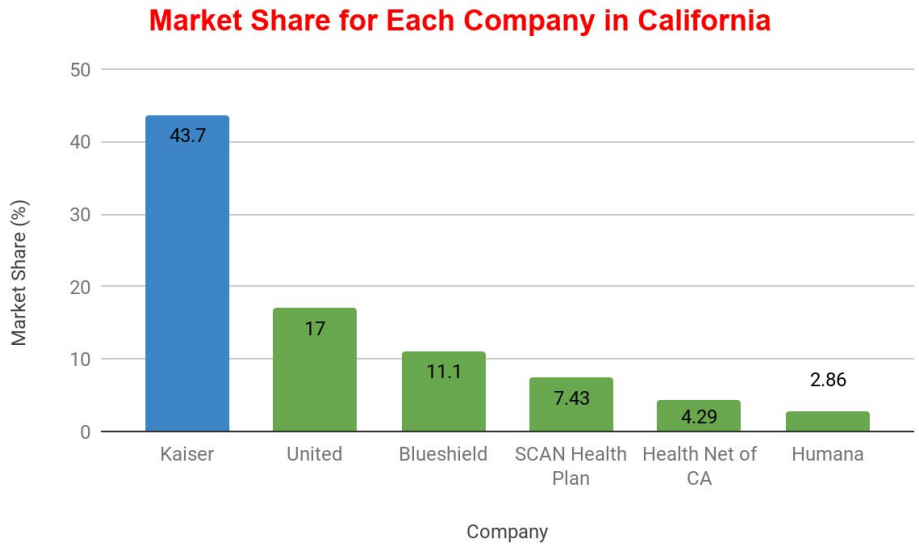
Question 1

In order to determine which companies could be recommended to be unified towards a single player, we calculated market share for each state and chose the top six companies. We then compared these market shares for each state and determined whether that state's insurance market is fragmented or concentrated. Overall, most of the states show the capability to have enough economies of scale and scope to be unified into a single player, shown by the different colors to highlight industry leaders in that state. However, California shows a different trend in that the market is highly fragmented. It should be noted though that inasmuch as this data is a comprehensive analysis of the industry, it is only a snapshot for 2019, and not historical data, which might show differences since policies have changed regarding market share power. In addition, the rate of mergers and acquisitions differ from state to state, which affects the market share.

Individual analysis per state:

California

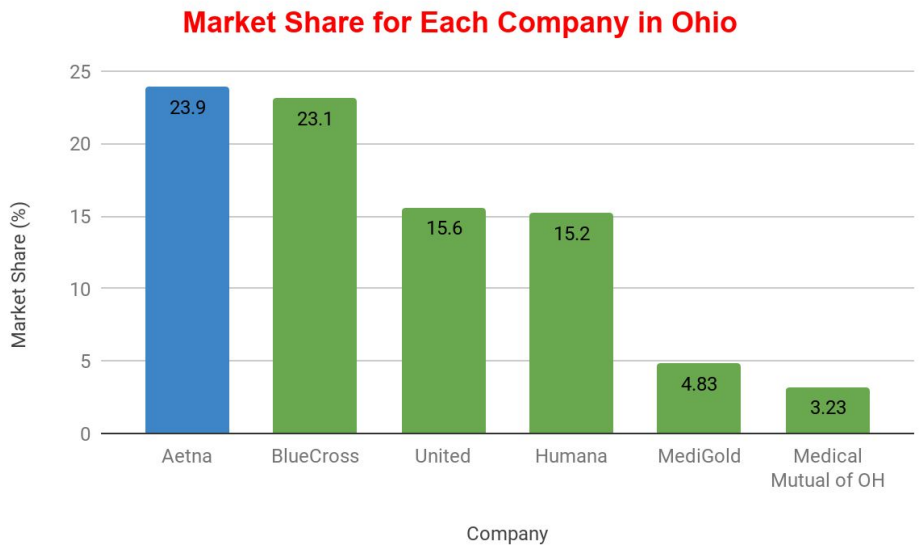
In CA, Kaiser has the largest market share, which is 43.70%, and its HHI is 2417. The single payer in the insurance market for CA should be Kaiser. The market is fragmented for CA as we see that apart from the highest 43.7%, the remaining market share is shared by multiple players. Thus CA should focus on better integration of players as fragmented market poses more threat to the overall healthcare system. CA being one of the highest in terms of population, it will be interesting to further understand if there are concentrated players in the metropolitan cities compared to the whole state.



Ohio

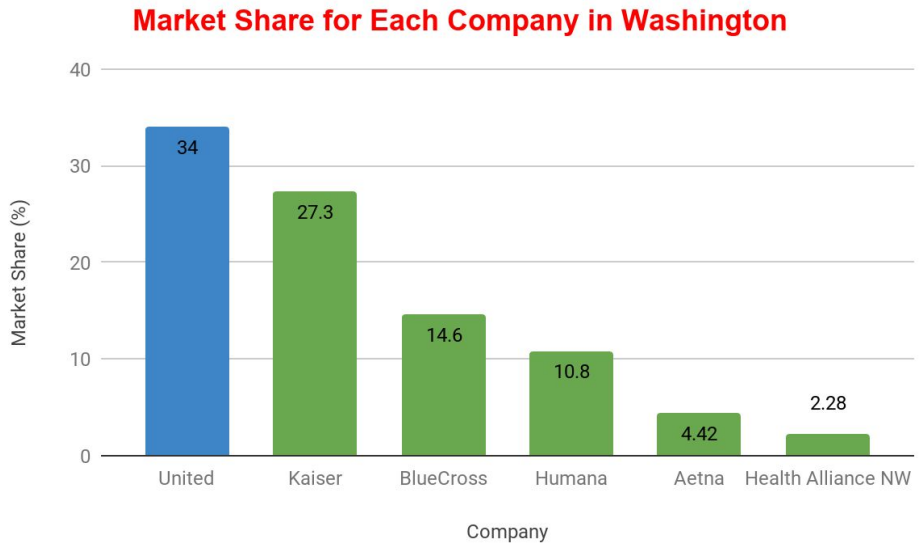
In Ohio, Aetna Health Inc is the leader at (23.92%), closely followed by BlueCross BlueShield (23.13%), and Medical Mutual of Ohio with the lowest market share at almost 3.23%, and the

HHI of OH is 1638. We can see that the state has a concentrated market with major players being Aetna,BlueCross, United and Humana.OH has better regulations and also a better healthcare system.



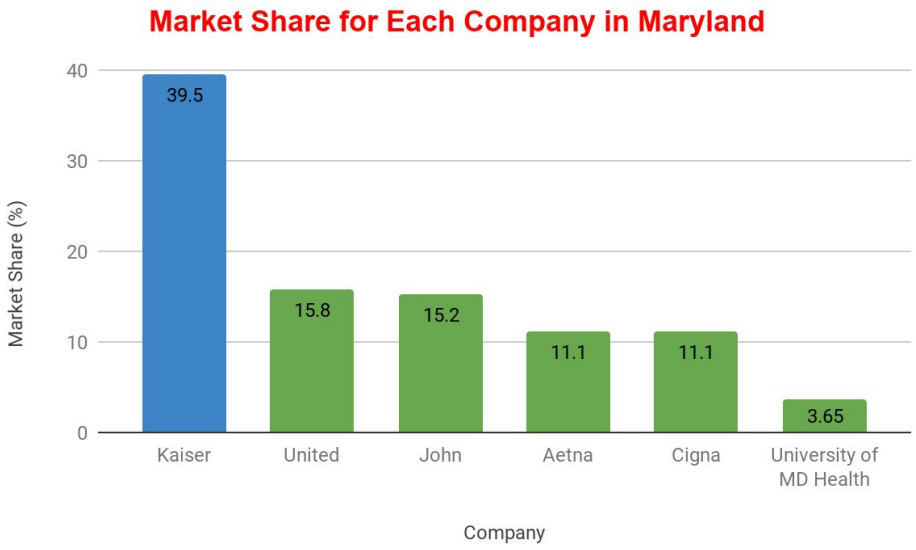
Washington

Washington is a concentrated market and therefore could be unified towards a single payer. UnitedHealthcare is the biggest payer with 34.00% market share and the HHI of WA is 2266, which again indicates better regulation and more Americans prefer such states as this uncomplicates the healthcare process for the patient.



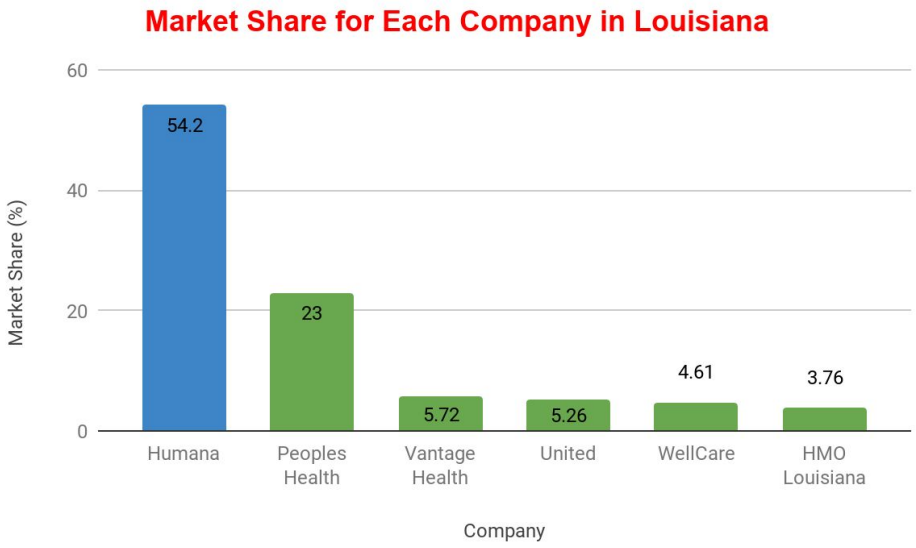
Maryland

In the state of Maryland, Kaiser has the largest market share, which is 39.48% and therefore the industry is concentrated and can be unified into a single payer model; the HHI of MD is 2307.This indicates that the state has a more regulated and integrated healthcare.



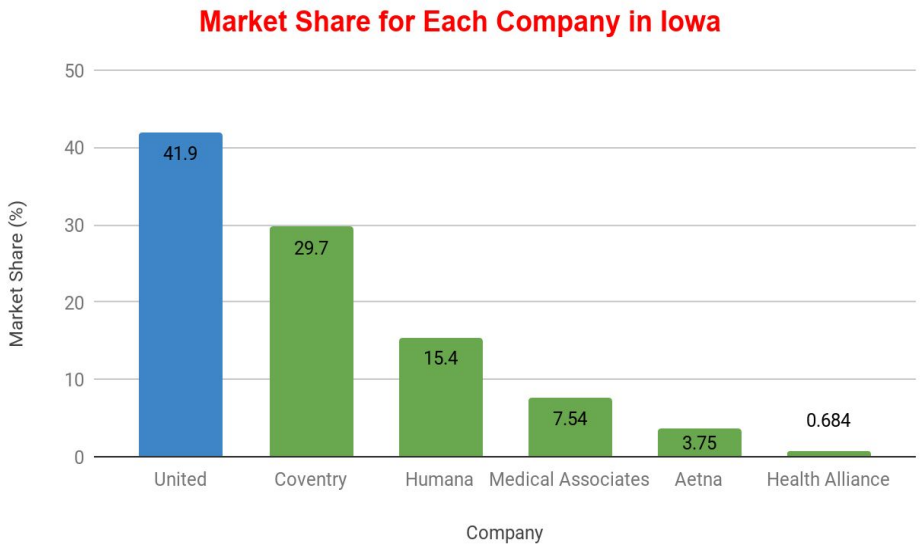
Louisiana

In the state of Louisiana, Humana has the biggest market share of 54.16%, which is more than half of the total market share. The industry in this state is highly concentrated, with an HHI of 3566. Therefore, the market can be unified into a single payer model - Humana which covers more than 50% of the market share and the rest 50% is between a few other players.



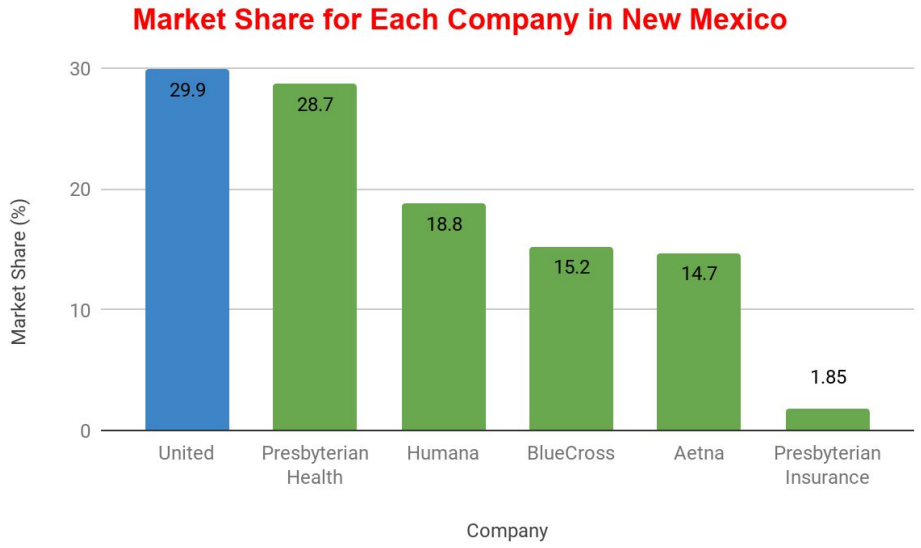
Iowa

In Iowa, UnitedHealthCare occupies 41.91%, which implies that the market can be unified into a single payer model, and the HHI of NM is 2946, followed by Coventry and Humana, the state has a concentrated market indicating a regulated healthcare system.



