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Impact of Race and Social Determinants of Health on Outcomes in Patients with Aggressive B-cell nHL Treated with CAR-T

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Abstract:
Healthcare disparities driven by multiple social, economic, and/or environmental factors lead to inequalities in health outcomes. CAR-T cell immunotherapy is an effective therapy for relapsed/refractory B-cell non-Hodgkin lymphoma (r/r B-NHL). However, data are limited on the impact of the convergence of race and social determinants of health on outcomes for patients treated with CAR-T therapy. We examined the impact of interactions between race and insurance type on health care utilization and outcomes in patients treated with CAR-T for aggressive B-NHL. Adult patients with r/r B-NHL treated with CD19 CAR-T were identified between 2015 and 2021 across 13 US academic centers. Insurance type, demographic and clinical data were collected and analyzed via Chi-squared and Kaplan-Meier analysis. Cox multivariable regression (MVA) was used to determine the impact of race/ethnicity and other variables on survival. 466 adult patients were included in our analysis. Median follow-up after CAR-T was 12.7 months. Median progression free survival (mPFS) was longer for Caucasians (11.5 months) than for African Americans (3.5 months, HR 1.56 [1.03-2.4], p=0.04) or Asians (2.7 months, HR 1.7 [1.02-2.67], p=0.04). Differences in median overall survival (mOS) were not significant. For Medicare (n=206) vs Medicaid (n=33) vs private insurance (n=219) vs self-pay (n=7): mPFS was 15.9 vs 4.2 vs 6.0 vs 0.9 months (p<0.001) and mOS was 31.2 vs 12.8 vs 21.5 vs 3.2 months (p<0.001), respectively. Collectively, our multi-center retrospective analysis showed that race and insurance status can impact outcomes for patients treated with CAR-T cell therapy.

Conflict of interest: COI declared - see note

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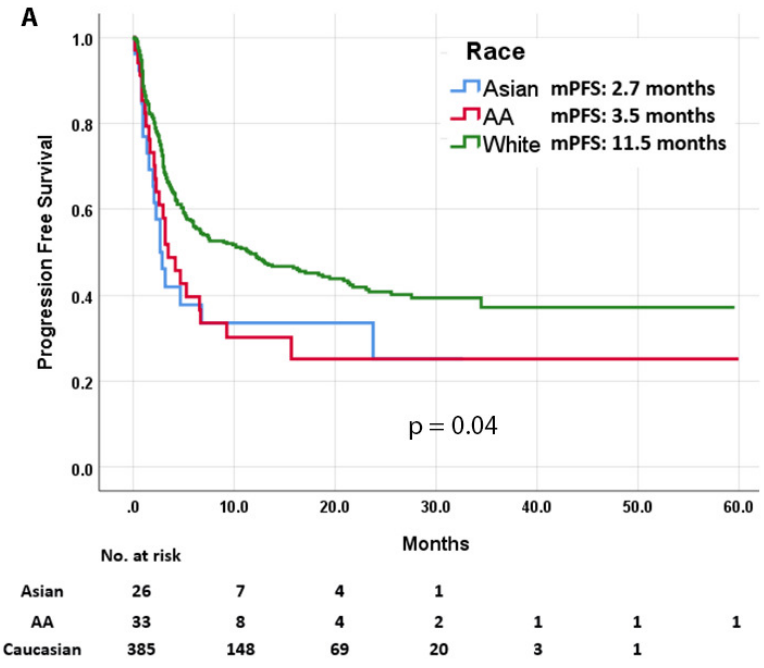
Figure 1



