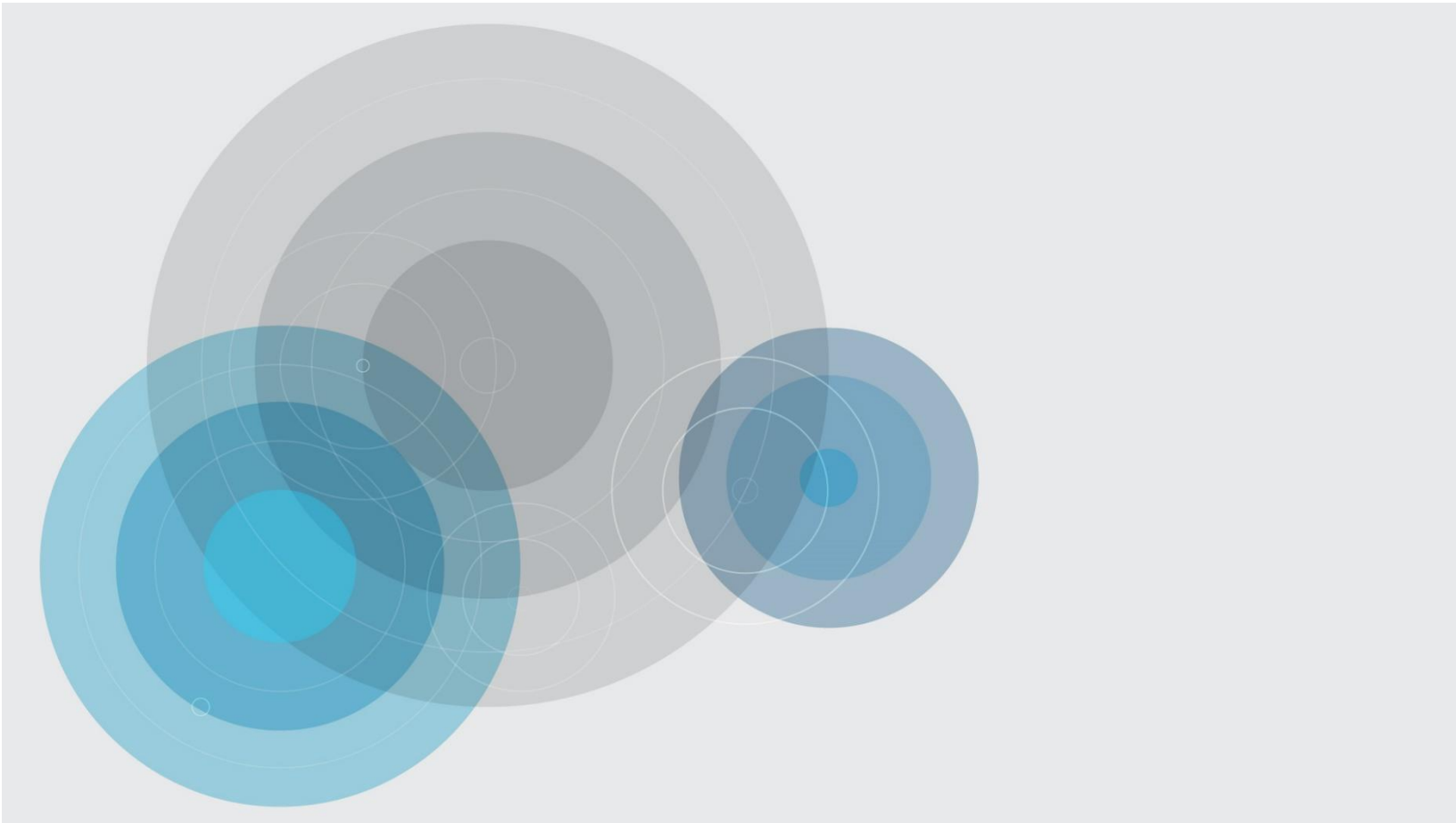
MILLIMAN CLIENT REPORT

Treatment patterns for patients with CAR T-indicated lymphoma diagnoses receiving third or later-line therapy

December 2020

Maggie Alston, CHFP
Carol Bazell, MD, MPH
Melissa Caplen, ASA, MAAA
Mila Shapoval, MPH
Annaliese Mugele

Commissioned by Gilead Sciences, Inc.



Milliman


Milliman

Table of Contents

Executive Summary

OVERVIEW OF DIFFUSE LARGE B-CELL LYMPHOMA AND CAR T-CELL THERAPY

Diffuse large B-cell lymphomas (DLBCLs) are the most common lymphoid neoplasms in adults,[1] with new annual cases of 5.6 per 100,000 people in the United States (U.S.).[2] About 40% to 50% of these patients end up with relapsed/refractory (R/R) disease, meaning they either failed to achieve complete remission after first-line therapy or relapsed after complete remission.[3] Current treatments for DLBCL include chemotherapy, high-dose chemotherapy with autologous stem cell rescue, allogeneic stem cell transplant (SCT), and chimeric antigen receptor (CAR) T-cell therapy, in addition to experimental clinical trials.[4]

CAR T-cell therapy is a relatively new cancer treatment where a patient's autologous T-cells are genetically modified in the laboratory to attack cancer cells, and then infused back into the patient.[5] For B-cell lymphoma patients, the therapy is currently indicated only for patients who have already received two or more lines of systemic treatment.[6,7] The first CAR T-cell product for lymphoma was approved in October 2017, and more have followed.[8–10] CAR T-cell therapies for lymphomas have a U.S. average list price of $373,000.[11] This price, combined with shifting payer policies, may have impacted the uptake of CAR T-cell therapy. We analyzed the utilization of CAR T-cell therapies for the treatment of R/R DLBCL in the commercial and Medicare fee-for-service (FFS) markets as a case study of the short-term changes in treatment uptake after the approval of a complex, individualized cell therapy. More novel, resource-intensive cell therapies are expected to be launched over the next decade, with costs that will likely be similar to or exceed the current average acquisition cost of such treatments.[12]

METHODOLOGY

We performed a detailed descriptive analysis to identify the characteristics and treatment patterns of potentially CAR T-cell therapy-eligible adult R/R B-cell lymphoma patients covered by commercial insurance or Medicare FFS. We estimated the potentially eligible adult Medicare FFS and commercially insured populations as patients with CAR T-indicated lymphomas receiving a third or later-line of therapy (LOT), including those patients who actually received CAR T-cell therapy outside of a clinical trial for on-label indications. We subsequently analyzed the treatments received by these patients, the characteristics of the patients, and the providers who may have been associated with treatment decisions.

The analysis used the following data sources for the calendar years listed below:

1. Centers for Medicare and Medicaid Services (CMS) 100% Innovator Research Data Set:
    a. Parts A and B: 2013 to 2019
    b. Part D: 2013 to 2018
2. IBM MarketScan® Commercial Claims Database: 2013 to third quarter (Q3) 2019
    a. This is a sample database and does not contain claims for all commercially insured individuals in the U.S. After restricting the database to active employees or dependents aged 18 to 64 with medical and pharmacy coverage in a non-capitated health plan, the sample was around 18 million members per year, which is about 10% of the full commercially insured population.
3. Milliman Health Cost Guidelines™ Sources Database (CHSD), Commercial Claims: 2014 to 2018
    a. This is a sample database and does not contain claims for all commercially insured individuals in the U.S. After restricting the database to enrollees aged 18 to 64 with medical and pharmacy coverage in a non-capitated health plan, the sample was around 18 million members per year, which is about 10% of the full commercially insured population.

We identified patients with lymphoma types specified on the label for CAR T-cell therapies who could ultimately be CAR T-eligible if their disease was R/R after two or more LOTs: DLBCL not otherwise specified, primary mediastinal large B-cell lymphoma, high-grade B-cell lymphoma, and DLBCL arising from follicular lymphoma. We further limited these patients to those who could be identified as receiving a third or later-LOT, either non-clinical trial CAR T-cell therapy, allogeneic SCT, or third or later-line chemotherapy regimen. The descriptive analyses included population

estimates, demographic and geographic information, characteristics of hospitals providing later-line treatments, specific chemotherapy regimens, and patient participation in clinical trials.

KEY FINDINGS FROM MILLIMAN'S ANALYSIS

Patient populations

- We identified 1,850 Medicare FFS patients with a CAR T-cell indicated diagnosis receiving a third or later-LOT from October 2017 through the end of 2019.
    - 19% of these patients received CAR T-cell therapy in a non-clinical trial setting.
    - An additional 7% received allogeneic SCT.
    - An additional 74% received third or later-line chemotherapy.
- We identified 246 commercial sample patients with a CAR T-cell indicated diagnosis receiving a third or later-LOT from October 2017 through September 2019.
    - 30% of these patients received CAR T-cell therapy in a non-clinical trial setting.
    - An additional 17% received allogeneic SCT.
    - An additional 53% received third or later-line chemotherapy.

Patient characteristics

- In both markets, the patients receiving CAR T-cell therapy were younger than those receiving third or later-line chemotherapy, but older than those receiving allogeneic SCT.
    - Median age in years (10th-90th percentile) for Medicare FFS patients:
        - CAR T-cell therapy: 68 (61-75)
        - Allogeneic SCT: 66 (54-70)
        - Third or later-line chemotherapy: 71 (64-81)
    - Median age in years (10th-90th percentile) for commercial sample patients:
        - CAR T-cell therapy: 54 (32-62)
        - Allogeneic SCT: 52 (27-61)
        - Third or later-line chemotherapy: 55 (43-61)

Annual trends

- The portion of patients receiving CAR T-cell therapy increased more rapidly in the commercial market than the Medicare FFS population.
    - The percentage of Medicare FFS patients receiving CAR T-cell therapy rose from close to 0% in 2017 to 14% in 2018 and to 26% in 2019.
    - The percentage of commercial sample patients receiving CAR T-cell therapy rose from close to 1% in 2017 to 32% in 2018 and to 40% in 2019.
- In the Medicare FFS population, the CAR T-cell treated population appears to be drawn relatively evenly from the patients who would have previously received allogeneic SCT and those who would have received additional lines of chemotherapy.
- In the commercial sample, many more patients appeared to shift to CAR T-cell therapy from those who would have received allogeneic SCT.

Setting of treatments

- Third or later-line chemotherapy was more likely to be administered in the hospital inpatient setting for commercial sample patients (55%) compared to Medicare FFS patients (23%).
- 40% of CAR T-cell therapy treatments were administered at prospective payment system (PPS)-exempt cancer hospitals, compared to 24% of allogeneic SCT.
- 99% of CAR T-cell therapy treatments were administered at teaching hospitals, which was slightly higher than the 92% of allogeneic SCT provided at these facilities.

Geographic distribution of treatments

- In the Medicare FFS population, CAR T-cell therapy was overrepresented in the Middle Atlantic, New England, and West South Central U.S. census divisions, while it was underrepresented in the East North Central, South Atlantic, East South Central, and Mountain divisions.
- In the commercial sample, CAR T-cell therapy was overrepresented in the Middle Atlantic, New England, and East North Central, while it was underrepresented in the South Atlantic, East South Central, and West South Central divisions.

Chemotherapy regimens

- In both the commercial sample and Medicare FFS population, bendamustine and R-CHOP (rituximab, cyclophosphamide, doxorubicin, vincristine, prednisone) were among the top three most commonly identified regimens for the first course of chemotherapy observed.
- Bendamustine, ICE (ifosfamide, carboplatin, etoposide), GemOx (oxaliplatin, gemcitabine), GDP-1 (dexamethasone, cisplatin, gemcitabine), and regimens containing a second-line sentinel drug (cisplatin, carboplatin, oxaliplatin) were commonly identified in the later courses observed. Sentinel drugs are chemotherapy drugs that, when observed, indicated a specified LOT, without being matched to a guideline-based regimen for that LOT.
- We were not able to match a majority of chemotherapy courses to National Comprehensive Cancer Network Guidelines®-recommended regimens,[13] due to both a lack of specific drug codes for inpatient administrations and the use of chemotherapy regimens not included in the guidelines.

Use of intensive treatments

- In addition to CAR T-cell therapy indicated diagnoses and claims-based evidence of having received two or more lines of systemic treatment, in order to be eligible for CAR T-cell therapy patients need to be sufficiently healthy.
- In the Medicare FFS population, 50% of patients had evidence of intensive treatments (CAR T-cell therapy, allogeneic SCT, autologous SCT, inpatient-administered chemotherapy) which could indicate a sufficient health status, compared to 78% of the patients in the commercial sample.

This report was commissioned by Gilead Sciences, Inc. A subsidiary of Gilead, Kite Pharma, is the manufacturer of the CAR T-cell therapies Yescarta and Tecartus. The findings reflect the analysis of the authors; Milliman does not intend to endorse any product or organization. If this report is reproduced, it should be reproduced in its entirety, as pieces taken out of context could be misleading. Our analysis is based on historical DLBCL treatment patterns in the Medicare FFS-covered population and a sample of the commercially insured population, which may change over time. Analyses using different years, data sources, or LOT identification methodologies may produce different results. One of the co-authors, Melissa Caplen, is a member of the American Academy of Actuaries and meets its qualification standards for this work.

Introduction

Chimeric antigen receptor (CAR) T-cell therapy is a relatively new immunotherapy treatment for relapsed/refractory (R/R) B-cell hematological malignancies.[5] The first product derived from autologous T-cells to treat lymphomas was approved in October 2017.[9] Since then, new products and indications have been approved, which have expanded the pool of potential patients.[8,10] Reported barriers to increased uptake of approved CAR T-cell therapies include the logistics of referral to a CAR T-cell therapy certified center where cells can be collected, transported to the manufacturer's facility for processing, transferred back to the CAR T-cell facility, and reinfused; the toxicity of the therapy; and the resource intensity of this single administration treatment.[14] Most cell and gene therapies are given just once (single administration), with clinical value that accrues following that treatment. Typically, drugs and biologics are paid per-use, where the total payment is related to the duration of time patients are on therapy and clinical value accrues throughout and following the full treatment course.[15] In the case of resource-intensive, single administration cell and gene therapies, the full cost is incurred at the time the single administration is provided, as opposed to the cumulative cost of other regimens, which accrues over time. As more single administration novel cell therapies are expected to launch over the next decade, real-world analyses on the initial uptake of CAR T-cell therapy may provide useful insights into factors that influence their rates of adoption, which may inform efforts to improve timely access to new, evidence-based treatments.[12]

This white paper presents an analysis of the uptake of CAR T-cell therapy among R/R diffuse large B-cell lymphoma (DLBCL) patients who can be categorized as potentially eligible therapy recipients based on their diagnoses and prior cancer treatments observed in claims data (CAR T-cell therapy is currently indicated as third or later-line treatment). In both the Medicare fee-for-service (FFS) population and a sample of the commercial market, we examined the following:

- Patient characteristics, including age, gender, and urban/rural residence
- Setting of cancer treatments (inpatient, outpatient, and physician office)
- Geographic distribution of cancer treatments
- Use of intensive cancer treatments, including CAR T-cell therapy
- Annual changes in the utilization of CAR T-cell therapy
- Alternative cancer treatments received by patients who did not receive CAR T-cell therapy

Background

EPIDEMIOLOGY OF DIFFUSE LARGE B-CELL LYMPHOMA

DLBCL is the most common lymphoid neoplasm in adults, accounting for over 30% of non-Hodgkin lymphomas diagnosed annually in the United States (U.S.).[1] The rate of new diagnosis varies substantially by age and sex. The annual incidence of new cases of DLBCL is 6.7 per 100,000 men and 4.6 per 100,000 women per year in the U.S.[2] DLBCL is most commonly diagnosed in individuals aged 65 to 74 years (25% of all cases), followed by individuals aged 55 to 64 years (21%) and 75 to 84 years (20%).[2]

Due to the aggressiveness of the disease, patients typically present with rapidly enlarging lymph nodes accompanied by the relatively sudden onset of systemic symptoms, requiring urgent initiation of treatment.[16] In previously untreated DLBCL patients, rituximab-containing first-line therapy can achieve durable remission in approximately 60% of cases.[17,18] Initial diagnosis and treatment is expensive, with one study estimating the medical and pharmacy costs of DLBCL patients at over $15,000 per patient per month in the first year after diagnosis.[19] However, about 40% to 50% of DLBCL patients either fail to achieve complete remission with first-line therapy or relapse after achieving complete remission; these patients have R/R disease.[3] For R/R DLBCL patients, treatment with second-line chemotherapy followed by a hematopoietic autologous stem cell transplant (SCT) is potentially curative although only about 50% of patients who receive second-line therapy demonstrate sufficient chemotherapy sensitivity to be candidates for autologous SCT. Furthermore, 50% of DLBCL patients who do undergo autologous SCT subsequently relapse.[3]

Five-year DLBCL survival is approximately 64%.[2] As this survival rate is fairly close to the portion of patients who achieve durable remission after first-line therapy (50% to 60%),[3] the rate indicates that the vast majority of DLBCL patients with R/R disease die from the disease.

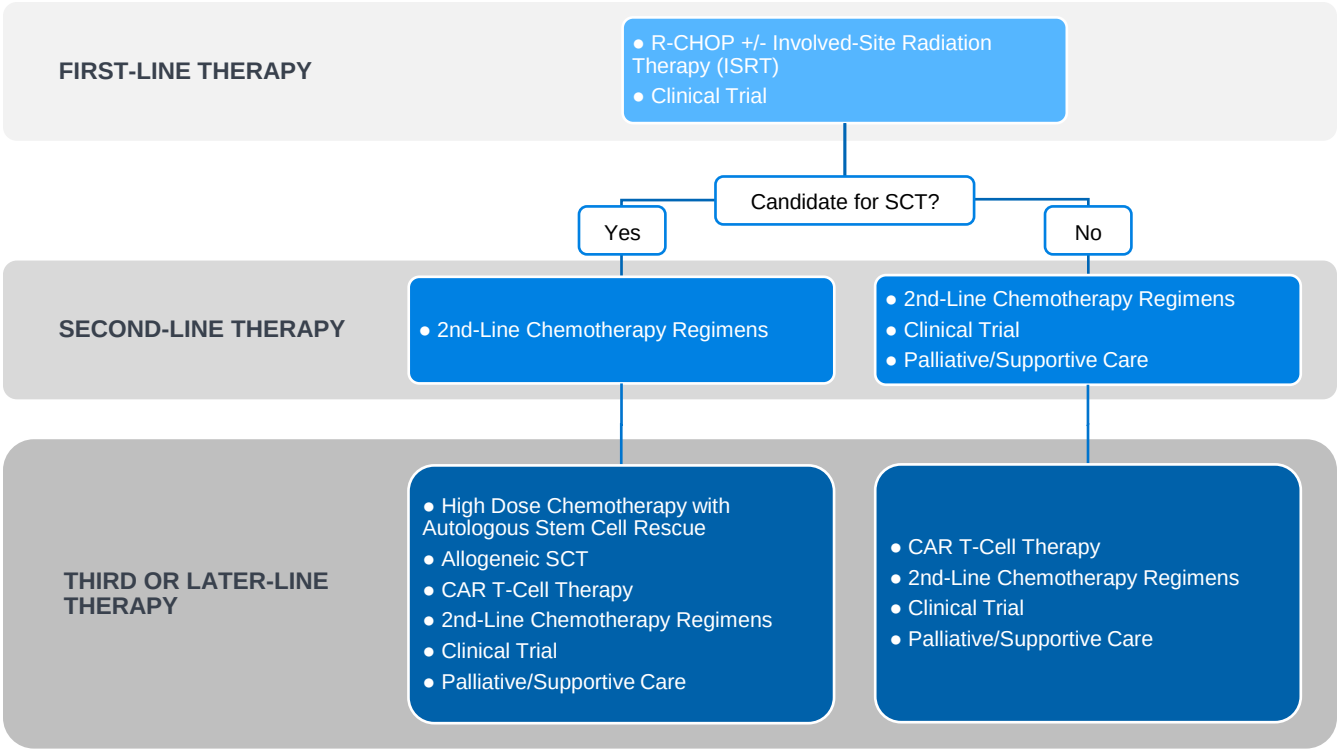
EVIDENCE-BASED TREATMENT OF DIFFUSE LARGE B-CELL LYMPHOMA

The diagnosis of DLBCL is usually based on pathological examination of an excisional biopsy of an enlarged, suspicious-appearing lymph node.[16] DLBCL is a heterogeneous disease, with patients exhibiting a wide range of outcomes.[20] Initial diagnosis and staging involves a physical examination, evaluation of performance status, lab testing including immunohistochemistry algorithms as surrogates for gene expression profiling and molecular studies, and whole body positron emission tomography/computed tomography scanning (PET/CT scan).[21] The staging workup identifies all sites of known disease and determines the prognostic and treatment implications of these characteristics. This is supplemented by information from the International Prognostic Index (IPI) or revised IPI (R-IPI) on clinical factors that influence prognosis: age, stage, the number of extranodal sites, performance status, and serum lactate dehydrogenase (LDH) levels.[16]

The National Comprehensive Cancer Network® (NCCN®) is a not-for-profit alliance of 30 leading cancer centers devoted to patient care, research, and education that develops evidence-based clinical practice guidelines in oncology (NCCN Guidelines®) detailing the sequential management decisions and interventions that currently apply to most cancers affecting patients in the U.S., including those with DLBCL.[13] According to the NCCN Guidelines, the R-CHOP regimen (rituximab, cyclophosphamide, doxorubicin, vincristine, and prednisone) is the backbone of first-line therapy for DLBCL. The guideline-based treatment regimens are different for patients with poor ventricular function, extreme frailty, age older than 80, or concurrent central nervous system (CNS) disease.[4] Patients who fail to go into complete remission or relapse would be recommended for second-line therapy, which varies based on whether or not the patient is a candidate for a SCT. Of note, many patients may not qualify for a SCT based on age, significant comorbidities, or poor performance status resulting from aggressive disease and/or multiple lines of prior treatment.[21]

Finally, for the large group of patients who fail to respond to second-line therapy or relapse, third or later line treatments include alternative chemotherapy regimens on the second-line and subsequent guidelines, as well as CAR T-cell therapy, allogeneic SCT, clinical trials, and supportive or palliative care.[4] The basic NCCN Guidelines treatment pathways for DLBCL are summarized in Figure 1.

