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# Economic Evaluation of Gene Therapy Products: A Systematic Review

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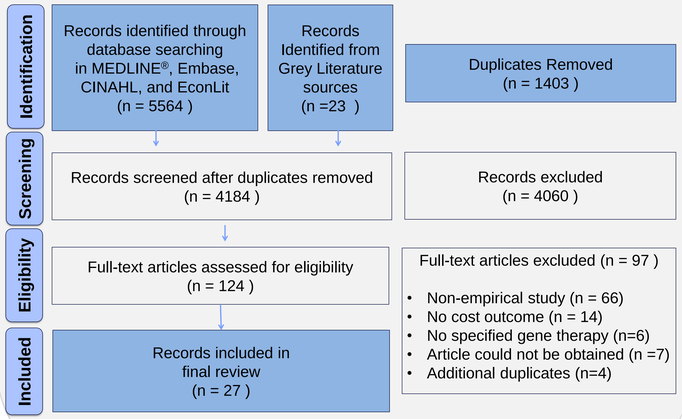
## BACKGROUND and OBJECTIVE

- **Gene therapy** is an emerging class of treatment based on altering gene expression, which aims to provide lifelong benefits from a single treatment
- **Cost of treatment is extremely high**, leading to concerns about financial impact for patients and the healthcare system
- Studies of economic sustainability are also faced with **uncertainties surrounding the long-term clinical effectiveness** of gene therapies

**Objective**: To conduct a systematic review of existing **cost-effectiveness studies on gene therapies,** and identify potential **challenges that economic evaluations face in this area**

## METHODS

**Inclusion Criteria:**
- Gene therapies with the potential to provide a long-term cure for a disorder with a single course of treatment that had either received regulatory approval or had entered a phase III trial
- English-, French-, or Spanish-language articles
- Studies with cost-related metrics



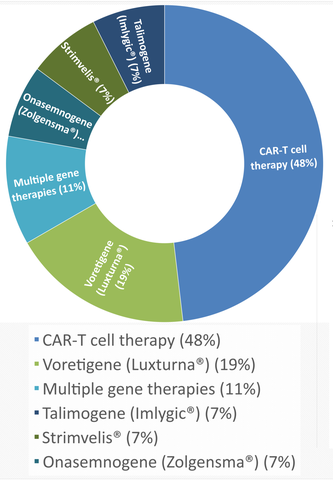

## RESULTS

### Characteristics of Included Studies

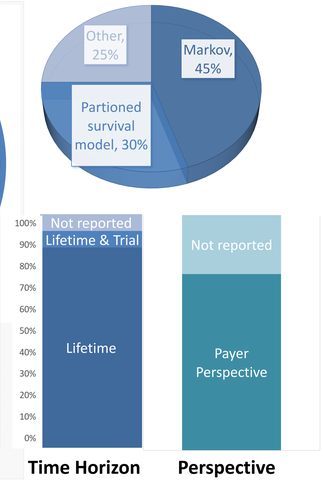
| Publication Year | n (%) |
|---|---|
| 2019 | 12 (44.4) |
| 2018 | 11 (40.7) |
| 2017 | 3 (11.1) |
| 2016 | 1 (3.7) |
| **Study Location** | |
| United States | 17 (63.0) |
| UK | 7 (25.9) |
| Canada | 2 (7.4) |
| Australia | 1 (3.7) |
| **Indication** | |
| Cancer[a] | 15 (55.6) |
| Inherited retinal dystrophy | 5 (18.5) |
| Spinal muscular atrophy T1 | 2 (7.4) |
| ADA-SCID[b] | 2 (7.4) |
| No specified indication | 3 (11.1) |
| **Study Type** | |
| Economic Evaluation | 20 (74.1) |
| Review/report | 7 (25.9) |

[a] Includes acute lymphoblastic leukemia, diffuse B-cell lymphoma, and metastatic melanoma; [b]Adenosine deaminase deficiency-severe combined immunodeficiency

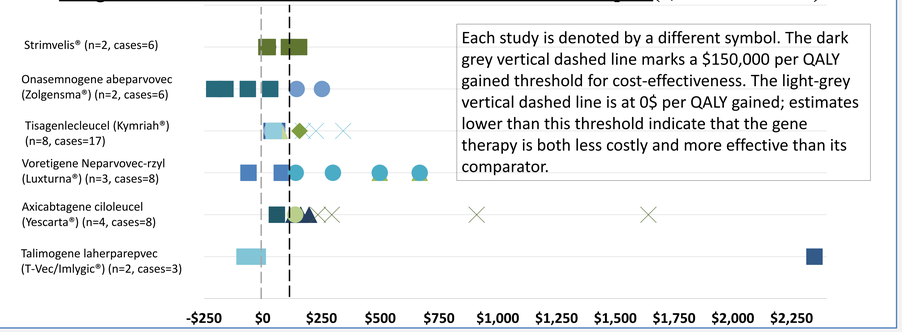
**Gene Therapies Featured in Included Studies (n=27)**




**Models used in Economic Evaluations (n=20)**




**Range of Incremental Cost-Effectiveness Ratios for Gene Therapies** (1,000 x 2019 USD)




## REMARKS

- Most studies investigated chimeric antigen receptor **T-cells (CAR T-cells) (48%) and cancers (56%)**
- Of the 27 studies, **74% were economic evaluations, of which 45% used Markov models, 72% used either a private or a public perspective, and 85% used a lifetime horizon**
- All economic evaluations reported that **gene therapy products gained Quality-adjusted Life-Years** (QALYs) relative to their comparator, but due to high costs **most were not deemed cost-effective**
- Some of the model parameters with the greatest impact on cost-effectiveness included **assumptions about the efficacy and duration of the therapy, the alternative treatments used as comparators, and the inclusion of indirect costs**
- The **range in cost effectiveness ratios was substantial, both between and within specific gene therapy products,** ranging from being cost-saving to costing over 2 million USD per QALY gained, which far exceeds accepted thresholds for cost-effectiveness
- Zolgensma, Imlygic, and Luxturna had studies that suggested they **may be dominant relative to the comparator** (i.e., both less costly and more effective)

## CONCLUSIONS

- Even at high price points, **curative gene therapies have the potential to be cost-effective,** especially for conditions with higher levels of mortality and/or disability
- Decision makers should take particular note of the **quality of inputs and reporting surrounding evidence on long-term clinical effectiveness of gene therapies,** and carefully examine variability in assumptions within studies before drawing conclusions