Proceedings of the 6th International Conference on Biological Engineering and Medical Science
DOI: 10.54254/2753-8818/2026.37212

Accessibility Barriers and Effectiveness Trade-Offs Across Healthcare Systems

Junyou Zheng

Department of Nursing, Peking Union Medical College, Beijing, China
202502044@student.pumc.edu.cn

Abstract. The implementation of PD-1/PD-L1 inhibitors is placing a heavy burden on the health care systems of both high and middle income countries. This paper uses a unified analytical framework to conduct a comparative analysis of three typical health care systems and determine how the financial burden of PD-1/PD-L1 inhibitors is distributed and what trade-offs in real world efficacy exist since however very little direct patient-level empirical evidence exists on the matter. Three major access dimensions that affect access are economic, temporal, and institutional/spatial barriers. In the United States costs are shifted to out-of-pocket payments made by patients while the United Kingdom has implemented waiting and prioritization mechanisms and China has both gaps between national policy and practice as well as uneven implementation across regions of the country. Each of the three systems is characterized by the existence of access barriers in one form or another, but the exact nature of the barriers varies from system to system. Insurance-related differences create differences in survival rates for certain patients in the United States. In the United Kingdom centralized timelines for assessment have led to delays in treatment while in China regional differences in the availability of pharmaceuticals in hospitals has led to the failure to provide financial assistance to those who need it most despite nominal reimbursement from insurance plans.

Keywords: PD-1/PD-L1 inhibitors, access barriers, healthcare system comparison, cost-effectiveness, policy implementation gaps

1. Introduction

In the last ten years, the introduction of PD-1/PD-L1 inhibitors (including pembrolizumab and nivolumab) has led to significant changes in oncology treatment for melanoma, NSCLC and renal cancer among others. The use of immune checkpoint inhibitors in most of these cancers has seen significant improvements in survival outcomes compared to traditional chemotherapy. However, these important advancements in medicine have come at the expense of high cost. Annual costs for PD-1/PD-L1 inhibition in the USA range between $150,000-200,000 for some of the inhibitors [1]. In China, while there are local alternatives to PD-1/PD-L1 inhibition with lower cost profiles, due to the importation of drugs, costs can still reach hundreds of thousands of RMB per year [1, 2]. These hefty expenditures have created a strain on health care budgets on both a national level and the

© 2026 The Authors. This is an open access article distributed under the terms of the Creative Commons Attribution License 4.0 (https://creativecommons.org/licenses/by/4.0/).

DOI: 10.54254/2753-8818/2026.37212

individual household level and raises important questions regarding access to treatment based on need.

Different healthcare systems have responded to this challenge in very different fashions. In the United States, the prices for pharmaceuticals are primarily controlled by market forces while patients' access is limited by private insurance and cost-sharing practices. In the United Kingdom, the cost-effectiveness and efficacy of new medicines is assessed by NICE which determines whether they should be included in the NHS. In China, the increasing reliance on centralized negotiations for prices allows the government to bring down the prices of expensive medicines by including them in the National Reimbursement Drug List (NRDL).

The main analytical question here is whether healthcare systems can actually turn clinical efficacy into meaningful and fair access for patients, rather than just verifying the clinical efficacy of PD-1/PD-L1 inhibitors. No healthcare system can ever be said to be truly superior; however, each of the different financing and implementation models has its own pros and cons. In this respect, China's model may serve as a relevant point of reference for middle-income countries with a high level of centralized administrative capacity for pharmaceutical governance, despite obviously having many gaps in application of the model itself. Of course, the U.S. system based on the market and the U.K. system that places primary emphasis on costing may be presented as examples of what should be avoided.

For ease of comparisons and systematic analyses, it is proposed here that healthcare policy can be treated as a three-step process: 1-Where and how strongly cost pressures are felt 2- The access barriers resulting from the above 1- and 3- the degree to which clinical effectiveness may be compromised, recognizing that firm evidence for clinical efficacy issues may not always be available for all clinical conditions.