FIGURE 1: NCCN GUIDELINES OPTIONS FOR DLBCL TREATMENT FOR EACH LINE OF THERAPY[4]



Note: R-CHOP = rituximab, cyclophosphamide, doxorubicin, vincristine, prednisone

CAR T-CELL THERAPY FOR RELAPSED/REFRACTORY DLBCL

CAR T-cell therapy is a relatively new cancer treatment where a patient's autologous T-cells collected by apheresis are genetically modified in the laboratory to attack cancer cells, and then infused back into the patient.[5] There are currently three products on the market: Axicabtagene ciloleucel (Yescarta), Tisagenlecleucel (Kymriah), and Brexucabtagene autoleucel (Tecartus). Of the CAR T-cell therapies with lymphoma indications, Yescarta was approved first in October 2017, followed by Kymriah in May 2018, and Tecartus in July 2020.[8–10]

Yescarta and Kymriah are currently indicated for certain types of relapsed or refractory non-Hodgkin lymphoma in adult patients after two or more lines of systemic treatment, specifically DLBCL, high-grade B-cell lymphoma, and transformed follicular lymphoma.[6,7] Yescarta's indication further includes primary mediastinal B-cell lymphoma.[6] Both therapies have a U.S. average sales price of $373,000 for the lymphoma indications.[11] These therapies commonly have severe short- and medium-term toxicities that may require hospitalization, including cytokine release syndrome, neurologic toxicities, hypersensitivity reactions, serious infections, prolonged cytopenias, and hypogammaglobulinemia. The clinical trials supporting the U.S. Food and Drug Administration (FDA) approvals of Kymriah and Yescarta did not provide information to indicate that patients ages 65 and older respond differently to treatment from younger subjects.[6,7]

IMPLICATIONS OF THE UPTAKE EXPERIENCE OF CAR T-CELL THERAPY FOR DLBCL

The analysis of the uptake of CAR T-cell therapy for DLBCL treatment across its initial years of availability is an important contemporary case study as more novel cell therapies are expected to be launched over the next decade, with costs that will likely exceed the current average acquisition cost of treatments.[12]

Research indicates that new cancer therapies have higher uptake in patients with limited treatment alternatives, such as R/R DLBCL patients. However, rates of uptake are uneven across the patient population for reasons that are not

well understood.[22] It is possible that challenges for payers, patients, and/or providers arising from the traditional "pay as you go" drug payment methodology contribute to slow diffusion of single-administration cell therapies. For these novel therapies, the cost of treatment is incurred with a single administration that has the potential to realize long-term clinical benefits, rather than throughout a treatment course that extends over time.[22] Kymriah and Yescarta provide real-world examples of how different healthcare systems in the EU5 countries (France, Germany, Italy, Spain, and the United Kingdom) have approached and managed the decision uncertainty associated with these new therapies. Within the EU5, countries have employed a range of strategies, from reimbursement that is subject to future changes as more data becomes available to rebates or installment payments that are linked to individual patient outcomes.[23] Overall, these approaches reflect a heightened focus among EU5 countries on outcomes-based reimbursement (OBR).

In the U.S., a survey of 20 certified CAR T-cell centers reported a perceived concern about the financial viability of CAR T-cell therapies.[24] The authors speculated that low reimbursement may result in limited access to CAR T-cell therapy for Medicare beneficiaries, as well as a shift from inpatient to outpatient CAR T-cell treatment due to Medicare payment policies.[24,25] For fiscal year (FY) 2019 (October 2018 to September 2019) and FY 2020 (October 2019 to September 2020), the Medicare FFS Inpatient Prospective Payment System (IPPS) established an additional payment for hospital admissions where CAR T-cell therapy was provided by granting the drugs eligibility for new technology add-on payments (NTAPs).[26] In addition, in 2019 CMS released a positive national coverage determination for CAR T-cell therapy that established uniform coverage requirements across the Medicare program.[27] For FY 2021, the IPPS established a new CAR T-cell-specific Medicare Severity-Diagnosis Related Group (MS-DRG) where payment is set based on historical hospital costs for non-clinical trial CAR T-cell therapy cases, similar to the standard IPPS rate-setting methodology.[11] It remains to be seen whether the new CAR T-cell therapy MS-DRG in FY 2021 will increase uptake that may have been slowed due to IPPS payment uncertainty and methodologic challenges in prior years.

In summary, the utilization of CAR T-cell therapies since their launch in the fourth quarter (Q4) of 2017 for the treatment of R/R DLBCL provides real-world experience that illustrates the short-term changes in treatment uptake in the commercial and Medicare FFS markets after the approval of a new, individualized cell therapy where the full treatment cost is incurred with a single administration that constitutes the complete treatment course. These changes in treatment patterns result from overlapping considerations of long-term treatment value, up-front therapy costs, longstanding Medicare payment methodologies that predate these therapeutic advancements, and access restrictions that confront new, single administration cell therapies that are in the pipeline. For example, as of November 2019, a review of the U.S. registry of clinical trials showed 52 CAR T-cell therapy trials for cancer, with the majority focused on hematological (57%), followed by central nervous system (8%), gastrointestinal (6%), skin (5%), genitourinary (4%), breast (4%), gynecologic (4%), respiratory (3%), sarcoma (2%), mesothelioma (2%), and other (5%).[28] Therefore, the recent experience of Yescarta and Kymriah may inform the development of long-term strategies to improve diffusion and speed uptake of newly approved novel cell therapies in the future.

Methodology

We performed a detailed descriptive analysis to identify the characteristics and treatment patterns of potentially CAR T-cell therapy eligible adult R/R B-cell lymphoma patients covered by commercial insurance or Medicare FFS. We estimated the potentially eligible adult Medicare FFS and commercially insured populations as patients with CAR T-indicated lymphomas receiving a third or later-line of therapy (LOT), including those patients who actually received CAR T-cell therapy outside of a clinical trial for on-label indications. We subsequently analyzed the treatments received by these patients, the characteristics of the patients, and the providers who may have been associated with treatment decisions.

The analysis used the following data sources for the calendar years listed below:

1. Centers for Medicare and Medicaid Services (CMS) 100% Innovator Research Data Set:
    a. Parts A and B: 2013 to 2019
    b. Part D: 2013 to 2018

2. IBM MarketScan® Commercial Claims Database: 2013 to Q3 2019
    a. This is a sample database and does not contain claims for all commercially insured individuals in the U.S. After restricting the database to active employees or dependents aged 18 to 64 with medical and pharmacy coverage in a non-capitated health plan, the sample was around 18 million members per year, which is about 10% of the full commercially insured population.
3. Milliman Health Cost Guidelines™ Sources Database (CHSD), Commercial Claims: 2014 to 2018
    a. This is a sample database and does not contain claims for all commercially insured individuals in the U.S. After restricting the database to enrollees aged 18 to 64 with medical and pharmacy coverage in a non-capitated health plan, the sample was around 18 million members per year, which is about 10% of the full commercially insured population.

We identified patients with lymphoma types specified on the label for CAR T-cell therapies who could ultimately be CAR T-eligible if their disease was R/R after two LOTs: DLBCL not otherwise specified, primary mediastinal large B-cell lymphoma, high-grade B-cell lymphoma, and DLBCL arising from follicular lymphoma. We further limited these patients to those who could be identified as receiving a third or later-LOT, either a non-clinical trial CAR T-cell therapy, allogeneic SCT, or a third or later-line chemotherapy regimen. The descriptive analyses included population estimates, demographic and geographic information, characteristics of hospitals providing later-line treatments, specific chemotherapy regimens, and patient participation in clinical trials.

Please see Appendix A for more information about the data sources used in this analysis and Appendix B for more detail about our methodology. Throughout this report, an asterisk (*) indicates that the data point is based on a sample of under 11 patients, consistent with CMS policy. Case total and subtotal figures may be reported as "> [number]" to prevent calculation of a masked data point.[29]

Results and discussion

PATIENT POPULATIONS

In our analysis, we identified patients with CAR T-indicated lymphomas and found approximately 86,000 such Medicare FFS patients in the CMS 100% Innovator Research Data Set from 2013 to 2019, and approximately 16,000 such commercial patients in the IBM MarketScan® Commercial Claims Database from 2013 to Q3 2019 and the Milliman CHSD Commercial Claims Database from 2014 to 2018. Note that, while our Medicare FFS data contains 100% of Medicare FFS beneficiaries, our commercial data represents only a sample of the commercially insured population.

We followed these patients from the date of the earliest CAR T-cell indicated diagnosis, the index date, for as long as they appeared in the data. We analyzed in detail the patients we determined were on their third or later-LOTs, as the current indication for CAR T-cell therapy requires prior completion of first- and second-line treatments. We determined patients were on their third or later-LOTs by the presence of at least one of the following:

- CAR T-cell therapy (excluding those administered as part of a clinical trial)
- Allogeneic SCT, which is only recommended under NCCN Guidelines for DLBCL as a third or later-LOT[4]
- Third or later-line chemotherapy

As the first CAR T-cell therapy for lymphoma was approved by the FDA in Q4 2017, we further subset these patients to those who were actively receiving treatment in Q4 2017 or later. For these patients, we analyzed demographic information as well as the setting and geographic distribution of cancer treatments (see Appendix C-11: U.S. Census Divisions).

We identified 1,850 Medicare FFS patients and 246 commercial sample patients with a CAR T-cell therapy indicated lymphoma diagnosis receiving a third or later-LOT from October 2017 through the end of 2019 for Medicare FFS, and from October 2017 through September 2019 for the commercial sample (Q4 2017 to 2019 throughout this paper). We refer to this group of patients as the study population. We extrapolated the commercial sample (age-adjusted) to

estimate about 1,013 such patients in the national U.S. commercial market. On average, we were able to follow the Medicare FFS patients for about three and a half years after their index dates, and the commercial sample patients for slightly under two years after their index dates. A member's index date may not be the date of their initial diagnosis with a CAR T-cell indicated lymphoma, as the initial diagnosis could have preceded the earliest date of data available for analysis for the patient. Note that our study population should not be considered a national estimate of patients with CAR T-cell therapy indicated diagnoses receiving a third or later-LOT, as we could not determine whether some patients were on a third or later-LOT based on the limited information in the claims data. For example, we observed 17,228 additional Medicare FFS patients and 2,778 additional commercial sample patients with CAR T-cell indicated lymphoma with treatment from October 2017 through 2019 who we were not able to identify as being on a third or later-LOT.

TABLE 1: CAR T-CELL INDICATED PATIENTS WITH A THIRD OR LATER-LOT, Q4 2017-2019 (STUDY POPULATION).

	MEDICARE FFS				COMMERCIAL SAMPLE			
PATIENT CHARACTERISTICS	CAR T-CELL NON-CLINICIAL TRIAL	ALLOGENEIC SCT	3RD+ LINE OF CHEMO-THERAPY	TOTAL	CAR T-CELL NON-CLINICIAL TRIAL	ALLOGENEIC SCT	3RD+ LINE OF CHEMO-THERAPY	TOTAL
Total Cases	350	134	1,366	**1,850**	74	42	130	**246**
Total Cases Extrapolated to Market†	350	134	1,366	**1,850**	305	172	535	**1,013**
% of Total Cases	19%	7%	74%	**100%**	30%	17%	53%	**100%**
Average Months in Data Post-Diagnosis Code Index Date	33.8	36.9	46.2	**43.2**	23.7	19.3	25.4	**23.9**

†Commercial case counts are extrapolated to Q4 2017 through full-year 2019 commercial market numbers for ages 18 to 64 using Q4 2017 to 2018 commercial enrollment from Kaiser Family Foundation with age-group breakdowns from U.S. Census data for commercial enrollees.[30,31]

PATIENT CHARACTERISTICS

The Medicare FFS patients in the study population were older, on average, than the commercial sample patients, as expected based on eligibility criteria for Medicare coverage. For Medicare FFS the median age was 69 years, compared to 54 for the commercial sample. The Medicare FFS patients also had a more even sex distribution at 57% male/43% female compared to 63% male/37% female in the commercial sample.

In both markets, the study population who received allogeneic SCT was the youngest on average. The Medicare FFS patients receiving allogeneic SCT were also more likely to be dual-eligible (22% vs. 16%) and eligible for Medicare based on disability or end-stage renal disease (ESRD) rather than age (28% vs. 17%), compared to the overall Medicare FFS study population. These results are consistent as members eligible for Medicare based on disability or ESRD are more likely to be dual-eligible and younger than members who aged into Medicare. In addition, allogeneic SCT is intensive treatment and, therefore, usually more broadly appropriate for younger, more physically fit patients.

TABLE 2: DEMOGRAPHICS FOR STUDY POPULATION.

PATIENT CHARACTERISTICS	MEDICARE FFS				COMMERCIAL SAMPLE			
	CAR T-CELL NON CLINCIAL TRIAL	ALLOGENEIC SCT	3RD+ LINE OF CHEMO-THERAPY	TOTAL	CAR T-CELL NON CLINCIAL TRIAL	ALLOGENEIC SCT	3RD+ LINE OF CHEMO-THERAPY	TOTAL
Total Cases	350	134	1,366	**1,850**	74	42	130	**246**
% of Total Cases	19%	7%	74%	**100%**	30%	17%	53%	**100%**
Dual Eligibility†								
% Dual	15%	22%	16%	**16%**	N/A	N/A	N/A	**N/A**
% Non-Dual	85%	78%	84%	**84%**	N/A	N/A	N/A	**N/A**
Initial Medicare Enrollment Reason								
% Aged	84%	72%	84%	**83%**	N/A	N/A	N/A	**N/A**
% Disabled and/or ESRD	16%	28%	16%	**17%**	N/A	N/A	N/A	**N/A**
Patient Age at Index Diagnosis								
10th Percentile	61	54	64	**63**	32	27	43	**35**
Median	68	66	71	**69**	54	52	55	**54**
90th Percentile	75	70	81	**80**	62	61	61	**61**
Gender								
% Female	39%	46%	44%	**43%**	35%	38%	38%	**37%**
% Male	61%	54%	56%	**57%**	65%	62%	62%	**63%**

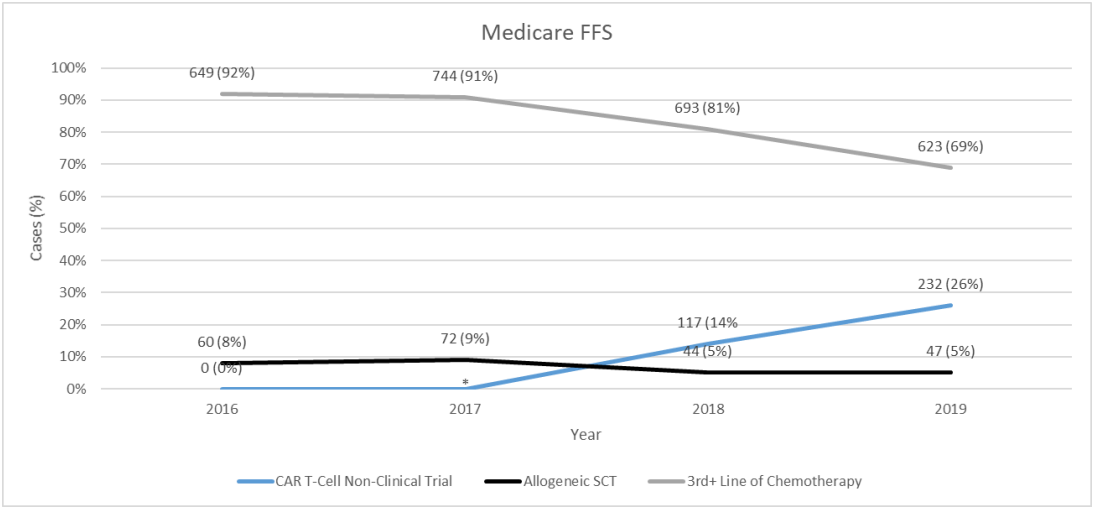
†Dual eligible status at the time of the earliest CAR T-cell therapy, allogeneic SCT, or third or later-line chemotherapy.

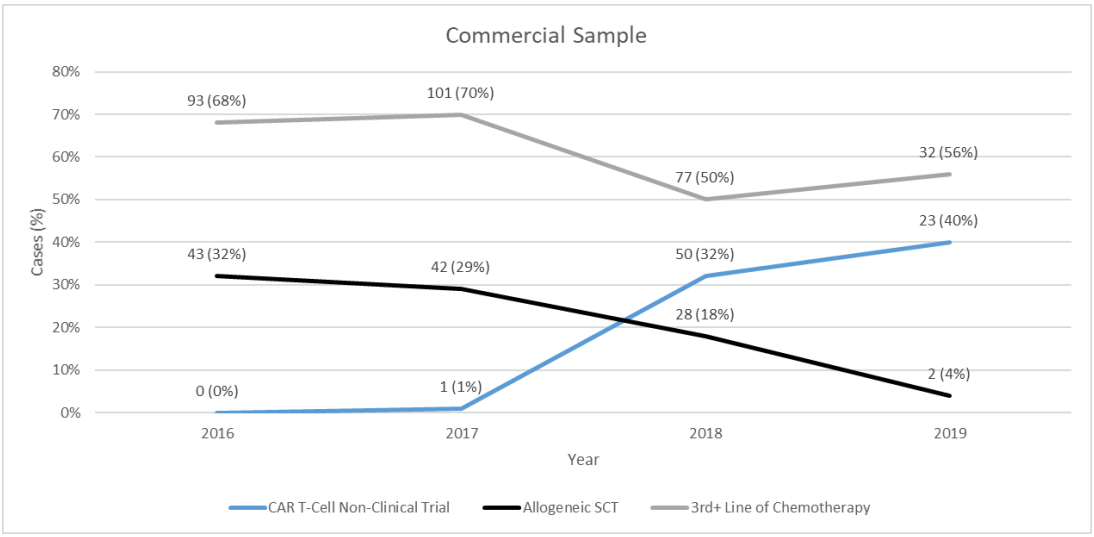
The split of third or later-LOTs between non-clinical trial CAR T-cell therapy, allogeneic SCT, and third or later-line chemotherapy is different between the Medicare FFS and commercial sample study populations. Patients in the commercial sample were much more likely to receive CAR T-cell therapy (30% vs. 19%) and allogeneic SCT (17% vs. 7%) compared to the Medicare FFS patients. This difference may be related to the relative youth of the commercial patients, which could make them, in reality or from the perspective of treating physicians, more likely to be able to handle such intensive treatments. Differences in coverage and payment for treatments between Medicare FFS and commercial insurance may also contribute to the observed treatment patterns.[27,32]

ANNUAL TRENDS

In order to analyze the changes in third or later-LOTs over time, we divided patients into annual groups for 2016 to 2019 based on the year the patient's third or later-LOT was identified. Note that patients may be present in the annual groups for multiple years if we observed a third or later-LOT for them in the data in each year. For example, a patient who received third-line chemotherapy in 2018 and allogeneic SCT in 2019 would be included in "third or later-line chemotherapy" category in 2018 and "allogeneic SCT" in 2019. The lower total patient counts in the earlier years of analysis are likely due to the shorter observation period in claims data available for evidence of third or later-LOT to accrue, as opposed to an increase in the frequency of patients with a CAR T-cell indicated diagnosis receiving a third or later-LOT over time. A shorter period to follow patient treatment regimens makes it more difficult to identify a course of chemotherapy as a third or later-LOT.

FIGURE 2: CAR T-CELL INDICATED PATIENTS WITH A THIRD OR LATER-LOT IN YEARS 2016, 2017, 2018, AND 2019.





Note: the same patient may appear in the 2016, 2017, 2018, and 2019 metrics, and may have a different qualifying event in each year.

An asterisk (*) indicates that the data point is based on a sample of under 11 patients and cannot be reported in compliance with our CMS 100% Innovator Research data use agreement. Case total and subtotal figures may be reported as "> [number]" to prevent calculation of a masked data point.

For Medicare FFS, the portion of patients receiving non-clinical trial CAR T-cell therapy increased steadily from close to 0% in 2017, to 14% in 2018, and to 26% in 2019. The uptake in the commercial sample was more rapid, with the portion of patients receiving non-clinical trial CAR T-cell therapy increasing from 1% in 2017, to 32% in 2018, to 40% in 2019. Several factors may have contributed to these differences in uptake across the markets, including Medicare coverage and payment changes in 2019. Prior to 2019, Medicare CAR T-cell coverage was determined by individual regional Medicare administrative contractors, leading to provider uncertainty especially for patients covered by Medicare Advantage.[33] During this same period, inpatient procedures for CAR T-cell therapy had no effect on MS-DRG assignment, so if CAR T-cell therapy was covered the MS-DRG payment would be unrelated to the cost and clinical characteristics of patients receiving these novel therapies.[26] In August 2019, CMS determined nationally that CAR T-cell therapy would be covered by Medicare and clarified that CAR T-cell therapy for Medicare Advantage members would be paid by Medicare FFS until 2021 due to the significant cost of this required coverage.[27,34] In

addition, in the FY 2019 IPPS for Medicare FFS, CAR T-cell therapy was assigned to a specific MS-DRG accompanied by eligibility for additional payment through NTAPs.[26] Unlike Medicare FFS, commercial payment is not standardized and each commercial insurer contract for CAR T-cell therapy is based on its own negotiated rates with providers, which are not publicly available.

