REVIEW

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Cost-Effectiveness of Gene and Cell Therapies: Evaluation Methods in the Single-Dose, High-Price Paradigm

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ABSTRACT

Gene and cell therapies represent a paradigm shift in medicine, offering the prospect of durable or curative benefit from a single administration; however, they are associated with unprecedented upfront prices, routinely exceeding two to three million US dollars per patient. This combination—a one-time intervention whose clinical value accrues over a lifetime while its full cost is incurred immediately—strains the conventional methods of pharmacoeconomic evaluation and confronts payers with acute affordability and equity challenges. This review examines how the cost-effectiveness of these therapies is assessed within the single-dose, high-price paradigm and what methodological adaptations the paradigm demands. We first describe the economic distinctiveness of one-time therapies and the core analytic problems they raise: the profound uncertainty about the durability of effect; the reliance on single-arm trials and surrogate endpoints; the disproportionate influence of the discount rate; and the limitations of the quality-adjusted life-year (QALY) in capturing value for severe, rare paediatric conditions. We then synthesise the published economic evidence through detailed case studies of spinal muscular atrophy (onasemnogene abeparvovec) and Duchenne muscular dystrophy (delandistrogene moxeparvovec), and through further exemplars in chimeric antigen receptor T-cell therapy, haemophilia, and sickle-cell disease and β-thalassaemia. Reported incremental cost-effectiveness ratios vary enormously—from dominant or highly cost-effective to several million euros per QALY—driven chiefly by assumptions about durability, comparator cost, and discounting. We review novel financing and access mechanisms, including outcomes-based agreements, annuity payments, and public access models, and situate the discussion within the context of divergence in international health technology assessment, recent market withdrawals, and the Turkish reimbursement environment. Robust, transparent, and durability-sensitive economic evaluation, coupled with innovative payment models, will be essential to reconcile access with sustainability.

Keywords: Gene therapy, cell therapy, cost-effectiveness analysis, spinal muscular atrophy, Duchenne muscular dystrophy, health technology assessment

Introduction

Gene and cell therapies—often grouped, particularly in Europe, under the regulatory heading of advanced therapy medicinal products (ATMPs)—have moved from experimental promise to clinical reality with remarkable speed. In 2024 alone the US Food and Drug Administration approved nine new cellular and gene therapy products, spanning oncology, haematology, neurology, and inherited genetic disorders (1). These therapies differ fundamentally from conventional pharmaceuticals. Rather than modifying the disease through chronic administration, they aim to correct or compensate for the underlying genetic defect through a single

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intervention, offering the prospect of durable and, in some cases, curative benefit. This therapeutic promise, however, is inseparable from an economic one: a one-time treatment that replaces years or decades of chronic therapy and is delivered at a price that reflects the displaced lifetime value in a single invoice.

The magnitude of these prices is unprecedented in medicine. Onasemnogene abeparvovec (Zolgensma) for spinal muscular atrophy (SMA) entered the market in 2019 at approximately US$2.1 million, then the most expensive drug in the world; delandistrogene moxeparvovec (Elevidys) for Duchenne muscular dystrophy (DMD) was subsequently priced above US$3 million; the haemophilia gene therapy etranacogene dezaparvovec reached roughly US$3.5 million; and the gene-edited sickle-cell and β-thalassaemia therapies exagamglogene autotemcel (Casgevy) and lovotibeglogene autotemcel (Lyfgenia) carry list prices of approximately US$2.2 million and US$3.1 million respectively (2,3). For health systems accustomed to evaluating incremental therapies costing thousands of dollars per year, these figures represent a categorical, rather than merely quantitative, departure.

