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REVIEW

Customized Marketing Strategies for Cancer Immunocyte Therapy Based on its Distinctive Attributes

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Abstract: Cancer constitutes a persistent global health challenge, and immunocyte therapy has emerged as one approach in oncological care. This narrative review aimed to systematically analyze, synthesize, and critically interpret the therapeutic characteristics, advantages, market landscape, and current access barriers of cancer immunocyte therapy, based on thematic clustering and cross-study integration of clinical evidence, market data, and industry reports. Immunocyte therapy exhibits distinctive features including personalization, long-term immune memory, and observed efficacy in refractory malignancies, yet its clinical accessibility is limited by high costs, low public and physician awareness, and unsuitable traditional marketing models. Through thematic synthesis and pattern identification across included studies, this review identified core strategic directions including precise hierarchical positioning, academic and digital medical education, innovative payment models, industrial-chain integration, data-driven dynamic optimization, policy leverage, and differentiated product-service strategies. Each strategy is supplemented with comprehensive implementation feasibility analysis, covering regulatory constraints, infrastructure limitations, cost implications, stakeholder barriers, and context-dependent variability to enhance practicality and credibility. These tailored marketing approaches are associated with improved market penetration, expanded patient access, and potential support for the clinical and commercial value of immunocyte therapy. This review provides evidence-based, analytically integrated strategic insights for enterprises, medical institutions, and policymakers to promote the rational commercialization and equitable access of cancer immunocyte therapy.

Keywords: cancer therapy, immunocyte therapy, personalized medicine, marketing strategies, market accessibility, cost-effectiveness

Type of Review

This article is a methodologically rigorous, structured, evidence-based narrative review that synthesizes existing literature, clinical evidence, market data, and industry reports to analyze the characteristics, advantages, market landscape, and customized marketing strategies of cancer immunocyte therapy. While not conducted as a systematic review or meta-analysis, it employs standardized literature searching, structured two-stage screening, explicit inclusion/exclusion criteria, independent dual-reviewer screening, and quality assessment to ensure rigor, transparency, and reproducibility. Its core output is an integrated, prioritized conceptual framework that positions the work as a cross-disciplinary synthesis—neither a pure clinical review nor a standalone policy commentary—connecting therapeutic attributes, health system constraints, and commercialization strategies while delivering a structured, implementable foundation for practice and policy guidance through comprehensive multidisciplinary integration and inductive analysis.

Introduction

Cancer remains a major global health threat. According to World Health Organization, approximately 20 million new cancer cases and 9.7 million new cancer deaths in 2022. To make things worse, in the past two decades, the overall incidence of cancer has shown an increasing trend, over 35 million new cancer cases are predicted in 2050, a 77% increase from the

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estimated 20 million cases in 2022. [1] Furthermore, the economic burden of cancer is staggering: the estimated global economic cost of cancer between 2020 and 2050 is $25.2 trillion.[2]

Surgery, radiotherapy, and chemotherapy remain the cornerstone modalities of cancer treatment. Radiotherapy achieves localized tumor control with enhanced precision to minimize normal tissue toxicity, while chemotherapy-induced adverse effects have been mitigated through targeted drug development.[3,4] Over the past decade, oncology therapeutics have advanced substantially, with immunotherapy emerging as an additional paradigm. Dostarlimab, a PD-1 monoclonal antibody, exemplified by antibody-based approaches, demonstrated clinical activity in a 2022 clinical trial, establishing a novel "immune ablation" strategy.[5] Cellular therapies have shown clinical outcomes across hematologic and solid malignancies. CAR-T cell therapy has been associated with durable remissions in hematologic cancers.[6] Parallel progress in solid tumors stems from tumor-infiltrating lymphocyte (TIL) therapy, which achieves objective response rates of 30–50% in metastatic melanoma and cervical cancer, with sustained efficacy attributed to its capacity to overcome tumor heterogeneity.[7]

Currently, traditional treatment plans and targeted therapies dominate the tumor treatment market.[8,9] Driven by the increasing incidence of cancer and breakthroughs in research and development, since the FDA approved the listing of Kymriah in August 2017, the market share of immune cell therapy in cancer treatment has been experiencing steady growth, showing a remarkable upward trend.[8,10] However, due to the highly individualized nature of current immune cell therapies and their substantial cost, this has imposed significant economic strain on the healthcare system.[10] Consequently, the exploration of innovative pricing mechanisms, marketing strategies, and reimbursement models has emerged as a critical step in ensuring treatment accessibility.

Despite remarkable clinical progress, immunocyte therapy faces unique commercialization and market access challenges that are distinctly different from conventional drugs and targeted therapies. These include ultra-high treatment costs, autologous personalized manufacturing, complex logistics and quality control, low physician and patient awareness, limited reimbursement coverage, and delayed clinical adoption.[11] Existing literature has predominantly focused on the clinical efficacy, safety, and technical optimization of immunocyte therapy, while comprehensive analyses integrating therapeutic characteristics with healthcare marketing and commercialization strategies remain scarce. Traditional pharmaceutical marketing models may be less suitable for the personalized, costly, and technically complex nature of immunocyte therapy. Existing literature is fragmented: clinical reviews ignore commercial barriers; marketing proposals lack clinical grounding; policy analyses lack structured frameworks. No study has systematically linked clinical evidence to a prioritized, feasibility-validated strategy framework. This represents a clear literature gap. This misalignment is well documented in health services and market access literature for cell and gene therapies.[12] This creates a critical research gap: a systematic review is urgently needed to clarify why and how customized marketing strategies should be designed for immunocyte therapy.

Against this backdrop, this manuscript positions itself as a structured narrative review that delivers an integrated conceptual framework and practice-oriented implications. Its core purpose is to bridge clinical oncology, health system delivery, and commercialization strategy. Moreover, this review establishes two core objectives. First, it aims to conduct a systematic comparative analysis and integrative synthesis of the differences in treatment characteristics and industrial features between immune cell therapy and traditional cancer treatments. Second, it endeavors to identify, cluster, and critically interpret the key obstacles in the process of market access and clinical promotion of immune cell therapy and formulate evidence-based and targeted marketing and commercialization strategies accordingly. The primary contribution is to transform descriptive findings into a hierarchical, constrained, implementable framework that addresses real-world regulatory, infrastructural, and stakeholder barriers. All strategies are embedded into real-world oncology practice, formal treatment pathways (NCCN/CSCO/ESMO), and healthcare delivery systems (specialized cancer centers, MDT teams, hospital treatment workflows) to ensure clinical compatibility and health system alignment. To avoid an over-broad framework, all strategies are organized into a structured prioritization hierarchy by impact and feasibility, providing clear practical guidance. Each strategy fully considers real-world constraints including regulatory policies, infrastructure conditions, cost input, and stakeholder attitudes to ensure realistic implementability. To attain these goals, this paper integrates multidisciplinary perspectives from clinical oncology, health economics, and marketing. It systematically compares, integrates, and cross-validates the advantages and limitations of immune cell therapy in comparison with

traditional therapies, identifies consistent patterns and divergent findings from the existing market landscape, and proposes targeted market promotion strategies based on its unique attributes. A conceptual framework is developed to synthesize, visualize, and logically link the customized marketing strategy system for immunocyte therapy. The ultimate objective is to bridge the gap between technological innovation and clinical practical accessibility and offer actionable decision-making references for relevant enterprises, clinicians, payers, and policymakers.

Methods

Literature Search Strategy

A comprehensive literature search was conducted in multiple academic databases including PubMed, Web of Science, Scopus, and China National Knowledge Infrastructure (CNKI). The search time range was from January 2010 to February 2025. The search keywords included: "cancer immunocyte therapy", "CAR-T cell therapy", "TIL therapy", "TCR-T cell therapy", "NK cell therapy", "cancer treatment marketing", "personalized medicine marketing", "market access of cell therapy", and "cost-effectiveness of cell therapy". The search was performed using Boolean operators (AND/OR) to ensure comprehensiveness, and no language restrictions other than English and Chinese were applied.

Literature Selection Criteria

Inclusion criteria: (1) Peer-reviewed original research articles, review articles, clinical trial reports, and market analysis reports related to cancer immunocyte therapy; (2) Literature focusing on clinical efficacy, safety, technical characteristics, market size, and marketing models of immunocyte therapy; (3) English and Chinese full-text literature with clear data and conclusions. Exclusion criteria: (1) Duplicate publications, conference abstracts without full text, and editorials; (2) Literature with incomplete data, unclear research design, or low methodological quality; (3) Studies unrelated to the core theme of immunocyte therapy and its marketing strategies.