The shift of patients to CAR T-cell therapy over time appears to come from both the patients who would have previously received allogeneic SCT and those who would have received additional lines of chemotherapy. The CAR T-cell treated population was drawn relatively evenly from these two groups in the Medicare FFS population, with a slightly greater decrease in allogeneic SCT. In 2016, there were about 11 Medicare FFS patients receiving third or later-line chemotherapy for every patient receiving allogeneic SCT; by 2019 this ratio had increased to about 13 Medicare FFS patients receiving third or later-line chemotherapy for every patient receiving allogeneic SCT. In the commercial sample, many more patients appeared to shift to CAR T-cell therapy from those who would have received allogeneic SCT. In 2016, there were about two commercial sample patients receiving third or later-line chemotherapy for every patient receiving allogeneic SCT; by 2019 this ratio had increased to about 16 commercial sample patients receiving third or later-line chemotherapy for every patient receiving allogeneic SCT.

SETTING OF TREATMENTS

For our analysis of individual third or later-LOTs, we included every non-clinical trial CAR T-cell therapy administration, allogeneic SCT, and third or later-line chemotherapy regimen that we found in the data between Q4 2017 and 2019. A single patient may have received multiple treatments over this time period. For third or later-lines of chemotherapy, we categorized each treatment by location: hospital inpatient, hospital outpatient, or physician office.

TABLE 3: TREATMENT SETTING FOR THIRD OR LATER-LINE CHEMOTHERAPY FOR STUDY POPULATION.

3RD+ LINE OF CHEMOTHERAPY	MEDICARE FFS	COMMERCIAL SAMPLE
Total Treatments Occurring in Q4 2017 to 2019	1,965	217
Treatment Setting		
% Hospital Inpatient	23%	55%
% Hospital Outpatient	46%	32%
% Physician Office	30%	13%

Medicare FFS treatments were more likely to occur outside of the hospital inpatient setting than commercial sample treatments. Only 23% of Medicare FFS third or later-line chemotherapy occurred in the hospital inpatient setting, while 46% took place in the hospital outpatient setting and the remaining 30% in the physician office setting. In the commercial sample, however, 55% of third or later-line chemotherapy occurred in the hospital inpatient setting, while only 32% took place in the hospital outpatient setting and the remaining 13% in the physician office setting. This difference may result from the younger age of commercial sample patients, making them more likely to be treated aggressively with intensive chemotherapy regimens, which tend to be administered in the hospital inpatient setting. Other factors, including member cost sharing, insurance coverage, utilization management, and payment dynamics, could also play a role in the prescribed treatment regimen and treatment setting.

We also grouped treatments by whether or not they were associated with clinical trials. Allogeneic SCT is more likely to be associated with clinical trials in the Medicare FFS population than in the commercial sample (>17% vs. 5%). However, third or later-line chemotherapy was less likely to be associated with a clinical trial in the Medicare FFS population than the commercial sample (9% vs. 13%). For the Medicare FFS population, we were able to identify the specific clinical trial associated with each treatment. Although over 17% of allogeneic SCT was associated with a clinical trial, only a small portion of these clinical trials were directly related to treatment for indicated CAR T-cell lymphomas. Most of the clinical trials were related to other conditions or supportive care. On the other hand, two-thirds of third or later-line chemotherapy associated with a clinical trial were in clinical trials directly related to

treatment for indicated CAR T-cell lymphomas. Information on the type of clinical trial was not available for the commercial sample.

TABLE 4: HOSPITAL AND CLINICAL TRIAL STATUS FOR THIRD OR LATER-LOTS FOR STUDY POPULATION.

	MEDICARE FFS			COMMERCIAL SAMPLE		
THIRD OR LATER-LOTS	**CAR T-CELL NON-CLINCIAL TRIAL**	**ALLOGENEIC SCT**	**3RD+ LINE OF CHEMO-THERAPY**	**CAR T-CELL NON-CLINCIAL TRIAL**	**ALLOGENEIC SCT**	**3RD+ LINE OF CHEMO-THERAPY**
Total Treatments Occurring in Q4 2017Q4 to 2019	350	119	1,965	74	37	217
% of Total Third or Later-LOTs	14%	5%	81%	22%	11%	66%
Hospital Type†						
% with Treatment Services at a PPS Exempt Hospital	40%	24%	13%	N/A	N/A	N/A
% with Treatment Services at a Teaching Hospital	99%	92%	57%	N/A	N/A	N/A
Clinical Trial Status‡						
% Treatment Related Clinical Trial	0%	*	6%	N/A	N/A	N/A
% Other Clinical Trial	0%	>17%	3%	N/A	N/A	N/A
% Total Clinical Trial	0%	>17%	9%	0%	5%	13%
% Non-Clinical Trial	100%	>71%	91%	100%	95%	87%

†A treatment is considered to include a certain type of hospital if a claim for the treatment is from at least one hospital of the given type. For chemotherapy lines of therapy solely based on pharmacy claims, we looked at facility claims for evaluation and management (E&M) visits occurring within 30 days of the chemotherapy prescription fill and considered the line of chemotherapy to include a certain type of hospital if we saw a facility claim from at least one hospital of the given type. Also note that these designations are not mutually exclusive—a hospital may fall into more than one category and a treatment can include claims from different hospitals of different types.
‡Treatments identified as part of a 'Treatment Related Clinical Trial' were coded with a clinical trial number that corresponded to a clinical trial specific to DLBCL treatment. Treatments with clinical trial numbers that corresponded to clinical trials for other cancer types, other non-cancer conditions, or supportive care only were placed in the 'Other Clinical Trial' group. This distinction is only available for the Medicare data, not for the commercial sample.
Note: An asterisk (*) indicates that the data point is based on a sample of under 11 patients and cannot be reported in compliance with our CMS 100% Innovator Research data use agreement. Case total and subtotal figures may be reported as "> [number]" to prevent calculation of a masked data point.

For Medicare FFS, we were able to classify the different treatments as occurring at a prospective payment system (PPS)-exempt or non-PPS-exempt cancer hospital (see Appendix C-10: PPS-Exempt Cancer Hospitals), and at a teaching or non-teaching hospital (see Appendix C-9: Teaching Hospitals). Forty percent of the non-clinical trial CAR T-cell therapy treatments were administered at a PPS-exempt cancer hospital, compared to 24% of allogeneic SCT. Whereas under the IPPS, Medicare pays hospitals a predetermined amount based on the clinical classification of each inpatient admission, by law inpatient services at the 11 PPS-exempt cancer hospitals are paid for based on their reported costs.[35] The high proportion of CAR T-cell therapy and allogeneic SCT provided at PPS-exempt cancer hospitals may stem from several factors, including the cancer specialization of these hospitals, their high rates of certification as CAR T-cell therapy eligible treatment centers, and the cost-based payment methodology under Medicare where hospitals are paid for providing treatment based on their actual costs incurred. In particular, the PPS-exempt hospitals' payment methodology has the potential to reduce the barriers to uptake of intensive and costly new treatments.[35] Under the standardized Medicare IPPS payment methodology, however, hospitals may receive payment that is lower than the cost they incurred for these therapies. Ninety-nine percent of non-clinical trial CAR T-cell therapy treatments were administered at teaching hospitals and 92% of allogeneic SCT, consistent with the specialized expertise and resource requirements for providing these intensive treatments. CMS defines teaching hospitals as "hospitals that receive payment for Medicare direct graduate medical education (GME), IPPS indirect medical education (IME), or psychiatric hospital IME programs."[36,37] The much lower rates of PPS-exempt cancer hospital and teaching hospital third or later-lines of chemotherapy treatments are partly due to a portion of those courses being administered in the physician office setting, whereas CAR T-cell therapy and allogeneic SCT cannot be provided in the physician office setting.

GEOGRAPHIC DISTRIBUTION OF TREATMENTS

The regional distribution of CAR T-cell therapy was noticeably different from the regional distribution of other third or later-LOTs.

TABLE 5: U.S. CENSUS DIVISION DISTRIBUTION OF THIRD OR LATER-LOTS FOR STUDY POPULATION.

	MEDICARE FFS				COMMERCIAL SAMPLE			
THIRD OR LATER-LOTS	CAR T-CELL NON CLINCIAL TRIAL	ALLOGENEIC SCT	3RD+ LINE OF CHEMO-THERAPY	TOTAL	CAR T-CELL NON CLINCIAL TRIAL	ALLOGENEIC SCT	3RD+ LINE OF CHEMO-THERAPY	TOTAL
Total Treatments Occurring in Q4 2017 to 2019	350	119	1,965	**2,434**	74	37	217	**328**
% of Total Third or Later-LOTs	14%	5%	81%	**100%**	22%	11%	66%	**100%**
U.S. Census Division†								
New England	12%	10%	> 7%	**8%**	9%	8%	5%	**6%**
Middle Atlantic	20%	12%	> 14%	**15%**	22%	22%	18%	**19%**
East North Central	13%	15%	> 16%	**16%**	12%	11%	9%	**10%**
West North Central	8%	*	> 9%	**> 8%**	8%	5%	8%	**8%**
South Atlantic	14%	19%	> 18%	**18%**	23%	24%	26%	**25%**
East South Central	*	*	> 6%	**> 5%**	3%	-	6%	**5%**
West South Central	13%	9%	> 10%	**10%**	3%	8%	9%	**7%**
Mountain	*	*	> 5%	**> 4%**	9%	14%	7%	**9%**
Pacific	15%	19%	> 15%	**15%**	7%	5%	9%	**8%**
Other/ Unknown	*	0%	*	**> 0%**	4%	3%	4%	**4%**

†The division in which each treatment was administered. See Appendix C-11: U.S. Census Divisions for a list of the states in each division.

Note: The regional distribution of patients in the commercial sample data does not represent the regional distribution of all commercially insured individuals in the U.S. Therefore, comparisons should only be made between the portions of patients receiving different treatments within a division, not between divisions.

An asterisk (*) indicates that the data point is based on a sample of under 11 patients and cannot be reported in compliance with our CMS 100% Innovator Research data use agreement. Case total and subtotal figures may be reported as "> [number]" to prevent calculation of a masked data point.

In the Medicare FFS population, the greatest regional disparity of CAR T-cell therapy compared to the percentage of total third or later-LOTs for the study population was seen in the Middle Atlantic. Twenty percent of non-clinical trial CAR T-cell therapy treatments were observed at providers in this census division, compared to 15% of total third or later-LOTs. CAR T-cell therapy was also overrepresented in New England and West South Central, while it was underrepresented in the East North Central, South Atlantic, East South Central, and Mountain divisions.

The difference between the regional distribution of CAR T-cell therapy and other third or later-LOTs was smaller in the commercial sample. CAR T-cell therapy was still overrepresented in the Middle Atlantic and New England, joined by East North Central, while it was still underrepresented in the South Atlantic and East South Central census divisions, joined by West South Central.

CHEMOTHERAPY REGIMENS

For the study population, we matched patients' chemotherapy courses in Q4 2017 to 2019 to the NCCN Guidelines regimens based on the types of drugs administered during each course. We organized the courses by the chronological order in which they appeared in the claims data. Therefore, the regimens listed as "First Course" in Table 6 may not be the first chemotherapy course in the patient's history.

TABLE 6: MOST COMMON CHEMOTHERAPY REGIMENS IN Q4 2017 TO 2019 FOR STUDY POPULATION.

	MEDICARE FFS				COMMERCIAL SAMPLE			
CHEMOTHERAPY REGIMENS	TOTAL REGIMENS	1ST MOST COMMON (% OF REGIMENS)	2ND MOST COMMON (% OF REGIMENS)	3RD MOST COMMON (% OF REGIMENS)	TOTAL REGIMENS	1ST MOST COMMON (% OF REGIMENS)	2ND MOST COMMON (% OF REGIMENS)	3RD MOST COMMON (% OF REGIMENS)
Order of Regimens Identified in Data[1]								
First Course	**384**	Bendamustine (27%)	R-CHOP (25%)	2nd Line Sentinel (14%)	**54**	R-CHOP (28%)	ICE (19%)	Bendamustine (13%)
Second Course	**892**	Unknown (46%)	2nd Line Sentinel (20%)	ICE (8%)	**88**	Unknown (56%)	Bendamustine (10%)	2nd Line Sentinel (9%)
Third Course	**802**	Unknown (49%)	Bendamustine (42%)	2nd Line Sentinel (13%)	**81**	Unknown (59%)	Bendamustine (12%)	GDP-1 (6%)
Fourth Course	**298**	Unknown (57%)	Bendamustine (12%)	GemOX (6%)	**26**	Unknown (73%)	GemOX (15%)	Bendamustine (4%)
Fifth Course	**108**	Unknown (69%)	* (*)	* (*)	**3**	Unknown (67%)	Bendamustine (33%)	N/A
Sixth Course	**42**	Unknown (71%)	* (*)	* (*)	**1**	Unknown (100%)	N/A	N/A
Seventh Course	**18**	Unknown (78%)	* (*)	* (*)	**1**	Unknown (100%)	N/A	N/A

[1]Patients may have had earlier regimens before the start of the time periods used in the data analysis.

Note: See Appendix C-8: Adjusted Chemotherapy Regimen List Based on NCCN Guidelines for the drugs included in each regimen. We did not require the steroids in an NCCN regimen to be present in order for the course to be assigned to the regimen for analysis. R-CHOP = rituximab, cyclophosphamide, doxorubicin, vincristine, prednisone; ICE = ifosfamide, carboplatin, etoposide; GemOX = oxaliplatin, gemcitabine; GDP-1 = dexamethasone, cisplatin, gemcitabine; 2nd Line Sentinel = regimen contains at least one second-line sentinel drug: cisplatin, carboplatin, or oxaliplatin, and did not match to an NCCN regimen.

An asterisk (*) indicates that the data point is based on a sample of under 11 patients and cannot be reported in compliance with our CMS 100% Innovator Research data use agreement. Case total and subtotal figures may be reported as "> [number]" to prevent calculation of a masked data point.

For patients in both Medicare FFS and the commercial sample, bendamustine and R-CHOP (rituximab, cyclophosphamide, doxorubicin, vincristine, prednisone) were among the top three most commonly identified regimens for the first course of chemotherapy identified. R-CHOP, which is one of the NCCN Guidelines-recommended first-line treatments for DLBCL,[4] made up about a quarter of these first observed courses. Bendamustine, one of the NCCN Guidelines-recommended second- or later-line treatments,[4] made up 27% of first observed courses for Medicare FFS, and 13% of first courses for the commercial sample. Bendamustine also appeared in the top three courses for most later courses of chemotherapy.

In the second through seventh courses found in the data, most of the chemotherapy regimens could not be matched to an NCCN Guidelines-recommended treatment, and this portion increased with the course number. As patients receive and possibly do not respond to the NCCN Guidelines-recommended treatments, it follows that they would move toward alternative or customized chemotherapy regimens where the evidence for a specific treatment is not strong. We note that a portion of these unknown regimens may have been NCCN Guidelines-recommended regimens administered in the inpatient setting where the individual drug codes that would allow us to match the treatment to a recommended regimen were not listed on the claim.

Another common regimen was ICE (ifosfamide, carboplatin, etoposide), which made up 19% of first observed courses for commercial sample patients and 8% of second courses for Medicare FFS patients. GemOX (oxaliplatin, gemcitabine) also appeared in the top three for both populations for the fourth course. Courses including a second-line sentinel drug (cisplatin, carboplatin, oxaliplatin) that could not be matched to a defined regimen were common in the first three observed courses for Medicare FFS patients, but only in the second course for commercial sample patients. GDP-1 (dexamethasone, cisplatin, gemcitabine) appeared among the top regimens for the commercial sample, but not in the Medicare FFS population.

Overall, the Medicare FFS and commercial sample patients received similar NCCN Guidelines-recommended chemotherapy regimens. Bendamustine and second-line sentinel drug regimens were more common in Medicare FFS than in the commercial sample, and the reverse was true for GDP-1, but the total list of top three regimens is almost identical. However, there may be differences in the unknown regimens received by these patients in the later courses or inpatient courses. Specifically for inpatient chemotherapy courses, Healthcare Common Procedure Coding System (HCPCS) codes to identify specific chemotherapy drugs are commonly not reported, so a disproportionate number of inpatient chemotherapy regimens are assigned to an unknown regimen.

USE OF INTENSIVE TREATMENTS

In our overall analysis, we approximated potential eligibility for CAR T-cell therapy by limiting our analysis to patients with CAR T-cell indicated diagnoses who received a third or later-LOT. While the medical evidence may indicate that a patient could benefit from a specific treatment regimen, a variety of factors play a role in the treatments individuals actually receive, including patient age and health, patient and provider preferences, member cost sharing, insurance coverage, payer utilization management, and payment dynamics. Claims data do not allow us to identify the impact of each of these factors on treatment patterns. However, as a proxy for intensive treatments for which patients must be sufficiently healthy, we examined the receipt of non-clinical trial CAR T-cell therapy, allogeneic SCT, autologous SCT, and third or later-line chemotherapy administered in the hospital inpatient setting, while acknowledging the limitation that other considerations may also have played a role in the treatments patients actually received.

TABLE 7: PRESENCE OF INTENSIVE TREATMENTS FOR STUDY POPULATION.

PATIENT EVIDENCE OF INTENSIVE TREATMENTS	MEDICARE FFS	COMMERCIAL SAMPLE
Total Cases	1,850	246
% of Cases with CAR T-cell Non-Clinical Trial	19%	30%
Additional % of Cases with Allogeneic SCT	7%	17%
Additional % of Cases with 3rd+ Line Chemotherapy Received in the Inpatient Hospital Setting	18%	28%
Additional % of Cases with Autologous SCT	6%	4%
Total % of Cases with Evidence of Intensive Treatments	**50%**	**78%**
Total % of Cases with No Evidence of Intensive Treatments	**50%**	**22%**

In the Medicare FFS study population, only 50% of patients showed evidence of these proxy intensive cancer treatments, compared to 78% of the commercial sample population. While it was beyond the scope of this study to determine the explanatory power of each of the patient, payer, and provider factors listed above on the observed treatment patterns, this is an important topic for future research.

Conclusion

In today's healthcare landscape, most biopharmaceutical innovation relies upon obtaining long-term investments in research and development as well as receiving broad health insurance coverage once a product comes to market.[38] Some experts have argued that traditional payment methodologies for novel therapies with complex mechanisms of action like CAR T-cell therapy may not be sustainable within the current payment landscape because providers lose money when they provide these new treatments, even when the treatments meet commonly cited cost-effectiveness thresholds.[39,40] Uptake of complex new technologies and treatments is a complicated process, depending not only on financing but also on the motivations of providers to adopt one treatment versus competitors; regulations; the culture of the organizations involved; physician training and attitudes; and patients' backgrounds, needs, and preferences.[41] This claims analysis of the uptake of CAR T-cell therapy in the Medicare FFS and commercial markets in the years

immediately following approval of two products for treatment of R/R DLBCL provides important insights into factors that may influence the rate of adoption of novel therapies.

Following first approval of CAR T-cell therapy for lymphomas in October 2017 through 2019, we observed the uptake among adult patients with indicated R/R DLBCL who had already been through two or more lines of systemic treatment increased steadily over time in both markets, ending at 26% of such Medicare FFS patients and 40% of such commercial sample patients in 2019. The shift of patients to CAR T-cell therapy came from patients who would have previously received the two other guideline-based treatments, specifically allogeneic SCT and additional lines of chemotherapy. In the commercial sample most of the CAR T-cell therapy population was drawn from patients who would have previously received allogeneic SCT. This may be because commercial patients were historically more likely to receive intensive treatments due either to their relative youth and better health status or to physician beliefs about the appropriateness of more aggressive therapy in this patient population. In contrast, in the Medicare FFS population the CAR T-cell treated population was drawn relatively evenly from the allogeneic SCT and chemotherapy groups. This finding suggests that physicians may consider CAR T-cell therapy to be appropriate for some patients who are not SCT candidates due to age or health status.

We also found evidence that the uptake of CAR T-cell therapy may be related to the accessibility of such treatments based on geography. The distribution of CAR T-cell therapy across U.S. census divisions was notably different from the distribution of allogeneic SCT and third or later-lines of chemotherapy. CAR T-cell therapy is only available in certified treatment centers that have the advanced capabilities required for providing these therapies, which may have contributed to the observed distribution patterns.[42,43] Access to teaching hospitals may also be related to CAR T-cell therapy uptake, as 99% of CAR T-cell therapy in the Medicare FFS population was provided at teaching hospitals, compared to 92% of allogeneic SCT and 57% of third or later-lines of chemotherapy.

Finally, the payment methodology for CAR T-cell therapy could also be impacting uptake. Notably, 40% of CAR T-cell therapy in the Medicare FFS population was performed at one of the 11 PPS-exempt cancer hospitals, where payment is based on reported costs rather than the prospectively established payment that is made under the IPPS to other acute care hospitals.[35,44] Only 24% of allogeneic SCT and 13% of third or later-lines of chemotherapy were performed at these PPS-exempt cancer hospitals.

This claims-based analysis of the diffusion of CAR T-cell therapy into practice in different markets in the several years following its approval illustrates some of the important factors that influence the rate of uptake of novel therapies. As additional cell therapies become available, these insights may help to inform efforts to improve timely access to and uptake of these new treatments through highlighting relevant factors that may slow their rate of adoption.

Caveats and Limitations

This report was commissioned by Gilead Sciences, Inc. A subsidiary of Gilead, Kite Pharma, is the manufacturer of the CAR T-cell therapies Yescarta and Tecartus. The findings reflect the analysis of the authors; Milliman does not intend to endorse any product or organization. One of the co-authors, Melissa Caplen, is a member of the American Academy of Actuaries and meets its qualification standards for this work. If this report is reproduced, it should be reproduced in its entirety, as pieces taken out of context could be misleading. Our analysis is based on historical treatment patterns in the Medicare FFS-covered population and a sample of the commercially insured population, which may change over time. Analyses using different years, data sources, or line of therapy identification methodologies may produce different results.

Note that the figures presented in this report could potentially be overestimating the prevalence of CAR T-cell therapy among eligible patients as there were likely additional eligible patients on their third or later-LOT that we were unable to identify in the data. However, these figures could also be underestimating the prevalence of CAR T-cell therapy among truly eligible patients as we did not exclude patients based on health status, which would be considered before recommending a patient for CAR T-cell therapy.