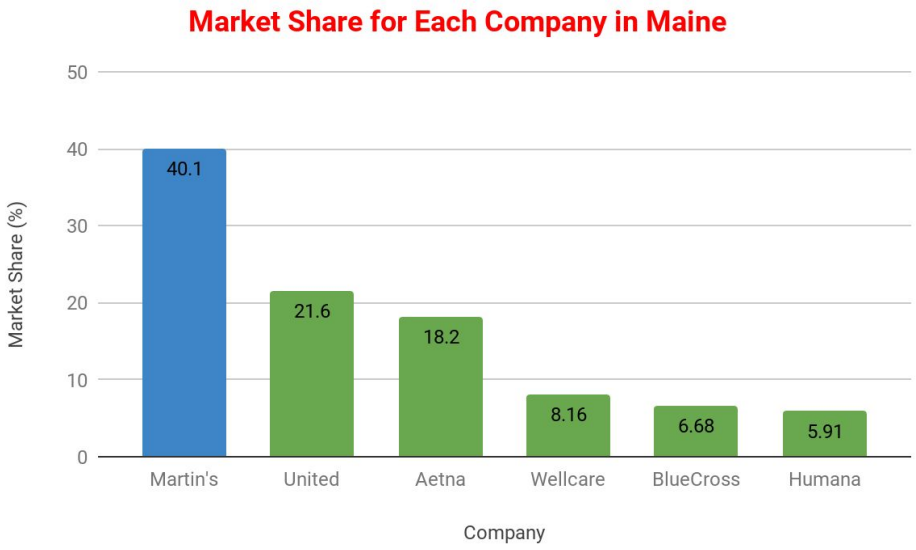
New Mexico

In New Mexico UnitedHealthcare and Presbyterian Health Plan have almost the same market share (29.92% and 28.74% respectively), and its HHI is 2320, indicating a concentrated market between a few players.



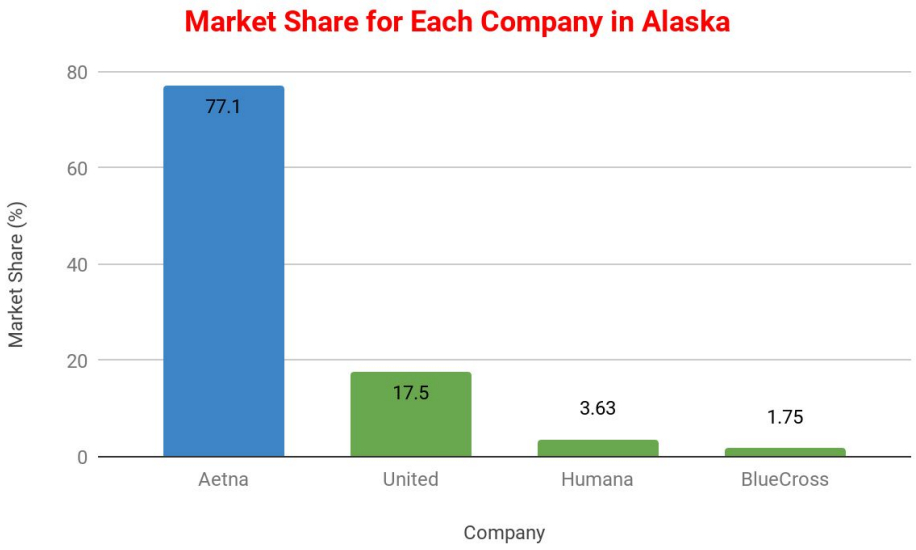
Maine

The insurance market in Maine is moderately concentrated, where Martin's Point Generations Advantage is the biggest player with 40.09% market share and the HHI of ME is 2529. Maine also has lesser population hence less competition in the state.



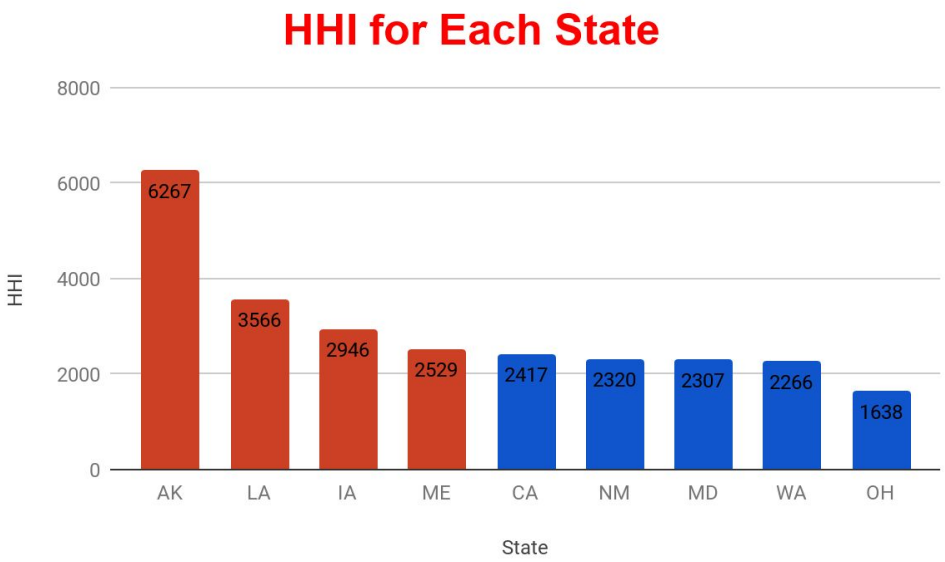
Alaska

In Alaska, there are only four major players, with Aetna Health Inc. occupying the largest market share of 77.10%. This is a strongly concentrated industry, which can be unified into a single payer model. Maine's HHI is 6267. Again Alaska is similar to Maine in terms of population dynamics and thus just one single player has the dominance in the market.



Evaluating Market Concentration for the nine states:

To measure market concentration for the insurance industry in the nine states, we used the Herfindahl-Hirschman index (HHI). The HHI is a measure of the size of firms in relation to the industry and an indicator of the amount of competition among them. To calculate this value, we squared the market share of each firm competing in the market for the nine states, and then summed the resulting numbers. To calculate the HHI, is a commonly accepted measure of market concentration (https://corporatefinanceinstitute.com).We infer that generally, the industry is concentrated, with Alaska, Louisiana, Iowa and Maine being the top four (https://corporatefinanceinstitute.com).



Although the HHI is useful in determining market concentration, it fails to define the specific market that is being examined. For example, even though the companies are competing in the same industry, each company has an advantage in different areas such as dental or medical. Therefore, within the marketplace, one company might have more percentage of the business for a specific segment of the market. That firm would thus have nearly a total monopoly for that specific area.

Question 2

The data reports that about 77% of the American population is covered by some form of dental insurance, with two-thirds of the population being enrolled in private coverage. Medicaid mandates comprehensive dental coverage for children, but not for adults. Individual states attempt to offer some level of comprehensive coverage, but on the whole, private coverage is more often observed in case of dental coverage.(https://www.nadp.org/Dental_Benefits_Basics/dental_bb_10). Thus, we will investigate which insurance players are the most significant to partner with in these particular states in terms of dental coverage.

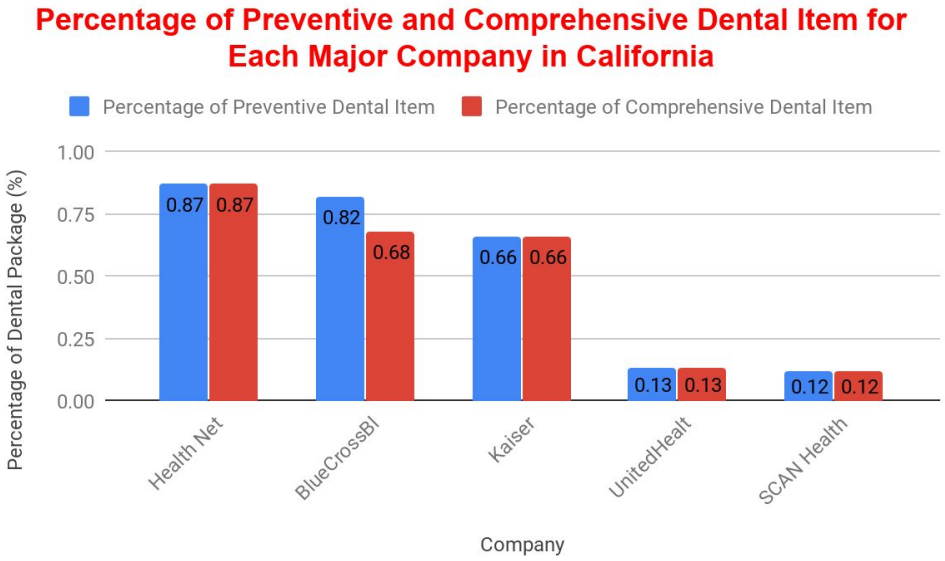
In order to understand how generous the insurance packages are, we evaluated the percentage of enrollees in each state, specifically for dental packages: Preventive and Comprehensive Dental Items. Preventive Plans offer basic routine oral exams, X-rays, cleanings, sealants, and fluoride treatments while Comprehensive Plans are the ones which include any and all types of treatment required to maintain dental health.

The percentage of enrollees enjoying dental benefits is very low in all the states we have studied and this leads to the assumption that that these plans are expensive and most senior citizens (age 65 and above) cannot afford them. This analysis exposes the need for Congress to investigate affordability in these plans and establish the root causes for such low enrollment numbers and find a remedy for this situation. There would be a better understanding on this data if we could get data on private customer demographics for the states.

State wise analysis for preventive and comprehensive dental plan:

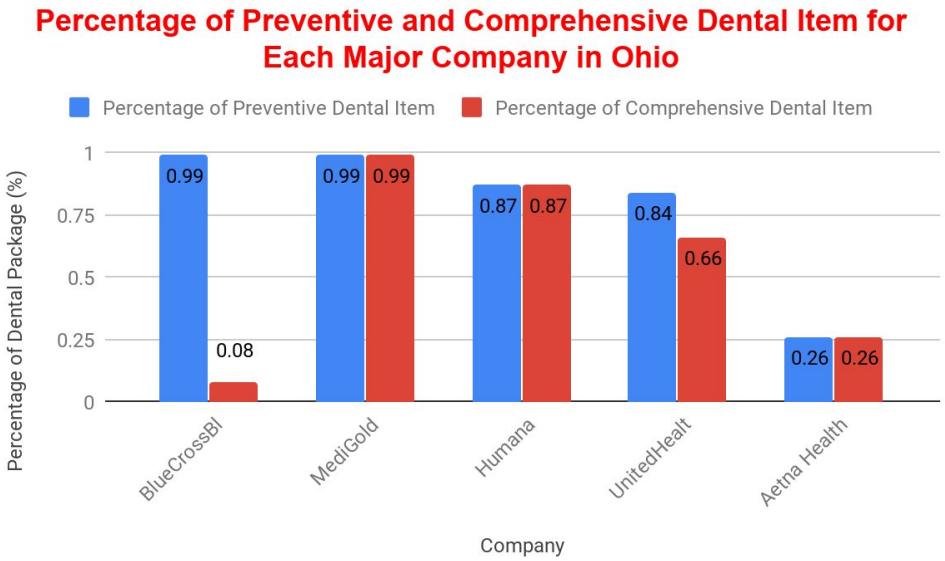
California

In California, Health Net of California has the most enrolles for both the Preventive and Comprehensive packages at approximately 0.87, and followed closely by BlueCross BlueShield at 0.82%. Hence there is similarity in the % of enrollments for both the packages for CA, this can be either due to higher affordability or similar package premiums for the state.



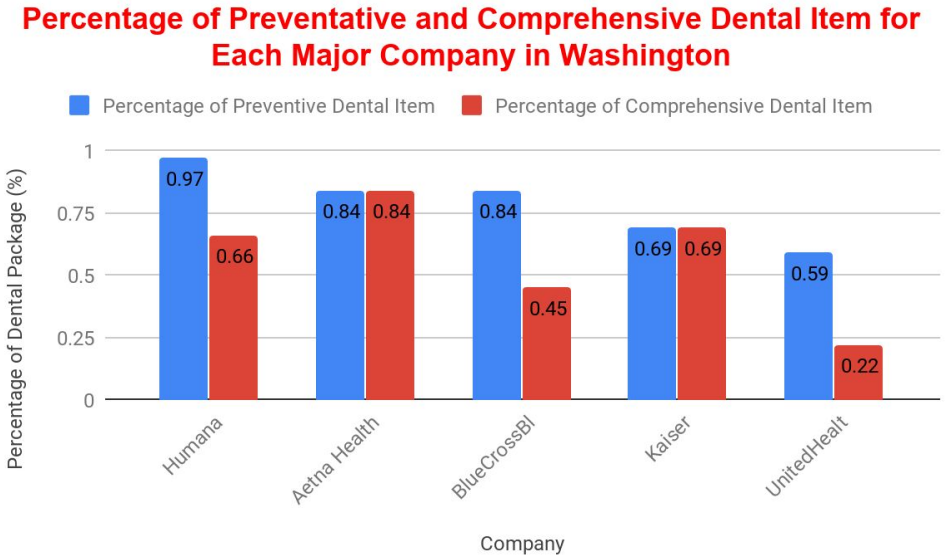
Ohio

In Ohio, we see the % of preventive is a lot higher (0.99%) than comprehensive plan enrols. However this format changes from the second highest insurance provider as we can see almost similar levels of % enrolments for the other 4 companies.This difference for BlueCross BlueShield can be because of a higher % premium for the comprehensive plan as compared to the other insurance providers.Ohio is a concentrated market for insurance providers and one thing which comes out in the dental analysis is that even though Aetna has the highest market share , they are the lowest in terms of dental packages.



