Diversity, Equity, and Inclusion in Gene and Cell Therapies Clinical Trials

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Objectives

Genetic, ethnicity, and sociodemographic factors affect the pharmaco-dynamics, pharmacokinetics, safety, and efficacy of gene and cell therapies.

This study assessed diversity, equity, and inclusion in gene therapy clinical trials authorized by FDA in 2010-2024.

Methods

We collected the data for pivotal trials of gene and cell therapies approved by the FDA from clinicaltrials.gov.

We conducted descriptive statistics and random-effects meta-analysis of the overrepresentation ratios of individual trials relative to the US racial and ethnic groups for specific disease states.

Results

The FDA authorized 32 gene and nine cell therapies in the period January 2010 - October 2024. Those therapies had a total of 122 pivotal clinical trials with an average of 3.28 ± 0.25

The sample included 32 clinical trials with a total of 3,519 human subjects (110±111.9) participants in the clinical trials. There were 27 (84.4%) clinical trials with 30 or more participants. Atidarsagene autotemcel had the lowest number of participant (7), and sipuleucel-T had the highest (512).

By race, 82.41% (n=2,900) identified as white, 6.62% (n=233) as black, and 4.6% (n=162) as Asian.

Results

Table 1: Characteristics of Pivotal Clinical Trials of Gene and Cell Therapies Approved by the FDA (2000-2024)

		Age	Male	Race					Ethnicity	
Therapy	**Disease**	**Mean (Range)**	**# (%)**	**White**	**Black**	**Asian**	**Other**	**Not reported**	**Non-Hispanic**	**Not reported**
idecabtagene vicleucel	Refractory multiple myeloma	60 (33-78)	82 (58.6%)	113	8	3	6	10	(80.0%)	
nadofaragene firadenovec	High-risk NMIBC with CIS	71 (NA)	125 (82.8%)	140	8	3	0	0	142 (94.0%)	1
lifileucel	Metastatic melanoma	55 (20-79)	84 (53.8%)	149	3	3	1	0	NA	NA
fidanacogene elaparvovec	Hemophilia B	33 (NA)	45 (100%)	33	1	7	4	0	35 (77.8%)	8
lisocabtagene maraleucel	Large B-cell lymphoma	60 (18-86)	174 (64.9%)	231	12	11	3	11	232 (86.6%)	10
ciltacabtagene autoleucel	Multiple Myeloma	62 (43-78)	57 (58.8%)	69	17	1	2	8	85 (87.6%)	6
exagamglogene autotemcel	Transfusion-depend. β-thalassemia	22 (12-35)	27 (51.9%)	18	0	22	5	7	46 (88.5%)	5
delandistrogene moxeparvovec	Duchenne Muscular Dystrophy	7 (3-20)	41 (100%)	30	0	5	6	0	35 (85.4%)	1
allogeneic cultured keratinocytes	Mucogingival	47 (18-71)	44 (45.8%)	87	1	5	3	0	85 (88.5%)	4
etranacogene dezaparvovec-drlb	Hemophilia B	42 (19-75)	54 (100%)	40	1	2	6	0	45 (83.3%)	0
talimogene laherparepvec	Melanoma	63 (NA)	187 (42.8%)	428	3	1	5	0	NA	NA
tisagenlecleucel	Acute lymphoblastic leukemia	12 (3-27)	48 (54.5%)	65	0	10	13	0	71 (80.7%)	0
donislecel	Type 1 diabetes	47 (21-67)	6 (20.2%)	30	0	0	0	0	29 (96.7%)	0
azficel-T	Bilateral Nasolabial Fold Wrinkles	46 (19-75)	53 (33.5%)	122	10	6	20	0	157 (99.4%)	0
atidarsagene autotemcel	Metachromatic leukodystrophy	NA	13 (65.0%)	18	0	2	0	0	19 (95.0%)	0
	Pre-symptomatic early juvenile	NA	6 (85.7%)	6	1	0	0	0	7 (100.0%)	0
	Early symptomatic early juvenile	NA	6 (60.0%)	10	0	0	0	0	10 (100.0%)	0
voretigene neparvovec	Biallelic RPE65 retinal dystrophy	15 (4-44)	13 (41.9%)	21	2	5	3	0	25 (80.6%)	0
lovotibeglogene autotemcel	Sickle cell disease	(12-43)	34 (63.0%)	1	48	1	0	4	50 (92.6%)	2
utologous Cultured Chondrocytes	Full-thickness cartilage defects	34 (16-54)	93 (64.6%)	144	0	0	0	0	100 (69.4%)	0
omidubicel-onlv	Sickle cell disease	38 (13-65)	72 (57.6%)	72	20	17	5	11	98 (78.4%)	11
sipuleucel-T	Metastatic prostate cancer	71 (40-91)	512 (100%)	461	30	4	17	0	496 (96.9%)	0
allogeneic processed thymus tissue	Cognenital Athymia	1 (0-3)	60 (57.1%)	76	21	0	8	0	85 (81.0%)	0
valoctocogene roxaparvovec-rvox	Congenital factor VII deficiency	30 (18-70)	134 (100%)	96	15	19	3	0	7 (5.2%)	0
elivaldogene autotemcel	Cerebral adrenoleukodystrophy	NA	67 (100%)	36	3	1	7	20	41 (61.2%)	9
allogeneic keratinocytes & fibroblasts	Thermal burns containing intact	44 (19-70)	76 (75.2%)	83	16	0	2	0	87 (86.1%)	0
brexucabtagene autoleucel	Mantle cell lymphoma	63 (38-79)	68 (82.9%)	75	1	0	6	0	67 (81.7%)	2
afamitresgene autoleucel	Metastatic synovial sarcoma	47 (16-78)	71 (54.6%)	112	4	8	2	4	112 (86.2%)	10
beremagene geperpavec	Dystrophic epidermolysis bullosa	17 (1-44)	20 (64.5%)	20	0	6	5	0	15 (48.4%)	0
axicabtagene ciloleucel	B-Cell lymphoma	56 (23-76)	73 (67.6%)	96	5	4	3	0	89 (82.4%)	0
betibeglogene autotemcel	ß-thalassemia	NA	11 (45.8%)	8	0	14	2	0	22 (91.7%)	1
onasemnogene abeparvovec	Spinal muscular atrophy	4(1-6)	10 (47.6%)	10	3	2	6	0	4 (19.0%)	0
Total		**31 (14-49)**	**2366 (67.24 %)**	**2,900**	**233**	**162**	**143**	**81**	**2,408 (68.4%)**	**32**

The aggregated effect size for representation ratios was 0.673, with a 95% confidence interval spanning from -0.132 to 1.759, suggesting a general tendency of underrepresentation. Black and Asian participants were underrepresented in the majority of trials.

Significant underrepresentation occurred for Large B-cell Lymphoma (Black) (effect size: 0.00003) and NMIBC (Black) (effect size: 0.009), with ratios substantially below the baseline. Only 3 clinical trials included at least 10 Black and 10 Asian patients.

Overrepresentation occurred for White non-Hispanic participants. Examples included multiple myeloma (White) (effect size: 5.11) and Sickle cell disease (White) (effect size: 6.17), with representation ratios exceeding 1.0.

Cancer trials predominated in both the number of studies and participant size, underscoring a substantial emphasis on oncology research relative to other indications, which had fewer trials and smaller participant numbers

Conclusions

Gene and cell therapy clinical trials have low diversity. Male, white, and non-Hispanic subjects were overrepresented in pivotal clinical trials. The findings indicate systemic obstacles to equitable enrollment and highlight the need for targeted measures to enhance diversity and equity in clinical trial.