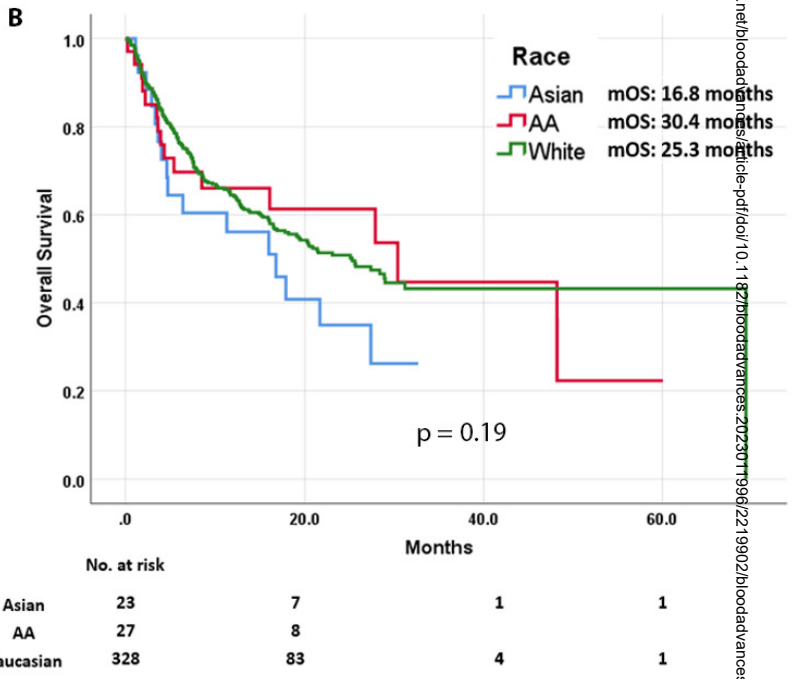
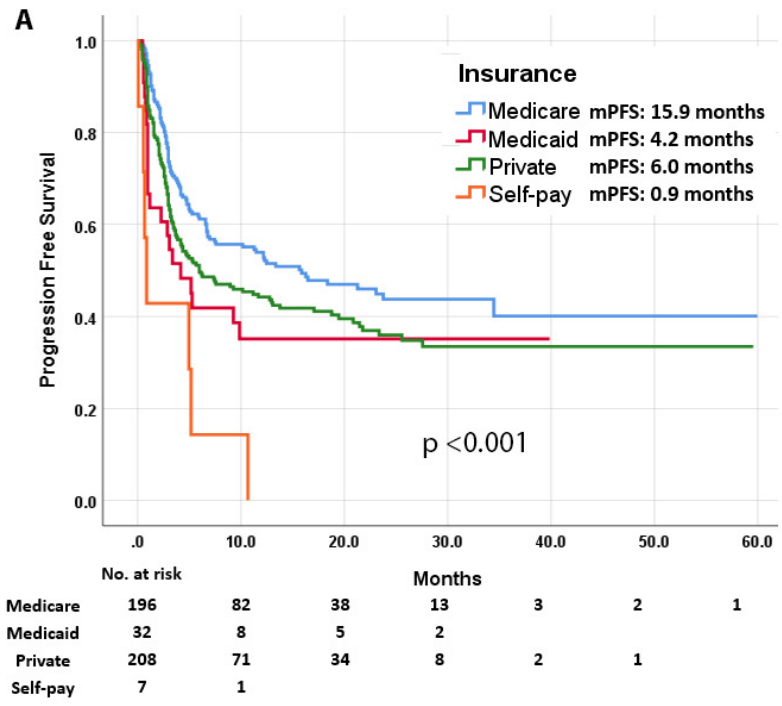
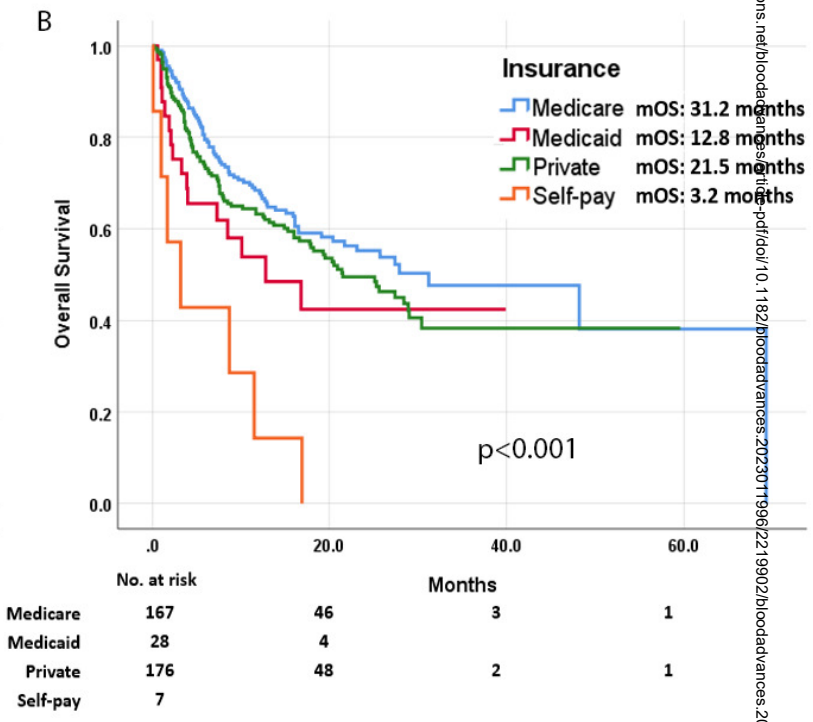