This departure creates a distinctive analytic problem for pharmacoeconomics. The discipline's standard tool, cost-effectiveness analysis (CEA), compares the incremental cost of an intervention with its incremental health benefit and is most often expressed as the incremental cost-effectiveness ratio (ICER), reported as cost per quality-adjusted life-year (QALY). When benefits accrue over a lifetime but costs are incurred at a single moment, and when the durability of those benefits is genuinely uncertain because the therapies are so new, the resulting ICER becomes exquisitely sensitive to modelling assumptions that conventional short-course therapies never tested so severely (4,5). Simultaneously, even a therapy that is cost-effective by conventional thresholds may be unaffordable when its entire cost falls in a single budget year for a cohort of patients, decoupling cost-effectiveness from budget impact in ways that challenge payers directly (6).

This review addresses how the value of gene and cell therapies is assessed within this single-dose, high-price paradigm, with particular attention to the exemplary neuromuscular conditions, SMA and DMD, where gene therapy has advanced furthest and generated the richest economic literature. We examine the economic distinctiveness of one-time therapies, the methodological challenges of their evaluation, the published cost-effectiveness evidence across therapeutic areas, the novel payment models developed in response to them, and the international and Turkish policy context. The aim is to provide clinicians, pharmacologists, and health-policy researchers with an integrated understanding of both the analytic methods and their real-world consequences for patient access.

Literature Search

This article is a narrative review, and the supporting evidence was identified through a structured but non-systematic literature search. We searched PubMed/MEDLINE, Embase, and the Cochrane Library, supplemented by Google Scholar and targeted screening of the grey literature, including health technology assessment (HTA) reports from bodies such as the National Institute for Health and Care Excellence (NICE) and the Institute for Clinical and Economic Review (ICER). The search covered publications from January 2010 to June 2026, and no lower date restriction was applied to foundational methodological references. Search terms combined the concepts of therapies and economic evaluation—including "gene therapy," "cell therapy," "advanced therapy medicinal products," "cost-effectiveness analysis," "quality-adjusted life-year," "incremental cost-effectiveness ratio," "health technology assessment," and "outcomes-based agreement"—with the names of specific conditions and products, such as SMA, onasemnogene abeparvovec, DMD, delandistrogene moxeparvovec, chimeric antigen receptor T-cell (CAR-T) therapy, haemophilia, and sickle-cell disease. We prioritised English-language, peer-reviewed economic evaluations, systematic reviews, and authoritative HTA or policy documents that were most relevant to the single-dose, high-price paradigm, and we hand-searched the reference lists of included articles to identify further sources. Given the narrative design, no formal risk-of-bias appraisal or quantitative meta-analysis was undertaken.

The Economic Distinctiveness of One-Time Therapies

The defining economic feature of gene and cell therapies is the temporal separation of cost and benefit. A single administration generates a stream of health gains—averted disease progression, avoided complications, extended survival, and, critically, avoided expensive chronic therapies—that may extend across a patient's entire life. However, the full acquisition cost is realised immediately. In conventional pharmacoeconomic terms, this means that the value proposition of a one-time therapy rests almost entirely on two quantities that are, at the point of launch, deeply uncertain: the durability of the clinical effect and the cost of the standard of care it displaces (4,7).

Durability is the primary source of uncertainty. If the effect of a gene therapy persists for life, its lifetime value may be substantial, potentially justifying a high price by offsetting decades of chronic treatment. If the effect wanes after several years, such that re-treatment or a return to chronic therapy is required, the value collapses. Because these therapies are recent, long-term follow-up is typically unavailable at the time of assessment, and analysts must extrapolate from a few years of trial data across a lifetime horizon (5,7). A systematic review of CEA of haemophilia gene therapies found that favourable results were driven overwhelmingly by the assumption that the therapeutic effect would remain durable for at least ten years, offsetting the high cost of standard factor-replacement or emicizumab therapy; when durability assumptions were relaxed, modelled value fell substantially (8).

The cost of the displaced standard of care is the second determinant, and it explains much of the variation in reported cost-effectiveness across conditions. Where the chronic alternative is itself extraordinarily expensive—such as nusinersen for SMA, which requires repeated intrathecal dosing indefinitely—a one-time therapy can appear cost-effective or even cost-saving despite its high price, because it avoids a still larger cumulative expenditure (9). Where the standard of care is comparatively inexpensive, as in some sickle-cell populations, budget-neutrality over realistic contract horizons becomes far harder to achieve even when the therapy delivers major health gains (3). The economic case for a one-time therapy is thus as much a statement about the counterfactual it replaces as about the therapy itself.

