Care Utilization Patterns Differed Among Beneficiaries With Cancer and Heart Diseases

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ABSTRACT

Heart diseases and cancer are among the major causes of most deaths for adults in the United States. Therefore, we wanted to explore how patterns of healthcare utilization differed for patients with cancer versus with heart diseases. This study might potentially discover the difference between patients with cancer and heart disease in terms of where they go to receive care services and which factors would affect the average care utilization per person.

This study contains these main analyses using the SynUSA data developed by Prof. Steve Parente. First, we used the claim and beneficiary data to examine the average total allowed amount and average visits at different relevant places of service varied among the different condition groups, including cancer only, heart diseases only, both these conditions, and neither condition. Second, we looked at the patterns of utilizations differed among age groups for cancer-only and heart-diseases-only condition. Third, we explored average utilization among different insurance types for every condition. Fourth, we looked at how average allowed amount varied over different US states and regions. For every analysis, we ran multiple ANOVA to reaffirm these findings to be statistically significant.

We found that, first, cancer and heart diseases diagnosis resulted in the higher average care utilization in terms of number of visits and allowed amount. Patients with both conditions consumed care as much as ones with either cancer or heart diseases added up together. Second, cancer and heart diseases were more common in older population. However, cancer-only children group had much higher average allowed amount than other older groups as petriadic cancer is more curable and the treatment tends to have better outcomes. Unlike cancer-only group, there was no much difference in average allowed amount among heart-diseases-only beneficaries across all age groups. Third, Non-group and Medicaid enrollees tended to have higher average allowed amount, relative to members of other insurance types. We believe low-income was the major social-economic characteristic as well as care was delivered at bare minimum for Non-group and Medicaid increased the chance of these beneficiaries seeking more care than others. Fourth, the care utilization was higher some Western states compared to others regions. We believe that Western states were mostly rural having less developed care system and hospitals tended to have more power to set the price as the main reasons of the higher allowed amount.

STUDY DATA AND METHODS

This study research was conducted using Synthetic USA (SynUSA) dataset, developed be Professor Steve Parente at the University of Minnesota.

The SynUSA contains 184,851 beneficiary records and over six million claim records (both professional and facility claims). Each beneficiary includes either of five major insurance types: Employer Sponsored Insurance (ESI), Medicaid (under 65), Medicare Fee-For-Service, Medicare Advantage, and Non-Group (both ACA exchange and non-exchange), state and 4 census region variables, major age categories, sex, federal poverty level, and household income. For SynUSA claim data, we mainly looked at claim type, ICD-9 diagnosis codes, allowed amount, speciaty codes and place of service codes, and date of each claim for analysis. The SynUSA only includes data of 2015 and was mainly used to extract pattern of care utilization in terms of average allowed amount and number of visits to each related place of service.

For this study, we defined disease condition into 4 categories: Cancer Only, Heart Diseases Only, Both Conditions, and Neither Condition. Any beneficiary with at least two claims having either cancer or heart diseases indicator will subject to that condition. We defined beneficiaries with cancer as whom have any kind of malignant neoplasm while benefiaries with heart diseases are whom has either chronic rheumatic heart diseases, ischemic heart diseases, pulmonary heart diseases, or/and other forms of heart disease, by mapping the first three digits of ICD-9 diagnosis codes of each claim. Beneficiaries with both condition are whom has both cancer and heart diseases diagnosis indicator; whereas, ones with neither conditions are whom have neither cancer nor heart diseases diagnoses or no claim data.

We grouped places of services into these categories. For professional claims, place of services are either primary care visit (including general practice, family medicine, internal medicine, pediatrics, or geratric medicine), cardiologist visit (including cardiology, vascular surgery, cardiac surgery, or cardiac electrophysiology), oncologist visit (including hemotology/oncology, medical oncology, surgical oncology, radiation oncology, or gynecologist/oncology), and other visits. For facility claims, place of services are categorized into either inpatient facility (including inpatient hospital) or outpatient facility (including on-campus outpatient hospital, ambulatory surgical center, comprehensive outpatient rehabilitation facility, or end-stage renal treatment facility).

To extract the patterns of care utilization among patients with cancer, heart diseases, both condition, and neither condition, we summarized the data to see how the average allowed amount and number of visits at different categorized places of service for each condition group varied by age groups, by insurance types, and among each US states. For each analysis, we conducted ANOVA tests to confirm the mean differences among groups were statistically significant then discuss these differences further.