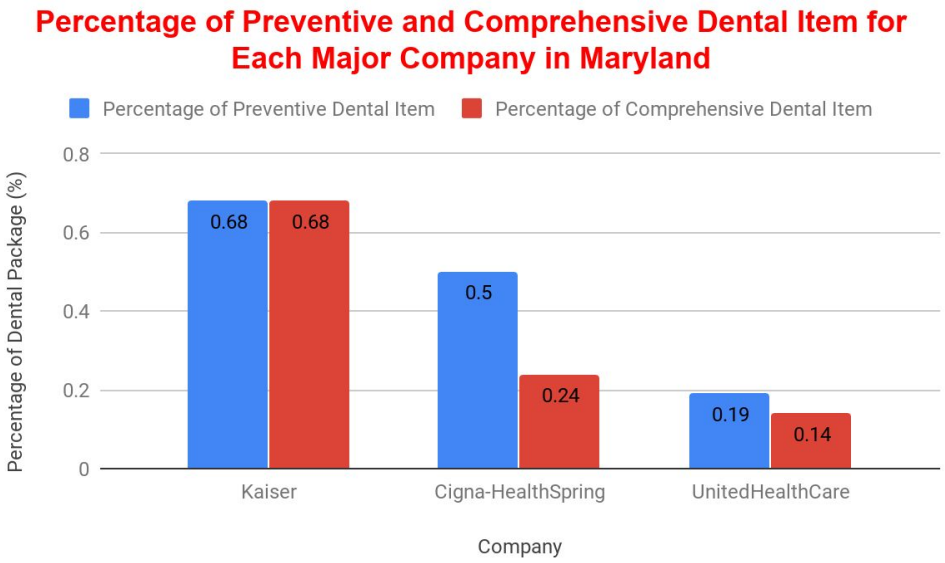
Washington

The state of Washington has higher levels of enrolments for Preventive as compared to Comprehensive, as a state being highly concentrated with a few players - United being the highest in terms of market share - they apparently have less % of preventive enrolments and fewer % for comprehensive plans, the reason can be again high premiums. However Humana has the highest % of enrolments in the state for preventive (0.97%) and Aetna has the highest for Comprehensive plan(0.84%). A deeper analysis on the type of packages and demographics would be very beneficial for some more substantial conclusion.



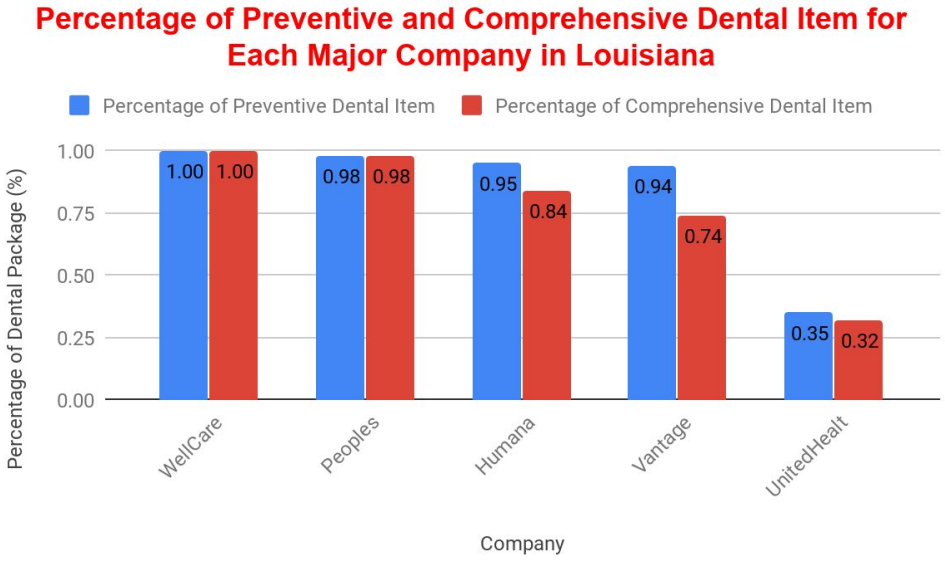
Maryland

For the state of Maryland, the percentage of Preventive plans is on average higher than the Comprehensive plan, where Kaiser has about 0.68% for both plans, while Cigna has a huge difference in plans of Preventive and Comprehensive packages of 0.5% and 0.24% respectively. There might be a premium to enrol in the Cigna Comprehensive dental package compared to the Preventive package.



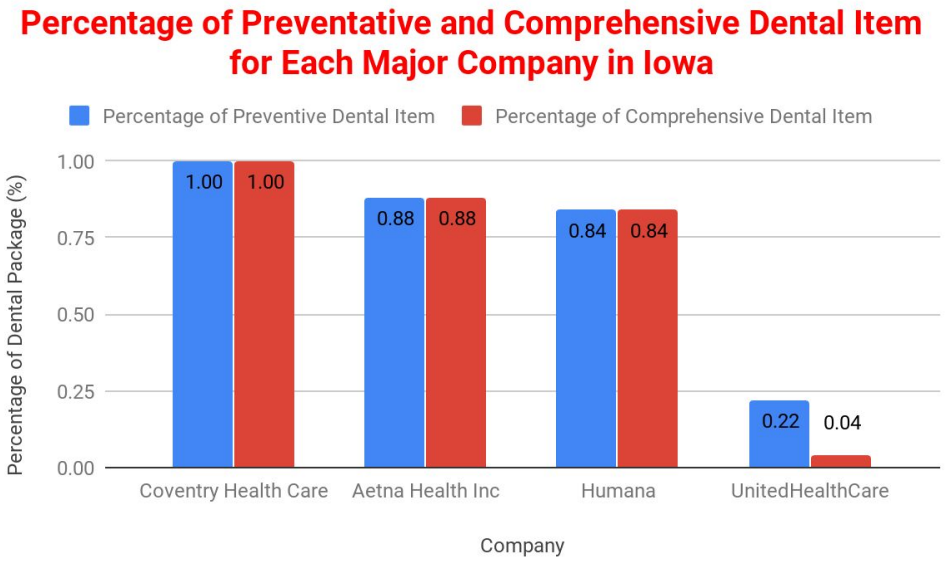
Louisiana

In Louisiana, there seems to be no significant difference in percentage enrollment for the Preventive and Comprehensive package. WellCare has the most enrollees at 1.00% compared for both plans, while United Health Care has 0.35% and 0.32% for the Preventive and Comprehensive plans respectively. Overall, in Louisiana the affordability for both plans is almost the same, so enrollees choose according to their preferences.



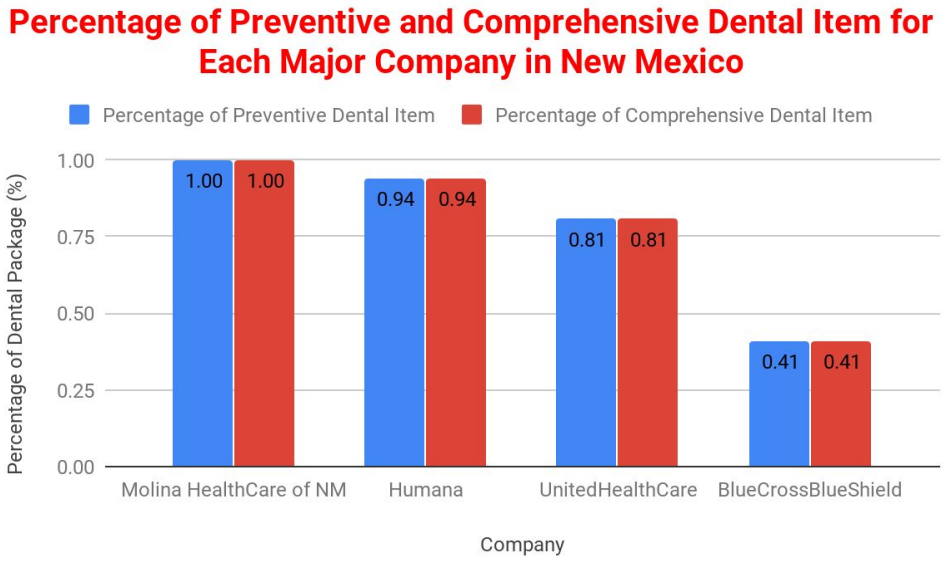
Iowa

Insurance companies in Iowa show an interesting range of dental coverage. United Health, a large company, surprisingly shows very low coverage for their enrollees with preventive services being around 0.22% for preventive services and 0.04 for comprehensive services. Coventry Health offered the most coverage, with about 1% of enrollees enjoying both benefits. Aetna and Humana covered similar percentages of enrollees; 0.88% in the former and 0.84% in the latter for both benefits.



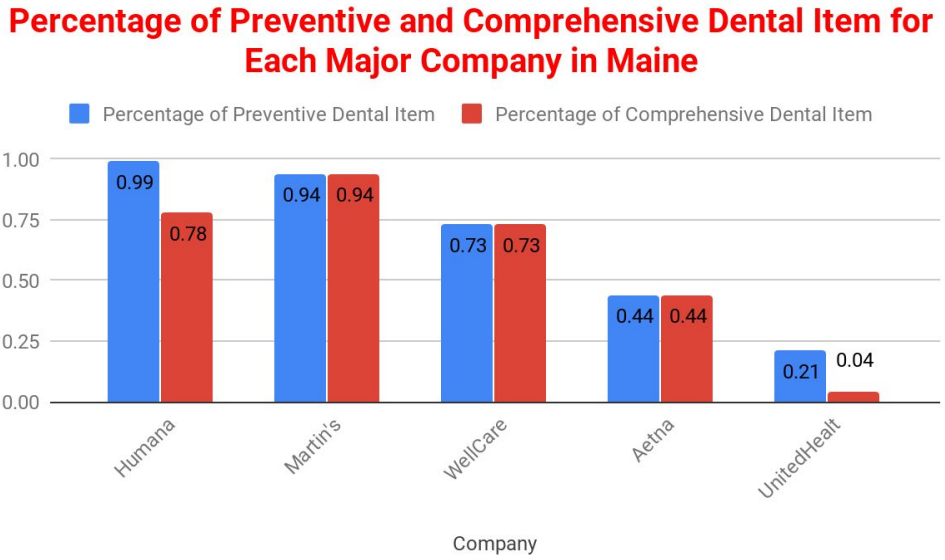
New Mexico

The top insurance companies in New Mexico cover 1% to about 0.4% of the enrollees. There is a uniformity in the offering of Preventive and Comprehensive dental coverage of the enrollees in New Mexico. Molina Healthcare covers about 1% of their enrollees, which Blue Cross Blue Shield covers about 0.41% of them. There are fewer top players in the market in NM, and hence the competitiveness of the plans might be a factor to consider.



Maine

For the state of Maine, the percentage of enrollees for each plan is almost the same with some notable differences with Humana and United Healthcare. Humana has 0.99% enrollees for the Preventive plan when compared to 0.78% for the Comprehensive plan, which is about a 0.2% difference. United Health care on the other hand has a huge difference in enrollee percentage for the Preventive (0.21%), and Comprehensive plan (0.04%).



Alaska

The plans offered by insurance companies in Alaska responded negatively to the question of the presence of preventive and comprehensive dental coverage, and hence there was no data to report for this state. Surprisingly out of the 2,059,590 total enrollees in Alaska, no one is getting either of the two dental benefits in the insurance package. Alaska, being sparsely populated may need more attention in this aspect. Since dental health is an important part and should be taken by all senior citizens maybe the plans could be made more viable and affordable. The insurance coverage in Alaska is one of the most expensive compared to all of the other states. Alaska shows some of the highest spending for private health insurance per enrollee, about 31% higher than the national average.Rising costs and with about a fourth of the population in insured by Medicaid, it is likely that this is one of the reasons for low dental coverage in Alaska. (https://www.adn.com/alaska-news/health/2017/07/01/heres-how-alaskans-get-their-health-insurance/)

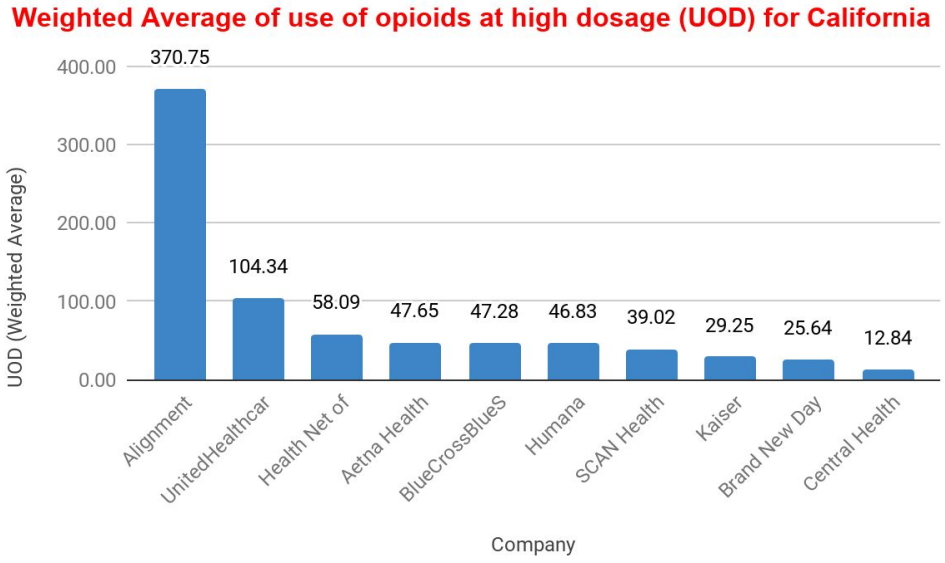
Question 3

To measure how responsive and responsible insurance companies for the nine states are, we used the weighted average use of opioids at high dosage (UOD). This rate helps to measure if members are prescribing opioids for a long time, which could be rendered unsafe for patients. Based on this calculation, we infer that if a contract has a high UOD, then opioids are being prescribed for a prolonged time, which is bad. It is important to note that since these are different states, some states don't have top ten states as shown in the visualizations below.

