

Dissertation at D cube  
analytics



# Market analysis for CAR-T cell therapy

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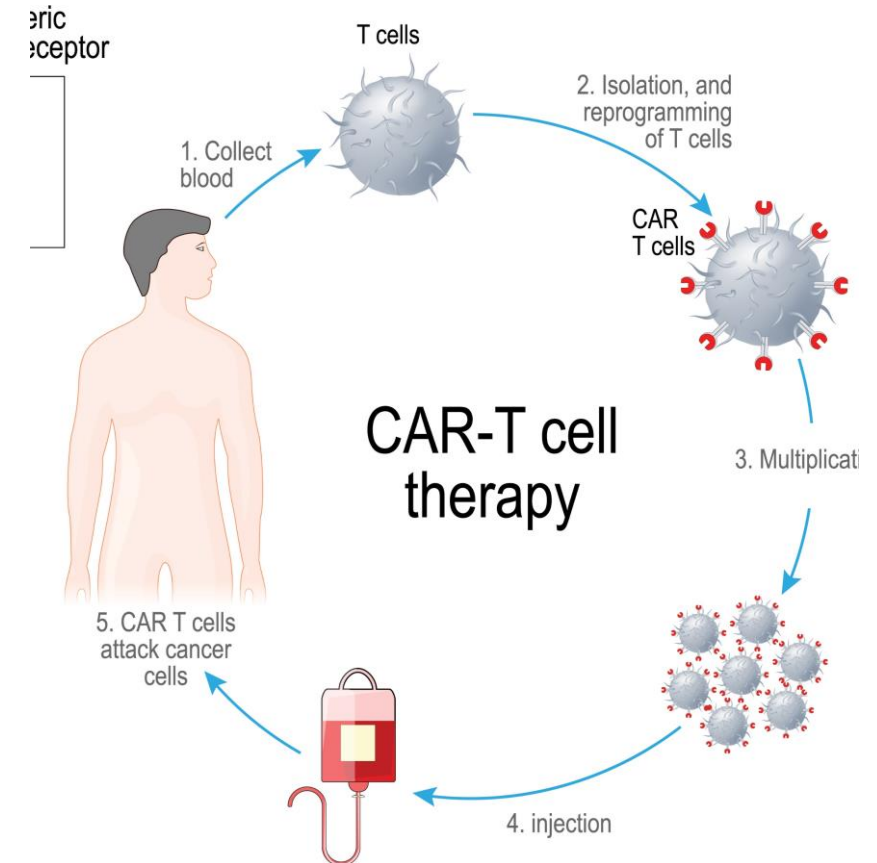
Under the guidance of

