DOI:10.31557/RRO.2024.10.2.155

REVIEW

Prospective Episode/Bundle-Based Reimbursement in Radiation Oncology: Opportunities and Challenges

Shayan Sheikhmiri[1], Alireza Ghorbani[2], Shakiba Javadi[3], Seyed Alireza Javadinia[4], Seyedehhoda Khatibmasjedi[5]

[1]Radiation Oncologist, Shahid Beheshti University of Medical Sciences, Cancer Research Center, Tehran, Iran. [2]Department of Public Health, School of Health, Sabzevar University of Medical Sciences, Sabzevar, Iran. [3]Radiation oncologist, Department of Radiation-Oncology, Faculty of Medicine, Shiraz University of Medical Sciences, Shiraz, Iran. [4]Non-Communicable Diseases Research Center, Sabzevar University of Medical Sciences, Sabzevar, Iran. [5]Palliative care department, Case Western Reserve University, University Hospitals, Seidman Cancer Center, Cleveland, Ohio, USA.

Abstract

Payment reform has become an important issue in cancer policy because reimbursement mechanisms influence not only healthcare expenditure but also clinical practice, resource allocation, and service sustainability. This issue is particularly relevant to radiation oncology, where care involves substantial fixed infrastructure costs, complex treatment planning and quality assurance, and an increasing shift toward shorter, evidence-based treatment regimens. This brief review examines the literature on prospective, case-based, bundled, and episode-based payment models in oncology, with particular emphasis on radiotherapy. Across the available evidence, cost containment is the most consistent reported effect, whereas impacts on service utilization, quality, and clinical outcomes are more heterogeneous and appear to depend on payment design and implementation context. In radiation oncology, episode-based models may be most appropriate when reimbursement is linked to clinically meaningful treatment episodes, adjusted for disease site and treatment complexity, and periodically recalibrated to reflect changes in technology, practice patterns, and resource requirements. Conversely, rigid or inadequately priced tariffs may create incentives that conflict with evidence-based practice, including the adoption of shorter treatment regimens or the financial sustainability of lower-volume providers. Overall, the evidence does not support either blanket adoption or rejection of episode-based reimbursement. Rather, effective implementation requires context-sensitive payment design, appropriate risk adjustment, and continuous monitoring of cost, quality, access, and clinical outcomes.

Keywords: Radiotherapy, Episode-based payment, Bundle-based payment, Global payment, Fee-for-service, Iran

Rep Radiother Oncol, **10 (2)**, 155-162

Submission Date: 06/11/2024 Acceptance Date: 08/01/2024

Introduction

Health economics plays a central role in the sustainability of modern healthcare systems by addressing the competing objectives of equitable access, clinical quality, and efficient use of limited resources. These challenges are particularly pronounced in cancer care, where population aging, increasing cancer incidence, and the rapid adoption of advanced technologies have contributed to rising healthcare expenditure. In radiation oncology, the economic implications are especially relevant because treatment requires substantial infrastructure, specialized personnel, treatment planning, quality assurance, and increasingly sophisticated technologies. At the same time, advances in radiotherapy have enabled shorter treatment regimens, creating a potential mismatch between conventional reimbursement structures and contemporary patterns of care.

Provider payment mechanisms are an important policy instrument because they influence incentives for service volume, resource use, efficiency, and quality. Payment systems can broadly be classified as prospective or retrospective, although many health systems use hybrid arrangements. Under prospective payment, reimbursement

Corresponding Author:
Dr. Shayan Sheikhmiri
Radiation Oncologist, Shahid Beheshti University of Medical Sciences, Cancer Research Center, Tehran, Iran.
Email: Sheikhmiri.Shayan@gmail.com

is determined according to a predefined rate or payment structure rather than being based entirely on the actual services subsequently delivered. Examples include global budgets, salaries, capitation, per diem payments, diagnosis-related groups (DRGs), case-based payments, and episode- or bundle-based payments.

Episode-based or bundled payment models are particularly relevant to oncology because they shift the unit of reimbursement from individual services toward a defined period or episode of care. By establishing a predetermined payment for a clinically defined set of services, these models may improve expenditure predictability and encourage coordination and resource efficiency. However, they may also create unintended incentives if payment levels do not adequately reflect differences in disease severity, treatment complexity, or provider costs. Potential concerns include underprovision of services, avoidance of clinically complex patients, and reduced access for patients or providers facing higher treatment costs.