UOD Analysis for different companies in each state using weighted average:

California

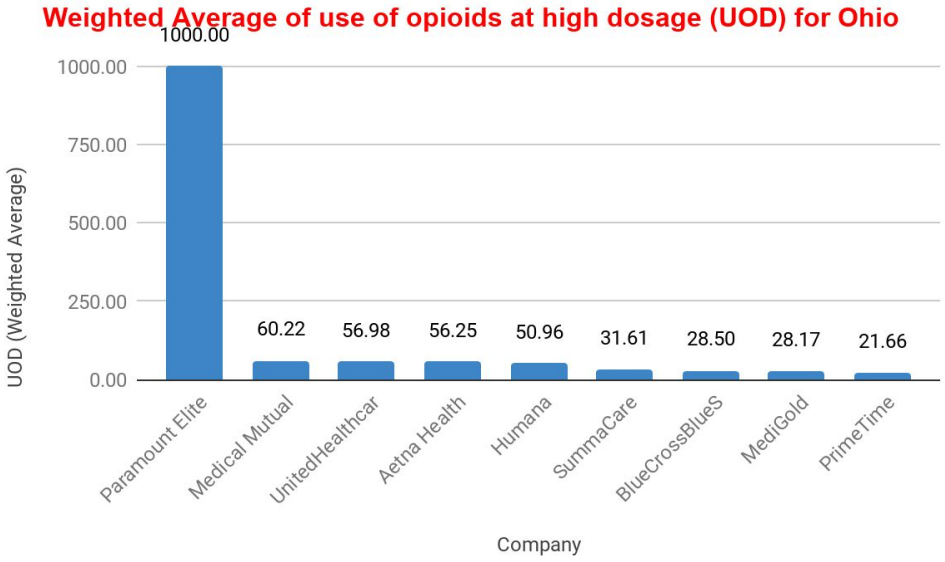
In California, Alignment Health Plan is the worst prescriber of opioids at 370.75, while Central Health Medicare Plan is the least, with a rate of about 12.84. The average of UOD rates for top 10 insurance companies in California state is 78.17. California has high rates of UOD which needs to be reduced to ensure a healthy population. Both Alignment and UnitedHealthcare needs to revamp its prescription policies as soon as possible.



Ohio

In Ohio, Paramount Elite prescribes the opioids at a very high rate, approximately 1000.00. PrimeTime Health Plan prescription rate is at 21.66, which is the lowest in this state and almost five times that of Paramount Elite. The average of UOD rates for top 8 insurance companies in Ohio state is 41.79 excluding the anomaly value of 1000. The average is quite low compared

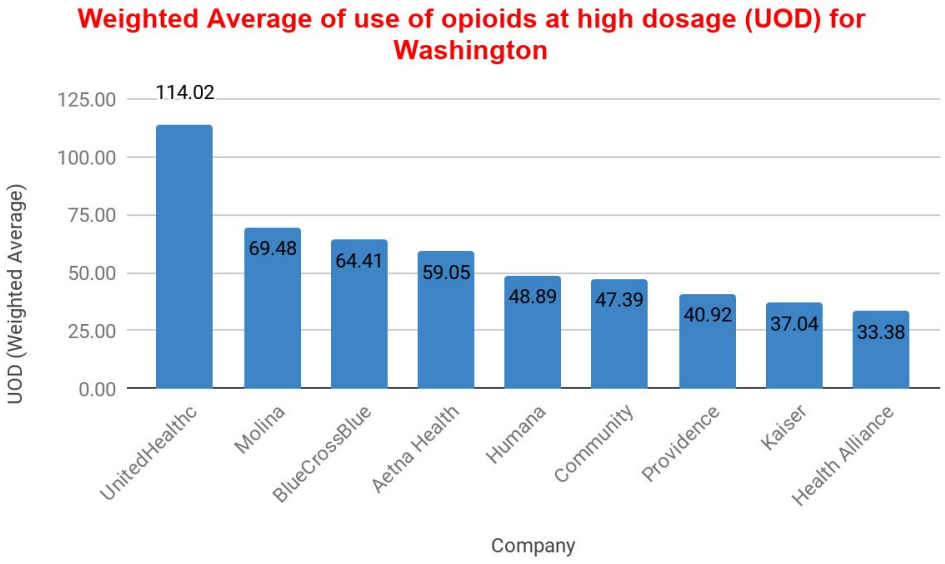
to most states. We believe government has placed restrictions and rules properly to ensure that the population stays healthy.



***please note : Paramount Elite has a high value of 1000 because of two very high value of enrollments**

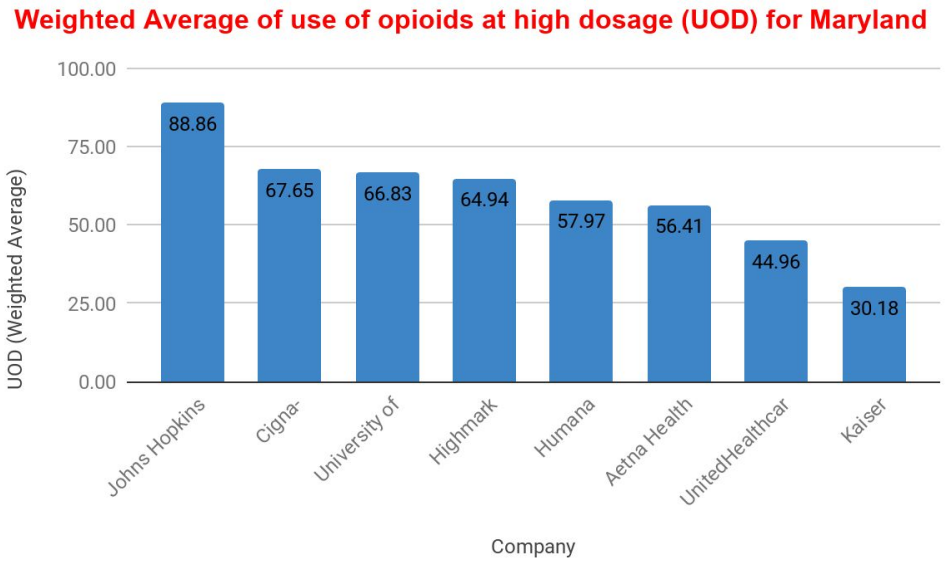
Washington

UnitedHealthcare prescribes the most opioid drugs at a weighted average rate of 114.02 in the state of Washington. The average of UOD rates for top 9 insurance companies in Washington state is 57.18.



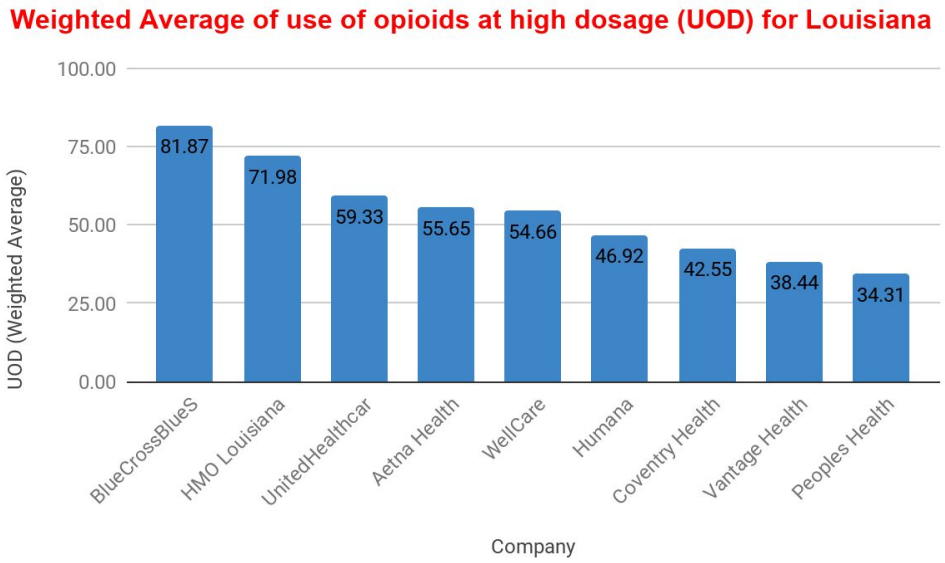
Maryland

In Maryland, Hopkins Health Advantage Inc prescribes the highest opioid drugs at a rate of 88.86. Kaiser prescribes the least at 30.18. The average of UOD rates for top 8 insurance companies in Maryland state is 59.72. We believe Hopkins Health Advantage needs to review its policies to make sure the UOD rate comes down for its enrollees.



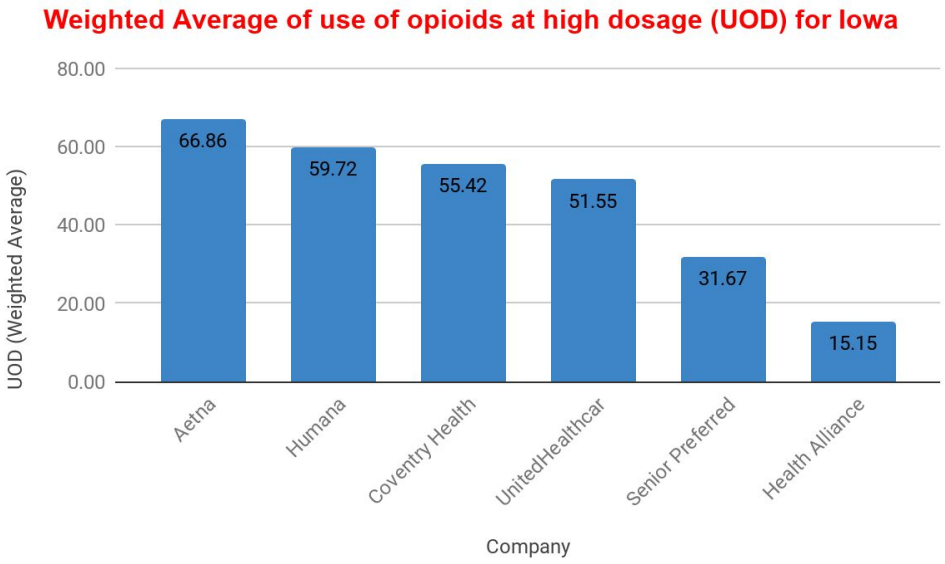
Louisiana

In Louisiana, BlueCross BlueShield prescribes the most opioids at a rate of 81.87. Peoples Health Inc prescribes the least at 34.31. The average for top 9 insurance companies in Louisiana state is 53.97. BlueCross BlueShield needs to reduce its UOD rate. HMO Louisiana also needs to review its policies to reduce the UOD rate.



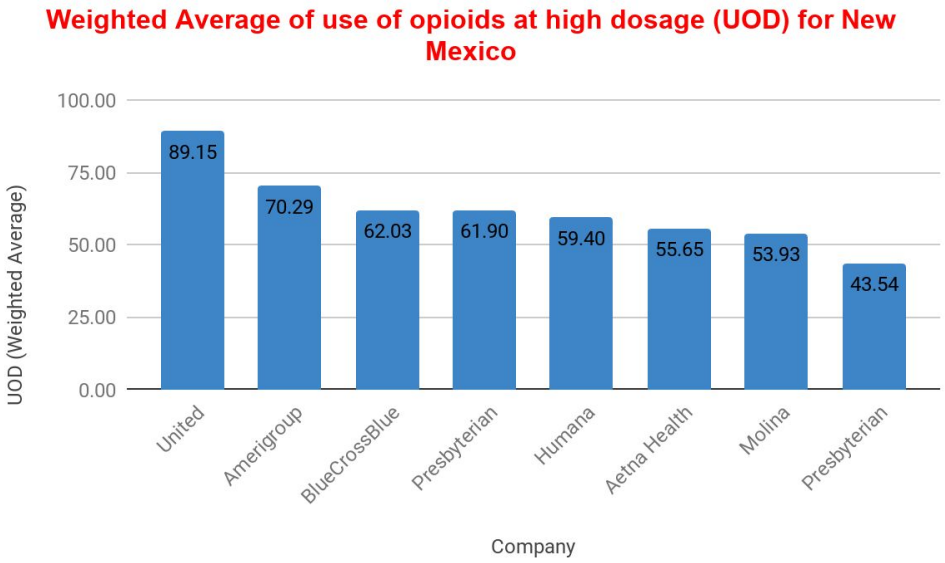
Iowa

In Iowa, Aetna prescribes opioids at a higher rate compared to its competitors. Its weighted UOD average is 66.86, while Health Alliance-Midwest Inc prescribes opioids at a lower rate of 15.15.The average of UOD rates for top 6 insurance companies in Iowa state is 46.73. Iowa still has a lot of work to do in terms of regulating opioid administration, however, it is doing better compared to other states.