ANALYSIS RESULTS WITH DISCUSSIONS

SynUSA consisted of 184,851 beneficiaries. Of the patients in our sample, 52.93 percent were female and 20.94 percent were 65 or older, 29.58 percent were 45-64, 11.60 percent were 35-44, 17.28 percent were 19-34, and 20.59 percent were teenagers. Specially, 9.79 percent had heart diseases, 4.75 percent percent had cancer, and 1.5 percent had both cancer and heart diseases

(Exhibit 1). The disease prevalence of this data is quite aligned with the CDC statistics that 9.27 percent (30.3 million (Thomas, 2020) over 326.8 million people of the US population in 2018) had heart diseases and 5.5 percent had cancer (Roser & Ritchie, 2015)

Cancer and heart diseases diagnosis significantly increased the average cost of care and average visit at all places of service. Beneficiaries with either cancer or heart diseases diagnoses were billed around six times higher than ones without these conditions (Exhibit 1). The average allowed amount was much higher for patients with both conditions and approximate the total average of the allowed amount of patients with cancer only and patients with heart diseases only (Exhibit 1). Also, the average allowed amount for heart disease treatment was a little higher than for cancer treatment (Exhibit 1). The differences in the average allowed amount among disease conditions were statistically significant with p-value less than 0.0001, according to the ANOVA test.

In terms of the average visit, regardless of any diagnosis, primary visit and other types of visit were more popular at the professional level while outpatient visit was much higher than inpatient visit at the facility level (Exhibit 1). The average visit at all places of service spiked substantially when a beneficiary got diagnosed with either cancer, heart diseases, or both. In general, heart disease patients tended to have more visits than ones with cancer, excluding oncologist visit (Exhibit 1). This might indicate that heart disease patients required more regular check-up and care than cancer patients. Also, the average inpatient visit of patients heart diseases only was two times higher than of patients with cancer only (Exhibit 1), meaning that patients with heart diseases might have higher chance of complications and need more intensive care than cancer alone. Finally, patients with both conditions had more regular visit at all places of services compared to patients of other conditions (Exhibit 1). We believe patients with both conditions were exposed to high risk of complications; therefore, they needed more constant monitoring at professional offices and care facilities than patients with a single condition. The differences in the mean number of visits by disease conditions were statistically significant at all places of service with p-values less than 0.0001, according to our ANOVA tests.

Exhibit 1

Average allowed amount and average visits, by disease conditions, 2015

Conditions	Number of Patients	Prevalence	Average Allowed Amount	Average Primary Care Visits	Average Cardiologist Visits	Average Oncologist Visits	Average Other Visits	Average Inpatient Visits	Average Outpatient Visits
Cancer Only	5,919	3.25%	$14,718.49	4.14	0.39	2.33	13.59	0.24	4.64
Heart Disease Only	15,091	8.29%	$15,792.06	6.94	3.42	0.21	14.60	0.53	4.80
Both Conditions	2,727	1.50%	$28,970.20	8.62	4.42	3.73	22.75	0.79	8.23
Neither Condition	158,258	86.96%	$2,602.35	2.16	0.09	0.03	4.58	0.05	0.95

***Source:** Author's analysis of SynUSA data developed from proprietary data by Professor. Steve Parente at the University of Minnesota. **Notes:** Beneficiaries who had no claim records were categorized as "Neither Condition" and had zero amount claim.*

Patterns of healthcare utilization by age categories for each disease condition. In general, the older the age group, the more patients got diagnosed with either cancer, heart diseases, or both conditions. Cancer and heart diseases were more popular in the older population rather than

younger one as more than 90 percent patients in the cancer-only, heart-diseases-only, and both-conditions group were 45 or older (Exhibit 2). The average allowed amounts of patients with cancer or/and heart diseases were always higher than of patients without these conditions, regardless of any age (Exhibit 2). Among cancer-only beneficiaries, though cancer was not common among children (00-18), the average allowed amount of this group was very huge, relative to other age groups. According to a research about Medical Cost of Cancer Care for Privately Insured Children, cancer treatment in pediatric patients is more complex and expensive, and resource-intensive than adults (Borrescio-Higa & Valdés, 2021). The costs were even higher for younger children (Borrescio-Higa & Valdés, 2021). As pediatric cancer is generally more curable then geriatric cancer, we believe children were likely allowed more treatment than old patients, which substatially increased the average allowed amount. In contrast, the average allowed amounts for heart-diseases-only patients had very little difference among all age groups. We didn't find any resource that explained why the utilization was quite similar among age groups. This could be another interesting research topic to close the gap of knowledge. Also, the differences in the mean allowed amounts by different age categories, for each disease condition, were statistically significant with p-values less than 0.0006 for heart-diseases-only group and less than 0.0001 for other condition groups, according to our ANOVA tests.