These issues are especially important in radiation oncology, where treatment costs vary substantially according to disease site, treatment intent, fractionation schedule, technology, and patient complexity. The increasing adoption of hypofractionation further challenges reimbursement models based primarily on treatment volume or number of fractions. A payment system that fails to account for these changes may unintentionally discourage clinically appropriate innovations or create financial pressures for providers.

Reimbursement in oncology is more than a financing mechanism; it can influence how cancer services are organized, delivered, and sustained. Payment systems shape incentives for clinical practice and service utilization and may affect providers' capacity to maintain the personnel, infrastructure, and coordination required for multidisciplinary cancer care. These considerations are particularly relevant in oncology, where treatment pathways are complex, resource-intensive, and increasingly dependent on technologies and processes that extend beyond individual billable services [1-5].

The limitations of traditional fee-for-service (FFS) reimbursement have therefore received increasing attention in cancer policy. By linking payment to the volume of individual services, FFS may create incentives for greater service intensity and fragmentation rather than coordination and value. Although FFS remains widely used because of its administrative familiarity, it may be less well suited to oncology, where outcomes often depend on the coordination and quality of care delivered across an entire treatment episode rather than on the volume of individual services [1, 3-7].

These concerns have contributed to interest in prospective, bundled, case-based, and episode-based payment models. These approaches seek to shift reimbursement from individual services toward predefined clinical units or episodes of care, with the potential to improve expenditure predictability, promote efficiency, and reduce incentives for unnecessary service volume [4, 7]. However, evidence regarding their effectiveness is heterogeneous. Outcomes depend on several design and implementation factors, including the definition of the episode, risk adjustment, services included in the payment, quality safeguards, and the characteristics of the healthcare delivery system in which the model is implemented [2, 5, 8].

These considerations are particularly important in radiation oncology. Radiotherapy requires substantial fixed capital investment and involves multiple resource-intensive processes, including simulation, treatment planning, contouring, dosimetry, image guidance, quality assurance, and equipment maintenance. Consequently, reimbursement policies may influence not only short-term expenditure but also technical quality, access to treatment, workforce and infrastructure sustainability, and the financial viability of treatment centers, particularly those operating at lower volumes or in resource-constrained settings [9-11].

The growing use of hypofractionation further highlights the potential mismatch between reimbursement and contemporary clinical practice. Shorter treatment regimens are supported by evidence across several disease sites and can reduce patient burden and treatment demand. However, payment structures based primarily on the number of fractions may create financial disincentives for adopting clinically appropriate shorter regimens if they do not adequately account for treatment planning, quality assurance, fixed infrastructure, and other costs that are not directly proportional to fraction number [1, 12-14]. This issue illustrates the importance of aligning reimbursement with both clinical evidence and the underlying cost structure of radiotherapy.

Accordingly, this review examines the evidence on prospective, case-based, bundled, and episode-based payment models in oncology, with particular emphasis on radiation therapy. It focuses on their effects on costs, utilization, quality, clinical outcomes, provider incentives, and access to care, and considers the design and implementation factors that may influence their suitability for health systems transitioning from FFS reimbursement, including Iran.

Conceptual Basis for Prospective and Episode-Based Payment

Prospective payment models shift reimbursement from individual billable services toward a predefined case, clinical package, or episode of care. By weakening the direct relationship between the volume of services delivered and total reimbursement, these models may reduce incentives for unnecessary service use and encourage more efficient resource allocation [8]. However, their effectiveness depends substantially on how the payment unit is defined and adjusted for clinical variation.

Defining an appropriate payment episode is particularly challenging in oncology. Patients with the same cancer diagnosis may differ considerably in disease stage, treatment intent, comorbidities, toxicity risk, and need for supportive care. A payment model that does not adequately account for this heterogeneity may create incentives

for underprovision of care or avoidance of clinically complex patients. These challenges are especially evident in radiation oncology, where resource requirements vary according to disease site, target geometry, motion management, imaging requirements, treatment intent, and planning complexity. A single-fraction palliative treatment and a highly conformal definitive course, for example, involve substantially different levels of technical and planning effort and should not necessarily be treated as equivalent payment units [9].

Accordingly, reimbursement approaches based on clinically meaningful characteristics, such as disease site, treatment intent, and treatment complexity, may provide a better basis for payment than formulas determined solely by fraction number or equipment category [10, 15]. Such models may better reflect actual resource requirements while reducing incentives to select treatment regimens primarily on the basis of reimbursement.

However, clinically differentiated payment should not imply that all technologies warrant higher reimbursement. Payment design should distinguish clinically meaningful differences in resource use and outcomes from differences attributable primarily to technological novelty. In this context, reimbursement should be aligned with evidence of clinical benefit, appropriate resource use, and the actual costs of delivering care rather than with the perceived sophistication of a treatment platform [10, 11].