The commercial analysis is based on a sample of the commercial insured population that is not regionally balanced. Therefore, the regional distribution of commercial treatments should only be used to compare to the relative distribution of different treatments, not to determine the true regional distribution of specific treatments.

Appendix A: Data Sources

CMS 100% INNOVATOR RESEARCH DATA SET

The Medicare 100% Innovator Research data set contains all Medicare Parts A, B, and D paid claims for Medicare fee-for-service (FFS) beneficiaries. Information includes county of residence, diagnosis codes, procedure codes, DRG codes, site of service information, beneficiary age, eligibility status, and an indicator for health maintenance organization (HMO) enrollment. We used Parts A, B, and D data for 2013 to 2018, and Parts A and B data for 2019.

IBM MARKETSCAN® COMMERCIAL CLAIMS DATABASE

The MarketScan® database represents the inpatient and outpatient healthcare service use of a sample of approximately 30 million individuals nationwide who are covered by the benefit plans of large employers, health plans, and government and public organizations. We restricted the members in the database to active employees or dependents aged 18 to 64 with medical and pharmacy coverage in a non-capitated health plan, resulting in a final sample of around 18 million members per year, about 10% of the full commercially insured population. The MarketScan® database links paid claims and encounter data to detailed patient information across sites and types of providers, and over time. Member identification codes are consistent from year to year and allow for multiyear longitudinal studies. The database contains diagnosis codes; procedure codes and diagnosis-related group (DRG) codes; national drug codes (NDCs); and site of service information and the amounts allowed and paid by commercial insurers. We used data for calendar years 2013 to Q3 2019.

MILLIMAN CHSD COMMERCIAL CLAIMS DATABASE

The CHSD database contains proprietary historical claims experience from several of Milliman's Health Cost Guidelines™ (HCG) data contributors. The database contains annual enrollment and paid medical and pharmacy claims for a sample of over 20 million commercially insured individuals covered by the benefit plans of large employers, health plans, and governmental and public organizations nationwide. We restricted the members in the database to enrollees aged 18 to 64 with medical and pharmacy coverage in a non-capitated health plan, resulting in a final sample of around 18 million members per year, about 10% of the full commercially insured population. We used data for calendar years 2014 to 2018.

In our processing, we identified and removed the repeated record for the one out of 246 patients with CAR T-indicated lymphomas who received a third or later-LOT in Q4 2017 or later who was included in both commercial databases. This represents 0.4% of potential patients and a smaller portion of patient-years. Our national estimates reflect adjustment for this duplication.

Appendix B: Methodology

For this analysis, we used Medicare FFS and commercial medical and pharmacy claims for calendar years 2013 to 2019. Members were eligible to be included in this analysis if they had at least one month of commercial medical and pharmacy coverage from January 1, 2013, through September 30, 2019, were enrolled in A, B, and D coverage for at least one month in Medicare FFS from January 1, 2013, through December 31, 2018, or were enrolled in A and B coverage for at least one month in Medicare FFS from January 1, 2019, through December 31, 2019. Due to unavailability, Medicare Part D claims for 2019 calendar year were excluded from this analysis.

TERMINOLOGY

Indicated diagnosis: The patient has claims-based evidence of a diagnosis specific to a labeled indication for CAR T-cell therapy: DLBCL not otherwise specified, primary mediastinal large B-cell lymphoma, high-grade B-cell lymphoma, and DLBCL arising from follicular lymphoma.

Patient index date: The earliest date within our data sources for which an identified patient had a qualified claim (acute or non-acute inpatient, emergency department, observation, or outpatient visit) with a diagnosis code specific to a labelled indication for CAR T-cell therapy. The cancer treatments considered for this analysis were limited to treatments occurring on or after the index date.

Third or Later-Line: The patient had claims-based evidence of a third or later-LOT for DLBCL. LOTs are assigned based on the NCCN Guidelines for treatment of DLBCL.

GENERAL METHODOLOGY

Identification of indicated diagnosis patients

We identified patients with lymphoma types specified on the label for CAR T-cell therapies with at least one acute inpatient claim or observation claim or at least two outpatient, emergency department (ED), or nonacute inpatient claims (see Appendix C-1: Qualified Claims) separated by at least 30 days but within 12 months of one another with an ICD-9-CM or ICD-10-CM diagnosis code (see Appendix C-2: CAR T-cell Therapy Indicated Diagnosis Codes) in any position on the claim, representing on-label diagnosis that may be treated with Yescarta or Kymriah. We excluded patients with at least one qualified claim with a diagnosis code for primary CNS lymphoma in any diagnosis code position during their period of enrollment. The earliest claim we observed was considered the member's index date.

Identification of patients on a third or later-LOT

We identified indicated diagnosis patients as being on a third or later-LOT if we found one of the following treatments occurring after their index dates:

- CAR T-cell therapy not identified as a clinical trial
- Allogeneic SCT
- Third or later-line chemotherapy

According to the NCCN Guidelines for DLBCL, CAR T-cell therapy and allogeneic SCT are only recommended as a third or later-line treatment.[4]

These patients were grouped according to the above hierarchy: patients receiving CAR T-cell therapy were considered "CAR T-cell patients"; remaining patients receiving allogeneic SCT were considered "Allogeneic SCT patients"; remaining patients receiving third or later-line chemotherapy were considered "Third or later-line chemotherapy patients."

We investigated the specific clinical trial numbers for clinical trial treatments in the Medicare FFS population. Many of the CAR T-cell therapy clinical trials we identified were for providing the therapy outside of the currently approved

CAR T-cell therapy indication of after two or more lines of systemic treatment. Therefore, we excluded these CAR T-cell therapy clinical trial treatments from the analysis. For allogeneic SCT, most of the clinical trials we identified were related to supportive care changes rather than receipt of a SCT at a different point in a DLBCL patient's treatment journey. As there was no evidence to indicate the observed allogeneic SCT clinical trials were not given as third or later-LOTs, we retained them in the analysis. Finally, because we counted chemotherapy courses in order to identify a course as third or later-line chemotherapy, the presence of clinical trial chemotherapy courses would not disrupt our logic. Therefore, clinical trial chemotherapy courses were also retained in our analysis.

Identification of relevant treatments

CAR T-cell therapy

We identified an instance of CAR T-cell therapy as any claim occurring on or after the patient's index date with a CAR T-cell therapy ICD-10 procedure code, HCPCS code, or NDC (see Appendix C-3: CAR T-Cell Therapy Administration Codes). Claims occurring within 30 days of a previous claim for CAR T-cell therapy were considered part of the same case. Cases that were identified as CAR T-cell therapy administered as part of a clinical trial were excluded. If a case met any of the following conditions we considered it to be clinical trial CAR T-cell therapy:

- The condition code 30 (non-research services provided to all patients, including managed care enrollees, enrolled in a Qualified Clinical Trial) was found on the claim (only available in the Medicare FFS data).
- The ICD-10 diagnosis code Z006 (encounter for examination for normal comparison and control in clinical research program) was found on the claim in any position.
- The modifier code Q0 (investigational clinical service provided in a clinical research study that is in an approved clinical research study) was found on the claim.
- The aggregate billed charges under pharmacy revenue codes was less than $223,800 (allowed costs used for MarketScan®, where billed charges are not available).
    - For Medicare FFS, if the aggregate billed charges under pharmacy revenue codes were at least $373,000 we did not consider the case to be a clinical trial, regardless of the other codes found on the claim.

Stem cell transplants (allogeneic and autologous)

We identified an instance of a SCT as any claim occurring on or after the patient's index date with a SCT ICD-9 procedure code, ICD-10 procedure code, or HCPCS code (see Appendix C-4: Stem Cell Transplant Codes). Claims occurring within 30 days of a previous claim for CAR T-cell therapy were considered part of the same case. We excluded cases that had total billed and allowed charges (including the full inpatient stay, if applicable) under $10,000. If codes for both allogeneic and autologous SCT were present during a transplant case, we used the following logic to assign a SCT type:

- ICD-9 and ICD-10 procedure codes took precedence over HCPCS codes.
- If both autologous and allogeneic SCT ICD procedure codes were present, or neither were, the HCPCS code with the highest allowed cost took precedence.

Lines of chemotherapy

Beginning on the patient's index date and continuing through the remaining period of coverage, we constructed mutually exclusive courses of chemotherapy and assigned chemotherapy course beginning and ending dates for each patient using the following methodology.

- We identified administrations or prescription fills (including days' supply) for all chemotherapy drugs (see Appendix C-5: Chemotherapy Drug List). The drug begin date was the earliest date of administration or prescription fill.

  - For each chemotherapy administration, the drug end date was the date of the last administration plus 30 day of runout, where no administration of the same drug was observed for 30 days following the runout period.
    - For inpatient chemotherapy administrations identified solely by ICD-9 and ICD-10 diagnosis codes, without chemotherapy drug HCPCS codes reported, the begin date was the admission date, and the drug end date was 30 days following the discharge date.
  - For chemotherapy prescription fills, the drug end date was the date of the last day of the days' supply, where no prescription fills of the same drug were observed for 30 days.
  - A drug could have more than one begin and end date during the analysis period if the patient was treated with the same drug during different periods of time separated by at least a 30-day treatment gap.
- We combined the individual chemotherapy drug periods (from begin date to end date) into distinct, non-overlapping courses of chemotherapy.
  - Starting with the first chemotherapy drug begin date, we assigned all chemotherapy drugs administered within 60 days of the first drug to the same course.
  - The course was ended either on the last drug end date of the drugs assigned to the course or the day before the drug start date for a new drug not assigned to the course.
  - Certain drugs used for maintenance, consolidation therapy, supportive therapy, or for other cancer types were excluded from starting or ending a chemotherapy course (see Appendix C-5: Chemotherapy Drug List).
    - Rituximab was also excluded from starting or ending a chemotherapy course as it is an optional drug that, if used, may not be present consistently throughout a regimen.
- We identified courses as specific NCCN Guidelines-recommended regimens if they included all drugs for the regimen (see Appendix C-8: Adjusted Chemotherapy Regimen List Based on NCCN Guidelines).[4]
  - We did not require the steroids in a regimen to be present in order for the course to be assigned to an NCCN Guidelines regimen (see Appendix C-5: Chemotherapy Drug List).
  - We did not require rituximab to be present in order for the course to be assigned to an NCCN Guidelines regimen as rituximab is generally an optional drug in regimens.
  - We also did not consider rituximab alone to be its own regimen because of the challenges of distinguishing a course with rituximab alone from a course with rituximab added on. The NCCN Guidelines do include rituximab alone as a second or later-line regimen.
  - We also did not consider lenalidomide +/- rituximab to be its own regimen as lenalidomide is also used as maintenance therapy in between chemotherapy courses. The NCCN Guidelines do include lenalidomide +/- rituximab as a second or later-line regimen.
  - Courses assigned to an NCCN Guidelines first-line regimen or including a first-line sentinel drug (doxorubicin) were considered to be first-line courses.
    - First-line sentinel drugs are individual drugs that are almost always used only in the first line.
  - Courses assigned to an NCCN Guidelines second or later-line regimen or including a second or later-line sentinel drug (carboplatin, cisplatin, oxaliplatin) were considered to be second or later-line courses.
    - Second-line sentinel drugs are individual drugs that are almost always used only in the second or later-lines.
    - We exclude rituximab from analysis as a second or later-line regimen as it is also an optional add-on to other regimens. Its specific regimen use is challenging to distinguish in claims data.

    - Courses that could not be assigned to an NCCN Guidelines regimen and did not contain a sentinel drug were considered to be unknown courses.
- We numbered chemotherapy courses according to their identification as first-, second-, or later-line and order found in the data as follows:
    - A first-line course was labeled as course 1.
    - A second or later-line or unknown course found directly after a first-line course was labeled as course 2.
    - A second or later-line course with no prior courses was labeled as course 2+.
    - A second or later-line or unknown course found directly after a course labeled as course 2, 3, 4, etc. was labeled with the consecutive course number.
    - A second or later-line or unknown course found directly after a course labeled 2+, 3+, 4+, etc. was labeled with the consecutive course number.

DESCRIPTIVE ANALYSIS

Extrapolation of the commercial sample to the full commercial market

We extrapolated the Q4 2017 or later (Q42017+) patients found in the commercial sample to the Q42017 through full year 2019 commercial market for members aged 18 to 64 using the following methodology. We used this time period because the first CAR T-cell therapy for DLBCL was approved in October 2017.

- Total commercial market enrollment for 2017 and 2018 were taken from the Kaiser Family Foundation reports; 2019 enrollment was approximated by 2018 data.[30]
- Total commercial market enrollment was broken out into age groups based on U.S. Census data for commercial enrollees.[31]
- Indicated diagnosis CAR T-cell patient, allogeneic SCT patient, and third or later-line chemotherapy patient counts within each age group were grossed up by multiplying by the ratio of commercial market enrollment for the age group over the denominator population for the age group in the commercial sample.
- The age group-specific grossed up member counts were then added together to develop the total extrapolated patient counts.

Treatment setting and hospital classification for third or later-LOTs

For each third or later-LOT in the Medicare FFS data, we identified the setting of the treatment (inpatient hospital, outpatient hospital, or professional office), and whether or not the treatment was provided at a teaching hospital (see Appendix C-9: Teaching Hospitals), or PPS-exempt hospital (see Appendix C-10: PPS-Exempt Cancer Hospitals). The distinctions of teaching and PPS-exempt hospitals were not available in the commercial sample data.

In order to assign each treatment to a setting of inpatient hospital, outpatient hospital, or physician office, and assign a hospital classification, we used the following methodology:

- For CAR T-cell therapy and SCT:
    - If the treatment was captured on an inpatient facility claim or a professional claim with an inpatient visit HCPCS code within three days, then the treatment was assigned to the inpatient hospital setting.
    - If the treatment was captured on an outpatient facility claim or a professional claim with an outpatient facility claim occurring within the prior three days, then the treatment was assigned to the outpatient hospital setting.

    - If any facility claim used in the assignment of setting was for a teaching hospital, we considered the treatment to occur at a teaching hospital. Similarly, if any facility claim used in the assignment of setting was for a PPS-exempt hospital, we considered the treatment to occur at a PPS-exempt hospital.
- For chemotherapy courses that included injectable drugs or inpatient admissions for chemotherapy, the setting was assigned based on the place of service of the injectable chemotherapy drug claims or the inpatient admission claims. The setting with the greatest number of days of chemotherapy administrations within the chemotherapy course was assigned. For inpatient admissions for chemotherapy, each day of the stay was counted as a chemotherapy administration day.
    - If any facility claim used in the assignment of setting was for a teaching hospital, we considered the treatment to occur at a teaching hospital. Similarly, if any facility claim used in the assignment of setting was for a PPS-exempt hospital, we considered the treatment to occur at a PPS-exempt hospital.
- For chemotherapy courses with no injectable drugs or inpatient admissions for chemotherapy, we looked for professional claims within +/-30 days of the drug script with both an E&M HCPCS code and a cancer diagnosis code in the principal position. We then looked for inpatient and outpatient facility claims occurring on the same day as these professional claims with either an E&M HCPCS code or HCPCS code G0463 (hospital outpatient clinic visit for assessment and management of a patient). If such a facility claim was found, we assigned the chemotherapy course to the facility claim type. If no such claim was found, we assigned the chemotherapy course to a physician office setting.
    - If any facility claim used in the assignment of setting was for a teaching hospital, we considered the treatment to occur at a teaching hospital. Similarly, if any facility claim used in the assignment of setting was for a PPS-exempt hospital, we considered the treatment to occur at a PPS-exempt hospital.

Participation in a clinical trial for third or later-LOTs

We classified third or later-LOT treatments as part of clinical trial or as a non-clinical trial treatment.

CAR T-cell therapy administrations were limited to those outside of a clinical trial using the logic previously defined (see the CAR T-cell therapy section above).

Allogeneic SCT and third or later-lines of chemotherapy were classified as part of clinical trial treatment if the SCT claim or any claim occurring during the span of the line of chemotherapy had at least one of the following:

- Condition code 30 (non-research services provided to all patients, including managed care enrollees, enrolled in a Qualified Clinical Trial).
- ICD-10 diagnosis code Z006 (encounter for examination for normal comparison and control in clinical research program).
- Modifier Q0 (investigational clinical service provided in a clinical research study that is in an approved clinical research study) or Q1 (routine clinical service provided in a clinical research study that is in an approved clinical research study).

For clinical trial participation observed in Medicare FFS, we also classified treatments as “Treatment Clinical Trial” if the reported clinical trial number corresponded to a clinical trial specific to DLBCL treatment. Treatments with clinical trial numbers that corresponded to clinical trials for other cancer types, other non-cancer conditions, or supportive care only were classified as ”Other Clinical Trial.” This distinction is not available in the commercial sample data.

Appendix C: Code Sets

TABLE C-1: QUALIFIED CLAIMS

Claim Type	HCPCS/CPT Codes	Revenue Codes
Outpatient	99201-99205, 99211-99215, 99241-99245, 99341-99345, 99347-99350, 99381-99387, 99391-99397, 99401-99404, 99411, 99412, 99429, 99455, 99456, G0402, G0438, G0439, G0463, G0466-G0468, T1015	0510-0517, 0519-0523, 0526-0529, 0982, 0983
Non-acute inpatient	99304-99310, 99315, 99316, 99318, 99324-99328, 99334-99337	0118, 0128, 0138, 0148, 0158, 0190-0194, 0199, 0524, 0525, 0550-0552, 0559
Acute inpatient	99221-99223, 99231-99233, 99238, 99239, 99251-99255, 99291, 99468, 99469, 99471, 99472, 99475-99480	010x, 0110-0115, 0117, 0119-0125, 0127, 0129-0135, 0137, 0139-0145, 0147, 0149-0155, 0157, 0159-0160, 0164, 0166-0175, 0179, 0200-0204, 0206-0214, 0219, 0720-0722
Observation	99217-99220, 99224-99226, G0378, G0379	
Emergency department	99281-99285, G0380-G0384	0450-0452, 0456, 0459, 0981

TABLE C-2: CAR T-CELL THERAPY INDICATED DIAGNOSIS CODES

Type of Code	Code	Description
ICD-10-CM	C8330	Diffuse large b-cell lymphoma, unspecified site
ICD-10-CM	C8331	Diffuse large b-cell lymphoma, lymph nodes of head, face, and neck
ICD-10-CM	C8332	Diffuse large b-cell lymphoma, intrathoracic lymph nodes
ICD-10-CM	C8333	Diffuse large b-cell lymphoma, intra-abdominal lymph nodes
ICD-10-CM	C8336	Diffuse large b-cell lymphoma, intrapelvic lymph nodes
ICD-10-CM	C8337	Diffuse large b-cell lymphoma, spleen
ICD-10-CM	C8338	Diffuse large b-cell lymphoma, lymph nodes of multiple sites
ICD-10-CM	C8339	Diffuse large b-cell lymphoma, extranodal and solid organ sites
ICD-10-CM	C8520	Mediastinal (thymic) large b-cell lymphoma, unspecified site
ICD-10-CM	C8522	Mediastinal (thymic) large b-cell lymphoma, intrathoracic lymph nodes
ICD-10-CM	C8523	Mediastinal (thymic) large b-cell lymphoma, intra-abdominal lymph nodes
ICD-10-CM	C8526	Mediastinal (thymic) large b-cell lymphoma, intrapelvic lymph nodes
ICD-10-CM	C8527	Mediastinal (thymic) large b-cell lymphoma, spleen
ICD-10-CM	C8528	Mediastinal (thymic) large b-cell lymphoma, lymph nodes of multiple sites
ICD-10-CM	C8529	Mediastinal (thymic) large b-cell lymphoma, extranodal and solid organ sites
ICD-9-CM	20000	Reticulosarcoma, unspecified site, extranodal and solid organ sites
ICD-9-CM	20001	Reticulosarcoma, lymph nodes of head, face, and neck
ICD-9-CM	20002	Reticulosarcoma, intrathoracic lymph nodes
ICD-9-CM	20003	Reticulosarcoma, intra-abdominal lymph nodes
ICD-9-CM	20006	Reticulosarcoma, intrapelvic lymph nodes
ICD-9-CM	20007	Reticulosarcoma, spleen
ICD-9-CM	20008	Reticulosarcoma, lymph nodes of multiple sites
ICD-9-CM	20070	Large cell lymphoma, unspecified site, extranodal and solid organ sites
ICD-9-CM	20071	Large cell lymphoma, lymph nodes of head, face, and neck
ICD-9-CM	20072	Large cell lymphoma, intrathoracic lymph nodes
ICD-9-CM	20073	Large cell lymphoma, intra-abdominal lymph nodes
ICD-9-CM	20076	Large cell lymphoma, intrapelvic lymph nodes
ICD-9-CM	20077	Large cell lymphoma, spleen
ICD-9-CM	20078	Large cell lymphoma, lymph nodes of multiple sites

TABLE C-3: CAR T-CELL THERAPY ADMINISTRATION CODES

Code Type	Code	Description	CAR T-Cell Product Name
ICD-10-PCS	XW033C3	Introduction of Engineered Autologous Chimeric Antigen Receptor T-cell Immunotherapy into Peripheral Vein, Percutaneous Approach, New Technology Group 3	YESCARTA or KYMRIAH
ICD-10-PCS	XW043C3	Introduction of Engineered Autologous Chimeric Antigen Receptor T-cell Immunotherapy into Central Vein, Percutaneous Approach, New Technology Group 3	YESCARTA or KYMRIAH
HCPCS	Q2040	Tisagenlecleucel, up to 250 million car-positive viable t cells, including leukapheresis and dose preparation procedures, per infusion	KYMRIAH
HCPCS	Q2041	Axicabtagene ciloleucel, up to 200 million autologous anti-cd19 car positive viable t cells, including leukapheresis and dose preparation procedures, per therapeutic dose	YESCARTA
HCPCS	Q2042	Tisagenlecleucel, up to 600 million car-positive viable t cells, including leukapheresis and dose preparation procedures, per therapeutic dose	KYMRIAH
HCPCS	0540T		YESCARTA or KYMRIAH
Revenue Center Code	0874*	Cell/Gene Therapy-Infusion of Modified Cells	YESCARTA or KYMRIAH
Revenue Center Code	0875*	Cell/Gene Therapy-Injection of Modified Cells	YESCARTA or KYMRIAH