Figure 2





Impact of Race and Social Determinants of Health on Outcomes in Patients with Aggressive B-cell nHL Treated with CAR-T

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Abstract (244/250):

Healthcare disparities driven by multiple social, economic, and/or environmental factors lead to inequalities in health outcomes. CAR-T cell immunotherapy is an effective therapy for relapsed/refractory B-cell non-Hodgkin lymphoma (r/r B-NHL). However, data are limited on the impact of the convergence of race and social determinants of health on outcomes for patients treated with CAR-T therapy. We examined the impact of interactions between race and insurance type on health care utilization and outcomes in patients treated with CAR-T for aggressive B-NHL. Adult patients with r/r B-NHL treated with CD19 CAR-T were identified between 2015 and 2021 across 13 US academic centers. Insurance type, demographic and clinical data were collected and analyzed via Chi-squared and Kaplan-Meier analysis. Cox multivariable regression (MVA) was used to determine the impact of race/ethnicity and other variables on survival. 466 adult patients were included in our analysis. Median follow-up after CAR-T was 12.7 months. Median progression free survival (mPFS) was longer for Caucasians (11.5 months) than for African Americans (3.5 months, HR 1.56 [1.03-2.4], p=0.04) or Asians (2.7 months, HR 1.7 [1.02-2.67], p=0.04). Differences in median overall survival (mOS) were not significant. For Medicare (n=206) vs Medicaid (n=33) vs private insurance (n=219) vs self-pay (n=7): mPFS was 15.9 vs 4.2 vs 6.0 vs 0.9 months (p<0.001) and mOS was 31.2 vs 12.8 vs 21.5 vs 3.2 months (p<0.001), respectively. Collectively, our multi-center retrospective analysis showed that race and insurance status can impact outcomes for patients treated with CAR-T cell therapy.

Key Point 1: Racial disparities exist in patients who received CAR-T therapy for aggressive B-NHL.

Key Point 2: Payor status impacts survival with improved survival noted in Medicare patients receiving CART.

Background:

Healthcare disparities driven by multiple social, economic, and/or environmental factors lead to inequalities in health outcomes [1,2]. Racial and ethnic disparities are further exacerbated by lower enrollment in clinical trials for new and promising therapies, which may ultimately lead to differences in outcomes and less utilization once these products are fully available on the market [3,4]. Insurance status is often a factor that further compounds these disparities [5]. Chimeric antigen receptor T-cell therapy (CAR-T) is a novel therapy for relapsed and refractory (r/r) B cell non-Hodgkin lymphoma (B-NHL) [6–8]. CAR-T therapy is now recommended as third line therapy and beyond for diffuse large B cell lymphoma (DLBCL) patients as well as for second line therapy in those who are transplant ineligible or who have primary refractory or relapsed disease occurring less than 12 months following first line chemotherapy, a population in which outcomes have been traditionally very poor. Trials have shown that in the second line setting, CAR-T has improved progression free survival (PFS) and overall survival (OS) as compared to autologous stem cell transplantation[9]. However, there is evidence that past and present clinical trials for CAR-T therapy have had suboptimal accrual of racial and ethnic minority patients [10,11]. For example, only 5% of patients on the pivotal Zuma 7 trial were Hispanic and 5% were African American[12]. As a result, data that examines the impact of race and social determinants of health on outcomes in patients treated with CAR-T therapy are limited. To address this gap, our objective was to examine the impact of interactions between race and insurance type, on access to care, health care utilization, and outcomes, in patients treated with CAR-T for aggressive B-NHL.