Findings from the Broader Oncology Literature

Evidence from the broader oncology literature indicates that cost reduction or slower expenditure growth is among the most consistent effects reported for prospective payment models. A recent systematic review found that studies across cancer care settings frequently reported reductions in overall spending or expenditure growth following implementation of prospective payment approaches [8]. These findings suggest that payment reform can influence healthcare expenditure and provider financial behavior.

Evidence regarding utilization and clinical outcomes is less consistent. The same review reported that many studies found no statistically significant changes in service utilization, while findings related to quality of care, survival, and other clinical outcomes were heterogeneous [8]. Thus, reductions in expenditure cannot be assumed to translate directly into either improved or poorer clinical outcomes.

The interpretation of cost savings therefore depends on how they are achieved. Lower expenditure may reflect reduced duplication, improved coordination, or more efficient use of resources, but it may also result from reduced service provision if payment incentives are poorly aligned with clinical needs. Accordingly, cost containment should be considered alongside access, quality, utilization, and patient outcomes when evaluating prospective payment models. The available evidence supports a multidimensional assessment of payment reform rather than reliance on expenditure alone.

A similar pattern is evident in a systematic review of alternative payment and care-delivery models in oncology [2]. The review found heterogeneous effects: some interventions improved measured value, whereas others showed limited benefit or unfavorable early effects. These findings suggest that the effectiveness of payment reform depends less on the nominal model whether bundled, prospective, or episode-based than on its specific design and implementation. Important determinants include the services included in the payment, risk adjustment, quality safeguards, and the organizational context in which the model operates.

More favorable outcomes were often reported when payment reform was accompanied by broader changes in care delivery, including improved care coordination, standardized clinical pathways, enhanced data systems, and quality monitoring [2]. This finding suggests that reimbursement reform is more likely to achieve its intended objectives when integrated into a broader organizational strategy rather than implemented as an isolated financial intervention. Its effects may also vary according to institutional resources, referral patterns, clinical culture, payer requirements, and administrative capacity. Consequently, the same payment model may produce different results across healthcare systems, provider organizations, or clinical settings.

Evidence concerning physician payment incentives in oncology further supports the importance of context [3, 6]. Although clinicians respond to financial incentives, their behavior is also influenced by professional norms, clinical guidelines, institutional constraints, and patient characteristics. The relationship between reimbursement and clinical practice is therefore not mechanically deterministic; financial incentives interact with broader clinical and organizational factors.

Overall, the broader oncology literature indicates that prospective payment has a more consistent association with changes in expenditure than with improvements in utilization, quality, or clinical outcomes. Its effects appear to depend substantially on payment design, implementation strategy, and the surrounding delivery system. Thus, prospective payment should be viewed not as a universally effective or ineffective intervention, but as a policy instrument whose consequences are conditional on how it is structured and integrated into clinical practice.

Why Radiation Oncology Merits Separate Consideration

Radiation oncology warrants separate consideration in payment reform because its delivery depends on substantial fixed infrastructure, specialized equipment, treatment-planning systems, quality assurance, engineering support, and highly trained personnel [9]. These characteristics create a cost structure in which many expenditures are not directly proportional to the number of treatment fractions delivered. Consequently, reimbursement that does not adequately reflect fixed and variable resource requirements may affect the financial sustainability of radiotherapy services, particularly in lower-volume or

resource-constrained settings.

Cross-national evidence from Europe demonstrates substantial variation in how radiotherapy is reimbursed, with payment units including individual fractions, treatment courses, diagnosis-related categories, mixed models, and broader budgetary arrangements [9]. This variation indicates that no single payment architecture has been universally adopted. European evidence also suggests that radiotherapy represents an important but relatively limited component of overall cancer expenditure [9,10]. Therefore, potential savings from aggressive reductions in radiotherapy reimbursement should be considered alongside their possible effects on treatment access, technical quality, workforce capacity, and service sustainability.

These considerations support a value-oriented approach to radiotherapy reimbursement. Payment should account for clinically relevant outcomes and differences in treatment complexity while also reflecting the resources required to deliver safe and effective care. Such an approach differs from both unrestricted FFS reimbursement and uniform cost containment because it seeks to align financial incentives with clinical value and actual resource requirements.