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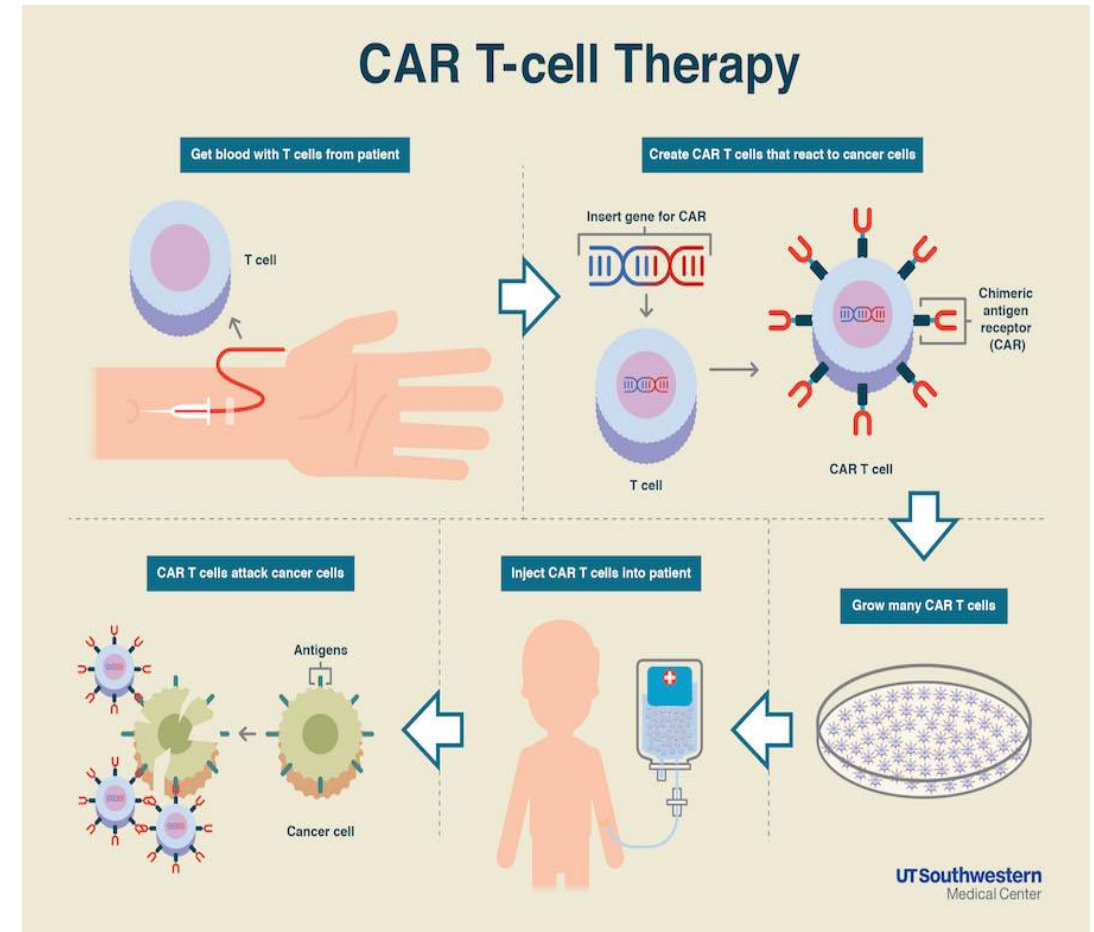
# CAR-T cell therapy

- T-cells are the type of immune system cell which are changed in laboratory to make them attack the cancer cells this type of treatment is known as CAR-T cell therapy.
- These T-cells are obtained from the patient's blood itself. A gene which binds with a specific type of protein on the patient's cancer cell is added to the T-cells in the laboratory.
- This receptor is known as CAR (chimeric antigen receptor). Patients are infused with these CAR-T cells which are grown in a large in the laboratory. This type of CAR-T cell therapy is used to treat a certain blood cancer, studies for the treatment of other types of cancers are still going on.



# Process of CAR-T cell therapy

- **Collection of the T cells:** The white blood cells or the WBCs which contain the T cells (acting as a defence mechanism for the body and fights against different infections and diseases) are first removed from the patient's blood with a procedure called **Leukapheresis**.
- **Preparation of CAR-T cells:** At the lab, these T-cells are altered by adding the genes which are specific Chimeric antigen receptor (CAR). After this process, a simple T-cell becomes the CAR-T cell.
- **Infusion of the CAR-T cells:** When there is an enough number of CAR-T cells made in the laboratory, they are ready to be given to the patient in need. Patients with cancer are called up few weeks before the infusion of CAR-T cells, during this time patients are given chemotherapy, so that the other immune cells are lowered in number, as these CAR-T cells are also a foreign material, and the defence mechanism of the body might be triggered through it. So to avoid wasting the CAR-T cells to be infused in the body of the patient a chemotherapy is given prior to this procedure



## Some of the approved CAR- T cell therapy along the years.

- US Food and Drug administration is responsible for the approval of CAR-T cell therapies. They have approved around 6 of CAR-T cell therapies from different companies over the years.

|                                                               |
|---------------------------------------------------------------|
| Axicabtagene ciloleucel, also known as axi-cel (Yescarta)     |
| Brexucabtagene autoleucel, also known as brexu-cel (Tecartus) |
| Lisocabtagene maraleucel, also known as liso-cel (Breyanzi)   |
| Idecabtagene vicleucel, also known as ide-cel (Abecma)        |
| Ciltacabtagene autoleucel, also known as cilta-cel (Carvykti) |