*When not accompanied by HCPCS 0537T (Chimeric antigen receptor [CAR] T-cell therapy; harvesting of blood-derived T lymphocytes for development of genetically modified autologous CAR T-cells, per day)

TABLE C-4: STEM CELL TRANSPLANT CODES

Code Type	Code	Description	SCT Type
HCPCS	38240		Allogeneic
ICD-10-PCS	30230AZ	Transfusion of Embryonic Stem Cells into Peripheral Vein, Open Approach	Allogeneic
ICD-10-PCS	30230G1	Transfusion of Nonautologous Bone Marrow into Peripheral Vein, Open Approach	Allogeneic
ICD-10-PCS	30230G2	Transfusion of Allogeneic Related Bone Marrow into Peripheral Vein, Open Approach	Allogeneic
ICD-10-PCS	30230G3	Transfusion of Allogeneic Unrelated Bone Marrow into Peripheral Vein, Open Approach	Allogeneic
ICD-10-PCS	30230G4	Transfusion of Allogeneic Unspecified Bone Marrow into Peripheral Vein, Open Approach	Allogeneic
ICD-10-PCS	30230X1	Transfusion of Nonautologous Cord Blood Stem Cells into Peripheral Vein, Open Approach	Allogeneic
ICD-10-PCS	30230X2	Transfusion of Allogeneic Related Cord Blood Stem Cells into Peripheral Vein, Open Approach	Allogeneic
ICD-10-PCS	30230X3	Transfusion of Allogeneic Unrelated Cord Blood Stem Cells into Peripheral Vein, Open Approach	Allogeneic
ICD-10-PCS	30230X4	Transfusion of Allogeneic Unspecified Cord Blood Stem Cells into Peripheral Vein, Open Approach	Allogeneic
ICD-10-PCS	30230Y1	Transfusion of Nonautologous Hematopoietic Stem Cells into Peripheral Vein, Open Approach	Allogeneic
ICD-10-PCS	30230Y2	Transfusion of Allogeneic Related Hematopoietic Stem Cells into Peripheral Vein, Open Approach	Allogeneic
ICD-10-PCS	30230Y3	Transfusion of Allogeneic Unrelated Hematopoietic Stem Cells into Peripheral Vein, Open Approach	Allogeneic
ICD-10-PCS	30230Y4	Transfusion of Allogeneic Unspecified Hematopoietic Stem Cells into Peripheral Vein, Open Approach	Allogeneic
ICD-10-PCS	30233AZ	Transfusion of Embryonic Stem Cells into Peripheral Vein, Percutaneous Approach	Allogeneic
ICD-10-PCS	30233G1	Transfusion of Nonautologous Bone Marrow into Peripheral Vein, Percutaneous Approach	Allogeneic
ICD-10-PCS	30233G2	Transfusion of Allogeneic Related Bone Marrow into Peripheral Vein, Percutaneous Approach	Allogeneic
ICD-10-PCS	30233G3	Transfusion of Allogeneic Unrelated Bone Marrow into Peripheral Vein, Percutaneous Approach	Allogeneic
ICD-10-PCS	30233G4	Transfusion of Allogeneic Unspecified Bone Marrow into Peripheral Vein, Percutaneous Approach	Allogeneic
ICD-10-PCS	30233X1	Transfusion of Nonautologous Cord Blood Stem Cells into Peripheral Vein, Percutaneous Approach	Allogeneic
ICD-10-PCS	30233X2	Transfusion of Allogeneic Related Cord Blood Stem Cells into Peripheral Vein, Percutaneous Approach	Allogeneic
ICD-10-PCS	30233X3	Transfusion of Allogeneic Unrelated Cord Blood Stem Cells into Peripheral Vein, Percutaneous Approach	Allogeneic
ICD-10-PCS	30233X4	Transfusion of Allogeneic Unspecified Cord Blood Stem Cells into Peripheral Vein, Percutaneous Approach	Allogeneic

Code Type	Code	Description	SCT Type
ICD-10-PCS	30233Y1	Transfusion of Nonautologous Hematopoietic Stem Cells into Peripheral Vein, Percutaneous Approach	Allogeneic
ICD-10-PCS	30233Y2	Transfusion of Allogeneic Related Hematopoietic Stem Cells into Peripheral Vein, Percutaneous Approach	Allogeneic
ICD-10-PCS	30233Y3	Transfusion of Allogeneic Unrelated Hematopoietic Stem Cells into Peripheral Vein, Percutaneous Approach	Allogeneic
ICD-10-PCS	30233Y4	Transfusion of Allogeneic Unspecified Hematopoietic Stem Cells into Peripheral Vein, Percutaneous Approach	Allogeneic
ICD-10-PCS	30240AZ	Transfusion of Embryonic Stem Cells into Central Vein, Open Approach	Allogeneic
ICD-10-PCS	30240G1	Transfusion of Nonautologous Bone Marrow into Central Vein, Open Approach	Allogeneic
ICD-10-PCS	30240G2	Transfusion of Allogeneic Related Bone Marrow into Central Vein, Open Approach	Allogeneic
ICD-10-PCS	30240G3	Transfusion of Allogeneic Unrelated Bone Marrow into Central Vein, Open Approach	Allogeneic
ICD-10-PCS	30240G4	Transfusion of Allogeneic Unspecified Bone Marrow into Central Vein, Open Approach	Allogeneic
ICD-10-PCS	30240X1	Transfusion of Nonautologous Cord Blood Stem Cells into Central Vein, Open Approach	Allogeneic
ICD-10-PCS	30240X2	Transfusion of Allogeneic Related Cord Blood Stem Cells into Central Vein, Open Approach	Allogeneic
ICD-10-PCS	30240X3	Transfusion of Allogeneic Unrelated Cord Blood Stem Cells into Central Vein, Open Approach	Allogeneic
ICD-10-PCS	30240X4	Transfusion of Allogeneic Unspecified Cord Blood Stem Cells into Central Vein, Open Approach	Allogeneic
ICD-10-PCS	30240Y1	Transfusion of Nonautologous Hematopoietic Stem Cells into Central Vein, Open Approach	Allogeneic
ICD-10-PCS	30240Y2	Transfusion of Allogeneic Related Hematopoietic Stem Cells into Central Vein, Open Approach	Allogeneic
ICD-10-PCS	30240Y3	Transfusion of Allogeneic Unrelated Hematopoietic Stem Cells into Central Vein, Open Approach	Allogeneic
ICD-10-PCS	30240Y4	Transfusion of Allogeneic Unspecified Hematopoietic Stem Cells into Central Vein, Open Approach	Allogeneic
ICD-10-PCS	30243AZ	Transfusion of Embryonic Stem Cells into Central Vein, Percutaneous Approach	Allogeneic
ICD-10-PCS	30243G1	Transfusion of Nonautologous Bone Marrow into Central Vein, Percutaneous Approach	Allogeneic
ICD-10-PCS	30243G2	Transfusion of Allogeneic Related Bone Marrow into Central Vein, Percutaneous Approach	Allogeneic
ICD-10-PCS	30243G3	Transfusion of Allogeneic Unrelated Bone Marrow into Central Vein, Percutaneous Approach	Allogeneic
ICD-10-PCS	30243G4	Transfusion of Allogeneic Unspecified Bone Marrow into Central Vein, Percutaneous Approach	Allogeneic
ICD-10-PCS	30243X1	Transfusion of Nonautologous Cord Blood Stem Cells into Central Vein, Percutaneous Approach	Allogeneic
ICD-10-PCS	30243X2	Transfusion of Allogeneic Related Cord Blood Stem Cells into Central Vein, Percutaneous Approach	Allogeneic
ICD-10-PCS	30243X3	Transfusion of Allogeneic Unrelated Cord Blood Stem Cells into Central Vein, Percutaneous Approach	Allogeneic
ICD-10-PCS	30243X4	Transfusion of Allogeneic Unspecified Cord Blood Stem Cells into Central Vein, Percutaneous Approach	Allogeneic
ICD-10-PCS	30243Y1	Transfusion of Nonautologous Hematopoietic Stem Cells into Central Vein, Percutaneous Approach	Allogeneic
ICD-10-PCS	30243Y2	Transfusion of Allogeneic Related Hematopoietic Stem Cells into Central Vein, Percutaneous Approach	Allogeneic
ICD-10-PCS	30243Y3	Transfusion of Allogeneic Unrelated Hematopoietic Stem Cells into Central Vein, Percutaneous Approach	Allogeneic
ICD-10-PCS	30243Y4	Transfusion of Allogeneic Unspecified Hematopoietic Stem Cells into Central Vein, Percutaneous Approach	Allogeneic
ICD-10-PCS	30250G1	Transfusion of Nonautologous Bone Marrow into Peripheral Artery, Open Approach	Allogeneic
ICD-10-PCS	30250X1	Transfusion of Nonautologous Cord Blood Stem Cells into Peripheral Artery, Open Approach	Allogeneic
ICD-10-PCS	30250Y1	Transfusion of Nonautologous Hematopoietic Stem Cells into Peripheral Artery, Open Approach	Allogeneic
ICD-10-PCS	30253G1	Transfusion of Nonautologous Bone Marrow into Peripheral Artery, Percutaneous Approach	Allogeneic
ICD-10-PCS	30253X1	Transfusion of Nonautologous Cord Blood Stem Cells into Peripheral Artery, Percutaneous Approach	Allogeneic
ICD-10-PCS	30253Y1	Transfusion of Nonautologous Hematopoietic Stem Cells into Peripheral Artery, Percutaneous Approach	Allogeneic
ICD-10-PCS	30260G1	Transfusion of Nonautologous Bone Marrow into Central Artery, Open Approach	Allogeneic
ICD-10-PCS	30260X1	Transfusion of Nonautologous Cord Blood Stem Cells into Central Artery, Open Approach	Allogeneic
ICD-10-PCS	30260Y1	Transfusion of Nonautologous Hematopoietic Stem Cells into Central Artery, Open Approach	Allogeneic
ICD-10-PCS	30263G1	Transfusion of Nonautologous Bone Marrow into Central Artery, Percutaneous Approach	Allogeneic
ICD-10-PCS	30263X1	Transfusion of Nonautologous Cord Blood Stem Cells into Central Artery, Percutaneous Approach	Allogeneic

Code Type	Code	Description	SCT Type
ICD-10-PCS	30263Y1	Transfusion of Nonautologous Hematopoietic Stem Cells into Central Artery, Percutaneous Approach	Allogeneic
HCPCS	38241		Autologous
ICD-10-PCS	30230G0	Transfusion of Autologous Bone Marrow into Peripheral Vein, Open Approach	Autologous
ICD-10-PCS	30230X0	Transfusion of Autologous Cord Blood Stem Cells into Peripheral Vein, Open Approach	Autologous
ICD-10-PCS	30230Y0	Transfusion of Autologous Hematopoietic Stem Cells into Peripheral Vein, Open Approach	Autologous
ICD-10-PCS	30233G0	Transfusion of Autologous Bone Marrow into Peripheral Vein, Percutaneous Approach	Autologous
ICD-10-PCS	30233X0	Transfusion of Autologous Cord Blood Stem Cells into Peripheral Vein, Percutaneous Approach	Autologous
ICD-10-PCS	30233Y0	Transfusion of Autologous Hematopoietic Stem Cells into Peripheral Vein, Percutaneous Approach	Autologous
ICD-10-PCS	30240G0	Transfusion of Autologous Bone Marrow into Central Vein, Open Approach	Autologous
ICD-10-PCS	30240X0	Transfusion of Autologous Cord Blood Stem Cells into Central Vein, Open Approach	Autologous
ICD-10-PCS	30240Y0	Transfusion of Autologous Hematopoietic Stem Cells into Central Vein, Open Approach	Autologous
ICD-10-PCS	30243G0	Transfusion of Autologous Bone Marrow into Central Vein, Percutaneous Approach	Autologous
ICD-10-PCS	30243X0	Transfusion of Autologous Cord Blood Stem Cells into Central Vein, Percutaneous Approach	Autologous
ICD-10-PCS	30243Y0	Transfusion of Autologous Hematopoietic Stem Cells into Central Vein, Percutaneous Approach	Autologous
ICD-10-PCS	30250G0	Transfusion of Autologous Bone Marrow into Peripheral Artery, Open Approach	Autologous
ICD-10-PCS	30250X0	Transfusion of Autologous Cord Blood Stem Cells into Peripheral Artery, Open Approach	Autologous
ICD-10-PCS	30250Y0	Transfusion of Autologous Hematopoietic Stem Cells into Peripheral Artery, Open Approach	Autologous
ICD-10-PCS	30253G0	Transfusion of Autologous Bone Marrow into Peripheral Artery, Percutaneous Approach	Autologous
ICD-10-PCS	30253X0	Transfusion of Autologous Cord Blood Stem Cells into Peripheral Artery, Percutaneous Approach	Autologous
ICD-10-PCS	30253Y0	Transfusion of Autologous Hematopoietic Stem Cells into Peripheral Artery, Percutaneous Approach	Autologous
ICD-10-PCS	30260G0	Transfusion of Autologous Bone Marrow into Central Artery, Open Approach	Autologous
ICD-10-PCS	30260X0	Transfusion of Autologous Cord Blood Stem Cells into Central Artery, Open Approach	Autologous
ICD-10-PCS	30260Y0	Transfusion of Autologous Hematopoietic Stem Cells into Central Artery, Open Approach	Autologous
ICD-10-PCS	30263G0	Transfusion of Autologous Bone Marrow into Central Artery, Percutaneous Approach	Autologous
ICD-10-PCS	30263X0	Transfusion of Autologous Cord Blood Stem Cells into Central Artery, Percutaneous Approach	Autologous
ICD-10-PCS	30263Y0	Transfusion of Autologous Hematopoietic Stem Cells into Central Artery, Percutaneous Approach	Autologous
ICD-9-PCS	4100	Bone Marrow Transplant, Not Otherwise Specified	Autologous
ICD-9-PCS	4101	Autologous Bone Marrow Transplant Without Purging	Autologous
ICD-9-PCS	4102	Allogeneic Bone Marrow Transplant With Purging	Allogeneic
ICD-9-PCS	4103	Allogeneic Bone Marrow Transplant Without Purging	Allogeneic
ICD-9-PCS	4104	Autologous Hematopoietic Stem Cell Transplant Without Purging	Autologous
ICD-9-PCS	4106	Cord Blood Stem Cell Transplant	Allogeneic
ICD-9-PCS	4107	Autologous Hematopoietic Stem Cell Transplant With Purging	Autologous
ICD-9-PCS	4108	Allogeneic Hematopoietic Stem Cell Transplant With Purging	Allogeneic
ICD-9-PCS	4109	Autologous Bone Marrow Transplant With Purging	Autologous

TABLE C-5: CHEMOTHERAPY DRUG LIST

Chemotherapy Drug Name	Excluded From Starting or Ending a Course of Chemotherapy	Steroids
Abemaciclib	Y	
Abiraterone		
Acalabrutinib	Y	

Chemotherapy Drug Name	Excluded From Starting or Ending a Course of Chemotherapy	Steroids
Afatinib	Y	
Aldesleukin		
Alectinib	Y	
Alemtuzumab	Y	
Alpelisib	Y	
Altretamine		
Anastrozole	Y	
Anti-Thymocyte Globulin, Rabbit		
Apalutamide		
Arsenic Trioxide		
Asparaginase		
Atezolizumab	Y	
Avelumab	Y	
Axitinib	Y	
Azacitidine		
Bcg (Bacillus Calmette-Guerin) Live Vax, Intravesical		
Belinostat		
Bendamustine		
Bevacizumab	Y	
Bexarotene		
Bicalutamide		
Binimetinib	Y	
Bleomycin		
Blinatumomab	Y	
Bortezomib	Y	
Bosutinib	Y	
Brentuximab Vedotin	Y	
Brigatinib	Y	
Busulfan		
Cabazitaxel		
Cabozantinib	Y	
Cabozantinib Malate	Y	
Calaspargase Pegol-Mknl		
Capecitabine		
Carboplatin		
Carfilzomib	Y	
Carmustine		
Cemiplimab-Rwlc	Y	
Ceritinib	Y	
Cetuximab	Y	
Chlorambucil		
Cisplatin		
Cladribine		

Chemotherapy Drug Name	Excluded From Starting or Ending a Course of Chemotherapy	Steroids
Clofarabine		
Cobimetinib	Y	
Copanlisib	Y	
Crizotinib	Y	
Cyclophosphamide		
Cytarabine		
Dabrafenib	Y	
Dacarbazine		
Dacomitinib	Y	
Dactinomycin		
Daratumumab	Y	
Dasatinib	Y	
Daunorubicin		
Daunorubicin Citrate Liposome		
Daunorubicin Liposomal		
Decitabine		
Degarelix		
Denileukin Diftitox		
Dexamethasone	Y	Y
Dinutuximab	Y	
Docetaxel		
Doxorubicin		
Doxorubicin Liposomal		
Durvalumab	Y	
Duvelisib	Y	
Elotuzumab	Y	
Enasidenib	Y	
Encorafenib	Y	
Enzalutamide		
Epirubicin		
Erdafitinib	Y	
Eribulin	Y	
Erlotinib	Y	
Estramustine		
Etoposide		
Everolimus		
Exemestane		
Floxuridine		
Fludarabine		
Fluorouracil		
Flutamide		
Fulvestrant		
Gefitinib	Y	

Chemotherapy Drug Name	Excluded From Starting or Ending a Course of Chemotherapy	Steroids
Gemcitabine		
Gemtuzumab Ozogamicin	Y	
Gilteritinib	Y	
Glasdegib	Y	
Goserelin		
Histrelin		
Ibritumomab Tiuxetan	Y	
Ibrutinib	Y	
Idarubicin		
Idelalisib	Y	
Ifosfamide		
Ifosfamide+Mesna		
Imatinib	Y	
Inotuzumab Ozogamicin	Y	
Interferon, Gamma 1-B		
Iobenguane 131		
Ipilimumab	Y	
Irinotecan		
Ivosidenib	Y	
Ixabepilone		
Ixazomib	Y	
Lanreotide		
Lapatinib	Y	
Larotrectinib	Y	
Lenalidomide	Y	
Lenvatinib	Y	
Letrozole	Y	
Leuprolide	Y	
Leuprolide And Norethindrone	Y	
Lomustine		
Lorlatinib	Y	
Lutetium Lu 177 Dotatate		
Mechlorethamine		
Melphalan		
Mesna	Y	
Methylprednisolone	Y	Y
Midostaurin		
Mitomycin		
Mitotane		
Mitoxantrone		
Moxetumomab Pasudotox-Tdfk	Y	
Necitumumab	Y	
Nelarabine		

Chemotherapy Drug Name	Excluded From Starting or Ending a Course of Chemotherapy	Steroids
Neratinib	Y	
Nilotinib	Y	
Nilutamide		
Niraparib	Y	
Nivolumab	Y	
Obinutuzumab	Y	
Octreotide		
Ofatumumab	Y	
Olaparib	Y	
Omacetaxine		
Osimertinib	Y	
Oxaliplatin		
Paclitaxel		
Palbociclib	Y	
Panitumumab	Y	
Panobinostat		
Pazopanib	Y	
Pegaspargase		
Pembrolizumab	Y	
Pemetrexed		
Pentostatin		
Pertuzumab	Y	
Pomalidomide		
Ponatinib	Y	
Pralatrexate		
Prednisolone	Y	Y
Prednisone	Y	Y
Procarbazine		
Radium Ra-223		
Ramucirumab	Y	
Regorafenib	Y	
Ribociclib	Y	
Rituximab	Y	
Romidepsin		
Rucaparib	Y	
Ruxolitinib	Y	
Siltuximab	Y	
Sipuleucel-T		
Sonidegib	Y	
Sorafenib	Y	
Streptozocin		
Sunitinib Malate	Y	
Tagraxofusp-Erzs		

Chemotherapy Drug Name	Excluded From Starting or Ending a Course of Chemotherapy	Steroids
Talazoparib	Y	
Talimogene Laherparepvec		
Tamoxifen		
Tamoxifen Citrate	Y	
Temozolomide		
Temsirolimus		
Teniposide		
Thalidomide		
Thioguanine		
Thiotepa		
Topotecan		
Toremifene		
Tositumomab	Y	
Trabectedin		
Trametinib	Y	
Trastuzumab	Y	
Trastuzumab And Hyaluronidase	Y	
Trifluridine/Tipiracil		
Triptorelin		
Valrubicin		
Vandetanib	Y	
Vemurafenib	Y	
Venetoclax		
Vinblastine		
Vincristine		
Vinorelbine		
Vismodegib	Y	
Vorinostat		
Ziv-Aflibercept		

TABLE C-6: FIRST-LINE SENTINEL DRUGS

First-Line Sentinel Drug Names
Doxorubicin
Doxorubicin Liposomal

TABLE C-7: SECOND OR LATER-LINE SENTINEL DRUGS

Second or Later-Line Sentinel Drug Names
Carboplatin
Cisplatin
Oxaliplatin

TABLE C-8: ADJUSTED CHEMOTHERAPY REGIMEN LIST BASED ON NCCN GUIDELINES[4]

Regimen Name	Drugs Included	LOT
R-CHOP	Rituximab, cyclophosphamide, doxorubicin, vincristine, +/- prednisone	First-Line
EPOCH	Rituximab, cyclophosphamide, doxorubicin, vincristine, +/- prednisone, etoposide	First-Line
RCEPP	Rituximab, cyclophosphamide, procarbazine, etoposide, +/- prednisone	First-Line
RCDOP	Rituximab, cyclophosphamide, liposomal doxorubicin, vincristine, +/- prednisone	First-Line
RCEOP	Rituximab, cyclophosphamide, etoposide, vincristine, +/- prednisone	First-Line
RGCVP	Rituximab, cyclophosphamide, gemcitabine, vincristine, +/- prednisolone	First-Line
DHAP	+/- dexamethasone, cisplatin, cytarabine, +/- rituximab	Second or Later-Line
DHAX	+/- dexamethasone, oxaliplatin, cytarabine, +/- rituximab	Second or Later-Line
ESHAP	+/- methylprednisolone, cisplatin, cytarabine, etoposide, +/- rituximab	Second or Later-Line
ICE	Ifosfamide, carboplatin, etoposide, +/- rituximab	Second or Later-Line
MINE	Ifosfamide, mesna, mitoxantrone, etoposide, +/- rituximab	Second or Later-Line
GDP-1	+/- dexamethasone, cisplatin, gemcitabine, +/- rituximab	Second or Later-Line
GDP-2	+/- dexamethasone, carboplatin, gemcitabine, +/- rituximab	Second or Later-Line
GemOX	Oxaliplatin, gemcitabine, +/- rituximab	Second or Later-Line
Bendamustine	Bendamustine, +/- rituximab	Second or Later-Line
Bendamustine + Polatuzumab vedotin-piiq	Bendamustine, polatuzumab vedotin-piiq, rituximab	Second or Later-Line
Brentuximab vedotin	Brentuximab vedotin	Second or Later-Line
CEPP	+/- prednisone, cyclophosphamide, procarbazine, etoposide, +/- rituximab	Second or Later-Line
CEOP	+/- prednisone, cyclophosphamide, vincristine, etoposide, doxorubicin, +/- rituximab	Second or Later-Line
DA-EPOCH	+/- prednisone, cyclophosphamide, vincristine, etoposide, +/- rituximab	Second or Later-Line
Vinorelbine + Gemcitabine	Vinorelbine, gemcitabine, +/- rituximab	Second or Later-Line
Ibrutinub	Ibrutinib	Second or Later-Line

Note: We did not require the steroids in a regimen to be present in order for the course to be assigned to a regimen; these steroids are not listed as optional in the NCCN Guidelines. We did not consider rituximab alone to be its own regimen because of the challenges of distinguishing a course with rituximab alone from a course with rituximab added on. We also did not consider lenalidomide +/- rituximab to be its own regimen as lenalidomide is also used as maintenance therapy in between chemotherapy courses. The NCCN Guidelines do include rituximab alone and lenalidomide +/- rituximab as second or later-line regimens.

