An Evaluation of the Total Cost of Care for the Treatment of Relapsed/Refractory Multiple Myeloma with a Focus on B-Cell Maturation Antigen Targeting Therapies

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Background

Multiple myeloma (MM) is a cancer of the plasma cells and accounts for 10% of hematologic malignancies and 1% of all cancers[9]. A majority of MM cases are diagnosed in patients 65 years and older and has been found to be one the costliest cancers, despite affecting a smaller population of people[5].

In the last few years, the FDA has approved B-cell maturation antigen (BCMA) targeting therapies, including two chimeric antigen receptor (CAR) T-cell therapies, Abecma® (idecabtagene-vicleucel (ide-cel)) and Carvykti® (ciltacabtagene-autoleucel (cilta-cel)). CAR T is a one-time intravenous administration . Prior to CAR T administration patients are required to undergo leukapheresis to extract T-cells needed to manufacture the CAR T of choice. During this waiting period, patients may receive bridging therapy. One cycle of pre-treatment lymphodepleting chemotherapy is required to promote CAR T expansion and persistence[13].

The bispecific antibody therapy, Tecvayli® (teclistamab) also targets BCMA and is weight-based, subcutaneous, "off the shelf" product[2,11]. Inpatient administration consisting of 2 step-up doses and 1 maintenance dose is required, followed by weekly outpatient maintenance doses.

Objective

To describe the total cost of care and healthcare resource utilization for members initiating BCMA-targeted therapy for relapsed, refractory multiple myeloma.