Structured Literature Screening Process (Quantitative & Reproducible)

A two-stage, independent dual-reviewer screening process was implemented to ensure objectivity and reproducibility:

Stage 1: Initial screening: Two independent researchers (X.L. and C.W.) reviewed all titles and abstracts retrieved from databases. A total of 3286 records were initially identified. After removing duplicates (n=842), 2444 unique records remained. Studies clearly irrelevant to the topic were excluded, leaving 417 records for full-text screening.

Stage 2: Full-text screening: The same two researchers independently assessed full texts against inclusion/exclusion criteria. A total of 283 studies were excluded due to irrelevance (n=126), incomplete data (n=79), non-peer-reviewed gray literature (n=45), and low methodological quality (n=33). Finally, 134 studies were included in the qualitative synthesis.

Discrepancy resolution: Any disagreements at any stage were resolved via discussion or consultation with a third senior reviewer (X.H.) until consensus was reached.

Literature Quality Assessment

A standardized quality assessment was performed for all 134 included studies:

For clinical studies: Assessed using study design (randomized controlled trial > cohort study > case series), sample size, follow-up duration, outcome definition clarity, and risk of bias. For review/market studies: Assessed using literature comprehensiveness, data source authority, analytical logic, and conclusion validity. All studies were graded as high, moderate, or low quality; only high- and moderate-quality studies were used for core evidence synthesis.

Data Extraction and Synthesis

Two independent researchers screened the literature and extracted key information, including therapeutic mechanisms, clinical efficacy data, advantages and limitations of immunocyte therapy, market size, approved products, and existing marketing models. A standardized data extraction form was used to ensure consistency. Disagreements were resolved through discussion or consultation with a third reviewer. The synthesis follows narrative review methodology: thematic

extraction, cross-study pattern identification, and critical interpretation. The output is converted into a structured conceptual framework with prioritization and feasibility scoring, distinguishing this work from standard narrative reviews. The extracted data were qualitatively synthesized using thematic analysis: evidence was clustered into six core themes (therapeutic attributes, efficacy patterns, cost characteristics, market barriers, stakeholder cognition, marketing models); cross-study comparisons were performed to identify consistent patterns, contradictions, and evidence gaps; and critical interpretation was applied to resolve heterogeneity and derive integrated conclusions. Clinical pathway data, healthcare delivery structures, and real-world oncology practice guidelines were also extracted to integrate marketing strategies with clinical reality. Strategy impact and feasibility were systematically rated to establish a prioritization hierarchy for the final framework. Regulatory, infrastructure, cost, and stakeholder constraint data were additionally extracted to evaluate real-world implementation feasibility for each strategy.

Market Data Sources

Market size, growth rate, and product approval data were collected from authoritative industry research institutions (eg, GM Insights, Business Research Insights), FDA official approval announcements, and public clinical trial databases to ensure the authenticity and timeliness of market information.

The Advantages of Immunocyte Therapy vs Traditional Therapeutic Strategies

Anti-cancer drugs are utilized across a variety of treatment modalities, such as surgery, chemotherapy, radiotherapy, hormone therapy, targeted therapy, immune checkpoint inhibitor therapy, antibody-based therapy, and immunocyte therapy. In this chapter, we systematically evaluate the advantages and limitations of these diverse cancer treatment approaches and a comprehensive list of representative products currently in clinical applications is provided (Table 1).

Table 1 is structured with standardized analytical dimensions: therapeutic mechanism, core efficacy, clinical applicability, economic cost, technical complexity, and marketing suitability, enabling direct comparative analysis across therapies. Key differences relevant to marketing and commercialization are explicitly highlighted.

As shown in Table 1, immunocyte therapy differs fundamentally from traditional therapies in five core dimensions: it shows efficacy in refractory malignancies, relies on personalized autologous preparation, incurs ultra-high costs, requires ultra-high technical complexity, and may not fit traditional mass marketing models. Through cross-study comparative synthesis, these distinctive attributes form a logically consistent causal chain: personalized preparation leads to high costs and technical complexity, which in turn make traditional marketing unsuitable, thereby forming the foundational rationale for designing customized marketing strategies.

Immune cell therapy displays specific characteristics related to "living drugs" and immune modulation. Synthetic analysis across included clinical studies reveals eight consistent advantage patterns in comparison to other therapies, as manifested in the following aspects:

Long-Term Immune Memory: Transitioning From "Short-Term Elimination" to "Lifelong Protection"

The genetically engineered T cells proliferate continuously in the body and establish a reservoir of memory T cells that surveil for tumor recurrence over an extended period. For instance, in the treatment of B-cell lymphoma using CD19 CAR-T therapy, some patients have remained disease-free for over a decade (as demonstrated in the ZUMA-1 trial of Kymriah).[58] In contrast, chemotherapy or radiotherapy is only effective during the treatment window, lacks immune memory, and often results in relapse.[59,60] Targeted drug therapies necessitate continuous administration to suppress mutant clones, and disease progression accelerates upon discontinuation.[61,62] This long-term survival evidence directly supports the strategy of highlighting long-term value in precise hierarchical positioning.

Table 1 Analytical Comparison of Clinical and Commercial Attributes of Different Cancer Treatments

Treatment Methods	Therapeutic Mechanism	Core clinical Efficacy	Advantages	Limitations	Clinical Applicability	Representative Clinical Applications	Economic Cost	Technical Complexity	Marketing Suitability	Reference
Surgery	1. Direct resection of the lesion 2. Elimination of the risk of metastasis 3. Preventive intervention 4. Blocking the tumor-related pathological processes	Radical potential; rapid tumor reduction	1. Radical potential 2. Rapid tumor reduction 3. Precise pathological diagnosis 4. Basis of combined treatment 5. Progress in minimally invasive techniques 6. Palliative treatment	1. Anatomical limitations 2. Concealed metastasis risk 3. Functional impairment 4. Perioperative risk 5. Influence of tumor biological characteristics 6. Immunosuppression risk	Localized early-stage tumors	Anesthesia operation, Cryosurgical interventions, Laser-based treatments, Hyperthermic therapies, Photodynamic therapy	Moderate	Low	High (standardized services)	[13–19]
Chemotherapy	1.Interfere with the cell cycle of tumor cells 2. Induce apoptosis of tumor cells 3. Inhibit tumor angiogenesis 4. Release antigens and regulate immunity	Systemic tumor suppression	1. Systemic treatment 2. Synergistic combined treatment 3. Broad-spectrum applicability 4. Palliative relief 5. Dosage form technological progress	1. Toxic reaction 2. Tend to develop drug resistance 3. Insufficient targeting 4. Great difference in therapeutic effect 5. Risk of immunosuppression	Advanced systemic tumors	Cyclophosphamide, 5-FU, Doxorubicin, Paclitaxel, Cisplatin	Low	Low	High (mass promotion)	[20–26]
Radiotherapy	1. Directly damage tumor cell DNA 2. Indirectly generate free radical damage 3. Destroy tumor blood vessels 4. Immune activation 5. Biological effects of fractionated irradiation	Local tumor control	1. Local precise positioning 2. Minimally invasive and adaptable 3. Synergistic combined therapy 4. Palliative symptom relief 5. Safety gradually improves	1. Acute and long-term toxicity 2. Anatomical limitations and dose bottlenecks 3. Partial tumor resistance 4. Treatment time and economic burden 5. High technological dependence	Localized lesions	3D-CRT, IMRT, Cesium-131, Ruthenium-106, Iodine-125	Moderate	Moderate	High (standardized)	[27–32]

(*Continued*)

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Table 1 (Continued).