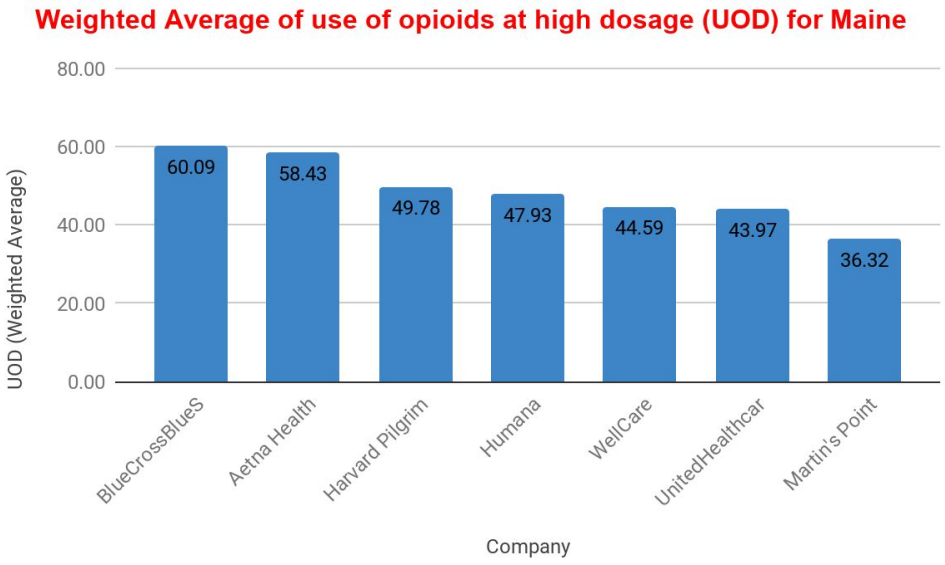
New Mexico

In New Mexico, United HealthCare Insurance Company prescribes opioids at a higher rate of 89.15, while Presbyterian Health Plan is doing slightly better at 43.54. The average of UOD rates for top 8 insurance companies in New Mexico state is 61.99. In this state, most companies could do better to monitor and regulate the use of opioids. However, there is still work that needs to be done.



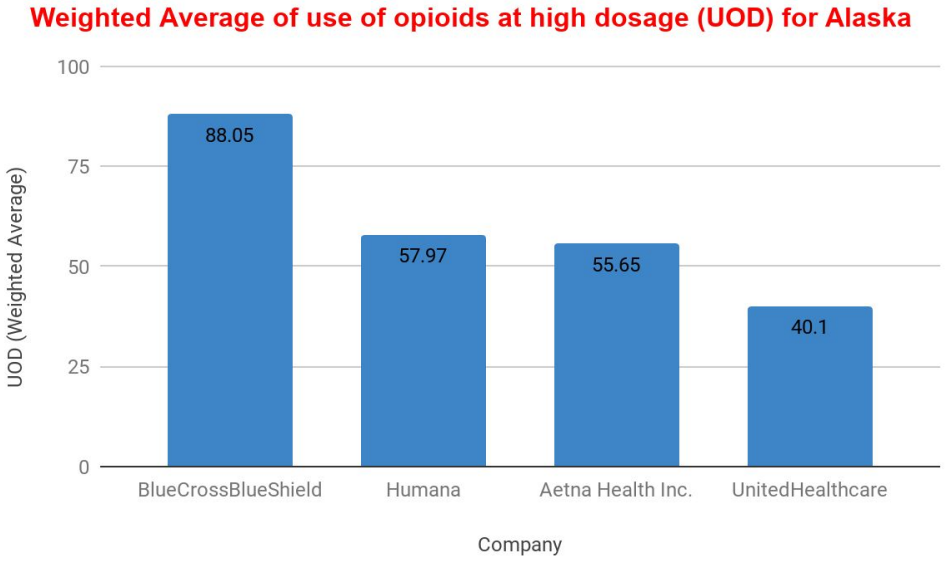
Maine

In the state of Maine, on average, most companies prescribe opioids for an extended period of time whereby BlueCross BlueShield prescribes the most at 60.09, and the lowest being Martin's Point Generations Advantage at 36.32. The average of UOD rates for top 7 insurance companies in Maine state is 48.73.



Alaska

In the state of Alaska, BlueCross BlueShield prescribes the most opioids drugs at 88.05, while UnitedHealthcare is more mindful about their prescriptions at 40.1. It should also be noted that this state only has 4 major players. The average of UOD rates for top 4 insurance companies in Alaska state is 60.44. BlueCross BlueShield needs to reduce its prescription of opioids to reduce the UOD rate.



Conclusion

In this project, we analyzed the insurance market as it relates to Medicare Part C model using data provided by the CMS. We determined the general market share and market concentration for each company in each of the nine states. We also wanted to understand the packages companies offer, especially in terms of dental plans, which could help the government to see if there are policies it could implement to increase generosity of these plans. Most importantly, the government is concerned about the opioid epidemic as it relates to prescriptions, especially for prolonged periods of times. To determine which companies in the nine states are careful about opioid drug prescriptions we used the weighted average of UOD. Companies could be incentivized to keep their UOD low financially based on an average they would have to achieve.

When investigating market power and competitiveness, the HHI showed that on average, the insurance industry is concentrated, where most states are above 2,000 with Alaska being the most concentrated at approximately 6267 except for Ohio, which is 1638. In terms of market share, most of the companies have clear incumbents that the government could unify into a single private payer. If market share is high, then the company is bound to benefit from economies and scale and scope, through its bargaining power in the market, which the government could use to cater for its senior citizens.

Although market share could be important in determining a single payer Congress can partner with, it is also important to investigate the features of packages each company offers. For example, dental care is essential and some companies offer it but some don't. It is important for senior citizens to have access to the right dental care options and the government strives to ensure that. For companies that offer dental services, we investigated the top five major insurance companies in terms of market share where enrollees enjoy the Preventative Dental Items and the Comprehensive Dental Items as supplement benefit under Part C. The analysis show that there is only a very small number of enrollees using these dental packages, which is a cause for concern to Congress. Therefore, for further studies, it would be important to determine the cause for this low number, and find solutions to increase the number of enrollees. On average, it seems like the Preventive percent of enrollees compared to the Comprehensive plan. This difference might come about as a result of affordability in each plan. Based on the percentage enrollment for each plan, we infer that the Comprehensive plan is a little expensive, while the Preventive package is the most affordable.

In addition to having comprehensive information about insurance package plans for its citizens, Congress is also interested in assessing and monitoring the use of opioids, especially in this climate where opioid abuse is rampant. It is important for Congress to see which companies are mindful of this crisis and doing their part to curb the problem. In order to investigate this, we used the HEDIS measure, UOD, where a large weighted

average of UOD implies that the company is prescribing more opioids for a prolonged period of time. On average, California, Ohio, and Washington have companies that have one of the highest UOD, with values above 100. For the other states, the values are between 30 and 90. This shows that inasmuch as companies are being mindful of the amount of opioid drugs they prescribe, there is still a long way to go. Therefore, Congress seeks to monitor this measure to reward and support those companies that are the most mindful of the opioid crisis and are doing their part such as Health Alliance-Midwest Inc in Iowa that prescribes opioids at a lower rate of 12.84.

Appendix of Healthcare HW2

Written by Zhiqi Chen, Nkosingiphile Shongwe, Salil Redkar, Debarati Mazumdar, Lakshmi Malavika Andavilli

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Quetion 1

```
library(readr)
library(readxl)
library(dplyr)
library(stringr)
# Monthly Enrollment by Contract/Plan/State/County
MEC <- read_csv("CPSC_Enrollment_Info_2019_01.csv")
# Monthly Enrollment by Plan
MEP <- read_csv("Monthly_Report_By_Plan_2019_01.csv")
# Major Insurance Organization Name
MIO <- read_excel("MajorInsuranceOrgs.xlsx")
# HEDIS Measures for Opioids Prescription
EOC <- read_excel("EOC170.xlsx")
# PDP Dental Data
PDP <- read.delim("pbp_b16_dental.txt")

MEC1 = MEC %>%
  filter(str_detect(`Contract Number`, paste(c("H", "R", "E"), collapse =
"|"))) %>%
  filter(`Enrollment` != "*") %>%
  filter(`State` == "CA" | `State` == "OH" | `State` == "WA" | `State` ==
"MD" | `State` == "LA" | `State` == "IA" | `State` == "NM" | `State` == "ME"
| `State` == "AK" )

MEC2 = MEC1
MEC2$`Plan ID` = formatC(MEC2$`Plan ID`, width=3, flag="0")
MEC2$Enrollment = as.numeric(MEC2$Enrollment)
MEC3 = MEC2 %>%
  select(`Contract Number`, `Plan ID`, `State`, `Enrollment`) %>%
  group_by(`Contract Number`, `Plan ID`, `State`) %>%
  summarize(Enrollment = sum(Enrollment))

MEP1 = MEP %>%
  filter(str_detect(`Contract Number`, paste(c("H", "R", "E"), collapse =
"|")))
MEP2 = MEP1 %>%
  select(`Contract Number`, `Plan ID`, `Organization Marketing Name`)

DATA1 = merge(MEC3, MEP2, by = c("Contract Number", "Plan ID"))
DATA2 = merge(DATA1, MIO, by = "Organization Marketing Name")
DATA3 = DATA2 %>%
```

```
  select(`MajorInsuranceOrgName`, State, Enrollment) %>%
  group_by(`MajorInsuranceOrgName`, State) %>%
  summarize(Enrollment = sum(Enrollment))
```

1. For CA

```
DATA_CA = DATA3 %>%
  filter(State == "CA")
Sum = sum(DATA_CA$Enrollment)
DATA_CA1 = DATA_CA %>%
  mutate(MS = Enrollment/Sum*100)
DATA_CA1 = DATA_CA1[order(-DATA_CA1$MS),]
head(DATA_CA1)
```

```
## # A tibble: 6 x 4
## # Groups:   MajorInsuranceOrgName [6]
##   MajorInsuranceOrgName    State Enrollment    MS
##   <chr>                    <chr>      <dbl> <dbl>
## 1 Kaiser                   CA       1178009 43.7
## 2 UnitedHealthcare         CA        458615 17.0
## 3 BlueCrossBlueShield      CA        299283 11.1
## 4 SCAN Health Plan         CA        200161  7.43
## 5 Health Net of California CA        115609  4.29
## 6 Humana                   CA         77086  2.86
```

```
DATA_CA2 = DATA_CA1 %>%
  mutate(MS2 = MS ** 2)
HHI_CA = sum(DATA_CA2$MS2)
HHI_CA
```

```
## [1] 2417.417
```

In CA, Kaiser has the largest market share, which is 43.70%, and the HHI of CA is 2417. The single payer in the insurance market of CA is Kaiser.

2. For OH

```
DATA_OH = DATA3 %>%
  filter(State == "OH")
Sum = sum(DATA_OH$Enrollment)
DATA_OH1 = DATA_OH %>%
  mutate(MS = Enrollment/Sum*100)
DATA_OH1 = DATA_OH1[order(-DATA_OH1$MS),]
head(DATA_OH1)
```

```
## # A tibble: 6 x 4
## # Groups:   MajorInsuranceOrgName [6]
##   MajorInsuranceOrgName  State Enrollment    MS
##   <chr>                  <chr>      <dbl> <dbl>
## 1 Aetna Health Inc.      OH        235889 23.9
## 2 BlueCrossBlueShield    OH        228070 23.1
## 3 UnitedHealthcare       OH        154204 15.6
## 4 Humana                 OH        149651 15.2
```

```
## 5 MediGold                OH          47677  4.83
## 6 Medical Mutual of Ohio OH          31868  3.23
```

```
DATA_OH2 = DATA_OH1 %>%
  mutate(MS2 = MS ** 2)
HHI_OH = sum(DATA_OH2$MS2)
HHI_OH
```

```
## [1] 1638.18
```

For OH, Aetna Health Inc. (23.92%) and BlueCrossBlueShield (23.13%) are two biggest players in the market, and the HHI of OH is 1638.

3. For WA

```
DATA_WA = DATA3 %>%
  filter(State == "WA")
Sum = sum(DATA_WA$Enrollment)
DATA_WA1 = DATA_WA %>%
  mutate(MS = Enrollment/Sum*100)
DATA_WA1 = DATA_WA1[order(-DATA_WA1$MS),]
head(DATA_WA1)
```

```
## # A tibble: 6 x 4
## # Groups:   MajorInsuranceOrgName [6]
##   MajorInsuranceOrgName     State Enrollment    MS
##   <chr>                     <chr>      <dbl> <dbl>
## 1 UnitedHealthcare          WA        151130 34.0
## 2 Kaiser                    WA        121370 27.3
## 3 BlueCrossBlueShield       WA         64684 14.6
## 4 Humana                    WA         48201 10.8
## 5 Aetna Health Inc.         WA         19656  4.42
## 6 Health Alliance Northwest WA         10112  2.28
```

```
DATA_WA2 = DATA_WA1 %>%
  mutate(MS2 = MS ** 2)
HHI_WA = sum(DATA_WA2$MS2)
HHI_WA
```

```
## [1] 2266.374
```

For WA, UnitedHealthcare is the biggest player with 34.00% market share, and the HHI of WA is 2266.

4. For MD

```
DATA_MD = DATA3 %>%
  filter(State == "MD")
Sum = sum(DATA_MD$Enrollment)
DATA_MD1 = DATA_MD %>%
  mutate(MS = Enrollment/Sum*100)
DATA_MD1 = DATA_MD1[order(-DATA_MD1$MS),]
head(DATA_MD1)
```

```
## # A tibble: 6 x 4
## # Groups:   MajorInsuranceOrgName [6]
##   MajorInsuranceOrgName                    State Enrollment    MS
##   <chr>                                    <chr>      <dbl> <dbl>
## 1 Kaiser                                   MD         47270 39.5
## 2 UnitedHealthcare                         MD         18956 15.8
## 3 Johns Hopkins HealthCare                 MD         18201 15.2
## 4 Cigna-HealthSpring                       MD         13318 11.1
## 5 Aetna Health Inc.                        MD         13249 11.1
## 6 University of Maryland Health Advantage MD          4374  3.65
```

```
DATA_MD2 = DATA_MD1 %>%
  mutate(MS2 = MS ** 2)
HHI_MD = sum(DATA_MD2$MS2)
HHI_MD
```

```
## [1] 2307.016
```

In MD, Kaiser has the largest market share, which is 39.48%; the HHI of MD is 2307.