# Top companies producing CAR-T cell therapy

|                                 |                                |
|---------------------------------|--------------------------------|
| AbbVie Inc.,                    | Adaptimmune Therapeutics PLC., |
| Amgen, Inc.,                    | Atara Biotherapeutics, Inc.,   |
| Aurora Biopharma, Inc.,         | Autolus Therapeutics PLC.,     |
| Bellicum Pharmaceuticals, Inc., | bluebird bio,                  |
| BioAtla LLC.,                   | Carina Biotech,                |
| CARsgen Therapeutics, Ltd.,     | CARTherics,                    |
| Celgene,                        | Collectis, Celularity,         |
| Celyad SA,                      | Creative Biolabs,              |
| DiaCarta, Inc.,                 | Endocyte, Inc.,                |
| F1 Oncology, Inc.,              | Fate Therapeutics Inc.,        |
| Gilead, Humanigen, Inc.,        | Immune Therapeutics, Inc.,     |
| Intrexon, Corp.,                | Juno Therapeutics, Inc.,       |
| Kite Pharma, Inc.,              | Lion TCR Pte Ltd.,             |
| MaxCyte, Inc.,                  | Mesoblast, Ltd.,               |

|                                |                              |
|--------------------------------|------------------------------|
| Minerva Biotechnologies Corp., | Mustang Bio, Inc.,           |
| Novartis AG                    | Oxford BioMedica PLC.,       |
| PeproMene Bio Inc.,            | Pfizer, Inc.,                |
| Posedia Therapeutics Inc.,     | Precision Biosciences, Inc., |
| ProMab Biotechnologies Inc.,   | Servier Oncology,            |
| Sorrento Therapeutics, Inc.,   | TC Biopharm Ltd.,            |
| Tessa Therapeutics Pte Ltd.,   | TILT Biotherapeutics Ltd.,   |
| Tmunity Therapeutics Inc.,     | TrakCel Ltd.,                |
| Xyphos,                        | ZIOPHARM Oncology, Inc.,     |

# Methodology

**Type of study:** Cross-sectional descriptive study

**Research question:**

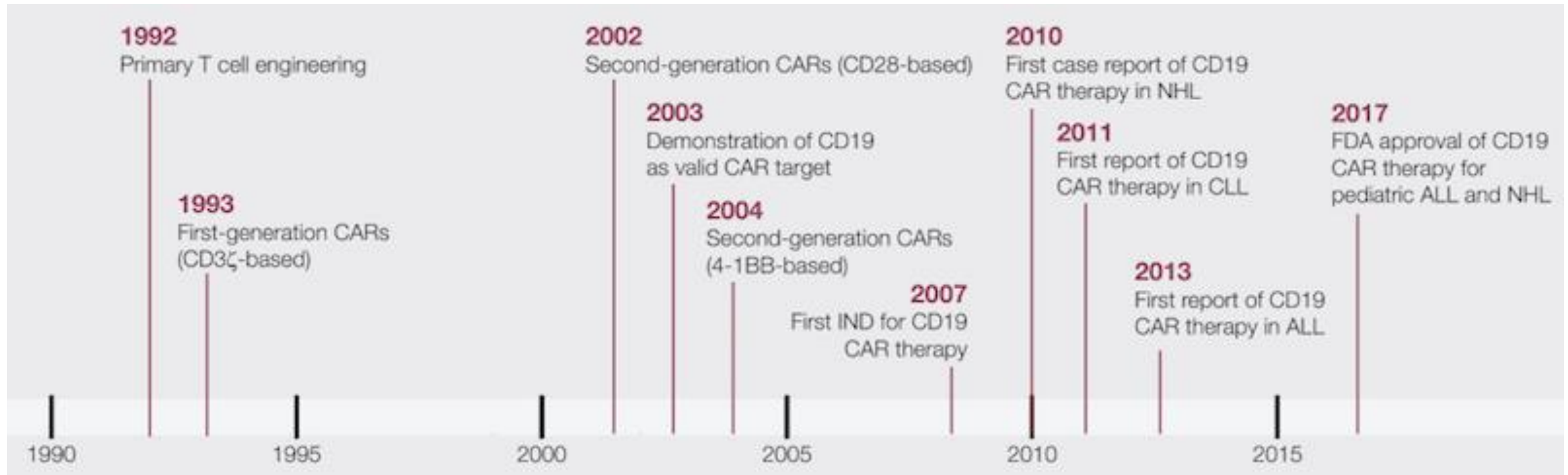
What are the market trends of CAR-T cell therapy?