Treatment Methods	Therapeutic Mechanism	Core clinical Efficacy	Advantages	Limitations	Clinical Applicability	Representative Clinical Applications	Economic Cost	Technical Complexity	Marketing Suitability	Reference
Hormone therapy	1. Inhibit hormone synthesis 2. Antagonize hormone receptor signals 3. Inhibit hormone release 4. Regulate hormone metabolism	Long-term disease control	1. High efficiency and specificity 2. Advantage of low toxicity 3. Long-term control and prevention 4. Synergistic combined therapy 5. Reversible adjustment	1. Drug resistance issue 2. Long-term accumulated side effects 3. Limited applicable population 4. Takes effect relatively slowly. 5. Drug interactions reduce therapeutic efficacy	Hormone-dependent tumors	Tamoxifen, Letrozole, Fulvestrant, Bicalutamide, Leuprorelin, Abiraterone	Low	Low	High (standardized)	[33–38]
Targeted therapy	1. Inhibit abnormal signal pathways 2. Targeted inhibition of tumor angiogenesis 3. Induce apoptosis of tumor cells 4. Regulate epigenetic modifications 5. Degrade oncogenic proteins	Precise tumor inhibition	1. Precise killing, high efficiency and low toxicity 2. Reverse drug resistance 3. Long-term disease control 4. Synergistic effect of combined treatment 5. Rapid expansion of indications	1. Inevitably drug resistance 2. Off-target effect 3. Depend on biomarker detection 4. Special toxicity risk 5. High cost and accessibility challenge	Biomarker-positive tumors	Gefitinib, Crizotinib, Vemurafenib, Imatinib, Palbociclib, Olaparib, Blinatumomab	High	Moderate	Moderate (targeted promotion)	[39–45]
Immune checkpoint inhibitor therapy	1. Block the inhibitory signaling pathway 2. Activate the function of effector T cells 3. Remodel the tumor immune microenvironment 4. Induce immune memory	Persistent remission; broad-spectrum	1. Persistent disease remission 2. Broad-spectrum anti- tumor effect 3. Synergistic treatment for enhanced efficacy 4. Preserve organ function 5. Low cumulative toxicity	1. The response rate varies greatly. 2. Immune-related toxicity risks 3. Complicated drug resistance mechanism 4. High economic burden 5. Imperfect markers for therapeutic efficacy prediction	Immune-sensitive tumors	Pembrolizumab, Atezolizumab, Ipilimumab, Relatlimab	High	High	Moderate (academic-driven)	[46–48]

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Antibody-based therapy	1. Directly target and kill tumor cells 2. Immune-mediated cytotoxicity 3. Delivery of cytotoxic drugs 4. Regulation of the tumor immune microenvironment	Precise targeted therapy	1. High specificity and low off-target toxicity 2. Multifunctional treatment mode 3. Synergistic treatment to increase therapeutic efficacy 4. Long-term effectiveness and convenience 5. Breakthrough in tumor drug resistance	1. Antigen heterogeneity leads to drug resistance 2. Immunogenicity risk 3. Special toxicity 4. Production and cost challenges 5. Poor penetration in solid tumors	Antigen-positive tumors	Trastuzumab, Bevacizumab, Cetuximab	High	High	Moderate (specialized promotion)	[49–52]
Immunocyte therapy	1. Engineer the transformation of T cells to recognize tumors 2. Expand tumor-specific immune cells to kill tumor cells 3. Break through the immunosuppressive microenvironment 4. Form long-lasting anti-tumor immune memory	Breakthrough in refractory tumors; long-term survival	1. A revolutionary therapeutic breakthrough 2. Highly individualized treatment approaches 3. Long-term benefits achieved with a single treatment 4. Synergistic combination therapy enhances therapeutic efficacy 5. Overcomes the challenge of drug resistance in conventional treatments	1. Potential toxicity risks 2. High complexity in preparation coupled with significant costs 3. Antigenic escape and disease recurrence	Relapsed/ refractory; personalized	Kymriah, Yescarta, Lifileucel	Ultra-high	Ultra-high	Low (traditional models); High (customized)	[53–57]

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Breakthrough in Overcoming Traditional Drug Resistance: Transitioning From "Target Dependence" to "Adaptive Attack"

T cells can dynamically recognize tumor antigen variations and attack antigen-negative cells via the bystander killing effect. For instance, in BCMA CAR-T therapy for multiple myeloma, even when BCMA expression is downregulated, tumor cells can still be eliminated through the antibody-dependent cellular cytotoxicity (ADCC) mediated by Fc receptors.[63] However, targeted therapies rely on single driver genes and are susceptible to drug resistance.[64] Moreover, immune checkpoint inhibitors require robust T cell infiltration and exhibit limited efficacy in cold tumors.[65] This adaptive efficacy evidence supports differentiated competitive positioning against targeted therapies and PD-1 inhibitors.

Individualized and Precise Killing: Transitioning From "Universal Solutions" to "Personalized Customization"

Based on the modification of patients' autologous T cells or the engineering of neoantigen-specific TCRs, the concept of "one person, one medicine" can be realized. For instance, NeoTCR-T cell therapy specifically targets individual mutant neoantigens (such as NY-ESO-1) for the treatment of advanced soft tissue sarcoma.[66] Nevertheless, chemotherapy and radiotherapy lack specificity and may cause damage to normal tissues.[67] Additionally, immune therapy depends on the homogeneous expression of antigens, making heterogeneous tumors more susceptible to immune escape.[68] Personalization evidence supports the "precision matching system" in the differentiated service strategy.

Multi-Target Attack Capability: Transitioning From "Individual Combat" to "Three-Dimensional Encirclement and Suppression"

T cells inherently express abundant TCRs capable of recognizing a wide range of tumor antigens. Furthermore, through engineered designs, such as CD19/CD22 dual-target CAR-T cells to prevent antigen escape,[69] or logic-gated CARs to prevent off-target toxicity.[70] Nevertheless, the single-target inhibition of targeted therapies can be easily bypassed by alternative signaling pathways.[64] Additionally, chemotherapy lacks specificity.[71]

Therapeutic Potential of Solid Tumors: Transitioning From "Hard-to-Reach" to "Microenvironment Remodeling"

The preliminary results of an ongoing Phase I clinical trial evaluating TILs demonstrate clinical activity in the treatment of advanced melanoma. Specifically, one patient achieved a complete response (CR), two patients achieved partial responses (PR), and the disease control rate was 100%.[72] These outcomes are different from other treatment modalities, suggesting the feasibility of curing advanced solid tumors with this approach. Furthermore, through genetic engineering, CAR-T cells can be modified to secrete cytokines such as IL-12 and IFNα2, thereby reversing the immunosuppressive tumor microenvironment.[73] In contrast, macromolecular drugs used in antibody or antibody-drug conjugate (ADC) therapies often struggle to penetrate the dense matrix of solid tumors.[74] While radiotherapy is effective for local control, it is limited in addressing systemic metastases, especially brain metastasis.[75] Solid tumor efficacy evidence supports potential patient population stratification and clinical trial expansion strategies.

Therapeutic Response in Synergy with the Host Immune System: Transitioning From "Passive Clearance" to "Active Activation"

T cells not only directly kill tumor cells and release tumor antigens but also activate endogenous T cells through the antigen spread effect, thereby establishing potential anti-tumor immunity. For instance, following CAR-T therapy, some patients exhibit regression of antigen-negative tumors, likely due to the activation of broader immune responses.[76] In contrast, surgery and radiotherapy primarily eliminate localized lesions without activating systemic immunity. Moreover, the immunosuppressive microenvironment induced by chemotherapy may potentially compromise therapeutic efficacy.[77]

Low Cumulative Toxicity: Transitioning From "Continuous Damage" to "One-Time Repair"

A single infusion of immune cells may be associated with long-term remission of the disease while avoiding the cumulative long-term toxicity associated with chemotherapy (eg, cardiotoxicity).[78] For instance, a 10-year follow-up study on CAR-T therapy in patients with hematological malignancies demonstrates that long-term quality of life is reported to be superior compared to that achieved with continuous chemotherapy regimens.[79] Low toxicity evidence supports patient education and emotional resonance strategies.

Innovation in Treatment Convenience: Transitioning From "Complex Treatment Regimens" to "Single-Injection Cures"

With the continuous advancement of technology, novel immune cell therapies are emerging at an unprecedented rate. For instance, universal CAR-T eliminates the need for personalized preparation by enabling an "off-the-shelf" supply (eg, ALLO-501A developed by Allogene).[80] In vivo CAR-T leverages innovative vectors to generate CAR-T cells directly within the patient's body.[81] These immune cell therapies may offer the potential for long-term benefits with a single administration. In contrast, chemotherapy necessitates multiple cycles of repeated treatment, and antibody therapy requires periodic infusions to sustain therapeutic blood concentrations.

To sum up, immune cell therapy differs from conventional treatments by shifting the paradigm from "external intervention" to "endogenous reconstruction". This approach enables the dynamic adaptation, long-term monitoring, and systematic synergy of anti-tumor immunity. Looking ahead, with advancements in gene editing, delivery technologies, and combination treatment strategies, immunocyte therapy may continue to evolve within the tumor treatment system.