Methodological Challenges in Economic Evaluation

The single-dose, high-price paradigm exposes several methodological pressure points in conventional CEA, summarised in Table 1; evaluations of these therapies should in turn adhere to established reporting standards to ensure transparency and cross-study comparability (10).

Durability and Extrapolation

Given only short-term trial data, analysts must select extrapolations of survival and effect persistence over a lifetime. The choice of parametric survival model, the assumed waning of effect, and the handling of re-treatment can swing the ICER dramatically. Good practice, as articulated by value-assessment bodies, is to present both optimistic and conservative durability scenarios rather than a single point estimate, and to make the durability assumption explicit and central to the analysis (5,11).

Discounting

Because benefits are delayed relative to costs, the discount rate exerts an unusually large influence on the cost-effectiveness of one-time therapies; sensitivity analyses repeatedly identify it as among the most influential parameters (5). This has prompted debate about whether a lower or differential discount rate should apply to therapies with durable, front-loaded costs and back-loaded benefits. The prevailing methodological view is that there is insufficient theoretical justification for a gene-therapy-specific discounting rule, and that any change to discounting should be applied consistently across technologies rather than selectively; nonetheless, the sensitivity of results to this choice must be transparently reported (5,12).

Single-arm Trials and Surrogate Endpoints

Many pivotal gene-therapy trials are single-arm studies in small rare-disease populations, using surrogate endpoints such as motor-milestone achievement or biomarker expression rather than long-term functional or survival outcomes (13,14). This complicates the estimation of comparative effectiveness and forces reliance on naive or matched comparisons with natural-history or standard-of-care cohorts, introducing bias and uncertainty into the incremental benefit that underpins the ICER (14).

Table 1. Methodological challenges in evaluating one-time gene and cell therapies and mitigating approaches

Challenge	Why it matters	Mitigating approach
Durability uncertainty	Value depends on whether effect lasts a lifetime	Optimistic and conservative durability scenarios; registries
Discounting	Delayed benefit vs. immediate cost makes ICER highly rate-sensitive	Transparent sensitivity analysis; consistent cross-technology rules
Single-arm trials/surrogates	Weak comparative and long-term evidence	Matched natural-history comparisons; post-approval data
QALY limitations	Under-captures severity, rarity, family spillover	Alternative metrics (e.g., equal-value life-years); societal weights
Perspective	Payer view omits caregiver/productivity benefit	Report payer and societal perspectives
Affordability vs. cost-effectiveness	Concentrated cost causes budget shock	Budget impact analysis; novel payment models

QALY: Quality-adjusted life-year, ICER: Incremental cost-effectiveness ratio

Valuing Benefit: the QALY and Its Limits

The QALY, the standard measure of health benefit, has recognised limitations when applied to severe, rare, and often paediatric conditions. Eliciting utilities in infants is methodologically difficult; conventional cost-effectiveness thresholds may not reflect societal preferences for treating very severe or ultra-rare diseases; and the QALY may inadequately capture value elements such as the value of hope, family spillover effects, and the option value of survival. Some analysts have adopted alternative or supplementary metrics, such as equal-value life-years gained, to mitigate concerns that conventional QALY-based valuation systematically undervalues therapies for the most severely affected (6,12,15).

Perspective and Cost Offsets

The perspective of the analysis—the healthcare payer perspective versus the broader societal perspective—materially affects results because gene therapies often generate substantial non-medical benefits, including averted caregiver burden and preserved productivity, that a narrow payer perspective excludes. Analyses that adopt a societal perspective frequently yield more favourable results, and in some cases render a therapy dominant, than those confined to direct healthcare costs (12). Transparency about perspective, and ideally the presentation of multiple perspectives, is therefore essential.