TABLE C-9: TEACHING HOSPITALS[36]

CCN	Teaching Hospital Name
010011	St. Vincents East
010018	Callahan Eye Foundation Hosp
010023	Baptist Medical Center South
010033	University Of Alabama Hospital
010039	Huntsville Hospital
010056	St Vincents Birmingham
010087	Univ Of South Alabama Medical Center
010090	Providence Hospital
010092	Dch Regional Medical Center
010103	Princeton Baptist Medical Center
010104	Trinity Medical Center
010113	Mobile Infirmary Medical Center
010118	Vaughan Regional Medical Center
010137	Cooper Green Mercy Hospital
010152	Infirmary West
010168	Jack Hughston Memorial Hospital
013300	The Childrens Hospital Of Alabama
013301	Usa Childrens And Womens Hospital
020001	Providence Alaska Medical Center
030002	Banner University Medical Center Phx
030006	Tucson Medical Center
030007	Verde Valley Medical Center
030013	Yuma Regional Medical Center
030014	John C Lincoln Medical Center
030022	Maricopa Medical Center
030024	St. Josephs Hospital & Medical Ctr
030030	Abrazo Central Campus
030038	Scottsdale Osborn Medical Center
030043	Canyon Vista Medical Center
030055	Kingman Regional Medical Center
030061	Banner Boswell Medical Center
030064	Banner University Med Center Tucson
030087	Scottsdale Shea Medical Center
030093	Banner Del E Webb Medical Center
030103	Mayo Clinic Hospital
030111	Banner University Med Center South
030121	Mountain Vista Medical Center
030123	Scottsdale Thompson Peak Med Ctr
033302	Phoenix Childrens Hospital
040004	Washington Regional Medical Center
040007	St Vincent Infirmary Medical Center
040014	White County Medical Center
040016	Uams Medical Center
040020	St Bernards Medical Center
040022	Northwest Medical Center Of Washingt
040042	Crittenden Regional Hospital
040055	Sparks Regional Medical Center
040067	Magnolia Regional Medical Center
040071	Jefferson Regional Medical Center
040114	Baptist Health Medical Center - Lr
040118	Nea - Baptist Memorial Health
043026	Baptist Health Rehabilitation Instit
043300	Arkansas Childrens Hospital
050008	Cpmc-R.K. Davies Medical Center
050017	Mercy General Hospital
050025	Ucsd Medical Center
050038	Santa Clara Valley Medical Center
050040	Lac Olive View/Ucla Medical Center
050047	California Pacific Medical Center
050055	St. Lukes Hospital
050057	Kaweah Delta Medical Center
050060	Community Regional Medical Center
050070	Kfh - South San Francisco
050071	Kfh - Santa Clara
050072	Kfh - Walnut Creek
050073	Kfh - Vallejo
050075	Kfh - Oakland
050076	Kfh - San Francisco
050077	Scripps Mercy Hospital
050096	West Covina Medical Center
050103	White Memorial Medical Center
050107	Marian Medical Center
050108	Sutter Medical Center - Sacramento
050112	Santa Monica Ucla Medical Center
050113	San Mateo Medical Center
050115	Palomar Medical Center
050116	Northridge Medical Center - Roscoe
050121	Adventist Medical Center
050128	Tri-City Medical Center
050129	St. Bernardine Medical Center
050137	Kfh - Panorama City
050138	Kfh - Los Angeles
050139	Kfh - Downey
050140	Kfh - Fontana
050146	City Of Hope National Medical Ctr
050149	California Hospital Medical Center
050152	Saint Francis Memorial Hospital
050153	Oconnor Hospital
050159	Ventura County Medical Center
050167	San Joaquin General Hospital
050169	Presbyterian Intercommunity Hospital
050191	St. Mary Medical Center
050192	Adventist Medical Center Reedley
050196	Central Valley General Hospital
050219	Coast Plaza Doctors Hospital
050228	San Francisco General Hospital
050231	Pomona Valley Hospital Med Ctr
050239	Glendale Adventist Medical Center
050243	Desert Hospital
050245	Arrowhead Regional Medical Center
050248	Natividad Medical Center
050262	Ronald Reagan Ucla Medical Center
050276	Contra Costa Regional Medical Center
050277	Pacific Hospital Of Long Beach
050280	Mercy Medical Center Redding
050289	Seton Medical Center
050291	Sutter Santa Rosa Regional Hospital
050292	Riverside University Health System
050315	Kern Medical Center
050320	Alameda County Medical Center
050327	Loma Linda University Medical Center
050348	Uci Medical Center

CCN	Teaching Hospital Name
050373	Lac+Usc Medical Center
050376	Harbor-Ucla Medical Center
050390	Hemet Valley Medical Center
050393	Pih Hospital - Downey
050394	Cmh Of San Buenaventura
050396	Santa Barbara Cottage Hospital
050411	Kfh - South Bay
050424	Scripps Green Hospital
050425	Kfh - Sacramento
050426	West Anaheim Medical Center
050438	Huntington Hospital
050441	Stanford Health Care
050444	Mercy Medical Center Merced
050454	Ucsf Medical Center
050457	St. Marys Medical Center
050464	Doctors Medical Center Of Modesto
050471	Good Samaritan Hospital
050485	Long Beach Memorial Medical Center
050502	St. Vincent Medical Center
050510	Kfh - San Rafael
050512	Kfh - Fremont
050515	Kfh - San Diego
050516	Mercy San Juan Medical Center
050537	Sutter Davis Hospital
050541	Kfh - Redwood City
050561	Kfh - West Los Angeles
050570	Fountain Valley Reg Medical Center
050573	Eisenhower Medical Center
050581	Lakewood Regional Med. Ctr.
050586	Chino Valley Medical Center
050590	Methodist Hospital Of Sacramento
050599	Uc Davis Medical Center
050603	Saddleback Memorial Medical Center
050604	Kfh - San Jose
050609	Kfh - Oc-Anaheim
050625	Cedars-Sinai Medical Center
050660	Usc Norris Cancer Hospital
050674	Kfh - South Sacramento
050677	Kfh - Woodland Hills
050686	Kfh - Riverside
050690	Kfh - Santa Rosa
050696	Keck Hospital Of Usc
050710	Kfh - Fresno
050717	Rancho Los Amigos Natl.Rehab.Ctr.
050746	Orange County Global Medical Center
050748	Kfh - Manteca
050760	Kfh - Antioch
050763	Silver Lake Medical Center
050767	Kfh - Vacaville
050772	Kfh - Roseville
050776	College Medical Center
050777	Kfh - San Leandro
053300	Valley Childrens Hospital
053301	Childrens Hosp & Res Cntr Oakland
053302	Childrens Hospital Los Angeles
053303	Rady Childrens Hospital - San Diego
053304	Childrens Hospital Of Orange Count
053305	Lucile Packard Childrens Hospital

CCN	Teaching Hospital Name
053309	Miller Childrens Hospital
054009	Resnick Neuropsychiatric Hospital At
054093	Llu Behavioral Medicine Center
054144	Langley Porter Psychiatric Hospital
060001	North Colorado Medical Center
060010	Poudre Valley Hospital
060011	Denver Health Medical Center
060012	St Mary Corwin Medical Center
060014	Presbyterian St Lukes Medical Ctr
060015	St Anthony Hospital
060020	Parkview Medical Center
060023	St. Marys Hospital & Medical Center
060024	University Of Co Hospital
060028	Saint Joseph Hospital
060031	Penrose/St. Francis Healthcare
060032	Rose Medical Center
060034	Swedish Medical Center
060064	Porter Adventist Hospital
060065	North Suburban Medical Center
060100	The Medical Center Of Aurora
060104	St Anthony North Health Campus
060112	Sky Ridge Medical Center
062011	Craig Hospital
063301	Childrens Hospital Colorado
064001	Co. Mental Health Inst. - Pueblo
070001	Hospital Of Saint Raphael
070002	Saint Francis Hospital
070005	Waterbury Hospital
070006	The Stamford Hospital
070007	Lawrence & Memorial Hospital
070010	Bridgeport Hospital
070012	Rockville General Hospital Inc.
070016	St. Marys Hospital
070018	Greenwich Hospital
070020	Middlesex Hospital
070022	Yale-New Haven Hospital
070025	Hartford Hospital
070027	Manchester Memorial Hospital
070028	St. Vincents Medical Center
070031	The Griffin Hospital
070033	Danbury Hospital
070034	Norwalk Hospital
070035	The Hospital Of Central Connecticut
070036	John Dempsey Hospital
073300	Connecticut Childrens Medical Center
074011	Connecticut Mental Health Center
080001	Christiana Care Health System
080003	St. Francis Hospital Wilmington
083300	Alfred I Dupont Hosp For Children
090001	George Washington Univ Hospital
090003	Howard University Hospital
090004	Georgetown University Hospital
090005	Sibley Memorial Hospital
090006	Providence Hospital
090011	Washington Hospital Center
093025	National Rehabilitation Hospital
093300	Childrens Hospital
094001	St. Elizabeths Hospital

CCN	Teaching Hospital Name
100001	Shands Jacksonville Medical Center
100002	Bethesda Hospital Inc
100006	Orlando Health
100007	Florida Hospital
100009	University Of Miami Hospital
100012	Lee Memorial Hospital
100017	Halifax Medical Center
100022	Jackson Memorial
100025	Sacred Heart Hospital
100032	Bayfront Health St. Petersburg
100034	Mt. Sinai Medical Center
100035	Manatee Memorial Hospital
100038	Memorial Regional Hospital
100039	Broward Health Medical Center
100040	St. Vincents Medical Center-Riversi
100050	Larkin Community Hospital Palm Sprin
100061	Mercy Hospital Inc.
100069	Florida Hospital-Carrollwood
100073	Holy Cross Hospital
100079	University Of Miami Hosp & Clinics
100080	Jfk Medical Center
100088	Baptist Medical Center
100110	Osceola Regional Medical Center
100113	Uf Health Shands
100127	Morton Plant Hospital
100128	Tampa General Hospital
100130	Lakeside Medical Center
100131	Aventura Hospital And Med Ctr
100135	Tallahassee Memorial Hospital
100151	Mayo Clinic Florida
100154	South Miami Hospital
100167	Plantation General Hospital
100168	Boca Raton Regional Hospital
100173	Florida Hospital Tampa
100179	Memorial Hospital Of Jacksonville
100180	St. Petersburg General
100181	Larkin Community Hospital
100187	Palmetto General Hospital
100189	Northwest Medical Center
100204	North Florida Reg Med Cntr
100209	Kendall Regional Medical Center
100212	Ocala Regional Medical Center
100224	University Hospital
100226	Orange Park Medical Center
100228	Westside Regional Medical Center
100234	West Palm Hospital
100238	Northside Hospital
100240	Anne Bates Leach Eye Hospital
100243	Brandon Regional Hospital
100248	Largo Medical Center
100256	Regional Medical Centre Bayonet Poin
100258	Delray Medical Center
100260	St. Lucie Medical Center
100264	Oak Hill Hospital
100269	Palms West Hospital
100271	H. Lee Moffitt Cancer Center
100275	Wellington Regl Medical Center
100276	Broward Health Coral Springs

CCN	Teaching Hospital Name
100284	Westchester General Hospital
100289	Ccf Hospital - Weston
100314	West Kendall Baptist Hospital
103301	Miami Childrens Hospital
110003	Mayo Clinic Health System Waycross
110006	St Marys Health Care System Inc
110007	Phoebe Putney Memorial Hospital
110010	Emory University Hospital
110028	University Health Services Inc.
110034	Mcg Medical Center
110036	Memorial Health Univ Med Center
110054	Floyd Medical Center
110064	Midtown Medical Center
110069	Houston Medical Center
110074	Athens Regional Medical Center
110076	Dekalb Medical Center
110078	Emory University Hospital Midtown
110079	Grady Memorial Hospital
110082	St. Josephs Of Atlanta
110083	Piedmont Hospital Inc.
110087	Gwinnett Hospital System Inc
110107	Medical Center Of Central Georgia
110115	Atlanta Medical Center
110203	Wesley Woods Center Of Emory Univers
110219	South Fulton Medical Center
113300	Egleston Childrens Hospital At Emory
120001	The Queens Medical Center
120004	Wahiawa General Hospital
120005	Hilo Medical Center
120007	Kuakini Medical Center
120011	Kfh-Hawaii
120022	Straub Clinic & Hospital
123300	Kapiolani Med Ctr For Women & Childr
130006	St. Lukes Regional Medical Center
130007	St. Alphonsus Regional Med Center
130014	West Valley Medical Center
130028	Portneuf Medical Center
130049	Kootenai Hospital District
140007	Presence St. Joseph Medical Center
140008	Gottlieb Memorial Hospital
140010	Northshore University Healthsystem
140012	Katherine Shaw Bethea
140015	Blessing Hospital
140018	Mount Sinai Hospital Medical Center
140029	Copley Memorial Hospital
140049	West Suburban Hosp Med Ctr
140051	Skokie Hospital
140053	St. Johns Hospital
140054	Macneal Hospital
140063	Oak Park Hospital
140065	Adventist Lagrange Memorial Hospital
140067	Saint Francis Medical Center
140080	Presence Saint Francis Hospital
140082	Louis A. Weiss Memorial Hospital
140083	Loretto Hospital
140088	University Of Chicago Hospitals
140091	Carle Foundation Hospital
140095	St Anthony Hosptal

CCN	Teaching Hospital Name
140103	St. Bernard Hospital
140113	Presence Covenant Medical Center
140114	Swedish Covenant Hospital
140117	Presence Resurrection Medical Center
140119	Rush University Medical Center
140122	Adventist Hinsdale Hospital
140124	John H. Stroger Jr. Hosp Of Cook Cty
140127	Advocate Bromenn Medical Center
140130	Northwestern Lake Forest Hospital
140135	Decatur Memorial Hospital
140148	Memorial Medical Center
140150	Board Of Trustees Of The University
140151	Sacred Heart Hospital
140158	Mercy Hospital & Medical Center
140164	Memorial Hospital Of Carbondale
140166	St Marys Hospital
140172	Franciscan St. James Health
140177	Jackson Park Hospital
140179	Little Company Of Mary
140180	Presence Saints Mary & Elizabeth Med
140182	Advocate Northside Health System
140186	Riverside Medical Center
140187	St. Elizabeth Hospital
140206	Norwegian American Hospital
140208	Advocate Christ Hospital
140209	Methodist Medical Ctr Of Illinois
140223	Advocate Lutheran General Hospital
140224	Presence Saint Joseph Hosp-Chicago
140228	Swedishamerican Hospital
140233	Saint Anthony Medical Center
140240	Westlake Community Hospital
140251	Community First Medical Center
140276	Loyola University Medical Center
140281	Northwestern Memorial Hospital
140300	Provident Hospital
140301	Oak Forest Hospital Of Cook County
142011	Holy Family Medical Center
143025	Schwab Rehab Hosp & Care Network
143026	The Rehab. Institute Of Chicago
143027	Marianjoy Rehab Hospital & Clinic
143300	Ann & Robert H. Lurie Childrens Hos
150002	Methodist Hospitals Inc
150004	Franciscan Health Hammond
150009	Clark Memorial Hospital
150012	St. Josephs Reg Med Center S. Bend
150017	Lutheran Hospital Of Indiana
150021	Parkview Hospital
150023	Union Hospital Inc.
150024	Eskenazi Health
150033	St. Francis Hospital & Health Center
150047	St Joseph Medical Center
150048	Reid Hospital & Health Care Services
150056	Indiana University Health
150058	Memorial Hospital Of South Bend Inc
150074	Community Hospital Of Indiana Inc.
150082	Deaconess Hospital
150084	St. Vincent Hospital & Hcc
150089	Ball Memorial Hospital
150090	Franciscan Health- Dyer
150100	St. Marys Medical Center
150126	Franciscan Health Crown Point
150128	Community Hospital South
150129	Westview Hospital
150154	Indiana Heart Hospital
150162	St. Francis Hospital & Health Center
150169	Community Hospital Of Indiana Inc.
153028	Rehabilitation Hospital Of Indiana
160016	Trinity Regional Medical Center
160024	Iowa Lutheran Hospital
160033	Genesis Medical Center - Davenport
160045	St. Lukes Methodist Hospital
160047	Jennie Edmundson Memorial
160058	University Of Iowa Hosp & Clinics
160064	Mercy Medical Center - Mason City
160067	Covenant Medical Center
160079	Mercy Medical Center
160082	Iowa Methodist Medical Center
160083	Mercy Medical Center-Des Moines
160101	Broadlawns Medical Center
160104	Trinity Bettendorf
160110	Allen Memorial Hospital
160146	St. Lukes Regl Medical Center
160153	Mercy Medical Center - Sioux City
170012	Salina Regional Health Center
170016	St.Francis Health Center
170040	University Of Kansas Hospital
170086	Stormont-Vail Regional Health Center
170104	Shawnee Mission Medical Center
170122	Via Christi Hospital Wichita
170123	Wesley Medical Center
180010	Saint Joseph Hospital
180013	The Medical Center
180017	T.J. Samson Community Hospital
180018	St. Claire Medical Center
180029	Hazard Arh
180035	St Elizabeth Healthcare
180036	Our Lady Of Bellefonte
180040	Jewish Hospital & St Marys Health
180044	Pikeville Medical Center
180056	Methodist Hospital
180067	University Hospital
180088	Norton Hospitals Inc
180093	Baptist Health Madisonville
180103	Baptist Health Lexington
180132	Lake Cumberland Regional Hosp
180141	University Of Louisville Hospital
183026	Cardinal Hill Rehabilitation Hospita
184015	Central State Hospital
190001	Washington-St.Tammany Med. Ctr.
190002	Lafayette General Medical Center
190005	University Medical Ctr. At New Orlea
190006	University Hospital & Clinics
190009	Huey P. Long Medical Center
190011	University Health Conway
190026	Rapides Regional Medical Center
190027	St. Patrick Hospital

CCN	Teaching Hospital Name
190036	Ochsner Clinic Foundation
190039	West Jefferson Medical Center
190040	Slidell Memorial Hospital
190041	Schumpert Medical Center
190046	Touro Infirmary
190060	Lake Charles Memorial Hospital
190064	Our Lady Of The Lake Rmc
190065	Baton Rouge General
190098	University Health Shreveport
190111	Willis-Knighton Health Systems
190122	Earl K. Long Medical Center
190135	Ochsner Baptist Medical Center
190146	East Jefferson General Hospital
190161	W.O. Moss Reg. Medical Center
190176	Tulane University Hospital & Clinics
190183	Southern Regional Medical Corp
190274	Ochsner Medical Center - Kenner Llc
190312	Our Lady Of The Angels Hospital Mc
193300	Childrens Hospital
200009	Maine Medical Center
200019	Southern Maine Health Care
200024	Central Maine Medical Center
200033	Eastern Maine Medical Center
200039	Mainegeneral Medical Center
204005	Spring Harbor Hospital
210002	University Of Maryland Med Sys
210004	Holy Cross Hospital
210008	Mercy Medical Center
210009	The Johns Hopkins Hospital
210011	St. Agnes Hospital
210012	Sinai Hospital Of Baltimore Inc.
210015	Medstar Franklin Square Medical Ctr
210022	Suburban Hospital
210024	Medstar Union Memorial Hospital
210029	Johns Hopkins Bayview Med. Ctr.
210034	Medstar Harbor Hospital
210038	Maryland General Hospital
210044	Greater Baltimore Medical Center
210056	Good Samaritan Hospital
210058	James Lawrence Kernan Hospital
213301	Kennedy Krieger
214000	Sheppard & Enoch Pratt Hospital
220001	Health Alliance
220002	Mount Auburn Hospital
220010	Lawrence General Hospital
220011	Cambridge Health Alliance
220012	Cape Cod Hospital
220017	Steward Carney Hopsital
220020	Steward St. Annes Hospital
220031	Boston Medical Center
220035	North Shore Medical Center
220036	Steward St. Elizabeths Medical Ctr
220046	Berkshire Medical Center
220052	Brockton Hospital Inc.
220070	Hallmark Health System
220071	Massachusetts General Hospital
220075	Mass Eye & Ear Infirmary
220077	Baystate Medical Center