5. For LA

```
DATA_LA = DATA3 %>%
  filter(State == "LA")
Sum = sum(DATA_LA$Enrollment)
DATA_LA1 = DATA_LA %>%
  mutate(MS = Enrollment/Sum*100)
DATA_LA1 = DATA_LA1[order(-DATA_LA1$MS),]
head(DATA_LA1)
```

```
## # A tibble: 6 x 4
## # Groups:   MajorInsuranceOrgName [6]
##   MajorInsuranceOrgName     State Enrollment    MS
##   <chr>                     <chr>      <dbl> <dbl>
## 1 Humana                    LA        173096 54.2
## 2 Peoples Health            LA         73532 23.0
## 3 Vantage Health Plan, Inc. LA         18285  5.72
## 4 UnitedHealthcare          LA         16805  5.26
## 5 WellCare                  LA         14743  4.61
## 6 HMO Louisiana             LA         12026  3.76
```

```
DATA_LA2 = DATA_LA1 %>%
  mutate(MS2 = MS ** 2)
HHI_LA = sum(DATA_LA2$MS2)
HHI_LA
```

```
## [1] 3566.049
```

In LA, Humana occupies more than half of the market share, which is 54.16%, and the HHI of IA is 3566.

6. For IA

```
DATA_IA = DATA3 %>%
  filter(State == "IA")
Sum = sum(DATA_IA$Enrollment)
DATA_IA1 = DATA_IA %>%
  mutate(MS = Enrollment/Sum*100)
DATA_IA1 = DATA_IA1[order(-DATA_IA1$MS),]
head(DATA_IA1)
```

```
## # A tibble: 6 x 4
## # Groups:   MajorInsuranceOrgName [6]
##   MajorInsuranceOrgName                State Enrollment     MS
##   <chr>                                <chr>      <dbl>  <dbl>
## 1 UnitedHealthcare                     IA         55372 41.9
## 2 Coventry Health Care                 IA         39213 29.7
## 3 Humana                               IA         20291 15.4
## 4 Medical Associates Health Plan, Inc. IA          9957  7.54
## 5 Aetna Health Inc.                    IA          4952  3.75
## 6 Health Alliance Medicare             IA           904  0.684
```

```
DATA_IA2 = DATA_IA1 %>%
  mutate(MS2 = MS ** 2)
HHI_IA = sum(DATA_IA2$MS2)
HHI_IA
```

```
## [1] 2945.576
```

For IA, UnitedHealthcare has the dominant position in the insurance market with 41.91% market share, and the HHI of NM is 2946.

7. For NM

```
DATA_NM = DATA3 %>%
  filter(State == "NM")
Sum = sum(DATA_NM$Enrollment)
DATA_NM1 = DATA_NM %>%
  mutate(MS = Enrollment/Sum*100)
DATA_NM1 = DATA_NM1[order(-DATA_NM1$MS),]
head(DATA_NM1)
```

```
## # A tibble: 6 x 4
## # Groups:   MajorInsuranceOrgName [6]
##   MajorInsuranceOrgName                 State Enrollment    MS
##   <chr>                                 <chr>      <dbl> <dbl>
## 1 UnitedHealthcare                      NM         44159 29.9
## 2 Presbyterian Health Plan              NM         42422 28.7
## 3 Humana                                NM         27805 18.8
## 4 BlueCrossBlueShield                   NM         22459 15.2
## 5 Molina Healthcare of New Mexico, Inc. NM          3572  2.42
## 6 Presbyterian Insurance Company, Inc.  NM          2731  1.85
```

```
DATA_NM2 = DATA_NM1 %>%
  mutate(MS2 = MS ** 2)
HHI_NM = sum(DATA_NM2$MS2)
HHI_NM
```

```
## [1] 2319.502
```

In NM, UnitedHealthcare and Presbyterian Health Plan have almost the same market share (29.92% and 28.74% respectively), and the HHI of LA is 2320.

8. For ME

```
DATA_ME = DATA3 %>%
  filter(State == "ME")
Sum = sum(DATA_ME$Enrollment)
DATA_ME1 = DATA_ME %>%
  mutate(MS = Enrollment/Sum*100)
DATA_ME1 = DATA_ME1[order(-DATA_ME1$MS),]
head(DATA_ME1)
```

```
## # A tibble: 6 x 4
## # Groups:   MajorInsuranceOrgName [6]
##   MajorInsuranceOrgName                State Enrollment    MS
##   <chr>                                <chr>      <dbl> <dbl>
## 1 Martin's Point Generations Advantage ME         45426 40.1
## 2 UnitedHealthcare                     ME         24437 21.6
## 3 Aetna Health Inc.                    ME         20618 18.2
## 4 WellCare                             ME          9249  8.16
## 5 Humana                               ME          6692  5.91
## 6 BlueCrossBlueShield                  ME          5419  4.78
```

```
DATA_ME2 = DATA_ME1 %>%
  mutate(MS2 = MS ** 2)
HHI_ME = sum(DATA_ME2$MS2)
HHI_ME
```

```
## [1] 2529.27
```

For ME, Martin's Point Generations Advantage has the largest market share (40.09%), and the HHI of ME is 2529.

9. For AK

```
DATA_AK = DATA3 %>%
  filter(State == "AK")
Sum = sum(DATA_AK$Enrollment)
DATA_AK1 = DATA_AK %>%
  mutate(MS = Enrollment/Sum*100)
DATA_AK1 = DATA_AK1[order(-DATA_AK1$MS),]
head(DATA_AK1)
```

```
## # A tibble: 4 x 4
## # Groups:   MajorInsuranceOrgName [4]
```

```
##   MajorInsuranceOrgName State Enrollment    MS
##   <chr>                 <chr>      <dbl> <dbl>
## 1 Aetna Health Inc.     AK           616 77.1
## 2 UnitedHealthcare      AK           140 17.5
## 3 Humana                AK            29  3.63
## 4 BlueCrossBlueShield   AK            14  1.75
```

```
DATA_AK2 = DATA_AK1 %>%
  mutate(MS2 = MS ** 2)
HHI_AK = sum(DATA_AK2$MS2)
HHI_AK
```

```
## [1] 6267.111
```

The insurance market in AK is highly concentrated in the hands of one big player, Aetna Health Inc.. This company has a 77.10% market share. The HHI of ME is 6267.

Question 2

```
colnames(PDP)[which(names(PDP) == "pbp_a_hnumber")] <- "Contract Number"
colnames(PDP)[which(names(PDP) == "pbp_a_plan_identifier")] <- "Plan ID"
colnames(PDP)[which(names(PDP) == "pbp_b16a_bendesc_yn")] <- "Prevent"
colnames(PDP)[which(names(PDP) == "pbp_b16b_bendesc_yn")] <- "Compre"
PDP$`Plan ID` = formatC(PDP$`Plan ID`, width=3, flag="0")
PDP = PDP %>%
  select(`Contract Number`, `Plan ID`, Prevent, Compre)
Q2_DATA = DATA2 %>%
  select(`Contract Number`, `Plan ID`, `State`, `Enrollment`,
`MajorInsuranceOrgName`)
Q2_DATA1 = merge(PDP, Q2_DATA, by = c("Contract Number","Plan ID"))
Q2_DATA2 = Q2_DATA1 %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Prevent, Compre)
Q2_DATA2 = na.omit(Q2_DATA2)
```

1. For CA

```
CA_5 = head(DATA_CA1, 5) %>%
  select(`MajorInsuranceOrgName`, MS)
Q2_CA = Q2_DATA2 %>%
  filter(State == "CA")
# Prevent
Q2_CA1 = Q2_CA %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Prevent) %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_all = sum(Enrollment))
Q2_CA2 = Q2_CA %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Prevent) %>%
  filter(Prevent == "1") %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_Prevent = sum(Enrollment))
Q2_CA3 = merge(Q2_CA1, Q2_CA2, by = "MajorInsuranceOrgName")
Q2_CA4 = merge(Q2_CA3, CA_5, by = "MajorInsuranceOrgName")
```

```
Q2_CA5 = Q2_CA4 %>%
  mutate(Pre_Percent = Sum_Prevent/Sum_all) %>%
  select(`MajorInsuranceOrgName`, MS, Pre_Percent)
# Compre
Q2_CA6 = Q2_CA %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Compre) %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_all = sum(Enrollment))
Q2_CA7 = Q2_CA %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Compre) %>%
  filter(Compre == "1") %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_Compre = sum(Enrollment))
Q2_CA8 = merge(Q2_CA6, Q2_CA7, by = "MajorInsuranceOrgName")
Q2_CA9 = merge(Q2_CA8, CA_5, by = "MajorInsuranceOrgName")
Q2_CA10 = Q2_CA9 %>%
  mutate(Compre_Percent = Sum_Compre/Sum_all) %>%
  select(`MajorInsuranceOrgName`, MS, Compre_Percent)
Q2_CA11 = merge(Q2_CA5, Q2_CA10, by = c("MajorInsuranceOrgName", "MS"))
Q2_CA11 = Q2_CA11[order(-Q2_CA11$MS),]
rownames(Q2_CA11) = NULL
head(Q2_CA11,5)
```

```
##      MajorInsuranceOrgName        MS Pre_Percent Compre_Percent
## 1                   Kaiser 43.702396   0.6601359      0.6601359
## 2        UnitedHealthcare 17.013940   0.1332795      0.1330026
## 3      BlueCrossBlueShield 11.102958   0.8216338      0.6835595
## 4         SCAN Health Plan  7.425678   0.1208377      0.1208377
## 5 Health Net of California  4.288923   0.8680243      0.8680243
```

2. For OH

```
OH_5 = head(DATA_OH1, 5) %>%
  select(`MajorInsuranceOrgName`, MS)
Q2_OH = Q2_DATA2 %>%
  filter(State == "OH")
# Prevent
Q2_OH1 = Q2_OH %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Prevent) %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_all = sum(Enrollment))
Q2_OH2 = Q2_OH %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Prevent) %>%
  filter(Prevent == "1") %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_Prevent = sum(Enrollment))
Q2_OH3 = merge(Q2_OH1, Q2_OH2, by = "MajorInsuranceOrgName")
Q2_OH4 = merge(Q2_OH3, OH_5, by = "MajorInsuranceOrgName")
Q2_OH5 = Q2_OH4 %>%
  mutate(Pre_Percent = Sum_Prevent/Sum_all) %>%
  select(`MajorInsuranceOrgName`, MS, Pre_Percent)
```

```
# Compre
Q2_OH6 = Q2_OH %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Compre) %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_all = sum(Enrollment))
Q2_OH7 = Q2_OH %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Compre) %>%
  filter(Compre == "1") %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_Compre = sum(Enrollment))
Q2_OH8 = merge(Q2_OH6, Q2_OH7, by = "MajorInsuranceOrgName")
Q2_OH9 = merge(Q2_OH8, OH_5, by = "MajorInsuranceOrgName")
Q2_OH10 = Q2_OH9 %>%
  mutate(Compre_Percent = Sum_Compre/Sum_all) %>%
  select(`MajorInsuranceOrgName`, MS, Compre_Percent)
Q2_OH11 = merge(Q2_OH5, Q2_OH10, by = c("MajorInsuranceOrgName", "MS"))
Q2_OH11 = Q2_OH11[order(-Q2_OH11$MS),]
rownames(Q2_OH11) = NULL
head(Q2_OH11,5)
```

```
##   MajorInsuranceOrgName        MS Pre_Percent Compre_Percent
## 1     Aetna Health Inc. 23.921868   0.2622547     0.26225470
## 2   BlueCrossBlueShield 23.128932   0.9881858     0.07581731
## 3      UnitedHealthcare 15.638066   0.8390833     0.66336152
## 4               Humana 15.176339   0.8735729     0.87357289
## 5             MediGold  4.834998   0.9935286     0.99352857
```

3. For WA

```
WA_5 = head(DATA_WA1, 5) %>%
  select(`MajorInsuranceOrgName`, MS)
Q2_WA = Q2_DATA2 %>%
  filter(State == "WA")
# Prevent
Q2_WA1 = Q2_WA %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Prevent) %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_all = sum(Enrollment))
Q2_WA2 = Q2_WA %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Prevent) %>%
  filter(Prevent == "1") %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_Prevent = sum(Enrollment))
Q2_WA3 = merge(Q2_WA1, Q2_WA2, by = "MajorInsuranceOrgName")
Q2_WA4 = merge(Q2_WA3, WA_5, by = "MajorInsuranceOrgName")
Q2_WA5 = Q2_WA4 %>%
  mutate(Pre_Percent = Sum_Prevent/Sum_all) %>%
  select(`MajorInsuranceOrgName`, MS, Pre_Percent)
# Compre
Q2_WA6 = Q2_WA %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Compre) %>%
```

```
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_all = sum(Enrollment))
Q2_WA7 = Q2_WA %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Compre) %>%
  filter(Compre == "1") %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_Compre = sum(Enrollment))
Q2_WA8 = merge(Q2_WA6, Q2_WA7, by = "MajorInsuranceOrgName")
Q2_WA9 = merge(Q2_WA8, WA_5, by = "MajorInsuranceOrgName")
Q2_WA10 = Q2_WA9 %>%
  mutate(Compre_Percent = Sum_Compre/Sum_all) %>%
  select(`MajorInsuranceOrgName`, MS, Compre_Percent)
Q2_WA11 = merge(Q2_WA5, Q2_WA10, by = c("MajorInsuranceOrgName", "MS"))
Q2_WA11 = Q2_WA11[order(-Q2_WA11$MS),]
rownames(Q2_WA11) = NULL
head(Q2_WA11,5)
```

```
##   MajorInsuranceOrgName        MS Pre_Percent Compre_Percent
## 1      UnitedHealthcare 34.004437   0.5918150      0.2234103
## 2                Kaiser 27.308400   0.6873198      0.6873198
## 3   BlueCrossBlueShield 14.553980   0.8358333      0.4517157
## 4                Humana 10.845285   0.9709965      0.6577664
## 5     Aetna Health Inc.  4.422624   0.8425926      0.8425926
```