2. Economic burden disparities across healthcare systems

The primary obstacle to access is financial. How the healthcare system organizes the payment for treatment plays a major role in determining which patients will receive the costly cancer treatments and in what case. The United States is a prime case of a "system" in which the financial liability is eventually passed on to the patients themselves. The cost of PD-1/PD-L1 inhibitors is set high by the pharmaceutical companies of the country, while most of the private insurance providers cover part of their costs. It must be noted, however, that just because a patient has insurance, it does not necessarily mean that he/she can afford the treatment. The presence of deductible and coinsurance means that the patient is still responsible for a large cost that might sum to thousands of dollars yearly. This is a characteristic of the private insurance companies' for-profit nature and the way they attempt to limit unnecessary usage of medical services by cost-sharing techniques. Because of such higher share of medical expenses paid by patients, the decision of whether to begin treatment or continue it is negatively affected in patients with advanced cancer.

There is a strong correlation between insurance status and significant differences in clinical outcomes among patients who receive immune checkpoint inhibitors. Zhao et al. indicated that the survival difference between insured and uninsured patients went from 12.5% to 17.7% in patients with melanoma after the availability of immune checkpoint inhibitors [3]. The gap in patients with NSCLC was increased by 1.3%. These relations show that although the highly effective targeted therapy is implemented, there will still be health care disparities. This might lead to even more inequality among groups of patients because the implementation of therapies is primarily influenced by the affordability of the insurance payer and the financial ability of the patient to pay for the

DOI: 10.54254/2753-8818/2026.37212

service. The survival differences can be understood as correlations, rather than causations, as unmeasured factors such as tumor stage and baseline health conditions may influence the outcomes.

Another aspect of inequity with regard to insurance is about the additional racial, economic and geographic inequalities. According to a SEER-Medicare study that examined 26,836 older patients with advanced NSCLC, non-Hispanic black patients received immune checkpoint inhibitors 15% less frequently than non-Hispanic white patients (adjusted OR 0.85, 95% CI0.75-0.96) [4]. Economically disadvantage areas lead to higher mortality rates in all cancer areas.

The issue of cost not only concerns published prices, but also actual expenses based on real treatment. For the nivolumab+ipilimumab therapy in PD-L1 <1% metastatic NSCLC, estimated total costs in the US are $ 262,974 compared to $ 146,772 of chemotherapy. For the same treatment, costs in China are only $ 43,217, while chemotherapy is only $ 15,269 [1]. Cost-effectiveness analysis shows that China is indeed cost-effective (ICER $29,143/QALY), while this is not the case for the US with an ICER of $104,126/QALY, which is over the $100,000/QALY value threshold [1]. This demonstrates that the ability to negotiate centralized prices creates a substantial improvement to the cost-effectiveness of novel anticancer drugs and therefore the therapeutic value greatly depends on the pricing system of healthcare countries.

Different nations have different system approaches in this respect. For example, in the UK, NHS pays for cancer treatment that the patient does not pay for directly. There are no costs for the patient, but the UK healthcare system itself still has some limited resources that create a problem. NICE assesses new medications in terms of efficacy and value measured in cost-per-QALY terms. Treatments that are deemed less cost-effective do not get access to clinical use [1].

Centralized price negotiation has helped China to lower the costs of novel medicines significantly, especially when they are manufactured in China. However, in China the affordability of treatment still varies across regions and populations. Even if insurance reimbursement is done at 70-85% level in rural areas, patients would still have costs higher than those of catastrophic expenditures in case of imported medications [2]. However, the domestic therapies are still affordable for the population.

The systems of China, the UK, and the US clearly demonstrate rather unique characteristics due to the system attitudes towards healthcare economics. It is noteworthy that patient assistance programs in the USA, Cancer Drugs Fund in the UK, and obligatory hospital formulary updates in China have not been able to eliminate the existing system failures [5, 6].

3. Time-related access limitations in treatment delivery

Affordability is merely one aspect of access to treatment. For the patients with aggressive cancers, the value of a drug is contingent on how soon the patient receives it. Delays in reimbursement, approvals, drug procurement and commencement of therapy lessen the practical value of pharmacological treatments that are clinically effective. The centralized evaluation system in the United Kingdom has significant temporal limitations. The standardized technology appraisal provided by NICE has provided a stringent assessment of clinical and economic value, but it demands an extended evaluation process. For pembrolizumab in NSCLC, the difference between the time point of regulatory approval and the time point of the formal recommendation by NICE is based on the indication of treatment, with a delay of 15 months for second-line therapy, 8 months for first-line monotherapy, and 11 months for first-line combination therapy for squamous NSCLC [5]. While waiting for these processes, patients with valid circumstances for using immune therapy are deprived routine NHS access to such therapy.