Methods:

We conducted a multi-center retrospective cohort study that included patients from 13 US academic centers. This study was approved by the Institutional Review Board of all involved sites. We identified adult patients diagnosed with relapsed or refractory (r/r) aggressive non-Hodgkin B cell lymphoma (B-NHL) treated with CD19 chimeric antigen receptor T-cell therapy (CAR-T) between January 1, 2015, through December 25, 2021. Variables examined included baseline demographics, insurance type, and clinical data. Demographic data included age at time of treatment, sex, and race. Race was stratified between Caucasian, African American

(AA), Asian, or other. We excluded patients categorized as “other” from our analysis as there were only 2 patients. Ethnicity was identified as either Hispanic or non-Hispanic. Both race and ethnicity were extracted from electronic medical records.

To evaluate clinical factors and health care utilization patterns that could impact outcomes, we assessed median lines of therapy prior to CAR-T, exposure to autologous stem cell transplantation (SCT) prior to CAR-T, median time from diagnosis to initiation of CAR-T, median time from most recent relapse or progression to initiation of CAR-T, time from apheresis to CAR-T infusion; utilization of bridging therapy, type of CAR-T construct used, administration of CAR-T on clinical trial, and administration of therapy after failure of CAR-T. Insurance type was categorized as either Medicare, Medicaid, private insurance, or self-pay. Outcomes that we analyzed were rates of toxicity including cytokine release syndrome (CRS) and immune-effector cell associated neurotoxicity syndrome (ICANS), overall response rate (ORR), complete response rate (CR), progression free survival (PFS), and overall survival (OS).

Baseline demographics, insurance type, and clinical data were compared across race and analyzed using chi-squared tests. PFS and OS were estimated using Kaplan-Meier analysis and their differences assessed by log-rank test. A cox multivariable regression was used to analyze the impact of race, ethnicity, and other clinical and demographic variables on PFS and OS. Variables used in the multivariable analysis (MVA) included race, age, insurance type, measures of disease burden (LDH, IPI at time of apheresis), and parameters of healthcare utilization including prior autologous SCT, CAR-T cell therapy administration on clinical trial, and use of bridging therapy to address our study objective.

IRB approval from Northwestern University

Results

Patient Characteristics and Measures of Health Care Utilization Prior to CAR-T

466 adult patients were included in our analysis. Table 1 outlines demographic and clinical data, and parameters of healthcare utilization for our patients. Only patients with de novo DLBCL or transformed follicular lymphoma were included for analyses. 406 (87%) patients were Caucasian, 34 (7%) AA and 26 (6%) Asian. Nine (2%) patients were Hispanic, all of whom identified as Caucasian. Caucasians were older compared to AAs and Asians (median age 59 vs 55 vs 55 years; p=0.004). There was no significant difference in median number of lines of therapy prior to CART by race (p=0.44). However, Caucasians were more likely to have had prior autologous SCT (p=0.04).

For Caucasians versus AAs versus Asians: median time from last relapse/progression pre-CAR-T to CAR-T was 2 vs 1.8 vs 1.2 months (p=0.9), rates of bridging were 44% vs 61% vs 46% (p=0.17)

and rates of utilization of clinical trials for CAR-T access were 29% vs 15% vs 19% (p=0.12), respectively. Median time from apheresis to CAR-T was 1.1 vs 1.1 vs 0.9 months (p=0.2), respectively. Asian patients had a significantly higher rate of LDH elevation at time of CAR-T collection (83%) than Caucasians (54%) and AAs (41%), (p=0.005). There was no difference in rates of grade 3 or higher CRS or ICANS across race (p=0.8 and 0.4 respectively).