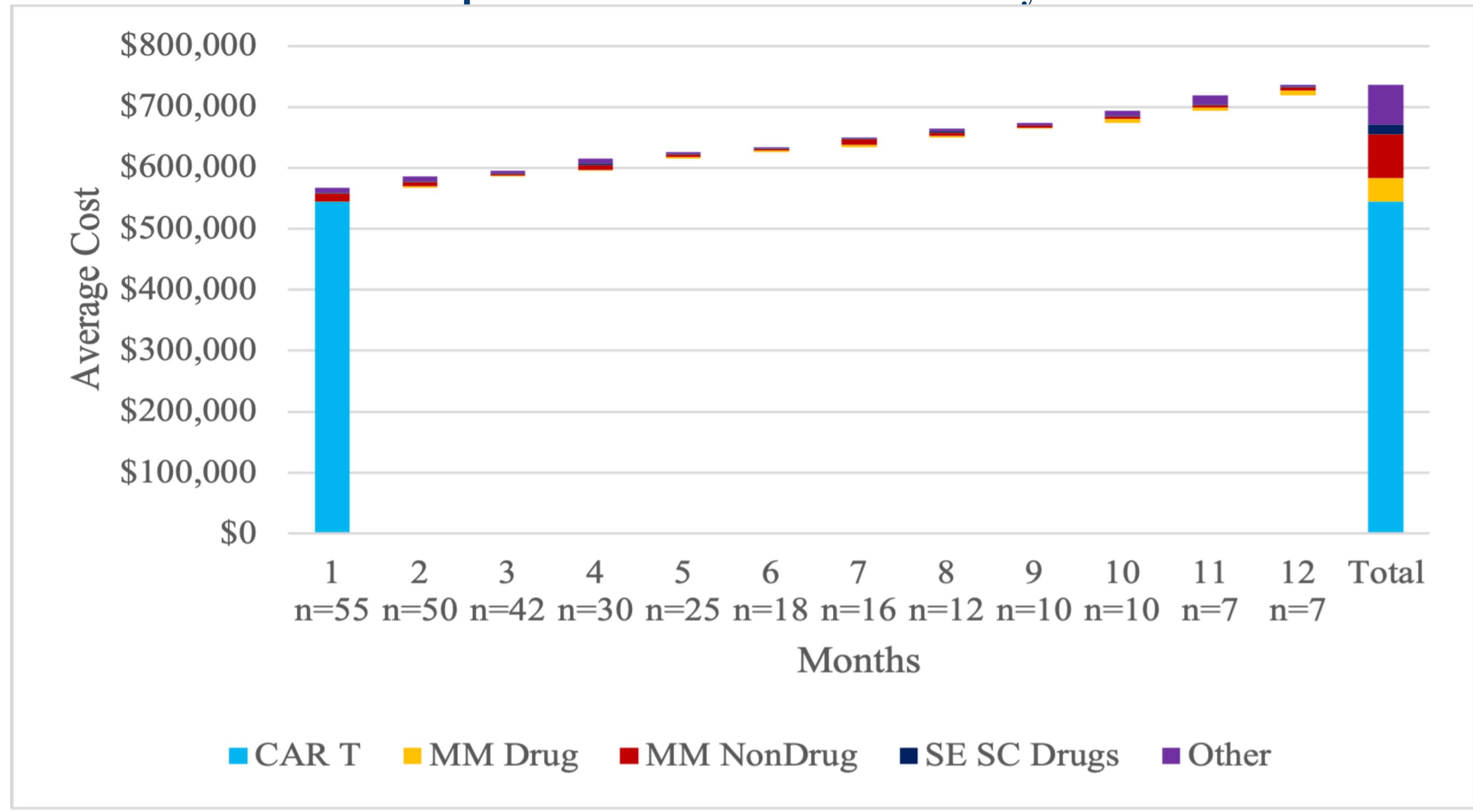
Methods

Analysis was conducted using integrated pharmacy and medical claims from a ~16 million commercially and ~800,000 Medicare insured populations. Ide-cel and cilta-cel (CAR T) claims were identified between March 2021, to March 2023, while teclistamab claims were identified from October 2022, through March 2023, using product specific codes. The first claim of the index drugs for each member was identified as their index date. Patients included were required to have continuous enrollment of 45 days before the index date. The timeframe of 45 days was chosen to capture the manufacturing processes that on average can take up to 4-6 weeks. Each members' post-index continuous enrollment was included until disenrollment, 365 days, or end of study period (March 31, 2023) which ever was earlier. Claims were categorized into 5 buckets shown below. Descriptive statistics were used to describe age, gender, and insurance coverage and costs. Teclistamab cost was extrapolated out to 8.5 months reflecting the median duration of therapy[11].

Total Cost				
Index Therapy	**Multiple Myeloma (MM) Drug**	**Multiple Myeloma (MM) NonDrug**	**Side Effect/Supportive Care Drug**	**Other**
Teclistamab Or CAR T (ide-cel, cilta-cel)	Other MM drugs besides drug of index e.g. daratumumab, lenalidomide, carfilzomib, bortezimib, pomalide, etc	Any remaining claim (i.e. nondrug) with a primary diagnosis code for multiple myeloma	E.g. denosumab, IV immunoglobulin, siltuximab, tocilizumab, granulocyte colony stimulating factor, epoetin alfa, low molecular weight heparin	Any remaining claims