Evidence Specifically Relevant to Radiotherapy Payment Reform

Direct evidence evaluating payment reform specifically in radiotherapy remains more limited than the broader oncology literature. However, available studies provide several relevant observations. A 2016 observational study of case-rate reimbursement reported changes in practice patterns following implementation across selected cancer sites. Guideline concordance improved in some settings, including bone metastases and prostate cancer, while undertreatment decreased and no substantial increase in overtreatment was observed [13]. Although these findings are encouraging, the observational design limits causal inference and the results may not be generalizable to other healthcare systems or disease sites.

A 2025 survey conducted by the American College of Radiation Oncology (ACRO) provides complementary evidence regarding clinician perspectives on payment design [15]. Respondents generally favored episode-based reimbursement organized according to disease site rather than treatment modality or fraction number. Although such survey findings do not establish the effectiveness of a payment model, they provide insight into the characteristics clinicians consider more compatible with contemporary radiotherapy practice.

Taken together, the available radiotherapy-specific evidence does not establish that episode-based reimbursement is superior to FFS across all settings. It does, however, suggest that prospective models may be more feasible when payment units correspond to clinically meaningful treatment episodes, allow appropriate flexibility in regimen selection, and account for differences in treatment complexity and resource requirements. Table 1 summarizes the principal differences between FFS and episode- or bundle-based reimbursement, with emphasis on considerations particularly relevant to radiation oncology.

Hypofractionation as a Critical Test of Payment Design

Hypofractionation provides an important example of the potential interaction between clinical innovation and reimbursement design. Shorter treatment regimens are supported by evidence across several disease sites and can reduce patient burden while increasing treatment capacity [1, 10]. However, reimbursement systems based primarily on treatment volume or fraction number may not adequately account for the resources required to deliver these regimens.

An Indonesian cost analysis illustrates this concern. The study found that radiotherapy tariffs for breast cancer did not adequately cover treatment costs and that hypofractionated regimens could further widen the gap between reimbursement and provider costs because fewer fractions generated lower reimbursement despite continued requirements for planning and other treatment-related resources [12]. Although these findings are context-specific, they illustrate a broader design issue: reimbursement should not create financial disincentives for evidence-based treatment regimens when those regimens are clinically appropriate and potentially more efficient.

Similar concerns have been raised regarding the sustainability of radiotherapy services in smaller and rural centers. A 2025 Medicare-focused analysis suggested that changes in reimbursement, declining treatment volumes, and increasing adoption of shorter regimens may create financial pressures for some providers [14]. These findings do not imply that hypofractionation is economically unfavorable. Rather, they highlight the need for payment models to account for planning, imaging, quality assurance, staffing, and fixed infrastructure costs that are not directly proportional to the number of fractions delivered.

Hypofractionation therefore provides a useful test of whether a reimbursement system is aligned with contemporary radiotherapy practice. A well-designed model should allow clinically appropriate reductions in treatment duration without creating inappropriate financial incentives against their adoption.

Administrative Burden and Prior Authorization

The effectiveness of reimbursement reform also depends on its administrative requirements. Evidence on prior authorization in cancer care indicates that payer requirements can delay treatment, increase administrative workload, and add complexity to clinical decision-making [16].

These concerns are particularly relevant to radiation oncology, where authorization requirements for advanced

Table 1. Comparison of Fee-for-Service and Episode-/Bundle-Based Payment Models in Oncology and Radiation Oncology