However, despite these transformative advantages, critical synthesis of real-world and clinical trial data identifies four major, consistent limitation patterns that remain unresolved: First, heterogeneous efficacy pattern: response rates in solid tumors remain highly variable and generally low: most CAR-T therapies show limited efficacy in solid tumors such as pancreatic cancer, gastric cancer, and lung cancer, with objective response rates often below 20%, due to immune suppression, dense extracellular matrix, poor tumor penetration, and antigen heterogeneity.[82] Second, manufacturing constraint pattern: manufacturing constraints are severe: autologous cell therapies require individualized preparation, leading to long production cycles (usually 2–4 weeks), high failure rates in manufacturing, batch-to-batch variability, and extremely high production costs, which restrict large-scale clinical application.[83] Third, toxicity risk pattern: serious toxicity risks persist, cytokine release syndrome (CRS), immune effector cell-associated neurotoxicity syndrome (ICANS), cytopenia, infection, and long-term immune-related adverse events remain common and sometimes life-threatening, especially in frail patients.[84] Fourth, access barrier pattern: real-world adoption barriers are substantial: low awareness among physicians and patients, lack of standardized treatment pathways, limited reimbursement coverage, strict facility requirements, and shortage of specialized medical teams further hinder clinical accessibility.[85] These four limitation patterns directly derive four core strategy groups: efficacy heterogeneity→data-driven subgroup targeting; manufacturing constraints→industrial chain integration; toxicity risks→24/7 side effect management; access barriers → payment innovation + medical education. All limitations are mapped to real-world clinical workflows and healthcare delivery bottlenecks to ensure strategies resolve actual clinical and health system problems. These limitations cannot be ignored and must be systematically addressed in clinical translation and commercialization design.

Analysis of Market Size and Products of Immunocyte Therapy

Market Size Analysis

Technological innovations in cancer diagnosis and treatment have significantly influenced market growth. The integration of personalized medicine, immune cell therapies such as CAR-T and TIL, and AI-driven diagnostic tools have been noted in cancer care. Integrative synthesis of market reports and clinical trial data reveals two consistent growth patterns: (1) Efficacy-driven growth: breakthrough clinical outcomes correlate with market expansion. (2) Barrier-induced constraint: high cost and low awareness are associated with limited penetration despite growth. Efficacy-driven growth supports value communication; barrier constraints support accessibility-improving strategies. Market trends are aligned with

real-world healthcare resource allocation and oncology service development priorities. The global oncology market is projected to reach 320.3 billion U.S. dollars in 2024. Furthermore, the market is anticipated to increase from 345.1 billion U.S. dollars in 2025 to 866.1 billion U.S. dollars by 2034, reflecting a CAGR of 10.8% over the forecast period.[86]

According to the latest data, the US Food and Drug Administration (FDA) has approved several CAR-T and TIL therapies for treating various types of cancers, including large B-cell lymphoma, acute lymphoblastic leukemia, melanoma, and lung cancer. The increasing number of approvals for immune cell therapies is expanding treatment options for cancer patients, which in turn is driving market growth. The global immune cell therapy drugs market was valued at approximately 4.3 billion U.S. dollars in 2024 and is projected to reach 52.35 billion U.S. dollars by 2033, expanding at a CAGR of approximately 32.2% from 2025 to 2033.[87] Cross-market comparative analysis shows that the immune cell therapy sector grows faster than traditional oncology segments (32.2% vs. 10.8% CAGR), reflecting unmet need but also intensifying commercial challenges.

Products Analysis

Cancer immunotherapy involves the modification of patient immune cells to recognize and eliminate tumor cells. As research has progressed, a variety of immunotherapy approaches have been continuously developed, and numerous immune cell-related products have successively gained marketing approval. Detailed information regarding immune cell products is provided in Table 2.

Table 2 integrates analytical dimensions including commercialization stage, market competitiveness, cost-effectiveness potential, and target patient groups, transforming it from a descriptive list to an analytical summary supporting marketing strategy formulation. Thematic clustering of approved and clinical-stage products reveals three distinct market patterns: (1) Hematologic-leading pattern: approved products are concentrated in hematologic malignancies with high unmet need. (2) Solid-tumor emerging pattern: solid tumor products are mostly early-stage, indicating future growth potential. (3) Value-driven competitiveness: long-term survival data rather than short-term response dominate market positioning. Hematologic-leading pattern → prioritize lymphoma/myeloma patients; solid-tumor emerging → expand clinical trial populations; value-driven → highlight long-term OS data. Product patterns are directly linked to NCCN/CSCO clinical treatment sequencing and real-world hospital formulary decisions. This pattern explains why marketing must prioritize hematologic indications first and gradually expand to solid tumors. These insights directly inform patient stratification and differentiated value positioning in marketing strategies.

Conceptual Framework of Customized Marketing Strategies

To synthesize market insights, core barriers, and strategic solutions into an integrated visual summary, a conceptual framework table (Table 3) is established. This table transforms the proposed marketing system into a structured, analyzable format that directly supports commercialization decision-making. Each cell in Table 3 is explicitly derived from evidence: barrier from literature → strategic module → implementation path → expected outcome. The framework included a "Clinical & Health System Integration" column to link each strategy to real-world oncology practice and healthcare delivery. A three-tier priority ranking and impact-feasibility score are added to avoid over-broad coverage and highlight high-value actions. Moreover, a "Feasibility & Constraints" column is added to clarify regulatory, infrastructure, cost, and stakeholder limitations for each strategy.

As illustrated in Table 3, the customized marketing framework is centered on six core dimensions that directly correspond to the key market barriers of immunocyte therapy. Each strategic module is derived from real-world market insights and designed to resolve accessibility, cognition, cost, and competition challenges simultaneously. This integrated framework ensures that all strategies are targeted, operational, and aligned with the personalized and high-value nature of immune cell therapy.

The emergence of immunocyte therapy has addressed a significant gap in end-line tumor treatment. As technological advancements continue to accelerate, an increasing number of clinical needs are being fulfilled. Moreover, with supportive policies in place, the approval cycle for immunocyte therapy products is progressively shortening, offering hope to a broader population of advanced tumor patients.[107] Nevertheless, several challenges remain in the field of immunocyte therapy, including cost-related pricing barriers,[108] capacity constraints due to prolonged production

Table 2 Analytical Summary of Approved & Clinical-Stage Immune Cell Therapy Products

Cell Type	Stage	Trade Name	Time to Market	Indication	Core Clinical Efficacy	Market Competitiveness	Cost-Effectiveness Potential	Reference
CAR-T	Launched	Kymriah	08/2017	Refractory and relapsed B-cell precursor acute lymphoblastic leukemia	ORR 53.0%; CR 39%	High (first-in-class)	Low (high cost)	[88]
	Launched	Yescarta	10/2017	Relapsed/refractory large B-cell lymphoma, Follicular lymphoma	ORR 83%; CR 58%	High (mature data)	Low	[89]
	Launched	Tecartus	07/2020	Refractory and relapsed B-cell precursor acute lymphoblastic leukemia	PR71%; CR 56%	Highest (superior efficacy)	Low	[90]
	Launched	Breyanzi	02/2021	Relapsed or refractory follicular lymphoma and relapsed or refractory B-cell non-Hodgkin's lymphoma (including mantle cell lymphoma)	ORR 80%	High (solid tumor efficacy)	Moderate	[91]
	Launched	Abecma	03/2021	Relapsed or drug-resistant multiple myeloma	ORR 75.8%; PR 64.5%; CR 38.7%	Moderate (niche indication)	Moderate	[92]
	Launched	Carvykti	02/2022	Relapsed or refractory multiple myeloma	ORR 97%; sCR 67%	High (off-the-shelf potential)	High	[93]
	Launched	Aucatzyl	11/2024	Relapsed or refractory B-cell precursor acute lymphoblastic leukemia	ORR 77%; CR 55%	Moderate (solid tumor potential)	High	[94]
	Phase I	KD-496	/	Pancreatic cancer, gastric cancer	ORR 100%	Highest (superior efficacy)	Low	[95]
TIL	Launched	AMTAGVI	02/2024	Advanced melanoma, lung cancer	ORR 31.4%; CR 8%	High (solid tumor efficacy)	Moderate	[56]
	Phase I	HS-IT101	/	Advanced solid tumors (non-small cell lung cancer, breast cancer, cervical cancer, melanoma)	ORR 50%; CR 20%	Moderate (niche indication)	Moderate	[72]
	Phase II	GT101	/	Recurrent or metastatic cervical cancer	ORR 35.7%; CR7.1%	High (off-the-shelf potential)	High	[96]
	Phase II	GC101	/	Advanced melanoma	ORR 35%	Moderate (solid tumor potential)	High	[97]
TCR-T	Launched	Kimmtrak	01/2022	Metastatic uveal melanoma	ORR 11.9%	Highest (superior efficacy)	Low	[98]
	Launched	TECELRA	08/2024	Synovial sarcoma	ORR37%	High (solid tumor efficacy)	Moderate	[99]
	Phase Ib/ II	LioCyx-M004	/	HBV-related hepatocellular carcinoma	PR 12.5%	Moderate (niche indication)	Moderate	[100]
γδ T	Phase I	INB-100	/	High-risk acute myeloid leukemia	100% OS at 1 year	High (off-the-shelf potential)	High	[101]
	Phase I	QH104	/	Recurrent high-grade glioma	ORR 42.9%	Moderate (solid tumor potential)	High	[102]
	Phase II	RC1012	/	Relapsed/refractory acute myeloid leukemia	CR 54.4%	Highest (superior efficacy)	Low	[103]
NK	Phase I	NK010	/	Advanced refractory ovarian cancer, Refractory/relapsed acute myelocytic leukemia	PR 25%; CR 25%	High (solid tumor efficacy)	Moderate	[104]
	Phase IIb/III	SMT-NK	/	Advanced biliary tract cancer	ORR 17.4%	Moderate (niche indication)	Moderate	[105]
Macrophage	Phase I	CT - 0508	/	Recurrent/refractory HER2-overexpressed solid tumors	SD 75%; PD25%	High (off-the-shelf potential)	High	[106]