Table 2 outlines clinical characteristics of our patients stratified by insurance type. Of note, we did not have any patients with non-Medicare/Medicaid forms of governmental insurance in our dataset. Self-pay patients predominantly consisted of international patients traveling to centers in the United States for CAR-T. There was no significant difference between types of insurance coverage (p=0.09) between races. As to be expected, Medicare patients were found to be significantly older than patients with other insurance types (64.0 years for Medicare vs 52.5 years for Medicaid vs 56.0 years for private vs 56.0 years for self-pay; p<0.001). Medicare patients also had a significantly longer time from initial diagnosis to CAR-T initiation (26.2 months) vs Medicaid (14.4 months) vs private (14.0 months) vs self-pay (14.5 months; p=0.001). There was no difference in rates of bridging therapy between insurance types (p=0.166), time from last progression to CAR-T (p= 0.067), nor LDH elevation at time of apheresis (p=0.979).

Response Rates and Next Line Treatment

Caucasian and AA patients had a higher day 180 ORR than Asian patients (51% vs 46% vs 19% respectively, p=0.04). However, there was no difference in day 180 CR between races (43% vs 42% vs 19% respectively, p=0.15).

Following progression, practice patterns for next line therapy were compared. The most commonly used next line therapies included chemotherapy, radiation, immunomodulatory agents, checkpoint inhibitors and polatuzumab-bendamustine-rituximab (pola-BR). For these salvage regimens, there was no difference in rates of utilization between races (p=0.812). However, Caucasians trended towards having further lines of therapy following progression after CAR-T therapy when compared to AA and Asian patients (46% vs 25% vs 28% respectively, p=0.05). Salvage therapies following CAR-T administration did not differ significantly between insurance groups (p=0.683).

Survival Outcomes

Median follow-up time was 12.7 months for our cohort. Median PFS (mPFS) was longer for Caucasians (11.5 months) than for AAs (3.5 months, HR 1.56 [1.03-2.4], p=0.04) or Asians (2.7 months, HR 1.7 [1.02-2.67], p=0.04, figure 1A). Differences in median OS (mOS) were not statistically significant across race (Figure 1B). Median OS (mOS) was 25.4 months in Caucasians vs 30.4 months in AAs (HR 1.0 [0.59 – 1.69], p=0.99) vs 16.8 months in Asians (HR 1.42 [0.84 – 2.42], p=0.19).

There were significant differences in mPFS and mOS between payer group (Figure 2A and 2B). For Medicare (n=206) vs Medicaid (n=33) vs private insurance (n=219) vs self-pay (n=7): mPFS was 15.9 vs 4.2 vs 6.0 vs 0.9 months (p<0.001) and mOS was 31.2 vs 12.8 vs 21.5 vs 3.2 months (p<0.001), respectively.

Table 3 outlines our multivariate analysis of PFS and OS in our patients. Race was found to impact PFS (p=0.03), with AAs having significantly worse PFS than Caucasians (HR 1.72 [1.05-2.82], p=0.03). Asians did not have a significantly worse PFS as compared to Caucasians (HR1.59 [0.94-2.7], p=0.08). Race overall did not impact OS (p=0.10). Insurance was found to impact both PFS and OS, with Medicare coverage having a positive impact on PFS and OS compared to patients with alternative insurances payors (p<0.001 and p<0.001, respectively). Medicare when compared individually to each insurance type showed significantly improved OS compared to Medicaid (HR 3.23 [1.55-6.72], p=0.002) and self-pay (HR 3.51 [1.44-8.54], p=0.006) but not private insurance (HR 0.94 [0.64-1.38], p=0.76). Use of bridging therapy also negatively impacted both PFS (HR 1.59 [1.19 – 2.12], p=0.002) and OS (HR 1.51 [1.06 – 2.15], p=0.02). LDH elevation at apheresis negatively impacted PFS (p=0.001) but was not significantly associated with worse OS (HR 0.91 [0.65 – 1.27], p=0.57). CAR-T received on clinical trial was associated with inferior OS (HR 1.47 [1.01 – 2.14], p=0.04). Receiving additional therapy after CAR-T was associated with improved OS (HR 0.64 [0.46 – 0.9], p=0.01).