DOI: 10.54254/2753-8818/2026.37212

These delays are more extensive than the NHS cancer waiting time standards, which are rarely matched in everyday clinical practice. The fact that there has been inconsistency in the evaluation system is evidenced by the recent developments in NICE. In 2026, nivolumab for head and neck cancer was turned down at first owing to both lack of clinical reasoning and high-cost effectiveness estimates surpassing the £30,000/QALY limit, not to mention the preliminary refusal of pembrolizumab for NSCLC [6, 7] due to exorbitant costs and insufficient data. Finally, different decisions on the same indication from the Scottish Medicines Consortium clearly show that long waiting does not necessary translate into favorable outcomes in payment matters.

Despite the quicker approval process and commercialization in the United States, challenges still exist in administrative procedures. In insurance, prior authorization mandates numerous clinical documents and processes to ensure eligibility so that high-cost medications are dispensed. In the United States, these delays may only be a few hours or days compared to weeks and months in the UK, but those differences can create a problem in that patients may suffer since commercial access timelines can be disregarded.

In China, the intentional administrative delays do not come from the country's bureaucratic policies since there is no central examination process. Hence, the inclusion in the NRDL does not guarantee that a product will be available within hospitals immediately because formulary and review times are different, and procurement processes may also vary from hospital to hospital. Consequently, district hospitals in urban areas can complete formulary updates more easily while district level hospitals in the countryside will experience greater challenges. Though the government has mandated that updates occur in a timely fashion, such policies will not necessarily eradicate the issue of varied pharmaceutical timelines throughout the country.

While temporal costs represent a universal but under-acknowledged barrier to treatment access among all three health systems, centralized assessment increases waiting time for treatment in the United Kingdom; administrative health insurance practices contribute to clinical delays in the United States; and delays in policy implementation lead to regional discrepancies in waiting times in China. Despite differences in processes, the same temporal barriers to access prevent patients from receiving the most appropriate treatment in a timely manner and maximize clinical effectiveness for patients with tumors. However, quantitative studies have not yet established a direct link between these waiting periods and a decrease in overall or progression-free survival rates.

4. Institutional and geographic gaps in policy implementation

The third dimension of accessibility to treatment has to do with the divide that exists in formal policy provisions with regard to clinical delivery. While drugs may have formal approval for use and there is eligibility for reimbursement, there are still a number of restrictions regarding accessibility. China is characterized with the pronounced institutional and spatial heterogeneity. For instance, while inclusion in the NRDL does not mean that all hospitals will stock the drug, there are factors such as hospital budget limitations, as well as the government's drug expenditure control policies, procurement processes, delayed updating of the national formulary etc. that limit access to anticancer drugs that have been negotiated for use.

A study that was carried out in the region to ascertain the rate of stocking of PD-1 inhibitors showed that 80% of the hospitals in Anhui Province stocked PD-1 inhibitors that were manufactured domestically. Less than 16% of local hospitals stocked imported immune checkpoint inhibitors. Local survey assessment indicates a finding confirming that rural households using PD-1 drugs from abroad pay over the established threshold for catastrophic expenditures, while local alternatives are accessible to households with similar payments [2]. Price negotiation reduces the drug cost overall

DOI: 10.54254/2753-8818/2026.37212

but does not address local inequities in drug availability or the economic burden on rural areas specifically [8-10].

Although the survey data has a significant local sampling bias, a national assessment completed on negotiated oncology drugs in tertiary hospitals across China reveals that the average drug availability is 12.50%, with only four antitumoral drugs having availability of over 50% [11]. The average availability of negotiated anticancer drugs in tertiary hospitals was only 12.50%, and just 5.48% of the sampled drugs had an availability rate exceeding 30% [11]. Thus, there is a significant difference between the amount of drug available locally in Anhui Province and the low national average for drug availability illustrating the significant spatial differences in the allocation of medical resources in China.