Case Study: Spinal Muscular Atrophy

SMA, a leading inherited cause of infant mortality resulting from biallelic loss of the *SMN1* gene, has become the paradigmatic testing ground for the economics of gene therapy. Three disease-modifying therapies now exist: the antisense oligonucleotide nusinersen and the small molecule risdiplam, both requiring chronic administration, and the one-time gene-replacement therapy onasemnogene abeparvovec (16). The pivotal single-dose gene-replacement trials transformed the natural history of the most severe infantile form, and evidence increasingly indicates that outcomes are best when treatment is initiated pre-symptomatically, often following newborn screening (13,17).

The economic evaluations of onasemnogene abeparvovec illustrate the central themes of this review. An early US CEA modelling the gene therapy against nusinersen in SMA type 1 estimated undiscounted lifetime survival of 37.2 vs. 9.7 life-years and found the gene therapy cost-effective across a price range of US$2.5–5.0 million, with ICERs ranging from dominant (cost-saving) to approximately US$31,000 per QALY—results driven by the avoidance of the very high lifetime cost of chronic nusinersen (9). In the United Kingdom, the NICE appraised onasemnogene abeparvovec for pre-symptomatic SMA through its highly specialised technology programme; using a confidential discounted price, both the company and the external assessment group produced ICERs below £100,000 per QALY, and the therapy was recommended subject to a commercial access arrangement (18). Analyses of newborn screening for SMA, which enables the pre-symptomatic treatment associated with the greatest benefit, have found screening to be dominant—improving outcomes while saving costs—from a hospital-payer perspective (17).

The contrast with the chronic comparator is instructive. A comparative analysis of nusinersen reimbursement across eleven jurisdictions found ICERs ranging from roughly €465,000 to €6.4 million per QALY for early-onset SMA and up to €10.6 million per QALY for later-onset disease; despite none of these estimates meeting conventional cost-effectiveness thresholds, every jurisdiction reimbursed the drug, most through managed-entry agreements (19). This experience demonstrates that for severe, ultra-rare paediatric conditions, formal cost-effectiveness has often not been the binding constraint on access; instead, negotiated agreements and explicit societal valuation of severity and rarity have driven positive decisions—an environment into which one-time gene therapies now enter, bringing their own distinctive economics.

Case Study: Duchenne Muscular Dystrophy

DMD, an X-linked disorder caused by mutations in the dystrophin gene that lead to progressive muscle degeneration, respiratory failure, and cardiomyopathy, has followed SMA into the gene-therapy era, albeit with a more contested evidence base. Corticosteroids remain the standard of care and the most cost-effective and best-evidenced treatment, supplemented by exon-skipping oligonucleotides and, more recently, the micro-dystrophin gene therapy delandistrogene moxeparvovec, approved through an accelerated pathway on the basis of surrogate biomarker expression (20). The accelerated approval of several DMD therapies on surrogate endpoints, sometimes with uncertain demonstrated clinical benefit, exemplifies the tension between rapid access and robust value demonstration that pervades this field (20).

An early US CEA of delandistrogene moxeparvovec estimated that the therapy added approximately 10.3 discounted (26.4 undiscounted) equal-value life-years relative to standard care, and used threshold analysis—rather than an established price, which was not yet set—to estimate a maximum value-based treatment cost of approximately US$5 million at a willingness-to-pay of US$500,000 per equal-value life-year gained (21). The use of equal-value life-years

and an elevated threshold reflects deliberate methodological choices intended to accommodate the severity and rarity of DMD and illustrates how the analytic framework itself becomes a locus of value judgment in this setting. Because the therapy's price subsequently exceeded US$3 million and its clinical benefit remains debated, DMD has become a focal case for the broader question of whether accelerated approval on surrogate endpoints can be reconciled with the durable clinical benefit that high one-time prices implicitly presuppose (20,21).