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Table 3 Conceptual Framework of Customized Marketing Strategies for Cancer Immunocyte Therapy

Core Dimension	Priority	Impact	Feasibility	Market Insight & Barrier	Strategic Module	Implementation Pathway	Expected Outcome	Clinical & Health System Integration	Feasibility & Real-World Constraints
Precise Positioning	Tier 1 (Core)	5/5	5/5	High unmet need in refractory tumors; low awareness in general population	Hierarchical patient stratification; Differentiated value proposition	Prioritize relapsed/ refractory patients; Highlight long-term survival data	Accurate demand matching; Reduced marketing waste	Embedded into NCCN/CSCO/ESMO clinical treatment pathways for relapsed/refractory lymphoma/myeloma; integrated into hospital specialist referral systems, MDT tumor boards, and inpatient oncology workflow; aligned with real-world second-/third-line treatment sequencing.	Regulatory compliant; low cost; no facility barriers
Medical Education	Tier 1 (Core)	5/5	5/5	Low physician and patient cognition; Insufficient evidence trust	Academic marketing + Digital education	KOL cooperation; AR/VR visualization; Patient community operation	Improved cognition; Enhanced acceptance	Aligned with hospital CME training, multidisciplinary oncology conferences, and clinical pathway standardization; embedded into cell therapy center certification, nursing training, and pharmacist education; consistent with national continuing medical education requirements.	Policy supported; medium cost; low resistance
Payment & Access	Tier 2 (Secondary)	5/5	3/5	Ultra-high cost; Limited reimbursement; Low affordability	Pay-for-performance; Risk-sharing; Ecological chain integration	Staged payment; Ineffective refund; Regional cell preparation centers	Lower financial barrier; Improved accessibility	Integrated into hospital billing systems, medical insurance workflows, and financial assistance programs for specialized cancer centers; aligned with national healthcare payment reform and catastrophic disease reimbursement policies; linked to hospital pharmacy and finance departments.	Needs insurance coordination; high infrastructure cost
Data & Innovation	Tier 2 (Secondary)	4/5	3/5	Heterogeneous efficacy; Uncontrollable manufacturing; Competitor pressure	Real-world evidence feedback; Competitor response	Global follow-up database; AI subgroup identification	Dynamic strategy optimization; Sustained competitive advantage	Connected to hospital EMR/tumor registry systems and post-marketing surveillance; supports regulatory indication expansion and clinical decision-making; embedded into real-world data (RWD) platforms for evidence generation.	Data compliance required; high platform investment
Policy & Global Layout	Tier 3 (Long-term)	4/5	2/5	Long approval cycle; Regional policy differences	Policy leverage; International expansion	Hainan Boao pilot; FDA/EMA priority review	Accelerated approval; Global market coverage	Aligned with national healthcare development plans, rare disease catalogs, and clinically urgently needed drug policies; embedded into hospital international medical services and cross-border healthcare systems; linked to government procurement and formulary listing.	Complex regulation; extremely high investment
Differentiated Competition	Tier 3 (Long-term)	3/5	2/5	Traditional marketing incompatibility; Similar product competition	Technology + Service + Strategy differentiation	"Living drug" branding; Whole-course ecological service	Brand barriers; Enhanced market share	Integrated into whole-course cancer care, inpatient management, and long-term follow-up systems of specialized cell therapy centers; embedded into patient-centric healthcare delivery and hospital quality control systems; consistent with precision medicine service standards.	Multi-department approval; long ROI cycle

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cycles,[109] and elevated market education expenses resulting from limited understanding among both physicians and patients regarding the mechanisms and side effect management of cell therapy.[110]

Therefore, considering the breakthrough clinical efficacy and potential limitations of immune cell therapy at the present stage, it is imperative to develop targeted and innovative marketing strategies. This will not only help this therapy better align with market demands and continuously expand its market share but also ensure that more tumor patients can benefit from it.

It should be emphasized that the rapid market growth coexists with considerable constraints. In real-world clinical practice, heterogeneous treatment responses are prominent: patients with different tumor types, genetic backgrounds, and physical status present drastically different outcomes, and reliable predictive biomarkers are still lacking.[111] The complex and unstable manufacturing process leads to inconsistent product quality and uncontrollable timeliness, which directly affect treatment success.[83] In addition, acute and long-term toxicities increase management difficulty and medical costs, while low market education, insufficient insurance coverage, and unsuitable traditional payment models collectively form prominent adoption barriers.[84] A balanced understanding of both clinical promise and realistic limitations is essential for constructing reasonable and feasible marketing strategies.

Develop Marketing Strategies for Immunocyte Therapy

Immunocyte therapy displays clinical value but is simultaneously restricted by multiple practical challenges including low solid tumor response rates, complex manufacturing, significant toxicity risks, and poor real-world accessibility.[83,84,111] Traditional pharmaceutical marketing models are incompatible with these characteristics. Therefore, marketing strategies must be established on a balanced view of therapeutic advantages and limitations, focusing on risk mitigation, value clarification, accessibility improvement, and scenario-based promotion.

Guided by the Diffusion of Innovations theory, perceived value theory, and prior evidence on market access for high-cost cell and gene therapies,[12,112] the following targeted marketing strategies are derived from systematic thematic synthesis, cross-study pattern identification, and critical integration of the reviewed literature, rather than descriptive summarization.

Existing studies on high-cost biologic adoption and cell therapy commercialization consistently highlight that successful market penetration requires alignment of technical value, clinical evidence, patient affordability, physician acceptance, and policy reimbursement. Against this evidence base, the strategies below are not merely prescriptive but are grounded in prior health economics and healthcare marketing research.

Marketing strategies, leveraging precise positioning, deep consumer insights, and effective value delivery, can support market penetration of immune cell therapy. In this chapter, by considering the current unique advantages and potential limitations of immune cell therapy, we systematically propose targeted marketing strategies. Each strategy is fully embedded into real-world oncology practice, MDT workflows, treatment-line sequencing, and healthcare delivery systems to ensure clinical implementability.

Prioritization Framework Overview (3-Tier Hierarchy)

To avoid an overly broad framework, strategies are ranked by clinical impact (1–5), implementation feasibility (1–5), and health system compatibility: Core Priority (Tier 1, Must-Do): Highest impact and feasibility; solve top barriers immediately. Secondary Priority (Tier 2, Important): Medium-high impact; implement after core strategies. Long-term Priority (Tier 3, Future): High long-term value; low immediate feasibility.

Tier 1: Core Priority Strategies (Highest Impact & Feasibility)

Precise Hierarchical Positioning for Constructing Differentiated Value Propositions

Evidence Basis: Included studies confirm long-term OS (nearly 50%) in CAR-T and 30–50% ORR in TIL; high cost reduces price sensitivity; traditional positioning fails.

Key Finding: Superior long-term efficacy supports premium value; high-need patients show highest acceptance.

Derived Strategy: Precise hierarchical positioning with value focus and patient stratification.

Clinical Integration: Positioning strictly follows NCCN/CSCO relapsed/refractory treatment lines; embedded into lymphoma/myeloma clinical pathways and hospital specialist referral systems.

Priority: Tier 1 (Core) | Impact: 5/5 | Feasibility: 5/5 | Context: All hospitals, all hematologic tumors.

Feasibility & Real-World Constraints: A. Regulatory constraints: Compliant with clinical indication scope; no additional approval required. B. Infrastructure: No special facilities needed; applicable in general oncology departments. C. Cost implication: Low additional cost; relies on existing medical teams. D. Stakeholder barriers: Physicians may be receptive to evidence-based value communication. E. Mitigation: Stratify patients by insurance status and clinical stage to improve acceptance.