Discussion

Our data represents the first to analyze the impact of both race and other social determinants of health on patients with r/r aggressive B-NHL treated with CAR-T. Despite being a multi-center study with several sites having an urban catchment, our patient population was majority Caucasian (87%). African Americans and Hispanics were underrepresented in our patient dataset. African Americans only made up 7% of our treated patients, while Hispanics made up 2%. To provide context, historically for B-NHL, non-Hispanic Caucasians have the highest incidence of disease (24.7 and 15.8 cases per 100,000 persons for male and females respectively) compared to AAs (17.4 and 12.4 cases per 100,000 persons for male and females respectively) and Hispanics (20.2 and 15.3 cases per 100,000 persons for male and females respectively)[13]. However, these incidences do not account for the substantially disproportionate under-representation of minorities in our dataset.

Unfortunately, our dataset is not unique in this regard. Locke and colleagues analyzed large B-cell lymphoma patients receiving axicabtagene ciloleucel and compared outcomes between racial groups in the real-world setting; this study had similar proportions of AA (5%) and Asians (6%) patients as our study, although they did capture a higher percentage of Hispanic patients (11%)[14]. Receipt of care at under-resourced centers with limited access to newest therapy and clinical trials may explain decreased representation of racial minorities in studies like ours[4]. Furthermore, patients included in this study were treated at major US academic institutions,

and while most centers were in urban settings, some data suggests that racial minorities can be less represented at major academic centers[15].

In our cohort as a whole, we previously reported survival outcomes consistent with results seen on prospective studies[16]. However, our MVA suggested discrepant findings in PFS and OS by race. Asians did have significantly lower ORR when compared to Caucasians and AAs, which did not translate to significant differences in PFS nor OS. AAs had significantly worse PFS than Caucasians, but significantly improved OS. These discrepancies may be attributed to sample size. These findings may also be attributed to the fact that Caucasians were older than their racial counterparts. Interestingly, there was no difference between racial groups when it came to resource utilization. Specifically, time from initial diagnosis to CAR-T, time from last relapse to CAR-T, number of prior lines of therapy, bridging therapy, rates or toxicities, and types of salvage regimens utilized following progression, were similar between racial groups and suggests against any of these modifiable factors as being responsible for differences in outcomes. That being said, our results do not capture patients facing insurance denial and/or poor access that would likely augment trends for racial and socioeconomic disparities identified in our CAR-T population. While difficult to prove in this analysis, a biologic impact from race could have also impacted these outcomes, as has been shown in treatments for other conditions[17].

Notably, our analyses did show a survival benefit overall for patients who received additional therapy following CAR-T (p=0.01). However, we also identified a trend towards receiving further therapy after disease progression following CART in Caucasians (p=0.05) which did not translate to a benefit in OS for Caucasian as compared to other races. To our knowledge, only one other analysis has investigated CAR-T outcomes in B-NHL between races. This analysis did show that Caucasian patients had improved ORR and CR when compared directly to AAs but this was not associated with differences in survival between the racial groups [14].

Our study also investigated the impact of insurance on outcomes with CAR-T and showed that patients on Medicare had the best outcomes. Medicare patients in our cohort may have had the advantage of having less aggressive disease, as suggested by their significantly longer time from diagnosis to CAR-T initiation; this may have led to the more favorable outcomes seen in cohort in our analysis. Our observations are complementary to what has been reported in the literature - traditionally Medicaid patients have overall worse outcomes in oncology compared to patients with other insurances, which has mainly been attributed to patients presenting with more advanced or aggressive disease which makes them ineligible for curative therapies, even though Medicaid patients are often younger [18,19].

The majority of our self-pay patients were international patients traveling to the United States seeking out CAR-T. As a result, these patients typically had a trend for longer times from progression to CAR-T (p=0.067). Longer times from progression to CAR-T infusion, termed 'brain-to-vein' time are felt to impact outcomes negatively amongst CART providers[20]. As a result, it is likely that self-pay patients had higher tumor burden prior to CART, a factor known

to impact progression post CAR-T[21,22]. Notably, Medicare patients also had statistically significant longer times from diagnosis to CAR-T infusion of 26 months. Patients with other payor types typically relapsed within ~ 12 months of their diagnosis in keeping with primary refractory disease. This suggests that Medicare patients may have had less aggressive disease biology to start, another factor that may have potentially contributed to better survival in this payor group. Inferior survival in primary refractory disease has been observed by other investigators and supports this postulation[23].