CCN	Teaching Hospital Name
220083	Beth Israel Deaconess Hospital-Needh
220086	Beth Israel Deaconess Medical Center
220088	New England Baptist Hospital
220090	Milford Regional Medical Center Inc
220101	Newton Wellesley Hospital
220105	Winchester Hospital
220110	Brigham And Womens Hospital
220111	Good Samaritan Medical Center
220116	Tufts Medical Center
220119	Faulkner Hospital
220162	Dana-Farber Cancer Institute
220163	Umass Memorial Medical Center
220171	Lahey Clinic Hospital Inc.
220175	Metrowest Medical Center
220176	Saint Vincent Hospital
222006	Lemuel Shattuck Hospital
223026	New England Rehabilitation Hospital
223034	Spaulding Rehabilitation Hospital
223302	Childrens Hospital Corporation
224007	Mclean Hospital
230002	St. Mary Mercy Hospital - Livonia
230004	Mh - Mercy Campus
230013	Pontiac General Hospital
230017	Bronson Methodist Hospital
230019	Providence Hospital
230020	Beaumont Hospital - Dearborn
230021	Lakeland Medical Center St. Joseph
230022	Community Health Center Branch Cty
230024	Sinai-Grace Hospital
230029	St. Joseph Mercy Hospital - Oakland
230037	Hillsdale Hospital
230038	Spectrum Health Hospitals
230041	Bay Regional Medical Center
230046	Univ Of Mi Hospitals & Hlth Ctrs
230047	Henry Ford Macomb Hospital
230053	Henry Ford Hospital
230054	Marquette General Hospital
230059	Saint Marys Health Care
230066	Mercy Health Muskegon
230069	Sjmhs - Livingston
230070	Covenant Medical Center
230077	St. Marys Of Michigan
230089	Beaumont Hospital Grosse Pointe
230092	W.A. Foote Memorial Hospital
230097	Munson Medical Center
230099	Monroe Regional Hospital
230104	Harper- Hutzel Hospital
230117	Borgess Medical Center
230130	William Beaumont Hospital - Royal Oa
230132	Hurley Medical Center
230141	Mclaren Regional Medical Center
230142	Beaumont Health - Wayne
230146	Henry Ford Wyandotte Hospital
230151	Beaumont Hospital - Farmington Hills
230156	St. Joseph Mercy Hospital - Ann Arbo
230165	St John Hospital & Medical Center
230167	Mclaren Greater Lansing
230176	Beaumont Hospital-Trenton

CCN	Teaching Hospital Name
230195	St. John Macomb-Oakland Hospital
230197	Genesys Regional Medical Ctr.
230207	Mclaren Oakland
230208	Carson City Hospital
230222	Midmichigan Medical Ctr
230227	Mclaren Macomb
230230	Edward W. Sparrow Hospital
230236	Metropolitan Hospital
230244	Garden City Hospital Osteopathic
230254	Crittenton Hospital Medical Center
230264	Southeast Michigan Surgical Hospital
230269	William Beaumont Hospital - Troy
230270	Beaumont Hospital - Taylor
230273	Detroit Receiving Hospital
230275	Healthsource Saginaw
230277	Huron Valley-Sinai Hospital
230297	Karmanos Cancer Hospital
233027	Rehabilitation Institute Of Michigan
233300	Childrens Hospital Of Michigan
234006	Pine Rest Christian Hospital
234011	Kingswood Hospital
240001	North Memorial Health Care
240002	St. Marys Medical Center
240004	Hennepin County Medical Center
240010	Mayo Clinic Hospital Rochester
240019	Smdc Medical Center
240036	St. Cloud Hospital
240038	United Hospital
240047	St. Lukes Hospital Of Duluth
240053	Park Nicollet Methodist Hospital
240057	Abbott Northwestern Hospital
240061	Mayo Clinic Methodist Hospital
240063	Healtheast St Josephs Hospital
240080	University Of Minnesota Medical Ctr
240093	Mayo Clinic Health System Mankatko
240106	Regions Hospital
240115	Mercy Hospital
240132	Unity Hospital
240210	Healtheast St Johns Hospital
240213	Healtheast Woodwinds Hospital
243300	Gillette Childrens Specialty Health
243302	Childrens Health Care
250001	University Of Mississippi Medical
250004	North Mississippi Medical Center
250009	Magnolia Hospital
250043	Neshoba County General Hospital
250069	Rush Foundation Hospital
250077	Wayne General Hospital
250078	Forrest General Hospital
250094	Wesley Medical Center
250102	Ms Baptist Medical Center
250104	Jeff Anderson Regional Medical Cente
250141	Baptist Mem Hospital Desoto
260020	Mercy Hospital - St. Louis
260022	Northeast Regional Medical Center
260027	Research Medical Center
260032	Barnes-Jewish Hospital
260040	Coxhealth
260047	Capital Region Medical Center
260048	Truman Med Ctr Hospital Hill
260091	Ssm Health St. Marys Hospital - Stl
260095	Centerpoint Medical Center
260102	Truman Medical Ctr Lakewood
260104	Ssm Health Depaul Hospital
260105	Ssm Saint Louis University Hospital
260108	Missouri Baptist Medical Center
260137	Freeman Oak Hill Health System
260138	St. Lukes Hospital Of Kansas City
260141	Univ Of Missouri Health Care
260162	Barnes Jewish West County Hospital
260176	Des Peres Medical Center
260179	St. Lukes Hospital
260180	Christian Hospital Northeast
260191	Barnes Jewish St. Peters Hospital
260193	St. Marys Medical Center
260209	Fulton Medical Center
260210	St. Alexius Hospital
263027	Rusk Rehabilitation Center A Joint
263301	St. Louis Childrens Hospital
263302	Childrens Mercy Hospital
264008	Center For Behavioral Medicine
270004	Billings Clinic
270014	St Patrick Hospital
270023	Community Medical Center
270049	St Vincent Healthcare
270051	Kalispell Regional Medical Center
280003	Bryan Medical Center
280009	Chi Health Good Samaritan
280013	The Nebraska Medical Center
280020	Chi Health St. Elizabeth
280023	Chi Health St. Francis
280030	Chi Health-Creighton Univ Med Center
280040	Nebraska Methodist Hospital
280060	Chi Health Bergan Mercy
280081	Chi Health Immanuel
283301	Childrens Hospital & Medical Center
290001	Renown Regional Medical Center
290003	Sunrise Hospital And Medical Center
290007	University Medical Center
290021	Valley Hospital Medical Center
290039	Mountain View Hospital
290045	St. Rose Dominican - Siena
300001	Concord Hospital Inc.
300003	Mary Hitchcock Memorial Hosp
300020	Southern Nh Medical Center
310001	Hackensack University Medical Center
310002	Newark Beth Israel Medical Center
310003	Palisades Medical Center
310005	Hunterdon Medical Center
310006	St. Marys Hospital - Passaic
310010	Princeton Healthcare System
310014	Cooper University Hospital
310015	Morristown Medical Center
310016	Christ Hospital
310019	St. Josephs Hospital & Medical Ctr
310021	St. Francis - Trenton

CCN	Teaching Hospital Name
310022	West Jersey Health System
310027	Trinitas Hospital
310029	Our Lady Of Lourdes Med. Ctr.
310031	Deborah Heart And Lung Center
310032	Inspira Medical Center Vineland
310038	Robert Wood Johnson Univ Hospital
310039	Raritan Bay Medical Center
310040	Hoboken University Medical Center
310044	Capital Health Med Center - Hopewell
310045	Englewood Hospital & Med Ctr
310048	Robert Wood Johnson Univ Hosp @ Som
310051	Overlook Medical Center
310054	Mountainside Hospital
310057	Memorial Hosp Of Burlington Cty
310058	Bergen Regional Medical Center
310060	St Lukes Warren Hospital
310061	Lourdes Medical Center-Burlington
310064	Atlanticare Regional Medical Center
310070	St. Peters University Hospital
310073	Jersey Shore University Med Ctr
310074	Jersey City Medical Center
310075	Monmouth Medical Center
310076	Saint Barnabas Medical Center
310081	Inspira Medical Center Woodbury Inc
310086	Kennedy University Hospital
310092	Helene Fuld Medical Center
310096	St. Michaels Medical Center
310108	Jfk Medical Center
310111	Centra State Medical Center
310118	Meadowlands Hospital Medical Center
310119	Uh - University Hospital
313025	Kessler Institute For Rehabiliatatio
314011	University Behavioral Healthcare
320001	University Of New Mexico Hospital
320002	St. Vincent Hospital
320004	Gerald Champion Regional Medical Ctr
320006	Eastern New Mexico Medical Center
320009	Lovelace Medical Center- Downtown
320017	Lovelace Womens Hospital
320018	Memorial Medical Center
320021	Presbyterian Hospital
320089	Unm Sandoval Regional Medical Center
330002	Peninsula Hospital Center
330004	The Kingston Hospital
330005	Kaleida Health
330006	St. Josephs Medical Center
330009	Bronx-Lebanon Hospital Center
330011	Our Lady Of Lourdes Memorial Hosp
330013	Albany Medical Center Hospital
330014	Jamaica Hospital Medical Center
330019	Ny Community Hospital Of Brooklyn
330024	Mount Sinai Hospital
330027	Nassau University Medical Center
330028	Richmond University Medical Center
330043	Southside Hospital
330044	Faxton-St. Lukes Healthcare
330045	Huntington Hospital
330046	Mount Sinai St. Lukes Roosevelt Hos

CCN	Teaching Hospital Name
330055	Newyork-Presbyterian/Queens
330056	The Brooklyn Hospital Center
330057	St. Peters Hospital
330059	Montefiore Medical Center
330064	New York Downtown Hospital
330065	Niagara Falls Memorial Medical Cente
330073	United Memorial Medical Center
330078	Sisters Of Charity Hospital
330080	Lincoln Medical&Mental Health Center
330086	The Mount Vernon Hospital
330090	Arnot-Ogden Medical Center
330100	New York Eye And Ear Infirmary
330101	New York Presbyterian Hospital
330103	Olean General Hospital
330106	North Shore University Hospital
330107	Peconic Bay Medical Center
330119	Lenox Hill Hospital
330125	Rochester General Hospital
330126	Orange Regional Medical Center
330127	Jacobi Medical Center
330128	Elmhurst Hospital Center
330136	Mary Imogene Bassett Hospital
330140	St. Josephs Hospital Health Center
330141	Brookhaven Memorial Hospital Medical
330152	Long Island College Hospital
330153	Ellis Hospital
330154	Memorial Hospital For Cancer And All
330157	Samaritan Medical Center
330159	Upstate Univ Hosp At Comm General
330160	Staten Island University Hospital
330164	Highland Hospital
330167	Winthrop University Hospital
330169	Mount Sinai Beth Israel
330181	Glen Cove Hospital
330182	St. Francis Hospital
330184	Montefiore New Rochelle Hospital
330185	John T Mather Memorial Hospital
330193	Flushing Hospital Medical Center
330194	Maimonides Medical Center
330195	Long Island Jewish Medical Center
330196	Coney Island Hospital
330198	South Nassau Communities Hospital
330199	Metropolitan Hospital Center
330201	Kingsbrook Jewish Medical Center
330202	Nyc Health + Hospitals/ Kings County
330203	Crouse Hospital
330204	Bellevue Hospital Center
330208	St. Johns Riverside Hospital
330214	Nyu Hospitals Center
330219	Erie County Medical Center
330221	Wyckoff Heights Medical Center
330224	Benedictine Hospital
330226	The Unity Hospital Of Rochester
330231	Queens Hospital Center
330233	Brookdale Hospital Medical Center
330234	Westchester Medical Center
330236	Newyork-Presbyterian/Brooklyn Method
330240	Harlem Hospital Center

CCN	Teaching Hospital Name
330241	University Hospital At Syracuse
330245	St. Elizabeth Medical Center
330246	St Charles Hospital
330259	Mercy Medical Center
330261	Phelps Memorial Hospital Center
330270	Hospital For Special Surgery
330279	Mercy Hospital Of Buffalo
330285	Strong Memorial Hospital
330286	Good Samaritan Hospital
330306	Lutheran Medical Center
330331	Plainview Hospital
330332	St. Joseph Hospital
330340	Southampton Hospital
330350	University Hospital Of Brooklyn
330353	Forest Hills Hospital
330354	Roswell Park Cancer Institute
330372	Franklin Hospital
330385	North Central Bronx Hospital
330393	Stony Brook University Hospital
330394	Uhs
330395	Episcopal Health Services
330396	Woodhull Hospital Center
330397	Interfaith Medical Center
330399	St. Barnabas Hospital
332008	Henry J. Carter Specialty Hospital
334001	Hutchings P.C.
334003	St. Lawrence P.C.
334004	Creedmoor P.C.
334009	New York P.I.
334010	Hudson River P.C.
334012	Greater Binghamton H.C.
334013	Pilgrim P.C.
334015	Rockland P.C.
334020	Rochester P.C.
334043	South Beach P.C.
334046	Capital District P.C.
334052	Buffalo P.C.
334053	Bronx P.C.
334054	Manhattan P.C.
334060	Kirby Forensic P.C.
334061	Mid-Hudson P.C.
340001	Carolinas Healthcare System Northeas
340002	Mission Hospital Inc
340014	Forsyth Memorial Hospital Inc
340017	Margaret R. Pardee Memorial Hospital
340024	Sampson Regional Medical Center
340028	Cape Fear Valley Medical Center
340030	Duke University Hospital
340040	Pitt County Memorial Hospital
340047	North Carolina Baptist Hospital
340050	S.E. Regl Medical Center
340061	University Of North Carolina Hosp.
340069	Wakemed Raleigh Campus
340075	Blue Ridge Healthcare Hospitals
340091	The Moses H. Cone Memorial Hospital
340113	Carolinas Medical Center
340130	Carolinas Healthcare System Union
340141	New Hanover Regional Medical Center

CCN	Teaching Hospital Name
340155	Duke Regional Hospital
343026	Carolinas Rehabilitation
350002	St Alexius Medical Center
350006	Trinity Hospitals/St Joes
350011	Sanford Medical Center - Fargo
350015	Sanford Health Bismarck
350019	Altru Health System-Altru Hospital
360003	Univer.Of Cincinnati Med Center Llc
360006	Riverside Methodist Hospital
360008	Southern Ohio Medical Center
360012	St. Anns Hospital
360014	Obleness Memorial Hospital
360016	Jewish Hospital Of Cincinnati
360017	Grant Medical Center
360019	Summa Barberton Hospital
360020	Summa Health System
360025	Firelands Regional Medical Center
360027	Akron General Medical Center
360035	Mount Carmel Health
360037	St. Vincent Charity Medical Center
360041	Uh Parma Medical Center
360048	Univ Of Toledo Medl Center
360051	Miami Valley Hospital
360052	Good Samaritan Hospital
360054	Holzer
360059	Metrohealth Medical Center
360064	St. Elizabeth Health Center
360066	St. Ritas Medical Center Llc
360068	The Toledo Hospital
360070	Mercy Medical Center
360072	Fairfield Medical Center
360074	Flower Hospital
360075	Uh Regional Hospitals
360077	Fairview Hospital
360078	Uh Portage Medical Center
360079	Kettering Memorial Hospital
360081	St. Charles Hospital
360084	Aultman Hospital
360085	The Ohio State University Hospital
360087	Lutheran Hospital
360090	St. Lukes Hospital
360096	East Liverpool City Hospital
360101	Huron Hospital
360112	St Vincent Medical Center
360115	Uh Bedford Medical Center
360123	Uh St John Medical Center
360131	Alliance Community Hospital
360133	Grandview Hospital
360134	Good Samaritan Hospital
360137	Uh Cleveland Medical Center
360141	Northside Medical Center
360144	South Pointe Hospital
360147	Marietta Memorial Hospital
360150	Summa Western Reserve Hospital
360151	Affinity Medical Center
360152	Doctors Hospital
360159	Adena Regional Medical Center
360161	St. Joseph Health Center

CCN	Teaching Hospital Name
360163	The Christ Hospital
360172	Mercy Regional Medical Center
360179	Bethesda Hospital
360180	Cleveland Clinic Hospital
360192	Uh Geauga Medical Center
360230	Hillcrest Hospital
360234	Mercy Health West Hospital
360239	Sycamore Hospital
360242	Ohio State University James Cancer H
360262	Mercy St. Anne Hospital
360276	St Elizabeth Boardman Health Ctr
360359	Uh Ahuja Medical Center
362004	Daniel Drake Center For Post-Acute C
363300	Childrens Hospital Medical Center
363302	Rainbow Babies & Childrens Hospital
363303	Childrens Hospital Medical Center
363305	Nationwide Children's Hospital
363306	Dayton Childrens Hospital
370001	Hillcrest Medical Center
370008	Norman Regional Hospital Authority
370014	Alliancehealth Durant
370016	Bass Baptist Health Center
370018	Jane Phillips Medical Center
370028	Integris Baptist Medical Center
370034	Mcalester Regional Health Center
370037	St Anthony Hospital
370056	Comanche County Memorial Hospital
370078	Osu Medical Center
370089	Tahlequah City Hospital
370091	Saint Francis Hospital
370093	Ou Medical Center
370106	Integris Southwest Medical Center
370114	St. John Medical Center
370190	Southwestern Regional Medical Center
370201	Surgical Hospital Of Oklahoma
374000	Griffin Memorial Hospital
374020	Laureate Psychiatric Hospital
380004	Providence St. Vincent Medical Ctr
380007	Legacy Emanuel Hospital & Health Ctr
380009	Ohsu Hospital And Clinics
380014	Good Samaritan Hospital Corvallis
380017	Legacy Good Samaritan Hospital
380022	Samaritan Albany General Hospital
380047	St Charles Medical Center
380050	Sky Lakes Medical Center
380061	Providence Portland Medical Center
380082	Providence Milwaukie Hospital
380090	Bay Area Hospital
380091	Kaiser Sunnyside Medical Center
380103	Kaiser Westside Medical Center
390001	Community Medical Center
390002	Upmc Mckeesport
390003	Geisinger Bloomsburg Hospital
390004	Holy Spirit Hospital
390006	Geisinger Medical Center
390009	Saint Vincent Hospital
390026	Chestnut Hill Hospital
390027	Temple University Hospital

CCN	Teaching Hospital Name
390028	Upmc Mercy Hospital
390036	Heritage Valley Beaver
390042	The Washington Hospital
390044	Reading Hospital And Medical Center
390045	Williamsport Hospital & Medical Ctr
390046	York Hospital
390049	St. Lukes Hospital
390050	Allegheny General Hospital
390063	Upmc Hamot
390066	The Good Samaritan Hospital
390067	Pinnacle Health Hospitals
390068	Heart Of Lancaster Regional Medical
390073	Altoona Regional Health System
390079	Robert Packer Hospital
390080	Jeanes Hospital
390081	Delaware County Memorial Hospital
390090	Western Pennsylvania Hospital
390093	Clarion Hospital
390096	St. Joseph Medical Center
390097	Hospital
390100	Lancaster General Hospital
390101	Memorial Hospital
390102	Upmc St Margaret
390107	Upmc Passavant
390108	Montgomery Hospital
390110	Memorial Medical Center
390111	Hospital Of The Univ Of Penna
390113	Meadville Medical Center
390114	Magee Womens Hospital Of Upmc
390115	Aria Health
390116	Mercy Suburban Hospital
390119	Moses Taylor Hospital
390127	Phoenixville Hospital
390132	St. Joseph Hospital
390133	Lehigh Valley
390137	Wilkes-Barre General Hospital
390139	Bryn Mawr Hospital
390142	Albert Einstein Medical Center
390151	The Chambersburg Hospital
390156	Mercy Catholic Medical Center
390162	Easton Hospital
390164	Upmc - Presbyterian Shadyside
390174	Thomas Jefferson Univ. Hospital
390178	Upmc Horizon Hospital
390180	Crozer Chester Medical Center
390195	Lankenau Medical Center
390196	American Oncologic Hospial
390197	Sacred Heart Hospital
390198	Millcreek Community Hospital
390219	Latrobe Area Hospital
390223	Presbyterian Medical Center
390226	Pennsylvania Hospital Of Uphs
390231	Abington Memorial Hospital
390237	Regional Hospital Of Scranton
390256	Milton S. Hershey Medical Center
390263	Muhlenberg Hospital Center
390267	Forbes Regional Hospital
390268	Mount Nittany Medical Center