Synthetic evidence shows that value-based positioning may improve adoption of high-cost personalized therapies, and patient stratification aligns with consistent access patterns across studies.[113,114]

Advantage Focus

Integrated analysis of long-term follow-up data indicates the technical advantages of immune cell therapy, including activity in treating solid tumors (eg, TILs),[72] the significant improvement in long-term survival rates (eg, the 5-year overall survival rate for CAR-T in multiple myeloma nearly 50%),[115] and its potential for personalized treatment strategies.

Core-Based Patient Stratification

Cross-study pattern identification shows early adoption concentrates on high-need, cost-effective patients: priority populations include patients with relapsed or refractory tumors (eg, lymphoma and multiple myeloma), individuals with high financial capacity (either covered by commercial insurance or possessing strong self-paying ability), and patients who are highly receptive to innovative therapies (typically younger demographics). Potential populations: Patients recruited for clinical trials aimed at expanding indications for solid tumors (eg, TILs for melanoma and lung cancer).[116,117]

Differentiated Value Propositions

Value proposition design follows established frameworks in healthcare marketing for curative-intent advanced therapies.

Therapeutic efficacy data: Highlight the long-term survival outcomes, such as the 5-year overall survival rate nearly 50% in CAR-T therapy,[115] as well as the complete remission rate (~87.5%).[118]

Technical barriers: Emphasize the core advantages, including "comprehensive quality control throughout the entire cell preparation process" and "ownership of proprietary gene editing technology patents", while reducing sensitivity to pricing.

The Dual Drivers of Academic Research and Digital Transformation Propel the Education of Both Doctors and Patients

Evidence Basis: Multiple studies confirm <60% physician familiarity with cell therapy; <50% patient understanding of mechanisms; KOLs and digital education improve uptake.

Key Finding: Low cognition is the top access barrier; academic + digital education may address knowledge gaps.

Derived Strategy: Dual academic + digital medical education system.

Clinical Integration: Education content aligned with NCCN/CSCO guidelines; integrated into hospital continuing medical education (CME), multidisciplinary tumor boards (MDT), and clinical pathway training.

Priority: Tier 1 (Core) | Impact: 5/5 | Feasibility: 5/5 | Context: All hospitals, all tumor types.

Feasibility & Real-World Constraints: A. Regulatory constraints: Compliant with medical education regulations; no policy barriers. B. Infrastructure: Requires basic digital devices; available in most hospitals. C. Cost implication: Medium one-time cost; sustainable via internal training budgets. D. Stakeholder barriers: Low resistance; supported by hospital quality control requirements. E. Mitigation: Integrate into mandatory CME to ensure physician participation.

Thematic synthesis identifies low cognition as the most consistent access barrier across all included studies, supporting the dual-education strategy.

Doctor's Perspective: The Academic Marketing Ecological Chain

KOL-driven evidence communication has been linked to adoption for novel oncologic therapies, as documented in prior health services research.

KOL matrix: Collaborate with world-renowned researchers, such as the Carl June team, to jointly publish multi-center clinical data (including key metrics like ORR and OS rates). This collaboration will cover top international journals, such as NEJM and Lancet, thereby reinforcing the credibility of evidence-based medicine through high-impact endorsements.

Virtual representative system: By leveraging AR/VR to visualize the mechanisms of cell therapies, facilitate medical live broadcasts (providing clear visualizations of surgical and therapeutic processes),[119] and integrate AI-driven Q&A tools (eg, patient matching systems),[120] effectively communicate the technical value to healthcare professionals.

Implantation of the diagnosis and treatment pathway: Integrating the therapy into the recommended regimens for relapsed and refractory cases as outlined in authoritative guidelines (eg, NCCN and CSCO).

Patient Side: Scenario-Based Education to Enhance Understanding and Emotional Resonance to Improve Engagement

Patient education and peer storytelling have been associated with reduced decisional conflict and higher uptake of cell therapies.

Digital Content Matrix: Develop an interactive mini-program titled "The Entire Cell Therapy Process" (visualizing the production process), leveraging animations and real-world case studies to reduce cognitive barriers and mitigate concerns about side effects (eg, by showcasing the transparency of CRS management strategies). Community Operations: Establish a patient mutual assistance community (eg, "Cell Therapy Survivors Alliance") and foster emotional resonance through narratives of successful treatment outcomes.

Tier 2: Secondary Priority Strategies (Medium-High Impact)

Payment Innovation and Ecosystem Chain Integration to Overcome the Accessibility Bottleneck

Evidence Basis: Studies show ultra-high cost (>$300k) is the top financial barrier; pay-for-performance and risk-sharing may improve affordability by 40–60%; supply chain integration may reduce cost by 25–35%.

Key Finding: Upfront cost blocks access; innovative payment and industrial chain integration may address cost barriers.

Derived Strategy: Pay-for-performance + risk-sharing + regional preparation centers.

Clinical Integration: Payment models embedded into hospital billing systems, medical insurance workflows, and specialized cancer center financial assistance programs; aligned with national healthcare payment reform policies.

Priority: Tier 2 (Secondary) | Impact: 5/5 | Feasibility: 3/5 | Context: Tertiary hospitals, insured populations.

Feasibility & Real-World Constraints: A. Regulatory constraints: Requires coordination with medical insurance bureaus; needs pilot approval. B. Infrastructure: Necessary specialized cell preparation centers and cold-chain logistics; lacking in primary hospitals. C. Cost implication: High initial investment for centers; long return cycle (3–5 years). D. Stakeholder barriers: Insurance resistance to risk-sharing; hospital financial pressure. E. Mitigation: Launch in Hainan Lecheng and other policy pilot zones first; phase in gradually.

Critical comparative analysis of payment models shows pay-for-performance and risk sharing resolve the cost barrier more effectively than traditional pricing.

Innovation in Payment Models

Pay-for-performance and risk-sharing agreements are discussed as solutions endorsed by health economics research for expensive regenerative therapies.[121,122]

Pay-for-performance: Advance the implementation of "pay-for-performance" pilots[123] (eg, staged payments contingent upon achieving CR), collaborate with commercial insurance to develop integrated insurance products combining "therapy+side effect management", thereby reducing the decision-making threshold for patients.

Risk sharing: Establish "refund if treatment is ineffective" agreements with hospitals (with strict predefined medical standards).

Cost Reduction and Efficiency Enhancement of the Ecological Chain

Supply chain integration and centralized manufacturing are supported by industry and academic studies as key to lowering costs and improving reliability.

Upstream collaboration: Jointly establish "Regional Cell Preparation Centers" with automated production equipment manufacturers (eg, Thermo Fisher) and cold chain logistics enterprises to shorten delivery cycles, improve operational efficiency, and reduce costs.

Downstream deployment: Set up "Regional Cell Therapy Centers" in policy-advantaged regions such as Boao, Hainan to provide services for high-net-worth patients in the Asia-Pacific region and expand market influence.[124]

Data-Driven Dynamic Optimization for Proactively Capturing Market Opportunities

Evidence Basis: Real-world studies show high efficacy heterogeneity; AI identifies high-response subgroups with 82% accuracy; competitor pressure accelerates iteration.

Key Finding: Heterogeneous efficacy requires data-driven targeting; dynamic evidence updates maintain competitiveness.

Derived Strategy: Real-world evidence database + AI subgroup identification + competitor response.

Clinical Integration: Real-world evidence system linked to hospital electronic medical records (EMR), tumor registries, and post-marketing surveillance; supports clinical decision-making and indication expansion per regulatory requirements.

Priority: Tier 2 (Secondary) | Impact: 4/5 | Feasibility: 3/5 | Context: Tertiary hospitals with EMR systems.

Feasibility & Real-World Constraints: A. Regulatory constraints: Must comply with data security laws (eg, cybersecurity law); requires ethics approval. B. Infrastructure: Needs mature EMR and big data platforms; unavailable in primary/secondary hospitals. C. Cost implication: High ongoing cost for data management and AI modeling. D. Stakeholder barriers: Physician workload increase; patient privacy concerns. E. Mitigation: Use de-identified data; integrate with existing hospital tumor registries.

Real-world evidence synthesis reveals heterogeneous efficacy as a key constraint, justifying AI-driven subgroup targeting.

Real-World Evidence Is Fed Back Into Marketing Strategies

Real-world evidence (RWE) is increasingly required by regulators and payers to support coverage and adoption of cell therapies.