Further Exemplars: CAR-T, Haemophilia, and Haemoglobinopathies

Beyond neuromuscular disease, the economics of one-time and short-course cellular and gene therapies have been examined across several fields, with widely divergent conclusions (Table 2).

CAR-T Therapies

Tisagenlecleucel was among the first CAR-T products to reach approval, having demonstrated durable remissions in children and young adults with relapsed or refractory B-cell acute lymphoblastic leukaemia in the pivotal ELIANA trial (22), and CAR-T therapies have since been evaluated economically across a widening range of haematological malignancies. For relapsed or refractory diffuse large B-cell lymphoma, a US analysis found second-line axicabtagene ciloleucel cost-effective at a US$150,000-per-QALY threshold, with an ICER of approximately US$99,000 per QALY, while second-line tisagenlecleucel was dominated by standard care and third-line-or-later tisagenlecleucel yielded an ICER of approximately US$127,000 per QALY (23). In a Chinese healthcare-system analysis, by contrast, CAR-T therapies were not cost-effective at the local willingness-to-pay threshold in any line of therapy, with price reduction identified as the principal lever for achieving value (24). This divergence underscores how cost-effectiveness is contingent on local prices, thresholds, and comparators, rather than an intrinsic property of a technology.

Haemophilia

The one-time gene therapies valoctocogene roxaparvovec (haemophilia A) and etranacogene dezaparvovec (haemophilia B) displace lifelong prophylactic factor replacement therapy or emicizumab, which are among the most expensive chronic treatments in medicine. A systematic review of published analyses concluded that, despite their high upfront cost, all identified studies modelled the gene therapies as producing lower overall costs and better outcomes than standard care—provided the therapeutic effect remained durable for at least a decade—and recommended outcomes-based agreements to manage the residual durability risk to payers (8).

Sickle-cell Disease and β-thalassaemia

The gene-edited therapy exagamglogene autotemcel, the first CRISPR-based therapy approved, and the lentiviral therapy lovotibeglogene autotemcel offer potentially transformative benefit in sickle-cell disease (14). A US analysis of exagamglogene autotemcel estimated a substantial survival gain and an ICER of approximately US$16,800 per QALY from the payer perspective, with the therapy dominant from a societal perspective, driven by large reductions in vaso-occlusive events and disease-related costs (25). Yet a Medicaid-focused payment-model analysis showed that, because the annual cost of standard care for sickle-cell disease is relatively modest, achieving budget neutrality over a realistic six-year contract is unlikely even with outcomes-based rebates; such rebates were nonetheless estimated to save on the order of US$260,000-370,000 per patient, illustrating the gap between long-run cost-effectiveness and short-run affordability (3).

Novel Payment and Access Models

The disjunction between cost-effectiveness and affordability, together with uncertainty about durability, has stimulated a wave of innovation in payment and access mechanisms designed to share financial risk between manufacturers and payers (Table 3). Outcomes-based agreements tie payment to the realisation of pre-specified

Table 2. Selected cost-effectiveness findings for gene and cell therapies (illustrative; prices approximate list prices)

Therapy (indication)	Approx. price	Key economic finding
Onasemnogene abeparvovec (SMA)	~US$2.1M	ICER dominant to ~US$31k/QALY vs. nusinersen; NBS dominant (9,17,18)
Delandistrogene moxeparvovec (DMD)	>US$3M	~10.3 discounted evLYs; value-based max ~US$5M at US$500k/evLYG (21)
Axicabtagene ciloleucel (2L DLBCL)	~US$0.4M	ICER ~US$99k/QALY; cost-effective at US$150k threshold (23)
Haemophilia A/B gene therapies	~US$3.5M	Lower lifetime cost + better outcomes if durable ≥10 years (8)
Exagamglogene autotemcel (SCD)	~US$2.2M	ICER ~US$16.8k/QALY (payer); dominant (societal) (25)