4. For MD

```
MD_5 = head(DATA_MD1, 5) %>%
  select(`MajorInsuranceOrgName`, MS)
Q2_MD = Q2_DATA2 %>%
  filter(State == "MD")
# Prevent
Q2_MD1 = Q2_MD %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Prevent) %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_all = sum(Enrollment))
Q2_MD2 = Q2_MD %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Prevent) %>%
  filter(Prevent == "1") %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_Prevent = sum(Enrollment))
Q2_MD3 = merge(Q2_MD1, Q2_MD2, by = "MajorInsuranceOrgName")
Q2_MD4 = merge(Q2_MD3, MD_5, by = "MajorInsuranceOrgName")
Q2_MD5 = Q2_MD4 %>%
  mutate(Pre_Percent = Sum_Prevent/Sum_all) %>%
  select(`MajorInsuranceOrgName`, MS, Pre_Percent)
# Compre
Q2_MD6 = Q2_MD %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Compre) %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_all = sum(Enrollment))
Q2_MD7 = Q2_MD %>%
```

```
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Compre) %>%
  filter(Compre == "1") %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_Compre = sum(Enrollment))
Q2_MD8 = merge(Q2_MD6, Q2_MD7, by = "MajorInsuranceOrgName")
Q2_MD9 = merge(Q2_MD8, MD_5, by = "MajorInsuranceOrgName")
Q2_MD10 = Q2_MD9 %>%
  mutate(Compre_Percent = Sum_Compre/Sum_all) %>%
  select(`MajorInsuranceOrgName`, MS, Compre_Percent)
Q2_MD11 = merge(Q2_MD5, Q2_MD10, by = c("MajorInsuranceOrgName", "MS"))
Q2_MD11 = Q2_MD11[order(-Q2_MD11$MS),]
rownames(Q2_MD11) = NULL
head(Q2_MD11,5)
```

```
##   MajorInsuranceOrgName       MS Pre_Percent Compre_Percent
## 1                Kaiser 39.48478   0.6837667      0.6837667
## 2      UnitedHealthcare 15.83401   0.1890694      0.1425406
## 3    Cigna-HealthSpring 11.12457   0.5048055      0.2431296
```

5. For LA

```
LA_5 = head(DATA_LA1, 5) %>%
  select(`MajorInsuranceOrgName`, MS)
Q2_LA = Q2_DATA2 %>%
  filter(State == "LA")
# Prevent
Q2_LA1 = Q2_LA %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Prevent) %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_all = sum(Enrollment))
Q2_LA2 = Q2_LA %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Prevent) %>%
  filter(Prevent == "1") %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_Prevent = sum(Enrollment))
Q2_LA3 = merge(Q2_LA1, Q2_LA2, by = "MajorInsuranceOrgName")
Q2_LA4 = merge(Q2_LA3, LA_5, by = "MajorInsuranceOrgName")
Q2_LA5 = Q2_LA4 %>%
  mutate(Pre_Percent = Sum_Prevent/Sum_all) %>%
  select(`MajorInsuranceOrgName`, MS, Pre_Percent)
# Compre
Q2_LA6 = Q2_LA %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Compre) %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_all = sum(Enrollment))
Q2_LA7 = Q2_LA %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Compre) %>%
  filter(Compre == "1") %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_Compre = sum(Enrollment))
Q2_LA8 = merge(Q2_LA6, Q2_LA7, by = "MajorInsuranceOrgName")
```

```r
Q2_LA9 = merge(Q2_LA8, LA_5, by = "MajorInsuranceOrgName")
Q2_LA10 = Q2_LA9 %>%
  mutate(Compre_Percent = Sum_Compre/Sum_all) %>%
  select(`MajorInsuranceOrgName`, MS, Compre_Percent)
Q2_LA11 = merge(Q2_LA5, Q2_LA10, by = c("MajorInsuranceOrgName", "MS"))
Q2_LA11 = Q2_LA11[order(-Q2_LA11$MS),]
rownames(Q2_LA11) = NULL
head(Q2_LA11,5)
```

```
##       MajorInsuranceOrgName        MS Pre_Percent Compre_Percent
## 1                    Humana 54.156811   0.9542789      0.8398468
## 2            Peoples Health 23.006070   0.9801650      0.9801650
## 3 Vantage Health Plan, Inc.  5.720856   0.9400887      0.7388492
## 4          UnitedHealthcare  5.257806   0.3534067      0.3175245
## 5                   WellCare  4.612665   1.0000000      1.0000000
```

6. For IA

```r
IA_5 = head(DATA_IA1, 5) %>%
  select(`MajorInsuranceOrgName`, MS)
Q2_IA = Q2_DATA2 %>%
  filter(State == "IA")
# Prevent
Q2_IA1 = Q2_IA %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Prevent) %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_all = sum(Enrollment))
Q2_IA2 = Q2_IA %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Prevent) %>%
  filter(Prevent == "1") %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_Prevent = sum(Enrollment))
Q2_IA3 = merge(Q2_IA1, Q2_IA2, by = "MajorInsuranceOrgName")
Q2_IA4 = merge(Q2_IA3, IA_5, by = "MajorInsuranceOrgName")
Q2_IA5 = Q2_IA4 %>%
  mutate(Pre_Percent = Sum_Prevent/Sum_all) %>%
  select(`MajorInsuranceOrgName`, MS, Pre_Percent)
# Compre
Q2_IA6 = Q2_IA %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Compre) %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_all = sum(Enrollment))
Q2_IA7 = Q2_IA %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Compre) %>%
  filter(Compre == "1") %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_Compre = sum(Enrollment))
Q2_IA8 = merge(Q2_IA6, Q2_IA7, by = "MajorInsuranceOrgName")
Q2_IA9 = merge(Q2_IA8, IA_5, by = "MajorInsuranceOrgName")
Q2_IA10 = Q2_IA9 %>%
  mutate(Compre_Percent = Sum_Compre/Sum_all) %>%
```

```
  select(`MajorInsuranceOrgName`, MS, Compre_Percent)
Q2_IA11 = merge(Q2_IA5, Q2_IA10, by = c("MajorInsuranceOrgName", "MS"))
Q2_IA11 = Q2_IA11[order(-Q2_IA11$MS),]
rownames(Q2_IA11) = NULL
head(Q2_IA11,5)
```

```
##   MajorInsuranceOrgName        MS Pre_Percent Compre_Percent
## 1      UnitedHealthcare 41.914509   0.2232897     0.04285559
## 2  Coventry Health Care 29.682757   1.0000000     1.00000000
## 3               Humana 15.359519   0.8373663     0.83736632
## 4     Aetna Health Inc.  3.748477   0.8832795     0.88327948
```

7. For NM

```
NM_5 = head(DATA_NM1, 5) %>%
  select(`MajorInsuranceOrgName`, MS)
Q2_NM = Q2_DATA2 %>%
  filter(State == "NM")
# Prevent
Q2_NM1 = Q2_NM %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Prevent) %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_all = sum(Enrollment))
Q2_NM2 = Q2_NM %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Prevent) %>%
  filter(Prevent == "1") %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_Prevent = sum(Enrollment))
Q2_NM3 = merge(Q2_NM1, Q2_NM2, by = "MajorInsuranceOrgName")
Q2_NM4 = merge(Q2_NM3, NM_5, by = "MajorInsuranceOrgName")
Q2_NM5 = Q2_NM4 %>%
  mutate(Pre_Percent = Sum_Prevent/Sum_all) %>%
  select(`MajorInsuranceOrgName`, MS, Pre_Percent)
# Compre
Q2_NM6 = Q2_NM %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Compre) %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_all = sum(Enrollment))
Q2_NM7 = Q2_NM %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Compre) %>%
  filter(Compre == "1") %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_Compre = sum(Enrollment))
Q2_NM8 = merge(Q2_NM6, Q2_NM7, by = "MajorInsuranceOrgName")
Q2_NM9 = merge(Q2_NM8, NM_5, by = "MajorInsuranceOrgName")
Q2_NM10 = Q2_NM9 %>%
  mutate(Compre_Percent = Sum_Compre/Sum_all) %>%
  select(`MajorInsuranceOrgName`, MS, Compre_Percent)
Q2_NM11 = merge(Q2_NM5, Q2_NM10, by = c("MajorInsuranceOrgName", "MS"))
Q2_NM11 = Q2_NM11[order(-Q2_NM11$MS),]
```

```r
rownames(Q2_NM11) = NULL
head(Q2_NM11,5)
```

```
##                    MajorInsuranceOrgName        MS Pre_Percent
## 1                    UnitedHealthcare 29.915792   0.8080572
## 2                             Humana 18.836672   0.9388993
## 3                BlueCrossBlueShield 15.214991   0.4115945
## 4 Molina Healthcare of New Mexico, Inc.  2.419874   1.0000000
##   Compre_Percent
## 1      0.8080572
## 2      0.9388993
## 3      0.4115945
## 4      1.0000000
```

8. For ME

```r
ME_5 = head(DATA_ME1, 5) %>%
  select(`MajorInsuranceOrgName`, MS)
Q2_ME = Q2_DATA2 %>%
  filter(State == "ME")
# Prevent
Q2_ME1 = Q2_ME %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Prevent) %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_all = sum(Enrollment))
Q2_ME2 = Q2_ME %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Prevent) %>%
  filter(Prevent == "1") %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_Prevent = sum(Enrollment))
Q2_ME3 = merge(Q2_ME1, Q2_ME2, by = "MajorInsuranceOrgName")
Q2_ME4 = merge(Q2_ME3, ME_5, by = "MajorInsuranceOrgName")
Q2_ME5 = Q2_ME4 %>%
  mutate(Pre_Percent = Sum_Prevent/Sum_all) %>%
  select(`MajorInsuranceOrgName`, MS, Pre_Percent)
# Compre
Q2_ME6 = Q2_ME %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Compre) %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_all = sum(Enrollment))
Q2_ME7 = Q2_ME %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Compre) %>%
  filter(Compre == "1") %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_Compre = sum(Enrollment))
Q2_ME8 = merge(Q2_ME6, Q2_ME7, by = "MajorInsuranceOrgName")
Q2_ME9 = merge(Q2_ME8, ME_5, by = "MajorInsuranceOrgName")
Q2_ME10 = Q2_ME9 %>%
  mutate(Compre_Percent = Sum_Compre/Sum_all) %>%
  select(`MajorInsuranceOrgName`, MS, Compre_Percent)
Q2_ME11 = merge(Q2_ME5, Q2_ME10, by = c("MajorInsuranceOrgName", "MS"))
```

```r
Q2_ME11 = Q2_ME11[order(-Q2_ME11$MS),]
rownames(Q2_ME11) = NULL
head(Q2_ME11,5)
```

```
##                   MajorInsuranceOrgName        MS Pre_Percent
## 1 Martin's Point Generations Advantage 40.088250   0.9423501
## 2                     UnitedHealthcare 21.565547   0.2138151
## 3                    Aetna Health Inc. 18.195296   0.4419924
## 4                             WellCare  8.162203   0.7305828
## 5                               Humana  5.905661   0.9967784
##   Compre_Percent
## 1     0.94235012
## 2     0.04075787
## 3     0.44199243
## 4     0.73058285
## 5     0.77609536
```

9. For AK

```r
AK_5 = head(DATA_AK1, 5) %>%
  select(`MajorInsuranceOrgName`, MS)
Q2_AK = Q2_DATA2 %>%
  filter(State == "AK")
# Prevent
Q2_AK1 = Q2_AK %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Prevent) %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_all = sum(Enrollment))
Q2_AK2 = Q2_AK %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Prevent) %>%
  filter(Prevent == "1") %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_Prevent = sum(Enrollment))
Q2_AK3 = merge(Q2_AK1, Q2_AK2, by = "MajorInsuranceOrgName")
Q2_AK4 = merge(Q2_AK3, AK_5, by = "MajorInsuranceOrgName")
Q2_AK5 = Q2_AK4 %>%
  mutate(Pre_Percent = Sum_Prevent/Sum_all) %>%
  select(`MajorInsuranceOrgName`, MS, Pre_Percent)
# Compre
Q2_AK6 = Q2_AK %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Compre) %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_all = sum(Enrollment))
Q2_AK7 = Q2_AK %>%
  select(`State`, `Enrollment`, `MajorInsuranceOrgName`, Compre) %>%
  filter(Compre == "1") %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_Compre = sum(Enrollment))
Q2_AK8 = merge(Q2_AK6, Q2_AK7, by = "MajorInsuranceOrgName")
Q2_AK9 = merge(Q2_AK8, AK_5, by = "MajorInsuranceOrgName")
Q2_AK10 = Q2_AK9 %>%
```

```
  mutate(Compre_Percent = Sum_Compre/Sum_all) %>%
  select(`MajorInsuranceOrgName`, MS, Compre_Percent)
Q2_AK11 = merge(Q2_AK5, Q2_AK10, by = c("MajorInsuranceOrgName", "MS"))
Q2_AK11 = Q2_AK11[order(-Q2_AK11$MS),]
rownames(Q2_AK11) = NULL
head(Q2_AK11,5)
```

```
## [1] MajorInsuranceOrgName MS                    Pre_Percent
## [4] Compre_Percent
## <0 rows> (or 0-length row.names)
```

Question 3

```
DATA4 = DATA2 %>%
  select(`Contract Number`, `MajorInsuranceOrgName`, State, Enrollment) %>%
  group_by(`Contract Number`, `MajorInsuranceOrgName`, State) %>%
  summarize(Enrollment = sum(Enrollment))
EOC = EOC %>%
  select(`Contract Number`, `EOC170-0010`)
DATA5 = merge(DATA4, EOC, by = "Contract Number")
DATA5$`EOC170-0010` = as.numeric(DATA5$`EOC170-0010`)
DATA5 = na.omit(DATA5)
DATA5 = DATA5 %>%
  filter(`EOC170-0010` != 0)
```