Of note, distance to treating center was not collected in our dataset. This is an important variable in understanding impact on access to care, insurance type and outcomes according to geographical distribution of race. Future studies addressing impact of social determinants of health on clinical outcomes should address this question. Taking things further, CART centers should be incentivized to focus on data collection and performance measurement unique to each organization to better identify the multifactorial core issues driving disparities in quality of care for racial and ethnic minorities across diverse geography.

In conclusion, our multi-center retrospective analysis showed that race and social determinants of health can influence treatment outcomes with CAR-T therapy. Our data shows that there are real disparities in who receives CAR-T for aggressive B-NHL by race. Additionally, we found that Medicare patients had improved outcomes compared to other payor types, although this was likely confounded by Medicare patients having less aggressive disease in this dataset. Undoubtedly, in datasets such as ours, the inability to capture patients with poor access as a result of distance to treating centers or other causes, or insurance denial, poses a barrier to analyses and would likely augment findings of disparities. However, such datasets serve to raise awareness of racial and ethnic disparities in health care among clinical providers and the general public which is a critical step toward reducing disparities in health care. Future prospective studies are needed to better understand the causation for these effects. The interaction between race and insurance status and their relative contributions to access and outcomes with CAR-T should be further explored. It will also be imperative for future prospective trials and studies to include better representation from racial minorities to confidently guide treatment strategies and decrease treatment disparities.

Authorship

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Tables and Figures:

Table 1: Differences in Demographic and Clinical Characteristics and CART Access by Race

	Caucasian (n=406)	African American (n=34)	Asian (n=26)	P-value
Median Age (range)	**59 (21 – 84)**	**55 (22 – 74)**	**55 (22 – 80)**	**0.004**
Sex (n,%) -Male -Female	 251 (62) 155 (38)	 21 (62) 13 (38)	 11 (42) 15 (58)	0.14
Histologic subtype* (n,%) -de novo DLBCL -transformed FL	 279 (77) 83 (23)	 20 (74) 7 (26)	 21 (91) 2 (9)	0.25
DHL/THL (n,%) -Yes -No	 76 (19) 330 (81)	 4 (12) 30 (88)	 3 (12) 23 (88)	0.41
DEL (n,%) -Yes -No	 68 (21) 262 (79)	 3 (10) 27 (90)	 3 (13) 20 (87)	0.27
Median # lines therapy prior to CART, n (range)	3 (1-6)	2.5 (1-5)	2 (1-6)	0.44
CART Timing -2nd line, n (%) -3rd line and beyond, n (%)	 157 (40) 172 (46)	 10 (30) 21 (64)	 11 (43) 13 (50)	0.63
AutoSCT prior to CART (n,%) -Yes -No	 113 (29) 274 (71)	 7 (21) 26 (79)	 2 (8) 24 (92)	0.04
Median time from diagnosis to CART, months (range)	18.3 (2.0-440.0)	20.9 (1.6-255.4)	13.3 (4.1-91.7)	0.45
Median time from last relapse/progression pre-CART CART infusion, months (range)	2 (0.0-61.0)	1.8 (0.3-38.0)	1.2 (0.3-33.3)	0.9
Time from apheresis to CART	1.1 (0.4-12.7)	1.1 (0.7-4.9)	0.9 (0.2-2.2)	0.2

infusion, months (range)				
Bridging therapy (n,%) -Yes -No	 169 (44) 218 (56)	 20 (61) 13 (39)	 12 (46) 14 (54)	 0.17
Insurance Coverage (n,%) -Medicare -Medicaid -Private -Self-Pay	 183 (45) 23 (6) 192 (47) 7 (2)	 12 (35) 6 (18) 16 (47) 0 (0)	 11 (42) 4 (15) 11 (42) 0 (0)	 0.09
CART on clinical trial (n,%) -Yes -No	 118 (29) 287 (71)	 5 (15) 29 (85)	 5 (19) 21 (81)	 0.12
CART product (n,%) -Axicabtagene-ciloleucel -Tisagenlecleu-cel -Lisocabtagene-maraleucel	 255 (63) 99 (25) 50 (12)	 20 (59) 12 (35) 2 (6)	 21 (81) 4 (15) 1 (4)	 0.18
IPI at time of CART collection (n,%) -0-3 -4-5	 265 (82) 58 (18)	 24 (83) 5 (17)	 18 (78) 5 (22)	 0.9
LDH elevated at time of CART collection (n,%) -Yes -No	 203 (54) 173 (46)	 13 (41) 19 (59)	 20 (83) 4 (17)	 0.005
Day 180 ORR with CART (%)	51	46	19	0.04
Day 180 CR with CART (%)	43	42	19	0.15
Further therapy after CART progression (n,%) -Yes -No	 102 (46) 118 (54)	 6 (25) 18 (75)	 5 (28) 13 (72)	 0.05