Exhibit 2

Variation in the patient distribution and average allowed amount, of each disease condition, by age categories, 2015

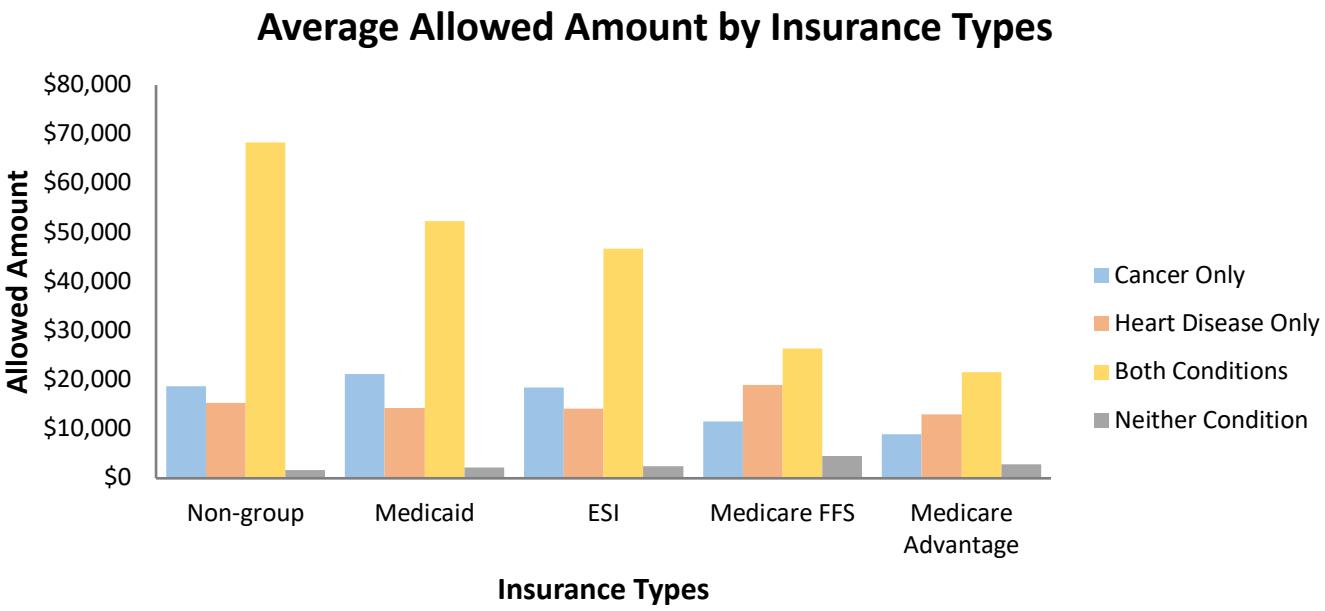
Age Categories	Number of Patients	Percentage Within Condition Group	Percentage to the Total Beneficiary	Average Allowed Amount
Cancer Only				
00-18	57	0.96%	0.03%	$54,576.63
19-34	159	2.69%	0.09%	$19,377.17
35-44	290	4.90%	0.16%	$20,078.85
45-64	2,430	41.05%	1.34%	$17,964.39
65+	2,983	50.40%	1.64%	$10,543.27
Heart Diseases Only				
00-18	232	1.5%	0.13%	$14,580.00
19-34	388	2.6%	0.21%	$15,034.00
35-44	529	3.5%	0.29%	$13,977.00
45-64	4,199	27.8%	2.31%	$14,202.00
65+	9,743	64.6%	5.35%	$16,635.00
Both Conditions				
00-18	2	0.1%	0.00%	$3,894.80
19-34	9	0.3%	0.00%	$134,682.74
35-44	15	0.6%	0.01%	$46,237.19
45-64	467	17.1%	0.26%	$47,371.61
65+	2,234	81.9%	1.23%	$24,604.17
Neither Conditions				
00-18	37,183	23.5%	20.43%	$1,493.37
19-34	30,892	19.5%	16.97%	$2,219.82
35-44	20,282	12.8%	11.14%	$2,452.17
45-64	46,746	29.5%	25.69%	$3,173.35
65+	23,155	14.6%	12.72%	$3,872.30

Source: *Author's analysis of SynUSA data developed from proprietary data by Professor. Steve Parente at the University of Minnesota.* ***Notes:*** *Beneficiaries who had no claim records were categorized as "Neither Condition" and had zero amount claim.*