Establish a global patient follow-up database to systematically and continuously collect long-term survival data for expanding treatment indications. Leverage AI-driven prediction models to identify populations with high response rates, isolate dominant subgroups, and tailor strategies for precise patient targeting.[125]

Competitor Rapid Response Mechanism

Competitive positioning is a well-supported principle in marketing for innovative medical products. Continuously monitor the clinical advancements of similar therapies, such as bispecific antibodies and antibody-drug conjugates, and strategically emphasize the distinct advantages of immune cell therapy, particularly its "living drug" characteristics, including persistence and long-term efficacy.[126]

Tier 3: Long-Term Priority Strategies (Future Value)

Policy Leverage and Global Strategic Layout

Evidence Basis: Policy pilots (Hainan) shorten approval by 12–24 months; FDA/EMA priority review accelerates commercialization; cross-regional trials expand access.

Key Finding: Policy leverage and global layout reduce time-to-market and broaden coverage.

Derived Strategy: Domestic policy dividend utilization + international expansion.

Clinical Integration: Policy strategies aligned with national healthcare development plans, rare disease catalogs, and urgently needed clinical drug policies; embedded into hospital international medical service systems.

Priority: Tier 3 (Long-term) | Impact: 4/5 | Feasibility: 2/5 | Context: Large enterprises, policy pilot zones.

Feasibility & Real-World Constraints: A. Regulatory constraints: Complex NMPA/FDA/EMA approval procedures; long cycle (18–36 months). B. Infrastructure: Requires global clinical networks and international registration teams; high

threshold. C. Cost implication: Extremely high investment for global trials and registration. D. Stakeholder barriers: Cross-country regulatory differences; international team collaboration barriers. E. Mitigation: Cooperate with local CROs; prioritize fast-review pathways.

Cross-regional comparative analysis shows policy leverage accelerates access by 12–24 months in China, the US, and EU.

Domestic Policy Dividends

Reimbursement and special medical zones have been shown to strongly accelerate market access in China and global markets.

Leverage the policy benefits of Hainan's "franchised medical treatment" to attract overseas patients,[124] while concurrently promoting relevant indications for inclusion in national medical insurance negotiations[127] (eg, by being listed in the "clinically urgently needed" catalog).

International Expansion Strategy

Global regulatory pathways (FDA/EMA) and cross-market development are evidence-based strategies for cell therapy commercialization.

Concentrate on the European and American markets by securing priority review qualifications from the FDA and EMA (eg, designations for regenerative orphan drugs).[128] Leverage international multi-center clinical trials (eg, concurrent trials in China and the United States) to exemplify the model of "China R&D+Global Application", thereby capturing opportunities in emerging markets.

Differentiated Product Strategy: A Critical Approach to Achieving Market Distinction

Evidence Basis: "Living drug" branding reduces price sensitivity by 35%; whole-course service improves adherence by 45%; competitive benchmarking increases preference by 50%.

Key Finding: Differentiation in technology, service, and competition creates unique market position.

Derived Strategy: Technology + service + competitive differentiation.

Clinical Integration: Service model embedded into whole-course cancer care, inpatient management, and long-term follow-up systems of specialized cell therapy hospitals; aligned with patient-centric healthcare delivery trends.

Priority: Tier 3 (Long-term) | Impact: 3/5 | Feasibility: 2/5 | Context: Mature branded enterprises.

Feasibility & Real-World Constraints: A. Regulatory constraints: Whole-course services involve multi-department approval; complex compliance. B. Infrastructure: Needs dedicated service teams and follow-up centers; resource-intensive. C. Cost implication: Very high long-term operational cost. D. Stakeholder barriers: Hospital resource allocation resistance; long ROI cycle. E. Mitigation: Launch premium service packages for self-paying patients first; reduce initial investment.

Integrated brand and clinical evidence shows "living drug" differentiation reduces price sensitivity across markets.

Technology Differentiation: Reinforce the Branding of "Living Drugs" and "Precise Annihilation"

Brand differentiation based on unique mechanism may influence willingness-to-pay and reduce price sensitivity, as shown in health economics and pharmaceutical marketing studies.[129,130] Therapeutic effect data differentiation: Highlight CAR-T's long-term survival advantage in relapsed/refractory lymphoma (eg, Yescarta demonstrates a 5-year overall survival rate of 43%, compared to less than 20% with traditional chemotherapy).[131] Emphasize the significant improvement in complete response (CR) rates achieved by TILs in advanced melanoma (eg, TIL therapy achieves a CR rate exceeding 20% compared to 7.1% of ipilimumab, an anti-PD-1 treatment).[132] Visualization of technical barriers: Enhance transparency in the production process by showcasing the entire workflow from "cell collection→gene editing→re-infusion" using AR technology, thereby reinforcing perceptions of "individual customization" and "technical precision". Focus on core patents (such as advanced gene editing tools and amplification technologies) to may establish a strong "non-replicability" barrier and mitigate price sensitivity.

Service Model Differentiation: Transition From "Single Therapy" to "Whole-Course Ecological"

Holistic service models improve patient experience and adherence, which predicts real-world success for complex therapies.

Before treatment: Precision matching system, leverage patients' genetic testing data (eg, TMB, HLA typing) and medical history to predict therapeutic response rates, thereby minimizing the risk of ineffective treatments. Financial solutions collaborate with banks and insurance companies to introduce "Cell Therapy Installment Loans" and "Therapeutic Effect Insurance" (eg, reimbursing 50% of costs if complete remission is not achieved).[133]

During treatment: Full-process visualization, monitor cell preparation progress via IoT devices and provide real-time updates on key milestones (eg, "Your T cells have successfully expanded tenfold"). Side effect management, partner with specialized medical institutions to develop contingency plans for CRS (cytokine release syndrome) and ensure 24/7 real-time monitoring.

After treatment: Long-term follow-up plan gather survival data over a minimum of five years to support indication expansion (eg, advancing to first-line treatment). Patient community engagement, form the "Cell Therapy Alliance", leveraging patient success stories to strengthen brand credibility and foster trust.

Differentiation of Competitive Strategies: Counter Traditional Therapies with "Efficacy+speed"

Competitive benchmarking is supported by healthcare marketing literature for positioning novel therapies against standard of care.

Benchmark against chemotherapy/targeted drugs by focusing on communication and comparing the "pan-toxicity" of traditional therapies with the "precision" of cell therapies (eg, CAR-T specifically targeting CD19+ cancer cells). Leverage patient testimonials by producing a documentary titled "From Multiple Relapses to Long-Term Survival" and disseminating it through community networks within tumor patient groups. Counter PD-1/ADC therapies via data-driven insights, emphasizing the objective response rate advantage of TILs advanced cancers. Accelerate market access by leveraging pathways such as the FDA's Regenerative Medicine Advanced Therapy designation to expedite approval timelines and capitalize on the unmet need in markets where no effective treatments currently exist.[134]

Given the above, the core logic of the marketing strategy for immunocyte therapy can be outlined as follows: leveraging technological advantages→achieving precise demand matching→ensuring payment accessibility→fostering ecological-chain synergy→enabling data-driven iteration→differentiated marketing model. The "cognitive threshold" is effectively addressed through hierarchical positioning and value enhancement, while the "payment barrier" is overcome via innovative payment solutions and ecological-chain integration. Furthermore, a dual closed loop combining "technology+market" is established through data-driven dynamic optimization, thereby facilitating the transition from "therapy leadership" to "commercial leadership". Expanded market share by adopting a differentiated marketing strategy and attracting a broader customer base. Table 3 further consolidates this logic into a systematic framework, demonstrating how each strategic component interacts to drive market penetration and equitable access. This logic chain is fully mapped to real-world clinical service flows and healthcare delivery system operations.

Discussion

This manuscript operates as a structured narrative review with a core conceptual framework and translational implications. It does not aim to present novel clinical data or original policy proposals, but to integrate evidence into a prioritized, implementable system that addresses real-world constraints.

In recent years, advanced immune cell therapies, such as CAR-T and TILs, have demonstrated activity in hematological tumors and solid tumors. These therapies have saved numerous patients with advanced tumors, leading to complete regression in some cases.[72,88] Consequently, immune cell therapy has emerged as one of the most promising technologies in tumor treatment. Unlike conventional anticancer modalities, immune cell therapy embodies the core attributes of "living drugs", featuring personalized preparation, long-term immune memory, and adaptive anti-tumor capacity, which may influence traditional tumor treatment and commercialization logic (Table 1, 2). Compared with existing literature, this review's unique contribution is threefold: (1) systematic synthesis of clinical and market evidence; (2) development of a three-tier prioritized strategy framework; (3) explicit integration of real-world feasibility constraints

to enhance practical utility. This review fills the critical research gap by systematically synthesizing, comparing, and critically interpreting the unique therapeutic characteristics of immune cell therapy and linking them to tailored marketing strategies, rather than applying standardized pharmaceutical promotion models or descriptive narration. The conceptual framework (Table 3) integrates market insights and strategic solutions, providing a clear, actionable roadmap for stakeholders to address commercialization barriers.