**Research objective:**

- To Understand the scope of market of CAR-T cell therapy.
- To Understand the trends and evolution of market of CAR-T cell therapy.
- To Understand the competition in the market for CAR-T cell therapy.
- To Understand the financial burden of CAR-T therapy on a patient.
- To Identify market size and CAGR of the industry.
- **Methodology:**
- **Inclusion criteria:** Pharmaceutical Companies producing CAR-T cell therapy all over the world. Selection of top five companies from the list for further research.

- **Exclusion criteria:** Pharmaceutical companies which were not producing CAR-T cell therapy.
- Historical data analysis: Using previously generated reports from different portals are being used.
- A thorough secondary research is conducted using different platforms like:
  - Clinical trial databases: Clinical trials.gov, clinical trials registry platform
  - Scientific publications: PubMed, High wire press
  - Product launch announcements: Google news
- **Market research reports:** Polaris market research, PR newswire, pharmaceutical technology, etc.
- **Market segmentation:** Based on Indication of the therapy, End User, Product type and region.
- Porter's five forces of the market, highlighting the five forces which are mainly responsible for driving the market.
- Competitor analysis of the top five products

# Development of CAR-T cell therapy and timeline

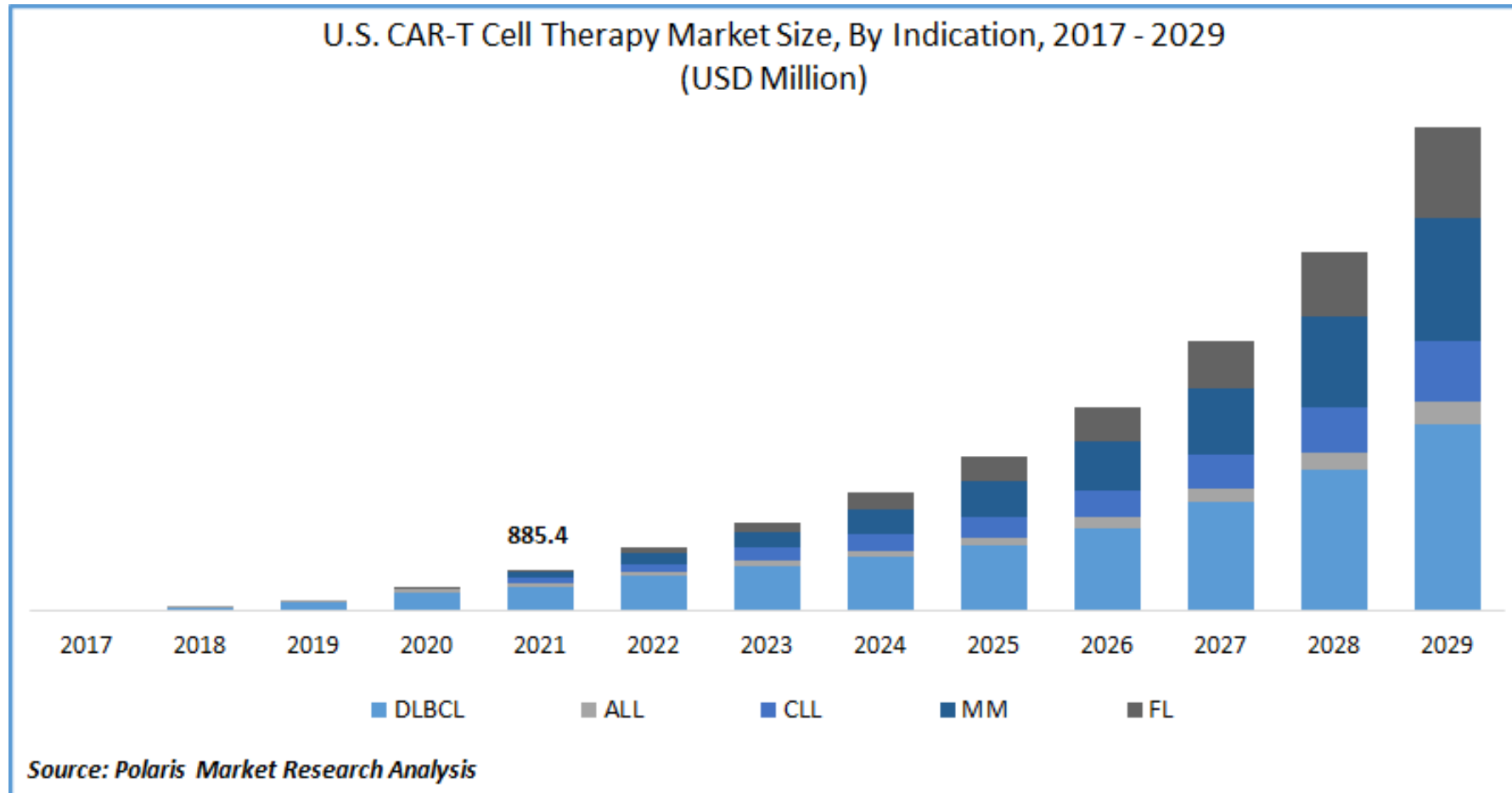


# Market size for the CAR-T cell therapy

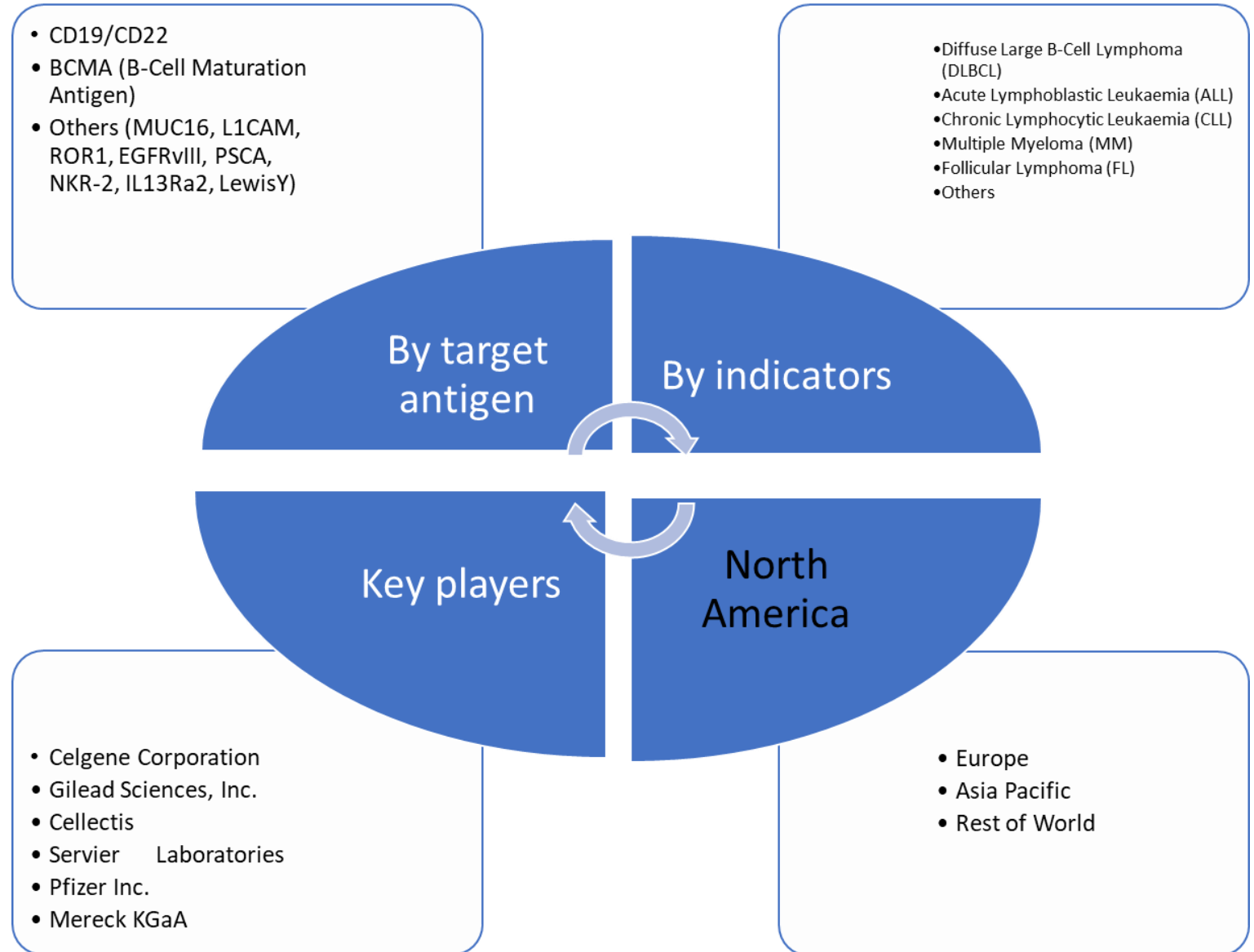
- The figure shows the increasing trend of global market for CAR-T cell therapy, starting with the year 2019, which was observed as 480 million USD with a CAGR of 45%, during the year 2020 global market size was 589.99 million USD with a CAGR of 31.16%. Despite the pandemic, year 2021 has shown the highest market size of 1965.3 million USD, along with the highest CAGR of 63.82%.