1. For CA

```
CA_10 = head(DATA_CA1, 10)
Q3_CA = DATA5 %>%
  filter(State == "CA") %>%
  mutate(EE = Enrollment * `EOC170-0010`)
Q3_CA2 = Q3_CA %>%
  select(`MajorInsuranceOrgName`, Enrollment, EE) %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_Enroll = sum(Enrollment),
            Sum_EE = sum(EE)) %>%
  mutate(UOD = Sum_EE/Sum_Enroll) %>%
  select(`MajorInsuranceOrgName`, UOD)
Q3_CA3 = merge(CA_10, Q3_CA2, by = "MajorInsuranceOrgName")
Q3_CA4 = Q3_CA3 %>%
  select(`MajorInsuranceOrgName`, State, UOD, MS)
Q3_CA4 = Q3_CA4[order(-Q3_CA4$UOD),]
rownames(Q3_CA4) = NULL
head(Q3_CA4, 10)
```

```
##           MajorInsuranceOrgName State       UOD        MS
## 1         Alignment Health Plan    CA 370.75000  1.642092
## 2              UnitedHealthcare    CA 104.33544 17.013940
## 3      Health Net of California    CA  58.09000  4.288923
## 4             Aetna Health Inc.    CA  47.64673  1.308502
## 5           BlueCrossBlueShield    CA  47.27959 11.102958
## 6                       Humana    CA  46.82629  2.859777
```

```
## 7              SCAN Health Plan    CA  39.02000  7.425678
## 8                        Kaiser    CA  29.25000 43.702396
## 9                 Brand New Day    CA  25.64000  1.225105
## 10 Central Health Medicare Plan    CA  12.84000  1.532540
```

2. For OH

```
OH_10 = head(DATA_OH1, 10)
Q3_OH = DATA5 %>%
  filter(State == "OH") %>%
  mutate(EE = Enrollment * `EOC170-0010`)
Q3_OH2 = Q3_OH %>%
  select(`MajorInsuranceOrgName`, Enrollment, EE) %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_Enroll = sum(Enrollment),
            Sum_EE = sum(EE)) %>%
  mutate(UOD = Sum_EE/Sum_Enroll) %>%
  select(`MajorInsuranceOrgName`, UOD)
Q3_OH3 = merge(OH_10, Q3_OH2, by = "MajorInsuranceOrgName")
Q3_OH4 = Q3_OH3 %>%
  select(`MajorInsuranceOrgName`, State, UOD, MS)
Q3_OH4 = Q3_OH4[order(-Q3_OH4$UOD),]
rownames(Q3_OH4) = NULL
head(Q3_OH4, 10)
```

```
##                MajorInsuranceOrgName State        UOD        MS
## 1                     Paramount Elite    OH 1000.00000  1.410635
## 2              Medical Mutual of Ohio    OH   60.21959  3.231783
## 3                   UnitedHealthcare    OH   56.97629 15.638066
## 4                  Aetna Health Inc.    OH   56.24519 23.921868
## 5                            Humana    OH   50.95754 15.176339
## 6 SummaCare Medicare Advantage Plans    OH   31.61000  2.329119
## 7                BlueCrossBlueShield    OH   28.50020 23.128932
## 8                           MediGold    OH   28.17347  4.834998
## 9              PrimeTime Health Plan    OH   21.66000  2.027318
```

3. For WA

```
WA_10 = head(DATA_WA1, 10)
Q3_WA = DATA5 %>%
  filter(State == "WA") %>%
  mutate(EE = Enrollment * `EOC170-0010`)
Q3_WA2 = Q3_WA %>%
  select(`MajorInsuranceOrgName`, Enrollment, EE) %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_Enroll = sum(Enrollment),
            Sum_EE = sum(EE)) %>%
  mutate(UOD = Sum_EE/Sum_Enroll) %>%
  select(`MajorInsuranceOrgName`, UOD)
Q3_WA3 = merge(WA_10, Q3_WA2, by = "MajorInsuranceOrgName")
Q3_WA4 = Q3_WA3 %>%
  select(`MajorInsuranceOrgName`, State, UOD, MS)
```

```
Q3_WA4 = Q3_WA4[order(-Q3_WA4$UOD),]
rownames(Q3_WA4) = NULL
head(Q3_WA4, 10)
```

```
##                             MajorInsuranceOrgName State       UOD         MS
## 1                                UnitedHealthcare    WA 114.02195 34.0044370
## 2         Molina Healthcare of Washington, Inc.    WA  69.48000  2.1224367
## 3                              BlueCrossBlueShield    WA  64.41090 14.5539800
## 4                                Aetna Health Inc.    WA  59.04695  4.4226243
## 5                                           Humana    WA  48.89083 10.8452846
## 6 Community HealthFirst Medicare Advantage Plan    WA  47.39000  2.0490863
## 7                    Providence Health Assurance    WA  40.92000  0.7596042
## 8                                           Kaiser    WA  37.04472 27.3084002
## 9                      Health Alliance Northwest    WA  33.38000  2.2752125
```

4. For MD

```
MD_10 = head(DATA_MD1, 10)
Q3_MD = DATA5 %>%
  filter(State == "MD") %>%
  mutate(EE = Enrollment * `EOC170-0010`)
Q3_MD2 = Q3_MD %>%
  select(`MajorInsuranceOrgName`, Enrollment, EE) %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_Enroll = sum(Enrollment),
            Sum_EE = sum(EE)) %>%
  mutate(UOD = Sum_EE/Sum_Enroll) %>%
  select(`MajorInsuranceOrgName`, UOD)
Q3_MD3 = merge(MD_10, Q3_MD2, by = "MajorInsuranceOrgName")
Q3_MD4 = Q3_MD3 %>%
  select(`MajorInsuranceOrgName`, State, UOD, MS)
Q3_MD4 = Q3_MD4[order(-Q3_MD4$UOD),]
rownames(Q3_MD4) = NULL
head(Q3_MD4, 10)
```

```
##                      MajorInsuranceOrgName State      UOD         MS
## 1                  Johns Hopkins HealthCare    MD 88.86000 15.2033546
## 2                      Cigna-HealthSpring    MD 67.65000 11.1245688
## 3 University of Maryland Health Advantage    MD 66.83000  3.6536164
## 4          Highmark Senior Health Company    MD 64.94000  0.4285106
## 5                                  Humana    MD 57.97000  2.4900390
## 6                     Aetna Health Inc.    MD 56.40790 11.0669328
## 7                      UnitedHealthcare    MD 44.96076 15.8340085
## 8                                  Kaiser    MD 30.18000 39.4847850
```

5. For LA

```
LA_10 = head(DATA_LA1, 10)
Q3_LA = DATA5 %>%
  filter(State == "LA") %>%
  mutate(EE = Enrollment * `EOC170-0010`)
Q3_LA2 = Q3_LA %>%
```

```
  select(`MajorInsuranceOrgName`, Enrollment, EE) %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_Enroll = sum(Enrollment),
            Sum_EE = sum(EE)) %>%
  mutate(UOD = Sum_EE/Sum_Enroll) %>%
  select(`MajorInsuranceOrgName`, UOD)
Q3_LA3 = merge(LA_10, Q3_LA2, by = "MajorInsuranceOrgName")
Q3_LA4 = Q3_LA3 %>%
  select(`MajorInsuranceOrgName`, State, UOD, MS)
Q3_LA4 = Q3_LA4[order(-Q3_LA4$UOD),]
rownames(Q3_LA4) = NULL
head(Q3_LA4, 10)
```

```
##       MajorInsuranceOrgName State      UOD         MS
## 1       BlueCrossBlueShield    LA 81.87000  0.1019961
## 2             HMO Louisiana    LA 71.98000  3.7625931
## 3          UnitedHealthcare    LA 59.32580  5.2578061
## 4         Aetna Health Inc.    LA 55.65000  2.7964458
## 5                   WellCare    LA 54.66000  4.6126650
## 6                     Humana    LA 46.92212 54.1568112
## 7      Coventry Health Care    LA 42.55000  0.4020399
## 8 Vantage Health Plan, Inc.    LA 38.44000  5.7208560
## 9            Peoples Health    LA 34.31000 23.0060697
```

6. For IA

```
IA_10 = head(DATA_IA1, 10)
Q3_IA = DATA5 %>%
  filter(State == "IA") %>%
  mutate(EE = Enrollment * `EOC170-0010`)
Q3_IA2 = Q3_IA %>%
  select(`MajorInsuranceOrgName`, Enrollment, EE) %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_Enroll = sum(Enrollment),
            Sum_EE = sum(EE)) %>%
  mutate(UOD = Sum_EE/Sum_Enroll) %>%
  select(`MajorInsuranceOrgName`, UOD)
Q3_IA3 = merge(IA_10, Q3_IA2, by = "MajorInsuranceOrgName")
Q3_IA4 = Q3_IA3 %>%
  select(`MajorInsuranceOrgName`, State, UOD, MS)
Q3_IA4 = Q3_IA4[order(-Q3_IA4$UOD),]
rownames(Q3_IA4) = NULL
head(Q3_IA4, 10)
```

```
##      MajorInsuranceOrgName State      UOD         MS
## 1        Aetna Health Inc.    IA 66.85882  3.7484766
## 2                  Humana    IA 59.72133 15.3595192
## 3     Coventry Health Care    IA 55.42000 29.6827572
## 4         UnitedHealthcare    IA 51.55359 41.9145087
## 5         Senior Preferred    IA 31.67000  0.1112734
## 6 Health Alliance Medicare    IA 15.15000  0.6842938
```

7. For NM

```
NM_10 = head(DATA_NM1, 10)
Q3_NM = DATA5 %>%
  filter(State == "NM") %>%
  mutate(EE = Enrollment * `EOC170-0010`)
Q3_NM2 = Q3_NM %>%
  select(`MajorInsuranceOrgName`, Enrollment, EE) %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_Enroll = sum(Enrollment),
            Sum_EE = sum(EE)) %>%
  mutate(UOD = Sum_EE/Sum_Enroll) %>%
  select(`MajorInsuranceOrgName`, UOD)
Q3_NM3 = merge(NM_10, Q3_NM2, by = "MajorInsuranceOrgName")
Q3_NM4 = Q3_NM3 %>%
  select(`MajorInsuranceOrgName`, State, UOD, MS)
Q3_NM4 = Q3_NM4[order(-Q3_NM4$UOD),]
rownames(Q3_NM4) = NULL
head(Q3_NM4, 10)
```

```
##                      MajorInsuranceOrgName State      UOD        MS
## 1                          UnitedHealthcare    NM 89.14959 29.915792
## 2 Amerigroup Community Care of New Mexico    NM 70.29000  0.960633
## 3                       BlueCrossBlueShield    NM 62.02677 15.214991
## 4    Presbyterian Insurance Company, Inc.    NM 61.90000  1.850133
## 5                                   Humana    NM 59.40086 18.836672
## 6                        Aetna Health Inc.    NM 55.65000  1.352880
## 7   Molina Healthcare of New Mexico, Inc.    NM 53.93000  2.419874
## 8                 Presbyterian Health Plan    NM 43.54000 28.739051
```

8. For ME

```
ME_10 = head(DATA_ME1, 10)
Q3_ME = DATA5 %>%
  filter(State == "ME") %>%
  mutate(EE = Enrollment * `EOC170-0010`)
Q3_ME2 = Q3_ME %>%
  select(`MajorInsuranceOrgName`, Enrollment, EE) %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_Enroll = sum(Enrollment),
            Sum_EE = sum(EE)) %>%
  mutate(UOD = Sum_EE/Sum_Enroll) %>%
  select(`MajorInsuranceOrgName`, UOD)
Q3_ME3 = merge(ME_10, Q3_ME2, by = "MajorInsuranceOrgName")
Q3_ME4 = Q3_ME3 %>%
  select(`MajorInsuranceOrgName`, State, UOD, MS)
Q3_ME4 = Q3_ME4[order(-Q3_ME4$UOD),]
rownames(Q3_ME4) = NULL
head(Q3_ME4, 10)
```

```
##                   MajorInsuranceOrgName State      UOD        MS
## 1                   BlueCrossBlueShield    ME 60.09129  4.782244
```

```
## 2                     Aetna Health Inc.    ME 58.43444 18.195296
## 3    Harvard Pilgrim Health Care, Inc.    ME 49.78000  1.300799
## 4                               Humana    ME 47.93322  5.905661
## 5                             WellCare    ME 44.59365  8.162203
## 6                      UnitedHealthcare    ME 43.97336 21.565547
## 7 Martin's Point Generations Advantage    ME 36.32271 40.088250
```

9. For AK

```
AK_10 = head(DATA_AK1, 10)
Q3_AK = DATA5 %>%
  filter(State == "AK") %>%
  mutate(EE = Enrollment * `EOC170-0010`)
Q3_AK2 = Q3_AK %>%
  select(`MajorInsuranceOrgName`, Enrollment, EE) %>%
  group_by(`MajorInsuranceOrgName`) %>%
  summarize(Sum_Enroll = sum(Enrollment),
            Sum_EE = sum(EE)) %>%
  mutate(UOD = Sum_EE/Sum_Enroll) %>%
  select(`MajorInsuranceOrgName`, UOD)
Q3_AK3 = merge(AK_10, Q3_AK2, by = "MajorInsuranceOrgName")
Q3_AK4 = Q3_AK3 %>%
  select(`MajorInsuranceOrgName`, State, UOD, MS)
Q3_AK4 = Q3_AK4[order(-Q3_AK4$UOD),]
rownames(Q3_AK4) = NULL
head(Q3_AK4, 10)
```

```
##   MajorInsuranceOrgName State   UOD        MS
## 1   BlueCrossBlueShield    AK 88.05  1.752190
## 2               Humana    AK 57.97  3.629537
## 3     Aetna Health Inc.    AK 55.65 77.096370
## 4      UnitedHealthcare    AK 40.10 17.521902
```