Non-group and Medicaid beneficiaries were prone to utilize more care than other group. Medicaid members with cancer-only condition had the highest average allowed amount, followed by Non-group then ESI members (Exhibit 3). Medicaid and Non-group with heart diseases only were among the groups with the highest average allowed amount. In terms of having both conditions, Non-group and Medicaid was also leading with higher average allowed amounts, compared to other groups. To intepret these patterns, we looked at characteristics of each insurance types and its enrollees. In fact, the majority of people with incomes below 400% of the federal poverty level (FPL) were enrolled in Non-group policies with only minimum essential coverage (Goforth, 2021). Medicaid enrollees are also mainly low-income people, families, pregnant women, the elderly, and people with disabilities. We believe enrollees in Medicaid or Non-group policies were at higher risk of getting these disease conditions, due to their poor lifestyle or living conditions, which would increase health utilization. In addition, Medicaid was deemed to provide low care quality and have poor outcomes on patients (Gottlieb, 2011); therefore, its enrollees tended to seek care more often. Medicaid patients also found it more challenging to access to routine and specialized care timely (Gottlieb, 2011), which worsened their existing conditions. On the other hand, Medicare groups had the lowest utilization for all disease conditions. A research confirmed that people who signed up for Medicare Advantage (MA) plans inclined to use less service and spend less money (KFF, 2019). MA shall be a good insurance for cancer and heart diseases with great outcomes; however, it is not for everyone due to high premium. Also, the differences in the mean allowed amounts by insurance types were statistically significant with p-values less than 0.0001 for all disease condition groups, according to our ANOVA tests.