CCN	Teaching Hospital Name
390270	Geisinger Wyoming Valley Med Ctr
390290	Hahnemann University Hospital
390304	Roxborough Memorial Hospital
390321	Coordinated Hospital Of Allentown
390326	St Luke Hospital Anderson Campus
390329	Einstein Medical Center Montgomery
393025	Bryn Mawr Rehabilitation Hospital
393038	Magee Rehabilitation Hospital
393302	Childrens Hospital Of Pgh Of Upmc
393303	The Childrens Hospital Of Philadelp
393307	St Christophers Hospital For Childr
394008	Friends Behavioral Health System
394023	Belmont Behavioral Healthcare
400014	Hospital Bella Vista
400015	San Juan Municipal Hospital
400016	Auxilio Mutuo Hospital
400021	Hospital De La Concepcion
400022	Hospital Damas
400044	San Lucas Ponce
400061	University District Hospital
400103	Mayaguez Medical Center
400105	Bayamon Regional Hospital
400112	Hospital Upr
400114	Hospital Dr. Alejandro Otero
400124	Hospital
410001	Memorial Hospital Of Rhode Island
410004	Roger Williams Hospital
410007	Rhode Island Hospital
410009	Kent County Memorial Hospital
410010	Women & Infants Hospital
410012	The Miriam Hospital
414000	Butler Hospital
420004	Medical University Of South Carolina
420007	Spartanburg Regional Medical Center
420009	Oconee Memorial Hospital
420018	Palmetto Richland
420027	Anmed Health
420033	Ghs Greer Memorial Hospital
420037	Ghs Hillcrest Memorial Hospital
420051	Mcleod Regional Medical Center
420071	Self Regional Healthcare
420078	Ghs Greenville Memorial Hospital
420079	Trident Regional Medical Center
420082	Aiken Regional Medical Center
420085	Grand Strand Regional Medical Center
420086	Palmetto Baptist
420102	Ghs Patewood Memorial Hospital
430016	Avera Mckennan
430027	Sanford Usd Medical Center
430077	Rapid City Regional Hospital
440002	Jackson-Madison County General Hosp
440012	Bristol Regional Medical Center
440015	University Of Tennessee Medical Cent
440017	Holston Valley Hosp & Med Ctr
440039	Vanderbilt University Medical Center
440048	Baptist Mem Hospital Memphis
440049	Methodist H/C Memphis Hospt.
440053	Saint Thomas Rutherford Hospital

CCN	Teaching Hospital Name
440063	Johnson City Medical Center
440082	Saint Thomas West Hospital
440104	Erlanger Medical Center
440111	Metro Nashville General Hospital
440133	Saint Thomas Midtown Hospital
440152	Regional One Health
440176	Indian Path Medical Center
440183	St. Francis Hospital
450002	The Hospitals Of Providence - Memori
450010	United Regional Health Care System
450011	St. Joseph Regional Health Center
450015	Dallas Co. Hosp. Dist.
450018	The University Of Texas Medical Br.
450021	Baylor University Medical Ctr
450024	University Medical Center Of El Paso
450033	Valley Baptist Medical Center
450035	St Joseph Medical Center
450037	Good Shepherd Medical Center
450039	Tchd D/B/A Jps Health Network
450040	Covenant Health System
450042	Providence Health Center
450044	Ut Southwestern University Hosp
450046	Christus Spohn Hosp Corpus Christi
450051	Methodist Dallas Medical Center
450054	Scott And White Memorial Hospital
450068	Memorial Hermann Texas Medical Cntr
450076	Ut Md Anderson Cancer Center
450101	Hillcrest Baptist Medical Center
450102	Christus Mother Frances Hosp-Tyler
450119	South Texas Health System
450124	University Med Center Brackenridge
450132	Medical Center Health System
450133	Midland Memorial Hospital
450135	Tx Hlth Harris Methodist Hospital
450184	Memorial Hermann Hospital Sys
450193	Chi St Lukes Health Baylor Med Ctr
450200	Wadley Regional Medical Center
450203	Weatherford Regional
450209	Northwest Texas Hospital
450213	University Health System
450222	Conroe Regional Medical Center
450231	Baptist Saint Anthonys Hospital
450237	Santa Rosa Healthcare
450280	Baylor Medical Center At Garland
450289	Harris Health System
450299	College Station Medical Center
450324	Texoma Medical Center
450330	Oakbend Medical Center
450352	Hunt Regional Medical Center
450358	The Methodist Hospital
450388	Methodist Hospital
450424	San Jacinto Methodist Hospital
450462	Texas Health Dallas
450638	Houston Northwest Medical Center
450644	West Houston Medical Center
450647	Medical City Dallas Hospital
450659	Park Plaza Hospital
450672	Plaza Medical Ctr Ft Worth

CCN	Teaching Hospital Name
450686	University Medical Center
450690	Ut Health Center At Tyler
450723	Methodist Charlton Medical Center
450766	Ut Southwestern Med Ctr- Zale Lipshy
450775	Kingwood Medical Center
450788	Corpus Christi Medical Center
450801	Christus St Michael
450809	North Austin Medical Center
450851	Baylor Heart And Vascular
450869	Doctors Hospital At Renaissance
453025	Memorial Hermann Tirr
453035	Sa Warm Springs Rehab Hosp
453036	Baylor Institute For Rehabilitation
453300	Cook Childrens Medical Center
453301	Driscoll Childrens Hospital
453302	Childrens Medical Center Of Dallas
453304	Texas Childrens Hospital
453310	Dell Childrens Medical Center
453315	Childrens Hospital Of San Antonio
454076	Harris Co Psychiatric Center
460001	Utah Valley Regional Med. Ctr.
460003	Salt Lake Regional Medical Center
460004	Mckay-Dee Hospital
460006	Lds Hospital
460009	U Of U Hospitals & Clinics
460010	Intermountain Medical Center
460047	St Marks Hospital
460060	Lone Peak Hospital
463301	Primary Childrens Hospital
464009	U Of Utah Neuropsychiatric Institute
470003	University Of Vermont Medical Center
470012	Southwestern Vermont Medical Center
490001	Norton Community Hospital Inc.
490005	Winchester Medical Center
490007	Sentara Norfolk General Hospital
490009	University Of Virginia Medical Cente
490011	Bon Secours Depaul Medical Center
490017	Maryview Hospital
490021	Centra Health
490024	Carilion Medical Center
490032	Vcu Health System Mcv Hospital
490033	Warren Memorial Hospital
490042	Carilion New River Valley Med Center
490043	Inova Loudoun Hospital Center
490044	Sentara Obici Hospital
490046	Sentara Leigh Hospital
490050	Virginia Hospital Center Arlington
490052	Riverside Regional Medical Center
490053	Johnston Memorial Hospital
490057	Sentara Va. Beach General Hospital
490059	St. Marys Hospital
490063	Inova Fairfax Hospital
490075	Danville Regional Medical Center
490110	Lewisgale Hospital - Montgomery
490112	Cjw Medical Center
490114	Lonesome Pine Hospital
490119	Sentara Princesss Anne Hospital
490136	St. Francis Medical Center

CCN	Teaching Hospital Name
493027	Riverside Rehabilitation Institute
493301	Childrens Hospital Of The Kings Da
500001	Uw Medicine/Northwest Hospital
500003	Phd#1 Dba Skagit Valley Hospital
500005	Virginia Mason Medical Center
500008	University Of Washington Med Ctr
500012	Yakima Regional Medical & Cardiac Ce
500019	Providence Centralia Hospital
500024	Providence St. Peter Hospital
500025	Swedish Medical Center Cherry Hill
500027	Swedish Medical Center
500036	Yakima Valley Memorial Hospital
500044	Deaconess Medical Center
500050	Peacehealth Southwest Medical Center
500053	Kennewick General Hospital
500054	Prov Sacred Heart Medical Center
500058	Kadlec Regional Medical Center
500064	Harborview Medical Center
500079	Good Samaritan Hospital
500088	Valley Medical Center
500119	Valley Hospital & Medical Center
500129	Tacoma General Allenmore Hospital
500141	St Francis Hospital
500152	Swedish Issaquah
503300	Seattle Childrens Hospital
510001	West Virginia University Hospitals
510002	Greenbrier Valley Medical Center
510006	United Hospital Center
510007	St. Marys Medical Center Inc.
510008	City Hospital Inc.
510022	Charleston Area Medical Center Inc.
510039	Ohio Valley General Hospital
510050	Wheeling Hospital
510055	Cabell Huntington Hospital
510058	Camden-Clark Memorial Hospital
510071	Bluefield Regional Medical Center
514008	River Park Hospital
514009	Mildred Mitchell-Bateman Hospital
520004	Mchs Franciscan Healthcare Inc
520008	Waukesha Memorial Hospital
520009	St. Elizabeth Hospital
520013	Sacred Heart Hospital
520028	Monroe Clinic
520030	Aspirus Wausau Hospital
520037	St. Josephs Hospital
520051	Columbia St Marys Hospital Milwaukee
520057	St. Clare Hospital
520066	Mercy Health System Corporation
520070	Mchs Eau Claire Hospital
520078	St. Francis Hospital
520083	St. Marys Hospital
520087	Gundersen Lutheran Medical Center I
520089	Meriter Hospital Inc.
520096	Wheaton Franciscan Healthcare - All
520098	University Of Wi Hospitals & Clinics
520136	Wheaton Franciscan Inc.
520138	Aurora Health Care Metro Inc.
520139	West Allis Memorial Hospital

CCN	Teaching Hospital Name
520160	Thedacare Regional Medical Center Ap
520177	Froedtert Mem. Lutheran Hospt.
520205	Midwest Orthopedic Specialty Hosp
523300	Childrens Hospital Of Wisconsin

CCN	Teaching Hospital Name
524000	Aurora Psychiatric Hospital
524001	Milwaukee Cty Mental Health Complex
530012	Wyoming Medical Center
530014	Cheyenne Regional Medical Center
670019	University General Hospital Lp

TABLE C-10: PPS-EXEMPT CANCER HOSPITALS[44]

CCN	PPS-Exempt Cancer Hospital Name
050146	City of Hope National Medical Center
050660	USC Kenneth Norris Jr. Cancer Hospital
100079	University of Miami Hospital and Clinics
100271	H. Lee Moffitt Cancer and Research Institute Hospital, Inc.
220162	Dana-Farber Cancer Institute
330154	Memorial Hospital for Cancer and Allied Disease
330354	Roswell Park Memorial Institute
360242	Arthur G. James Cancer Hospital and Research Institute
390196	American Oncologic Hospital (Fox Chase)
450076	The University of Texas M. D. Anderson Cancer Center
500138	Fred Hutchinson Cancer Research Center (Seattle Cancer Care Alliance)

TABLE C-11: U.S. CENSUS DIVISIONS[45]

Census Division	Included States
New England	Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont
Middle Atlantic	New Jersey, New York, Pennsylvania
East North Central	Illinois, Indiana, Michigan, Ohio, Wisconsin
West North Central	Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota
South Atlantic	Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia
East South Central	Alabama, Kentucky, Mississippi, Tennessee
West South Central	Arkansas, Louisiana, Oklahoma, Texas
Mountain	Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming
Pacific	Alaska, California, Hawaii, Oregon, Washington

References

1. Al-Hamadani M, Habermann TM, Cerhan JR, Macon WR, Maurer MJ, Go RS. Non-Hodgkin lymphoma subtype distribution, geodemographic patterns, and survival in the US: A longitudinal analysis of the National Cancer Data Base from 1998 to 2011. *Am J Hematol*. 2015;90(9):790-795. doi:10.1002/ajh.24086
2. NIH. Cancer Stat Facts : NHL — Diffuse Large B-Cell Lymphoma (DLBCL). Published 2020. Accessed January 10, 2020. https://seer.cancer.gov/statfacts/html/dlbcl.html
3. Epperla N, Badar T, Szabo A, et al. Postrelapse survival in diffuse large B-cell lymphoma after therapy failure following autologous transplantation. *Blood Adv*. 2019;3(11):1661-1669. doi:10.1182/bloodadvances.2019000102
4. National Comprehensive Care Network. *NCCN Clinical Practice Guidelines in Oncology (NCCN Guidelines): B-Cell Lymphomas*.; 2019.
5. Levine BL, Miskin J, Wonnacott K, Keir C. Global Manufacturing of CAR T Cell Therapy. *Mol Ther - Methods Clin Dev*. 2017;4(March):92-101. doi:10.1016/j.omtm.2016.12.006
6. Yescarta package insert. *U S Food Drug Adm*. 2017;(October). https://www.fda.gov/media/108377/download
7. Kymriah Package Insert. *U S Food Drug Adm*. Published online 2017:1-14. https://www.fda.gov/media/107296/download
8. U. S. Food and Drug Administration (FDA). FDA approves brexucabtagene autoleucel for relapsed or refractory mantle cell lymphoma. Published 2020. https://www.fda.gov/drugs/fda-approves-brexucabtagene-autoleucel-relapsed-or-refractory-mantle-cell-lymphoma
9. U. S. Food and Drug Administration (FDA). FDA approves axicabtagene ciloleucel for large B-cell lymphoma. Published 2017. https://www.fda.gov/drugs/resources-information-approved-drugs/fda-approves-axicabtagene-ciloleucel-large-b-cell-lymphoma
10. U. S. Food and Drug Administration (FDA). FDA approves tisagenlecleucel for adults with relapsed or refractory large B-cell lymphoma. Published 2018. https://www.fda.gov/drugs/resources-information-approved-drugs/fda-approves-tisagenlecleucel-adults-relapsed-or-refractory-large-b-cell-lymphoma
11. Centers for Medicare & Medicaid Services (CMS). Medicare Program; Hospital Inpatient Prospective Payment Systems for Acute Care Hospitals and the Long-Term Care Hospital Prospective Payment System and Final Policy Changes and Fiscal Year 2021 Rates; Quality Reporting and Medicare and Medicaid Promoting. *Dep Heal Hum Serv*. Published online 2020. doi:10.1017/CBO9781107415324.004
12. Quinn C, Young C, Thomas J, Trusheim M. Estimating the Clinical Pipeline of Cell and Gene Therapies and Their Potential Economic Impact on the US Healthcare System. *Value Heal*. 2019;22(6):621-626. doi:10.1016/j.jval.2019.03.014
13. National Comprehensive Care Network. The NCCN Clinical Practice Guidelines in Oncology. Published 2015. Accessed October 1, 2020. https://www.nccn.org/professionals/
14. Gajra A, Jeune-Smith Y, Kish J, Yeh TC, Hime S, Feinberg B. Perceptions of community hematologists/oncologists on barriers to chimeric antigen receptor T-cell therapy for the treatment of diffuse large B-cell lymphoma. *Immunotherapy*. 2020;12(10):725-732. doi:10.2217/imt-2020-0118
15. Elverum K, Whitman M. Delivering cellular and gene therapies to patients: solutions for realizing the potential of the next generation of medicine. *Gene Ther*. Published online 2019. doi:10.1038/s41434-019-0074-7
16. Liu Y, Barta SK. Diffuse large B-cell lymphoma: 2019 update on diagnosis, risk stratification, and treatment. *Am J Hematol*. 2019;94(5):604-616. doi:10.1002/ajh.25460
17. Umberto Vitolo, Marek Trněný, David Belada, et al. Obinutuzumab or Rituximab Plus CHOP in Patients with Previously Untreated Diffuse Large B-Cell Lymphoma: Final Results from an Open-Label, Randomized Phase 3 Study (GOYA). *J Hematol Oncol*. 2016;128(22):470. doi:10.1182/blood.V128.22.470.470
18. Bartlett NL, Wilson WH, Jung SH, et al. Dose-adjusted EPOCH-R compared with R-CHOP as frontline therapy for diffuse large B-cell lymphoma: Clinical outcomes of the Phase III intergroup trial alliance/CALGB 50303. *J Clin Oncol*. 2019;37(21):1790-1799. doi:10.1200/JCO.18.01994
19. Ren J, Asche C V., Shou Y, Galaznik A. Economic burden and treatment patterns for patients with diffuse large B-cell lymphoma and follicular lymphoma in the USA. *J Comp Eff Res*. 2019;8(6):393-402.

doi:10.2217/cer-2018-0094

20. Sehn LH, Berry B, Chhanabhai M, et al. The revised International Prognostic Index (R-IPI) is a better predictor of outcome than the standard IPI for patients with diffuse large B-cell lymphoma treated with R-CHOP. *Blood*. 2007;109(5):1857-1862. doi:10.1182/blood-2006-08-038257

21. National Comprehensive Care Network. *NCCN Framework for Resource Stratification of NCCN Guidelines: B-Cell Lymphomas: Enhanced Resources (Preliminary)*.; 2019.

22. Schmidt C. What Drives Diffusion of New Chancer Therapies. *Cancer Epidemiol Biomarkers Prev*. 2015;107(6):2-3. doi:10.1093/jnci/djv162

23. Jørgensen J, Hanna E, Kefalas P. Outcomes-based reimbursement for gene therapies in practice: the experience of recently launched CAR-T cell therapies in major European countries. *J Mark Access Heal Policy*. 2020;8(1):1715536. doi:10.1080/20016689.2020.1715536

24. Leech AA, Neumann PJ, Cohen JT, Jagasia M, Dusetzina SB. Balancing Value with Affordability: Cell Immunotherapy for Cancer Treatment in the U.S. *Oncologist*. 2020;25(7):1117-1119. doi:10.1634/theoncologist.2020-0025

25. Centers for Medicare & Medicaid Services (CMS). *Medicare Program; Hospital Inpatient Prospective Payment Systems for Acute Care Hospitals and the Long- Term Care Hospital Prospective Payment System and Policy Changes and Fiscal Year 2020 Rates*. Vol 84.; 2019. https://www.govinfo.gov/app/details/FR-2019-08-16/2019-16762

26. Centers for Medicare & Medicaid Services (CMS). *Medicare Program; Hospital Inpatient Prospective Payment Systems for Acute Care Hospitals and the LongTerm Care Hospital Prospective Payment System and Policy Changes and Fiscal Year 2019 Rates*. Vol 83.; 2018. https://www.govinfo.gov/content/pkg/FR-2018-08-17/pdf/2018-16766.pdf

27. Centers for Medicare & Medicaid Services (CMS). *Decision Memo for Chimeric Antigen Receptor (CAR) T-Cell Therapy for Cancers (CAG-00451N)*.; 2020. https://www.cms.gov/medicare-coverage-database/details/nca-decision-memo.aspx?NCAId=291

28. Moreno Cortes EF, Stein CK, Lengerke Diaz PA, Ramirez-Segura CA, Castro JE. Chimeric Antigen Receptor T Cell Therapy Pipeline at a Glance: A Retrospective and Systematic Analysis from Clinicaltrials.Gov. *Blood*. 2019;134(Supplement_1):5629-5629. doi:10.1182/blood-2019-132273

29. Centers for Medicare & Medicaid Services (CMS). *Chronic Condition Warehouse (CCW) and Virtual Research Data Center (VRDC) Data Output Review Process*.; 2020.

30. Kaiser Family Foundation. Health Insurance Coverage of the Total Population, Multiple Sources of Coverage | KFF. Kaiser Family Foundation. Published 2018. https://www.kff.org/other/state-indicator/total-population/

31. U.S. Census Bureau. 2017 American Community Survey Tables. Census.gov. Published 2017. https://data.census.gov/cedsci/

32. Andrews M. Staggering Prices Slow Insurers' Coverage Of CAR-T Cancer Therapy. *Kaiser Heal News*. Published online 2018. https://khn.org/news/staggering-prices-slow-insurers-coverage-of-car-t-cancer-therapy/

33. Advisory Board. Medicare is expanding CAR T-cell therapy coverage nationwide. (But some providers aren't happy.). Published 2020. Accessed October 18, 2020. https://www.advisory.com/daily-briefing/2019/08/09/car-t

34. Centers for Medicare & Medicaid Services (CMS). *Billing Instructions for Beneficiaries Enrolled in Medicare Advantage (MA) Plans for Services Covered by Decision Memo CAG-00451N*.; 2019. https://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNMattersArticles/Downloads/SE19024.pdf

35. US Government Accountability Office. *Payment Methods for Certain Cancer Hospitals Should Be Revised to Promote Efficiency*.; 2015. https://www.gao.gov/assets/670/668605.pdf

36. Centers for Medicare & Medicaid Services (CMS). *Open Payments List of Teaching Hospitals*.; 2017. https://www.cms.gov/OpenPayments/Downloads/2018-Reporting-Cycle-Teaching-Hospital-List-pdf.pdf

37. Centers for Medicare & Medicaid Services (CMS). Glossary and Acronyms. Published 2018. Accessed October 18, 2020. https://www.cms.gov/OpenPayments/About/Glossary-and-Acronyms#teachinghospital

38. Cutler D, Kirson N, Long G. Financing Drug Innovation in the US: Current Framework and Emerging

Challenges. *Pharmacoeconomics*. 2020;38(9):905-911. doi:10.1007/s40273-020-00926-2

39. Caffrey M. NCCN Panel Digs Into Reality of CAR T-Cell Reimbursement. *AJMC*. Published online 2020:2-8. https://www.ajmc.com/view/nccn-panel-digs-into-reality-of-car-tcell-reimbursement

40. Institute for Clinical and Economic Review. *Chimeric Antigen Receptor (CAR) T Cell Therapy for B Cell Cancers*.; 2018. https://icer-review.org/wp-content/uploads/2017/07/ICER_CAR_T_Final_Evidence_Report_032318.pdf

41. Nandakumar AK, Beswick J, Thomas CP, Wallack SS, Kress D. Pathways of health technology diffusion: The United States and low-income countries. *Health Aff*. 2009;28(4):986-995. doi:10.1377/hlthaff.28.4.986

42. Find a KYMRIAH Treatment Center. Published 2020. Accessed October 12, 2020. https://www.us.kymriah.com/treatment-center-locator/

43. Find an Authorized Treatment Center. Published 2020. Accessed October 12, 2020. https://www.yescarta.com/find-a-treatment-center/

44. Centers for Medicare & Medicaid Services (CMS). *PPS-Exempt Cancer Hospitals (PCHs)*. Vol 1983.; 2020. https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/AcuteInpatientPPS/PPS_Exc_Cancer_Hospasp

45. U.S. Census Bureau. Census Regions and Divisions of the United States. Published 2010. Accessed October 18, 2020. https://www2.census.gov/geo/pdfs/maps-data/maps/reference/us_regdiv.pdf

Milliman is among the world's largest providers of actuarial and related products and services. The firm has consulting practices in life insurance and financial services, property & casualty insurance, healthcare, and employee benefits. Founded in 1947, Milliman is an independent firm with offices in major cities around the globe.

milliman.com

CONTACT

Maggie Alston
maggie.alston@milliman.com

Carol Bazell
carol.bazell@milliman.com

Melissa Caplen
melissa.caplen@milliman.com