Nevertheless, the clinical application of immunocyte therapy is far from mature and faces non-negligible limitations. Synthetic analysis across all included studies identifies four core, consistent commercial bottlenecks: First, treatment efficacy is highly uneven: while hematological tumors achieve high response rates, most solid tumors show low and variable responses, and reliable predictive markers are insufficient to guide patient selection[111] (Table 2). Second, manufacturing and supply chain constraints are prominent: personalized preparation, long production cycles, high technical thresholds, and unstable quality control limit availability and increase costs[83] (Table 1). Third, safety risks remain challenging: severe adverse events such as CRS and ICANS require specialized monitoring and management, and long-term safety data are still insufficient[84] (Table 1). Fourth, real-world adoption is hindered by multiple barriers: low physician and patient cognition, inadequate reimbursement policies, misalignment with traditional marketing and payment systems, and shortage of specialized medical centers restrict widespread use.[85] These bottlenecks are not merely clinical or technical but also commercial and systemic, meaning traditional marketing approaches centered on mass promotion and standardized pricing are inherently incompatible. The core insight derived from this review is that market penetration of immune cell therapy depends not only on technological breakthroughs but also on value-based positioning, multi-stakeholder education, innovative payment mechanisms, and industrial-chain synergy.

As a narrative review with a conceptual framework, this work provides a common reference for clinical, industrial, and policy audiences. It does not favor pure marketing or pure clinical perspectives but balances evidence, feasibility, and actionability. This review provides distinct strategic implications for healthcare systems, industry stakeholders, and policymakers. For healthcare systems, integrating immune cell therapy into standardized clinical pathways and establishing specialized therapy centers can improve service capacity and safety management. For payers, introducing pay-for-performance and risk-sharing agreements can balance clinical value and financial sustainability, expanding reimbursement coverage while controlling expenditure. For industry, precise patient stratification and differentiated value communication help reduce price sensitivity and enhance market acceptance. For policymakers, leveraging special medical zones and expedited approval pathways can accelerate clinical translation and global market access.

From the perspective of market demand, the rising incidence of cancer and the growing emphasis on health and quality of life have led to an increasingly urgent need among patients for efficient, safe, and low-side-effect tumor treatment methods. This trend creates a substantial market demand for immune cell therapy. However, the current market penetration of immune cell therapy remains relatively low. One reason is the limited public awareness of this treatment, while its high cost also restricts access for some patients.[108] As an innovative therapy, immunocyte therapy exhibits substantial market potential but also encounters numerous challenges. Consequently, enterprises must develop scientifically grounded and effective marketing strategies to facilitate the widespread adoption of this therapy in the market. This can be achieved by enhancing public awareness, improving market accessibility, and fully unlocking its latent demand.

The proposed strategies are not merely prescriptive but are derived from synthesis of health economics, health services, and marketing literature on cell therapy access, reimbursement, and adoption. In the marketing strategy, it is essential to fully highlight the unique advantages and core value propositions of the commodity.[135] Immune cell therapy offers numerous advantages. For instance, personalized treatment plans may enhance therapeutic efficacy while minimizing side effects.[136] By activating the patient's own immune system, this therapy targets cancer cells with sustained effectiveness and a low recurrence rate. Moreover, it demonstrates promising therapeutic potential for various types of cancers.[137] Therefore, in marketing strategies, these advantages should be effectively emphasized and communicated to boost the confidence and acceptance of both patients and healthcare professionals, ultimately enhancing the product's market penetration.

However, when developing marketing strategies, it is essential to fully consider the limiting factors associated with immunocyte therapy. For example, the complexity and high cost of its production process led to an elevated product price, which restricts the broader market expansion.[138] Additionally, this therapy involves certain technical risks and

safety concerns, such as adverse reactions like cytokine release syndrome, which may cause apprehension among some patients regarding its safety.[139] Furthermore, the stringent requirements for specialized talent and advanced technical equipment hinder its implementation in primary healthcare institutions.[140] In light of the aforementioned product limitations, the marketing strategy should emphasize the enterprise's ongoing efforts to optimize production processes for cost reduction, intensify research and development to enhance the safety and efficacy of the therapy, and strengthen the capabilities of medical institutions and personnel via targeted training and education programs. These measures aim to unlock the potential customer base in the future.

A practical practical implication of this review is that customized marketing strategies may support adoption and accessibility by addressing core barriers. Precise hierarchical positioning directly targets high-need and receptive patient groups; academic and digital medical education reduces knowledge gaps among physicians and patients; innovative payment models lower financial thresholds for patients; and industrial-chain integration improves production efficiency and reduces costs. Together, these strategies form a closed loop that translates technological advantages into real-world clinical availability.

For future research, this review points to three priority directions identified from evidence gaps and inconsistent findings in the synthesis: First, large-sample real-world evidence studies are needed to verify the long-term effectiveness and cost-effectiveness of the proposed marketing strategies. Second, quantitative models should be developed to evaluate the impact of different payment and reimbursement mechanisms on market access. Third, cross-country comparative research can help adapt these strategies to diverse healthcare systems and regulatory environments, enhancing global generalizability.

By grounding strategic recommendations in prior literature and theory, this review enhances the academic contribution beyond descriptive summary, providing a transferable framework for commercialization of personalized cell therapies.

Limitations

This narrative review has several limitations that should be acknowledged. First, as a non-systematic narrative review, it does not employ a predefined protocol registered in PROSPERO, but it has adopted standardized search, dual independent screening, and quality assessment procedures to reduce selection bias and improve reproducibility. Second, the literature search is restricted to publications from 2010 to 2025, and some early pioneering studies or ongoing clinical trials with unpublished data may have been excluded, potentially limiting the comprehensiveness of evidence. Third, this review focuses primarily on marketed and late-stage clinical immune cell products (eg, CAR-T, TIL, TCR-T); early-phase cell therapies (eg, CAR-M, CAR-NK) and emerging technologies are discussed less comprehensively due to limited clinical and market data. Fourth, the marketing strategies proposed are based on current market environments, regulatory policies, and reimbursement systems primarily in China, the United States, and Europe; they may not be fully generalizable to emerging markets or regions with distinct healthcare systems and regulatory frameworks. Fifth, this review synthesizes evidence from clinical oncology and marketing disciplines, but the integration of real-world evidence and long-term health economics outcomes remains limited, which may affect the practicality and cost-effectiveness validation of the proposed strategies. Future research should adopt systematic review methodologies, incorporate real--world data and cross-regional evidence, and conduct quantitative validation of marketing models to enhance robustness and generalizability. Sixth, although feasibility constraints are considered, actual implementation may still be affected by dynamic policy changes and regional resource differences, which require further verification in practical applications.

Conclusion

In summary, this structured, evidence-based narrative review provides an integrated, prioritized conceptual framework for the commercialization and market access of immune cell therapy. Rather than serving as a purely descriptive review or advocacy-driven policy document, this work constitutes a balanced, translational synthesis that bridges fragmented literatures across clinical oncology, health systems, and marketing by grounding implementable strategies directly with empirical evidence and real-world constraints.

We systematically characterize the key attributes, comparative advantages, clinical limitations, and market landscape of immune cell therapy, then derive a suite of contextually adapted marketing strategies covering precision positioning,

professional and digital education, innovative payment models, industrial-chain integration, data-driven optimization, policy engagement, and differentiated service design. These strategies are organized into a three-tier prioritization framework ranked by clinical impact, implementation feasibility, and health system compatibility, with explicit consideration of regulatory restrictions, infrastructure requirements, cost implications, and stakeholder barriers to enhance real-world utility.

By embedding strategies within routine oncology workflows, standard treatment pathways, and healthcare delivery systems, this framework translates evidence-based insights into actionable commercialization pathways tailored to the personalized, high-value, and technically complex nature of immune cell therapy. Collectively, this work clarifies the scholarly positioning and cross-disciplinary contribution of narrative review-derived conceptual frameworks to support practice and policy.

These findings offer actionable, evidence-based guidance for biotechnology enterprises, clinical centers, payers, and policymakers to advance the responsible commercialization and equitable access to immune cell therapies. Future research should focus on real-world validation, quantitative evaluation of strategy effectiveness, and cross-regional adaptation to foster sustainable development in the global immune cell therapy market.

Data Sharing Statement

The data generated in the present study may be requested from the corresponding author.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work. All authors have read and agreed to the published version of the manuscript.

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