The expansion of policy coverage highlights the gaps that exist in health care implementation. The NRDL negotiation in 2025 is successful in 88% of cases as opposed to 76% in 2024 [8]. However, this nominally increased reimbursement coverage does not allow patients to access these drugs. In fact, over 90% of the new oncology drugs that were negotiated between 2023 and 2024 have received below 10% availability [11]. The defects pertaining to institutional implementation thus restrict the efficiency with which national health care policy translates.

In the United States, spatial and institutional barriers are prevalent. Availability of health insurance differs according to commercial health plans and employer coverage options with varied formularies as well as reimbursement policies limiting accessibility to particular drugs. Furthermore, essential oncology health care facilities are evidently limited, primarily contributing to geographical limitations for rural patients.

The U.K. NHS system has more nuanced policy application in comparison to commercial insurance in the U.S. and China's decentralized hospital management, thus resulting in certain regional disparities. The disparities in terms of availability of health care resources and differences in the capacity of providers and waiting times for treatment have affected appointment access for treatment.

Approval for drug reimbursement is not the same as access to treatment in reality. The various barriers such as delays in procurement, limitations in usage at the hospital level, insufficient number of specialists as well as geographical isolation have prevented the wide use of reimbursed health care technology. The example of the huge variation that exists in China concerning patient access illustrates the challenges of implementing a unified approach to health policy at the level of providers.

5. Discussion

Economic, time and institutional-space hindrances are active together as opposed to working independently. Rural residents in China are confronted with economic difficulties, delays in obtaining medications, and access costs that adversely affect them in different ways. For patients with insurance coverage in the U.S., the financial and administrative obstacles they encounter cause multiple problems. Although patients in the U.K. can avoid direct payment issues; they still have to deal with lengthy assessment delays.

Cost issue is not solvable by introducing reforms to medical systems since cost will always be redistributed along service delivery lines. American system focused on the market results in passing off the financial burden to patients that worsens the problem of socioeconomic inequality in terms of medical care. U. K. welfare oriented system gets rid of the financial risks connected to households but provides patients with worse timely treatment due to rationing of resources. In the case of China with the system of price negotiations, the overall cost of the drug decreases, however, it leads to

DOI: 10.54254/2753-8818/2026.37212

local implementation of the policy pressure and connect to having unequal access to treatment due to regional differences.

The inherently different advantages and weaknesses of the models under consideration have been demonstrated by the equitable access assessment. The U.S. approach is vulnerable to the effects of socioeconomic stratification and inequity of medical care. The United Kingdom's model offers stability of its financing but is significantly delayed in respect to treatment availability. The Chinese model of negotiation guarantees affordability in terms of nominal price (of drugs), but has ineffective results in practice due to the inefficiency of policy implementation. In case of middle-income countries having all the institutional framework and mechanisms for procurement of drugs, the Chinese model can provide some practical insights for innovative financing of cancer medicines. The U.S. market-oriented mechanisms and rationing mechanisms seen in the United Kingdom can offer little suitability in contexts of middle-income countries.

The analytical approach used in the analysis gives descriptive account of the mechanisms but offers no suggestion for formulating a policy. Further prospective research can bring forth quantitative data about access barriers in respect to the cost containment mechanism. As indicated in the research, there are a number of methodological and contextual limitations. One of the limitations is that the research deals only with PD-1 and PD-L1 inhibitors and the mechanisms for access barriers arrived at in the study cannot be extrapolated to CAR-T therapy, antibody-drug conjugates, and bispecific antibodies due their unique production, delivery and reimbursement processes. Secondly, the methodology employed in the study is under narrative review design which poses a bias in the selection of literature and how the findings are interpreted; hence only deductive reasoning may be used in drawing conclusions. Thirdly, the countries being considered viz. United States, United Kingdom, and China, have been treated as representative of health care systems and thus there is no consideration of heterogeneity among populations and regions within different systems. Most of the trade-offs related to effectiveness have been deduced using systematic and operational logic although insufficient clinical evidence proves the relationship between medical care access barriers and decrease in effectiveness. Fifthly, some pieces of information have been obtained from non-refereed and controversial sources posing some caution for interpretation of these findings. Inclusion of additional countries in the analysis can enhance understanding of financing mechanisms.