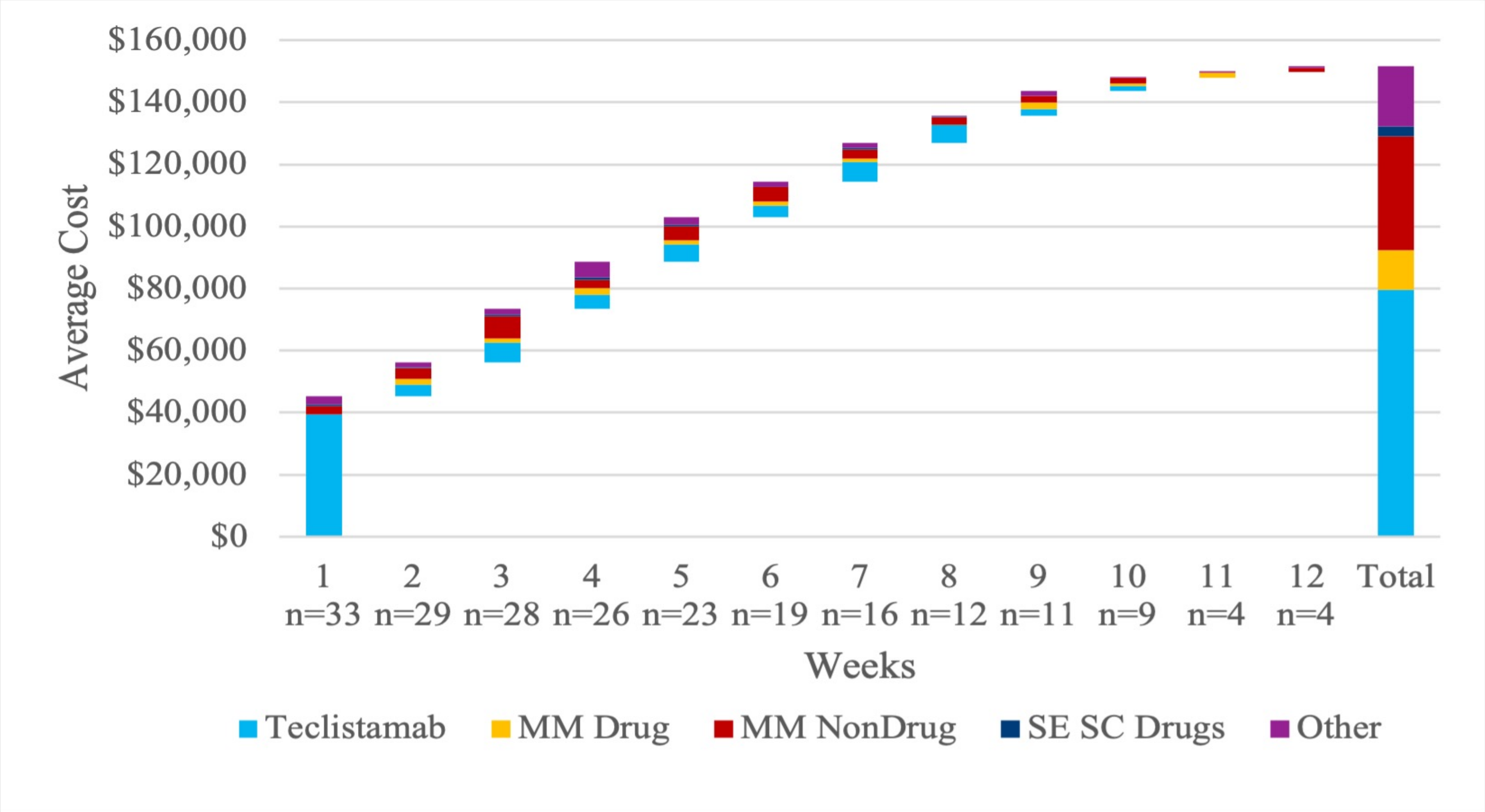
Results

Graph 1: CAR T Total Cost over 1 year



Total column reflects total average cost accumulated over 1 year for a patient after receiving CAR T. The n represents patients in continuous enrollment for the full month. 10 patients had less than 1 month of continuous enrollment data, so they were not included in the cost trend analysis. Baseline characteristics remained similar to Table 3. The total cost of care accumulated over 1 year is $736,231 and the cost of CAR T is $546,053, making up 74% of total cost of care.

Graph 2: Teclistamab Total Cost over 12 weeks



Total column reflects total average cost accumulated over 12 weeks for a patient receiving teclistamab. The n represents patients who were continuously enrolled for the full week. 4 patients had less than 7 days of continuous enrollment data, so they were not included in the cost trend analysis. Baseline characteristics remained similar to Table 3. The total cost of care accumulated over 12 weeks is $151,660 and the cost of teclistamab is $79,680, making up 53% of the total cost of care.

Table 1: Descriptive Statistics for Drug Cost

Index Drug	WAC	Min	25th Percentile	Median	Average	75th Percentile	Max
CAR T	$442,250	$1,556	$420,473	$480,716	$557,698	$585,114	$1,840,432
Teclistamab	$406,770	$47,553	$211,036	$388,251	$464,751	$573,404	$2,999,766

Both CAR Ts (ide-cel and cilta-cel) are included in this analysis. WAC was calculated by taking the average of the WACs for each CAR T (ide-cel and cilta-cel).