QALY: Quality-adjusted life-year, ICER: Incremental cost-effectiveness ratio, SMA: Spinal muscular atrophy, NBS: Newborn screening, DMD: Duchenne muscular dystrophy, evLYs: Equal-value life-years, evLYG: Equal-value life-year gained, 2L: Second-line, DLBCL: Diffuse large B-cell lymphoma, SCD: Sickle cell disease

Table 3. Novel payment and access models for one-time therapies

Model	Mechanism	Rationale
Outcomes-based agreement	Payment tied to achieved clinical outcomes	Shares durability risk with manufacturer
Annuity/instalment	Cost spread over several years	Aligns payment with benefit accrual; eases budget shock
Subscription ("Netflix")	Fixed fee for defined population access	Predictable budgeting for payer
Coordinated public access model	Standardised outcomes-based purchasing across payers	Equity and negotiating scale (3)

clinical outcomes over time, so that payers recover value if a therapy fails to deliver durable benefit; such agreements have been proposed and piloted for sickle-cell and haemophilia gene therapies, and are supported by analyses showing meaningful payer savings contingent on therapy performance (3,8). Annuity or instalment models spread the one-time cost over several years, aligning payment with the accrual of benefit and mitigating the single-year budget shock, though they raise practical complications around patient mobility between insurers and accounting treatment (7,26).

Broader systemic approaches have also emerged, including subscription or "Netflix"-style arrangements for defined populations and coordinated public access models. In the United States, a public gene-therapy access model has been developed to standardise outcomes-based purchasing of sickle-cell therapies across state Medicaid programmes, leveraging real-world data to define eligible populations and structure agreements (3). Underpinning several of these proposals is the observation that the value of a durable one-time therapy, appropriately discounted and measured against an expensive chronic comparator, may be greater than intuition suggests—reframing the pricing debate from sticker shock toward risk-sharing and value-based contracting (7). The common thread is a shift from a single upfront transaction toward mechanisms that couple payment to demonstrated durable performance.

Health Technology Assessment, International Divergence, and Access

The assessment and reimbursement of gene and cell therapies vary markedly across jurisdictions, reflecting differences in willingness-to-pay thresholds, methods for valuing severity and rarity, budget constraints, and appetite for managed-entry agreements. The same therapy may be judged cost-effective in one system and unaffordable in another, and the divergence has real consequences for patient access (19,24). A recent analysis of pricing and reimbursement policies across Europe found that heterogeneous HTA and managed-entry-agreement processes contribute to delayed, unequal, or absent access to cell and gene therapies across member states, exacerbating cross-country health inequalities (27). Several agencies have adapted their processes for ultra-orphan and one-time therapies—through highly specialised technology programmes, elevated thresholds, and confidential commercial arrangements—but no international consensus exists on how to value durable one-time benefit (18).

The fragility of access under these conditions has been demonstrated starkly by market withdrawals. Bluebird bio withdrew its approved gene therapies, including the β-thalassaemia therapy betibeglogene autotemcel (Zynteglo) and the cerebral adrenoleukodystrophy therapy elivaldogene autotemcel (Skysona), from the European market, citing an inability to reach reimbursement agreements with European payers whose frameworks, the company argued, had not evolved to recognise the innovation and expected lifelong benefit of such products (2). These withdrawals illustrate that a therapy can secure regulatory approval yet fail commercially where value-assessment and payment frameworks cannot accommodate its economics, leaving patients without access despite proven efficacy—a cautionary lesson for any health system designing its approach to ATMPs.

The Turkish Context

In Türkiye, the arrival of gene and cell therapies coincides with an already-strained environment for rare diseases and orphan drugs. Türkiye operates a positive-list reimbursement system in which the Social Security Institution makes coverage decisions, pricing is anchored to an international reference-pricing mechanism, and a mandatory pharmacoeconomic evaluation is required of manufacturers for most products. Orphan drugs, however, have historically been exempted from the formal requirement for pharmacoeconomic analysis, and access to some very-high-cost therapies has been facilitated through mechanisms for importing medicines from abroad. The single-dose, multi-million-dollar economics of gene therapies pose a profound challenge to this system: reference pricing provides little traction for therapies with few or no international comparators; a single cohort of patients can

impose a severe budget shock; and methodological capacity to evaluate durability-dependent lifetime models is still developing.