Exhibit 3

Average allowed amount, of insurance types, by disease conditions, 2015

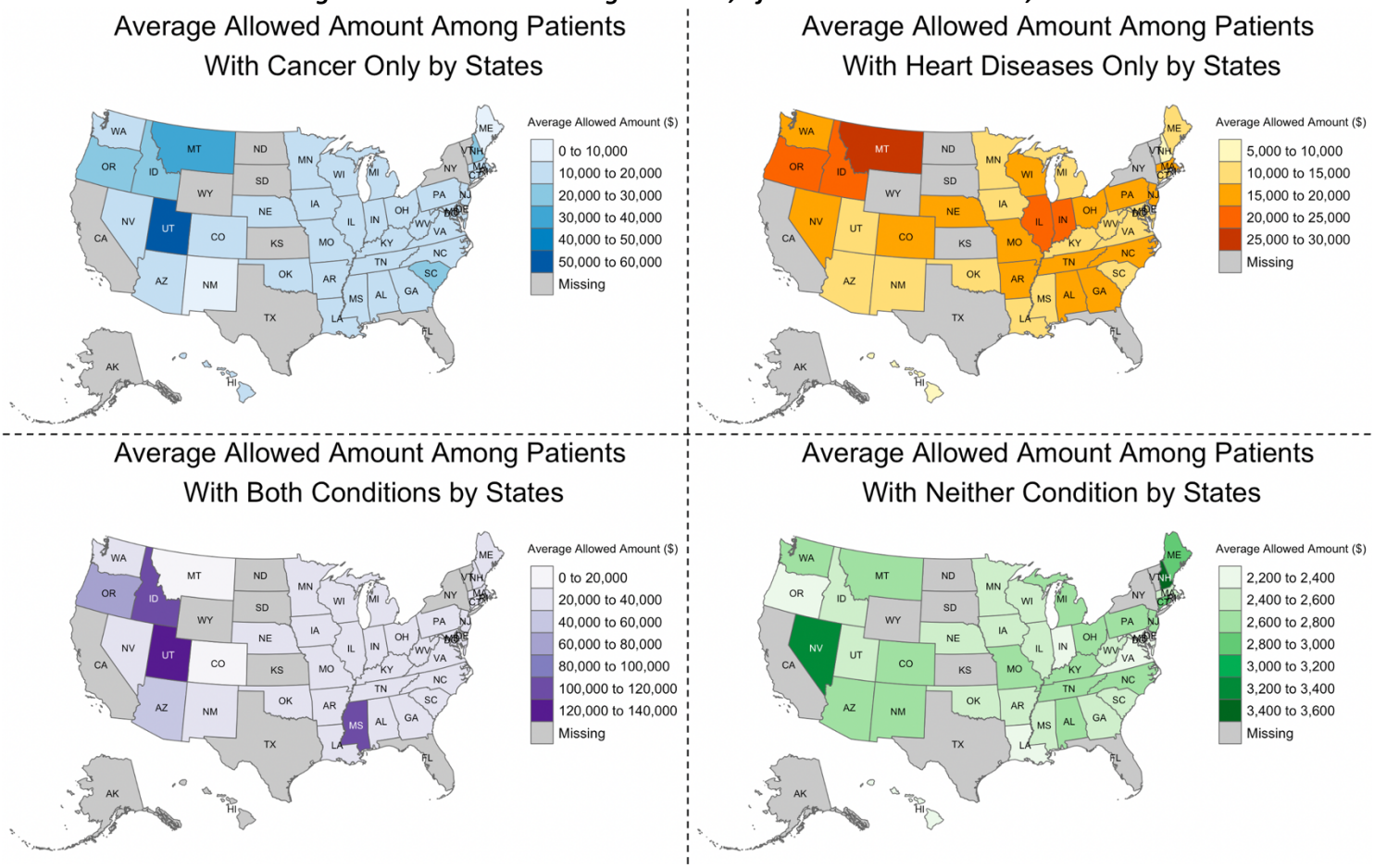


Source: *Author's analysis of SynUSA data developed from proprietary data by Professor. Steve Parente at the University of Minnesota.* ***Notes:*** *Beneficiaries who had no claim records were categorized as "Neither Condition" and had zero amount claim.*

Beneficiaries living in the Western states tended to have higher average allowed amount than ones living in other regions. Utah, Montana, Idaho, and Oregon were among states with the highest average allowed amount for beneficiaries with cancer only (See Exhibit 4). Residents of Montana, Idaho, and Oregon with heart diseases only also had very high average allowed amounts along with two Midwest states, Illinois and Indiana (See Exhibit 4). Having both conditions, patients in Utah and Idaho also leaded in the average allowed amount (See Exhibit 4). According to ANOVA test, the differences in the average allowed amount by states for every condition group were meaningful, proving that residents living these mentioned Western states actually utilized more care than the average. Studies showed that hospitals in Montata actually set price for private insurers two to three times higher than Medicare (Houghton, 2019). Also, patients paid a little more in rural areas (Houghton, 2019). This happened because hospitals had too much power to control the price (Houghton, 2019).

Exhibit 4

Variation in average allowed amount among US states, of each disease condition, 2015



Source: *Author's analysis of SynUSA data developed from proprietary data by Professor. Steve Parente at the University of Minnesota.* ***Notes:*** *Beneficiaries who had no claim records were categorized as "Neither Condition" and had zero amount claim. "Missing" means no beneficiary data was captured in that state.*

Our analysis had some limitations. In fact, the SynUSA data did not include pharmacy claim data; therefore, we could not see patterns of drug spending. Medication was a big part of treatment for these conditions, especially among patients with heart diseases. Missing prescription data might underestimate the average allowed amount of beneficiaries, especially, with heart diseases only and both conditions. Also, the SynUSA data did not have beneficiaries from high-populated and diverse states such as California, Texas, New York, and Florida. We might not see how beneficiaries of thoses states contributed to the patterns that we saw.

CONCLUSION

We studied healthcare utilization patterns among patients with cancer and heart diseases by analyzing the SynUSA dataset developed by Professor. Steve Parente. Beneficiaries in the dataset were categorized into having either cancer only, heart diseases only, both conditions, or neither condition. Utilization was measured by calculating average allowed amount and average number of visits at primary care, cardiologist, oncologist, and other places for professional claims and inpatient and outpatient settings for facility claims. We looked at how utilization varied by different condition groups, by age groups, by insurance types, and among US states. We also conducted ANOVA tests to confirm statistically significance of the mean differences for every analysis.

Beneficiaries with cancer and/or heart diseases diagnosis had significant higher care utilization in terms of number of visits at all places of services and dollar amount than ones with neither. Petriatic cancer is tremendously expensive but very rare. As cancer and heart diseases have higher prevalence in the older population, we believe a healthy lifestyle as an important factor to reduce the risk of getting these diseases. People should exercise more often and have a healthy diet to avoid these diseases. Also, Non-group and Medicare insurance were prone to poor care quality or lacked timely access to needed care, eventually rising care utilization. We recommend these insurance types should allow its beneficiaries to choose benefits for their needs rather than offer a comprehensive minimum coverage. In this way, patients would have more resources to access the right care and receive better care quality. Finally, utilization was higher in some states in the West region. In the case of Montana, “health care system and health insurance premiums were just unaffordable to society. So we need to change the system” (Houghton, 2019).

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