6. Conclusion

Different methods are implemented in the US, UK, and China regarding the expensive price of cancer immunotherapy. The US system is market-based and places the responsibility of payment on individual patients, which heightens the existing socioeconomic gap in medical care. The UK system is based on central evaluations that provides some level of financial protection but compromises the timeliness of receiving treatment. In China, the state takes care of drug pricing negotiations and leads to a decrease in the overall price of drugs as well as increases reimbursement activities. However, there are still significant differences in the application of these policies at the local level compared to that of the national level.

High treatment expenses cannot be removed by current health care systems but instead are redistributed throughout different phases of clinical care. The toll of access takes the form of monetary hardship for families, lengthy waits, transportation barriers, and differential availability of drugs. Unfortunately, there is no system that can eliminate all the accessibility trade-offs.

Creating ideal policies to expand access to advanced therapies needs an approach that favors implementation at the local level rather than a system optimization approach. The Chinese

DOI: 10.54254/2753-8818/2026.37212

negotiation method proves that centralized purchasing power can lower prices of medications while increasing public access not only by lowering the price of the medication. Additionally, a systematic optimization approach entails the procurement optimization plan, hospital formulary inventory control, balancing of regional assets, and building of medical service capacities. Thus, equal availability of treatment programs necessitates assessing the affordability of the system first, then its availability, and finally, its accessibility.

References

[1] Zhou, W., Li, S., & Zhou, Y. (2025). International cost-effectiveness analysis of nivolumab plus ipilimumab-based therapy for metastatic non-small cell lung cancer with PD-L1 lower than 1%. *Transl Lung Cancer Res, 14*(7), 2560-2570.

[2] Zhu, T., Ge, K., Shen, A., & Wu, Y. (2026). Availability, prices, and affordability of immune checkpoint inhibitors: A cross-sectional study in Anhui Province, China. *PharmacoEconomics Open, 10*(4), 695-706.

[3] Zhao, J., Graetz, I., Howard, D., Yabroff, K. R., & Lipscomb, J. (2025). Immune checkpoint inhibitors and survival disparities by health insurance coverage among patients with metastatic cancer. *JAMA Netw Open, 8*(7), e2519274.

[4] Yang, D., Karanth, S. D., Yoon, H. S., Yang, J. J., Lou, X., Bian, J., Zhang, D., Guo, Y., Yaghjyan, L., Akinyemiju, T., Rodriguez, E., Mehta, H. J., & Braithwaite, D. (2024). Disparities in utilization of immune checkpoint inhibitor therapy among older patients with advanced non-small cell lung cancer: A SEER-Medicare analysis. *JCO Oncol Adv, 1*, e2400008.

[5] Sharman Moser, S., Tanser, F., Siegelmann-Danieli, N., Apter, L., Chodick, G., & Solomon, J. (2023). The reimbursement process in three national healthcare systems: Variation in time to reimbursement of pembrolizumab for metastatic non-small cell lung cancer. *J Pharm Policy Pract, 16*(1), 22.

[6] National Institute for Health and Care Excellence. (2026). Nivolumab for treating recurrent or metastatic squamous cell carcinoma of the head and neck after platinum-based chemotherapy — first draft guidance. NICE. (ID: GID-TA10538).

[7] National Institute for Health and Care Excellence. (2026). *Pembrolizumab for metastatic non-small cell lung cancer — first draft guidance (May 2026)*. NICE.

[8] National Healthcare Security Administration. (2026). *2025 National Reimbursement Drug List negotiation results*. NHSA.

[9] Olateju, O. A., Mgbere, O., Thornton, J. D., Zeng, Z., & Essien, E. J. (2024). Disparities in survival outcomes among patients with metastatic melanoma in Texas: Implications for policy and interventions in the era of immune checkpoint inhibitors. *Am J Clin Oncol., 47*(11), 517–525.

[10] NHS England. (2025). *National cancer waiting times monitoring dataset guidance (Version 12.1)*. NHS England.

[11] Zhang, Y., Zhang, W., Deng, J., Liu, Y., & Sun, L. (2026). Analysis of nationwide availability of negotiated drugs in China's National Reimbursement Drug List. *Front Public Health, 13*, 1718627.