| Year | Market size (million USD) | CAGR (%) |
|------|---------------------------|----------|
| 2019 | 480 million USD           | 45%      |
| 2020 | 589.99 million USD        | 31.16%   |
| 2021 | 1965.8 million USD        | 63.82%   |

# Growth of US market for CAR-T cell therapy over the years.



# Market segmentation:



# Targeted audience for CAR-T cell therapy market are:

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Market manufacturers

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Raw material suppliers

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Research consultant

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Traders, distributors, and suppliers

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Government and regional agencies and research organisation  
Investment research firms.

# Porter's Five Forces for CAR-T cell therapy industry

## Threat of potential entrants

1. VOLATILE MARKET EASY FOR ENTRY OF NEW PRODUCTS
2. NEEDS FDA APPROVAL
3. INCREASED GOVERNMENT INVESTMENT
4. INCREASED AWARENESS AMONG PEOPLE REGARDING CANCER AND CAR-T CELL THERAPY
5. REGULATIONS REGARDING THE TRIALS AND DEVELOPMENT OF THE THERAPY.

## Threat of substitute products and services

1. NUMBER OF PRODUCTS ARE INCREASING IN THE MARKET
2. MULTIPLE NUMBER OF CLINICAL TRIALS ARE GOING ON BY DIFFERENT COMPANIES

## Competitive Rivalry

THE INDUSTRY DOMINATED BY SEVERAL COMPANIES, LEADING TO CREATE BARRIER FOR SMALLER COMPANIES TO ENTER

## Supplier bargaining

1. LESS NUMBER OF MANUFACTURING UNITS
2. LONG SUPPLY CHAIN AND LOGISTICS
3. NON AVAILABILITY OF RAW MATERIALS
4. LOW BARGAINING POWER AS THE COST IS VERY HIGH AND MARKET IS COMPETITIVE

## Buyer bargaining

1. INCREASED PREVALENCE AND INCIDENCE OF CANCER
2. HIGH BARGAINING POWER OF THE PATIENTS
3. INSURANCE COMPANIES COVERING THE EXPENSE

Porter's five forces model for CAR-T cell therapy market

- Threat of potential entrants
- Threat of substitute products and services
- Supplier bargaining power
- Buyer bargaining power

# Porter five forces analysis based on autologous and allogenic type of CAR-T cell therapy

**Trisagenlecleucel** is an autologous CAR T-cell therapy for B-cell acute lymphoblastic leukaemia (ALL) and is the first such therapy to other innovative cancer treatments.

**Allogeneic CAR-T** cells have been given to patients with cancer after lymphodepleting chemotherapy and were shown to expand in vivo without causing GVHD (94).  $\gamma\delta$  T cells recognize cancer through a broad spectrum of receptors, rather than in a single clonally expanded fashion, which may mitigate tumor escape via single antigen loss.