For teclistamab, WAC is $1,770 for a 30mg/3ml bottle. The displayed WAC was calculated using the average weight of 80kg and includes 2 step up doses (0.06mg/kg and 0.3mg/kg)[7]. Both the WAC and descriptive statistics were calculated to 8.5 months since that was the average treatment duration from MajesTEC-1[8]. To extrapolate out to 8.5 months, we found the average cost of the first 3 doses, which are inpatient and given in the first week[11] then found the average outpatient dose, which is given once weekly. The average inpatient doses were multiplied by 3 and the outpatient doses were multiplied by 33 to account for 8.5 months of treatment.

Table 2: Descriptive Statistics for pre-CAR T Treatment Costs

PRE-CAR T	Average	Min	Max	Median	Stdev	Skew
Total Cost	$54,591	$101	$257,106	$44,557	$45,506	1.68
Overall Multiple Myeloma (MM) Cost	$42,807	$1,894	$117,789	$36,731	$31,570	0.70

Pre-CAR T treatment costs were included to reflect bridging and lymphodepleting costs prior to receiving CAR T. Total cost reflects all costs incurred during the pre-period and includes all buckets. Overall Multiple Myeloma Cost reflects all costs associated with the treatment of multiple myeloma and includes MM drug cost, SE SC Drug Cost, and MM NonDrug Cost.

Table 3: Baseline Characteristics

Baseline Characteristics	CAR T (n=65)	Tecvayli (n=37)
Gender		
Male	36 (55%)	23 (62%)
Female	29 (45%)	14 (38%)
Average Age	60.5	62.9
Line of Business		
Commercial	52 (80%)	25 (68%)
Medicare	13 (20%)	12 (32%)
Received other MM therapies	12 (18%)	2 (5%)

Demographic characteristics of patients included in the study. CAR T is comprised of ide-cel (n=44) and cilta-cel (n=21). Received other MM therapies indicates number of patients who received other MM drugs after receiving the index therapy. For all CAR T cohort occurrences, ide-cel was the CAR T that these patients received as their index therapy.

Results

The average days following CAR T administration was 144 days, with the study including 65 patients. The average pre-treatment total cost of care was $54,591 and the average MM treatment cost was $42,807. The average cost of CAR T was $557,698 with the median cost of $480,716. For teclistamab the average days patients were on treatment was 45, with the study including 37 patients who met the inclusion criteria. When extrapolated out to 8.5 months, the average cost of teclistamab was $464,751, with the median being $388,251. Teclistamab is weight-based and administered weekly and pre-treatment cost was not considered for teclistamab since it is not required.

Most of the cost for CAR T patients was concentrated in the first month. The second highest cost category was MM NonDrug followed by Other and then side effect/supportive care (SE/SC). The average total cost of care for a patient who received CAR T was $736,231 over 1 year. For the timeline analysis of teclistamab, the highest cost was incurred during the first week. MM nondrug was the second highest cost category, followed by other costs, then MM drug and finally SE/SC management. The total cost of care for patients receiving teclistamab over 12 weeks was $151,660.

Limitations

- Small sample number allows outliers to skew data and decreases accuracy.
- Variable post-index days make it difficult to analyze all post treatment costs due to the variation in amount of data pulled for each patient.
- Real-world coding inaccuracies can make data hard to interpret
- Inconsistent inpatient coding practices as claim evidence of drug administration did not always reflect the expected cost.
- Lack of electronic health record data for assessing outcomes.

Conclusions

The findings of this study describe the real-world costs associated with receiving BCMA-targeted therapies in the US market as of March 2023. The data presented in this study is preliminary and ongoing assessment is needed to arrive at the real-world calculation. The breakdown into cost categories shows cost distribution, indicating that most of the total cost of care for both CAR T and teclistamab comes from BCMA targeted therapies themselves. However, the cost trend differs between the products as CART requires the full up-front cost on day 1 while teclistamab cost is spread over time due to its weekly dosing. These total cost of care trend differences may become important to stakeholders in their effort to optimize outcomes and ensure cost effective use of targeted BCMA therapies. However, more real-world data on safety, durability and appropriate patient selection will be needed.

As additional data becomes available and more RRMM patients are treated with these novel agents, an understanding of the real-world total cost of care of BCMA-targeted therapies will provide insights to patients, providers, and payers to the overall cost of these agents.

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Thank you to Pfizer, Inc. for funding the AMCP Foundation Oncology Internship Program.