***17 patients had other histologies including PMBCL, Richters, and transformed marginal zone lymphoma and were not included in this analysis**

Table 2: Clinical characteristics stratified by insurance type

	Medicare	Medicaid	Private	Self-pay	p-value
Median follow up time, (mo), median, (range)	12.7 (0.3-69.3)	7.3 (0.6-38.6)	12.5 (0.2-60.0)	8.7 (0.1-19.2)	0.161
Age, median (range)	64.0 (22.0-84.0)	52.5 (22.0-61.0)	56.0 (25.0-84.0)	56.0 (22.0-74.0)	<0.001

Prior lines of therapy, median (range)	2.0 (1.0-6.0)	3.0 (1.0-6.0)	2.0 (1.0-6.0)	2.0 (2.0-3.0)	0.814
CART Timing -2nd line, n (%) -3rd line and beyond, n (%)	73 (37) 90 (46)	13 (41) 18 (56%)	88 (42) 96 (46)	4 (57) 1 (14)	0.9
Time from diagnosis to CAR-T infusion, months (range)	26.2 (1.6-383.7)	14.4 (5.2-113.3)	14.0 (2.0-440.0)	14.5 (10.2-185.4)	0.001
Time from progression to CAR-T infusion, months (range)	2.0 (0.0-61.0)	1.7 (0.4-12.5)	2.0 (0.2-61.0)	3.2 (1.1-56.8)	0.067
Time from apheresis to CAR-T infusion, months (range)	1.1 (0.2-12.7)	1.1 (0.6-5.1)	1.1 (0.2-8.2)	1.1 (0.8-4.6)	0.417
Bridging therapy, n (%)	78 (39.8%)	15 (46.9%)	105 (50.0%)	2 (28.6%)	0.166
Elevated LDH at apheresis, n (%)	98 (68.1%)	15 (71.4%)	107 (66.9%)	4 (66.7%)	0.978

Table 3: Multivariable Analysis for PFS and OS

Variable	PFS		OS	
	HR (95% CI)	p-value	HR (95% CI)	p-value
Race		0.03		0.10
Asian vs. Caucasian	1.59 (0.94 – 2.7)	0.08	0.86 (0.47 – 1.56)	0.61
AA vs. Caucasian	1.72 (1.05 – 2.82)	0.03	0.51 (0.28 – 0.95)	0.03
Insurance		<0.001		<0.001
Medicaid vs. Medicare	2.07 (1.18 – 3.61)	0.01	3.23 (1.55 – 6.72)	0.002
Private vs. Medicare	1.33 (0.97 – 1.83)	0.08	0.94 (0.64 – 1.38)	0.76
Self-pay vs. Medicare	7.69 (3.1 – 19.1)	<0.001	3.51 (1.44 – 8.54)	0.006
Age	1.01 (1.0 – 1.02)	0.2	0.99 (0.98 – 1.01)	0.43
Prior AutoSCT	0.79 (0.57 – 1.1)	0.16	0.87 (0.59 – 1.29)	0.49

Use of Any Bridging	1.59 (1.19 – 2.12)	0.002	1.51 (1.06 – 2.15)	0.02
CART Received on Trial	1.08 (0.77 – 1.51)	0.67	1.47 (1.01 – 2.14)	0.04
IPI (4-5) at Time of Collection	1.18 (0.83 – 1.68)	0.36	1.24 (0.84 – 1.84)	0.29
LDH Elevated at Time of Collection	1.69 (1.25 – 2.28)	0.001	0.91 (0.65 – 1.27)	0.57
Further Therapy Post CART Received	-	-	0.64 (0.46 – 0.9)	0.01