## Porter's Five Forces Analysis

|                | Autologous                                                                                                                                                                                                                                            | Allogeneic                                                                                                                                                                                                                                   |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| High Incidence | <ul style="list-style-type: none"><li>- High bargaining power of suppliers</li><li>- High bargaining power of buyers</li><li>- High rivalry</li><li>- High threat of new entrants</li><li>- High threat of substitutes</li></ul>                      | <ul style="list-style-type: none"><li>+ Low bargaining power of suppliers</li><li>+ Low bargaining power of buyers</li><li>+ Low-to-moderate rivalry</li><li>+ Low threat of new entrants</li><li>+ Moderate threat of substitutes</li></ul> |
| Low Incidence  | <ul style="list-style-type: none"><li>+ Low bargaining power of suppliers</li><li>+ Low bargaining power of buyers</li><li>- Stronger rivalry than high incidence</li><li>- High threat of new entrants</li><li>+ Low threat of substitutes</li></ul> | <ul style="list-style-type: none"><li>+ Low bargaining power of suppliers</li><li>+ Low bargaining power of buyers</li><li>+ Low-to-moderate rivalry</li><li>+ Low threat of new entrants</li><li>+ Low threat of substitutes</li></ul>      |

# Financial burden of the therapy on a patient

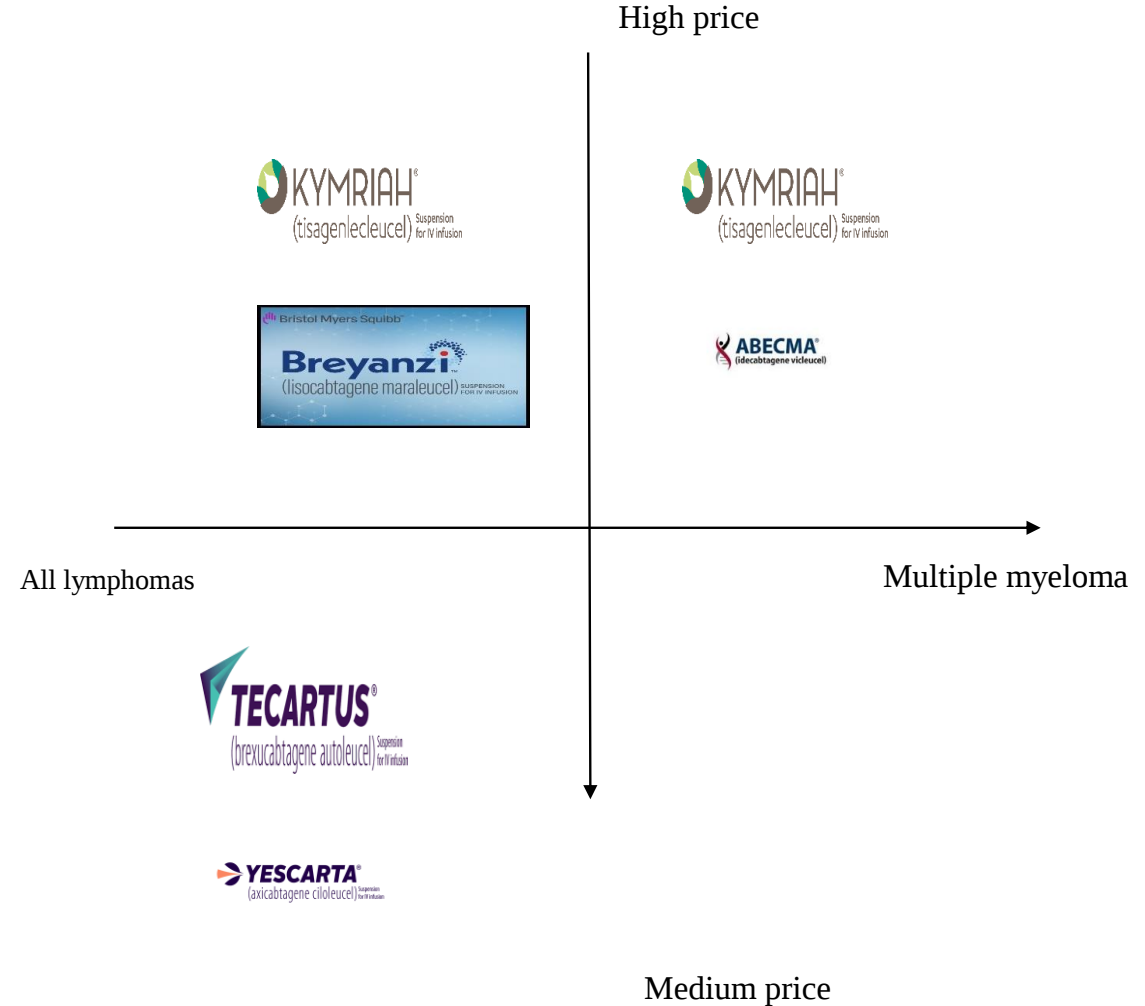
| Therapy and manufacturer                                              | Cost per shot (USD)                           |
|-----------------------------------------------------------------------|-----------------------------------------------|
| Tisagenlecleucel (Kymirah) Novartis                                   | ALL- \$475,000,<br>B-cell lymphoma- \$373,000 |
| Axicabtageneciloleucel (Yescarta) Kite pharma                         | \$399,000                                     |
| Lisocabtagenemaraleucel (Breyanzi) Bristol Myers Squibb               | \$410,300                                     |
| Brexucabtangencartoleucel (Tecartus) Kite pharma                      | \$399,000                                     |
| Idecabtagenevicleucel (Abecma) Bristol Myers Squibb/<br>Bluebird Bio. | \$419,500                                     |