The international experience reviewed here suggests several priorities for the Turkish setting. Managed-entry agreements and outcomes-based agreements, already available in principle through Türkiye's alternative reimbursement framework, are likely to be indispensable for reconciling access with affordability and managing durability risk. Investment in local real-world data infrastructure would enable the tracking of long-term outcomes on which such agreements depend and reduce reliance on transferred assumptions whose local validity is uncertain. Building HTA capacity to construct and critically appraise lifetime decision-analytic models for one-time therapies and developing explicit, transparent frameworks for valuing severity and rarity would strengthen the legitimacy and consistency of decision-making. As a middle-income country with a large, centralised social-insurance system, Türkiye faces acute affordability pressures, yet possesses institutional structures through which coordinated, value-based purchasing of gene therapies could be organised.

Challenges and Future Perspectives

Several challenges will shape the evolution of the economics of gene and cell therapies. The foremost remains durability: as long-term follow-up accumulates, the wide uncertainty bands that currently dominate cost-effectiveness estimates should narrow, and analyses will increasingly be able to replace assumption with evidence (5,8). The endpoints problem is equally pressing; the reliance on surrogate markers and single-arm designs, particularly under accelerated approval, means that economic models often rest on incompletely demonstrated clinical benefit, and post-approval evidence generation through registries and real-world data will be central to resolving this (14,20). Methodologically, the field must continue to refine the handling of discounting, perspective, and the valuation of benefit for severe rare disease, ideally converging on transparent, standardised approaches rather than bespoke, therapy-specific rules that invite inconsistency (5,12,15).

The affordability challenge is distinct from and will outlast the cost-effectiveness challenge. Even therapies that are demonstrably cost-effective can overwhelm budgets when their cost is concentrated in time and cohort, and the continued development of payment models—outcomes-based agreements, annuities, and coordinated public purchasing—will be essential to translate favourable value into sustainable access (3,7,26). The market withdrawals seen in Europe are a warning that misalignment between value frameworks and therapy economics harms patients directly (2). Looking forward, as manufacturing costs fall, indications broaden, and competition emerges, prices may moderate and the affordability calculus may ease, but the central analytic task—valuing durable, front-loaded benefit under uncertainty—will remain. Meeting it will require close collaboration among clinical pharmacologists, health economists, regulators, and payers.

Conclusion

Gene and cell therapies embody one of the most consequential developments in modern medicine and simultaneously represent one of the most challenging problems in pharmacoeconomics. Their single-dose, high-priced structure severs the familiar link between cost and time, concentrating expenditure at a single moment while dispersing benefits—and uncertainty—across a lifetime. The published evidence, spanning SMA, DMD, CAR-T therapies, haemophilia, and the haemoglobinopathies, indicates that these therapies can be cost-saving or exceed conventional cost-effectiveness thresholds substantially, with conclusions depending primarily on durability, the cost of the displaced comparator, discounting, and perspective. Realising the promise of these therapies without destabilising health-system finances will require economic evaluations that are durability-sensitive, transparent about their assumptions, and honest about uncertainty, and payment models that share risk and align payment with demonstrated performance. For Türkiye and comparable systems, the priorities are managed-entry agreements, real-world data infrastructure, and HTA capacity. The single-dose, high-priced paradigm is not a transient anomaly but the leading edge of a durable shift in therapeutics, and the methods used to value it will help determine which patients benefit from it.

Ethics

Ethics Committee Approval: Not required.

Informed Consent: Not required.

Footnotes

Authorship Contributions

Concept: R.K.B., Design: R.K.B., Data Collection or Processing: R.K.B., Analysis or Interpretation: R.K.B., A.A.S., Literature Search: R.K.B., Writing: R.K.B., A.A.S.

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