**Some other associated costs for the procedure: Estimated direct costs associated with CAR-T cell therapy for an average individual patient in 2 healthcare setting.**

| <b>Economic Inputs</b>                         | <b>Academic inpatient hospital</b> | <b>Non academic speciality oncology network</b> |
|------------------------------------------------|------------------------------------|-------------------------------------------------|
| <b>Drug costs</b>                              | <b>Value \$ USD</b>                |                                                 |
| CAR-T cell                                     | 373,000                            | 373,000                                         |
| Lymphodepletion                                | 1,578                              | 1,578                                           |
| Tocilizumab                                    | 4,368                              | 4,368                                           |
| Dexamethasone                                  | 2.5                                | 2.5                                             |
| Filgrastim                                     | 315                                | 315                                             |
| <b>Procedure costs</b>                         |                                    |                                                 |
| Radiology                                      | 76                                 | 22                                              |
| EEG                                            | 445                                | 330                                             |
| ECG                                            | 656                                | 239                                             |
| Lumbar puncture                                | 117                                | 87                                              |
| MRI                                            | 441                                | 327                                             |
| 1-h chemotherapy administration                | 364                                | 144                                             |
| CAR-T cell administration                      | 313                                | 176                                             |
| <b>Facility costs</b>                          |                                    |                                                 |
| ICU days                                       | 6546                               | 6546                                            |
| Inpatient days                                 | 2668                               | 2668                                            |
| Non-academic speciality oncology network visit | NA                                 | 76                                              |

# Competitor analysis

- Competitor analysis is done on the basis on price and types of diseases the products are designed to treat.



# Conclusion

- CAR-T cell therapy has proven to be a revolutionary discovery in the field of genetic engineering as well in the field of treatment of cancer.
- This therapy has shown some extraordinary results in refractory and relapsed B-cell malignancies.
- The industry of CAR-T cell therapy is growing every day, there are a handful of companies which are dominating the industry, which makes it difficult for smaller companies to enter in the market.
- There are several other reasons which make the entry of new products to enter in the market, like the government regulations, regulatory mechanism in terms of the approval of the drugs, disruption in the supply chain of raw materials, absence of large number of manufacturing units
- Since the approval of first CAR-T cell therapy in 2017, market for the therapy has been growing.
- Some of the factors responsible for the growth of the market are, promising results in the clinical trials of the treatment, increased incidence, and prevalence of cancer, rising awareness among people about cancer and its treatment, Government grants for the clinical trials, robust research and development by the companies, who have already entered in the market or are trying to enter in the market.

# Conclusion cont'd

- **The financial burden a patient** must bear for this treatment, including the main treatment and the associated treatment costs for the treatment. Which has proven to be very high out of pocket expenditure, as the insurance cover does not provide the cost of whole treatment.
- there are several which can be taken to reduce the cost of the treatment,
- faster production and manufacturing of CAR-T cell therapy which will enable the patient to reduce the cost of supportive treatment.
- Establishment of in-house manufacturing units in the specialised hospital or cancer hospitals. Ensuring a continuous supply chain and logistics.



**THANK YOU**