Dimension	Fee-for-Service (FFS)	Episode-/Bundle-Based Payment	Implications for Oncology	Specific Relevance to Radiation Oncology
Payment unit	Individual visits, procedures, or services	Predefined clinical episode or bundle	Shifts emphasis from individual services toward the overall care pathway	Episode definition should encompass relevant planning, treatment delivery, verification, and follow-up
Primary incentive	Service volume and billing intensity	Efficiency and resource management within a predefined payment	May reduce incentives for fragmented or unnecessary service use	May reduce incentives for unnecessary fractions but can underpay complex cases if poorly calibrated
Value-based alignment	Generally limited because payment is linked to service volume	Potentially stronger when linked to clinically meaningful episodes and quality safeguards	Better suited to appropriateness and coordinated care	Should support evidence-based fractionation without mechanically linking payment to fraction number
Care coordination	May encourage delivery of individual services rather than integrated care	More compatible with coordination across the treatment episode	Particularly relevant to multidisciplinary cancer care	Requires coordination among radiation oncologists, physicists, dosimetrists, therapists, and imaging personnel
Risk of overtreatment	Potentially higher because additional services generate additional reimbursement	Potentially lower because additional services are not automatically reimbursed separately	May reduce low-value utilization	May reduce incentives for unnecessarily prolonged treatment courses
Risk of undertreatment	Lower financial disincentive for additional services	Potential risk if payment is insufficient to cover required resources	Requires quality safeguards and outcome monitoring	Particularly important for technically complex or resource-intensive treatments
Expenditure predictability	Lower for payers because expenditure varies with service volume	Higher because payment is prospectively defined	Supports budget planning and expenditure control	Requires accurate case-mix adjustment and recognition of fixed infrastructure costs
Administrative requirements	Familiar and relatively straightforward within established billing systems	Greater complexity in episode definition, coding, risk adjustment, and recalibration	Administrative burden may affect implementation	Particularly challenging because treatment pathways vary by disease site, technique, intent, and fractionation
Sensitivity to case complexity	Complexity may be reflected through additional billable services	Requires explicit risk adjustment or episode stratification	Poorly designed bundles may disadvantage providers treating complex patients	Adjustment may be needed for disease site, treatment intent, re-irradiation, advanced techniques, and image guidance
Innovation	May encourage adoption of reimbursable technologies regardless of incremental value	Can support innovation if payment is regularly updated and evidence-aligned	Incentives depend on tariff design and updating mechanisms	Static tariffs may inadequately recognize IMRT, SBRT, IGRT, and adaptive workflows
Hypofractionation	May create financial disincentives because fewer fractions can reduce reimbursement	Can be better aligned when payment covers the treatment episode rather than individual fractions	Supports transition toward value-oriented treatment when appropriately designed	A central consideration because reimbursement should not discourage evidence-based shorter regimens
Infrastructure costs	May inadequately capture fixed capital and maintenance costs	Can incorporate such costs if tariffs are appropriately calculated	Important for resource-intensive oncology services	Critical because of equipment, maintenance, software, quality assurance, and specialized staffing requirements
Provider equity	May favor high-volume service delivery	May favor efficient systems but disadvantage smaller centers if underpriced	Poor calibration may increase differences between providers	Lower-volume and peripheral centers may be particularly vulnerable to inadequate episode payments
Quality monitoring	Not necessarily linked to outcomes	Requires systematic monitoring of quality and access	Necessary to ensure cost containment does not compromise care	Relevant indicators include waiting time, treatment interruptions, toxicity, imaging, guideline concordance, and access to advanced techniques
Main strengths	Familiarity, flexibility, and relatively low immediate provider financial risk	Greater expenditure predictability, potential efficiency gains, and stronger coordination incentives	Provides a potential pathway away from volume-driven reimbursement	May provide a more rational framework if complexity and infrastructure are appropriately recognized
Main limitations	Fragmentation, volume incentives, and potential overuse	Risk of underpayment, risk selection, administrative burden, and inappropriate episode definition	Effectiveness depends heavily on design and implementation	Poorly calibrated models may threaten provider sustainability, access, and adoption of evidence-based practice

modalities such as intensity-modulated radiation therapy (IMRT), stereotactic body radiotherapy (SBRT), and proton therapy may involve additional documentation, peer-to-peer review, or appeals [16]. Although utilization controls may serve legitimate purposes, excessive administrative requirements can delay clinically appropriate treatment and reduce operational efficiency.

This issue is relevant to episode-based payment because financial simplification may be offset by increased administrative complexity. A reimbursement model that reduces fragmentation in payment but introduces substantial authorization and documentation requirements may therefore achieve limited net efficiency gains. Administrative simplicity, transparency, and predictable authorization processes should consequently be considered explicit components of payment-model design [16].

Summary and Policy Implications

Overall, the available evidence suggests that prospective and episode-based payment models can influence expenditure and may reduce some incentives associated with fee-for-service reimbursement, but their effects on utilization, quality, and clinical outcomes remain heterogeneous [2, 8]. The evidence therefore does not support assuming that payment reform alone will improve efficiency or patient outcomes across all settings.

For radiation oncology, several design principles emerge from the available literature. First, payment units should correspond to clinically meaningful episodes and incorporate relevant differences in disease site, treatment intent, and complexity [10, 15, 16]. Second, reimbursement should account for the full resource requirements of radiotherapy, including treatment planning, imaging, staffing, quality assurance, equipment maintenance, and other fixed or semi-fixed costs [9, 12, 14]. Third, payment rates should be periodically recalibrated to reflect inflation, technological change, and evolving treatment patterns. Fourth, evaluation should extend beyond expenditure to include access, waiting times, treatment interruptions, appropriate utilization, toxicity, and variation across provider settings [10, 11]. Finally, administrative requirements should be proportionate and transparent so that payment reform does not replace one source of inefficiency with another.

These principles are particularly relevant when considering implementation in health systems with heterogeneous provider capacity and constrained resources. Payment reform in radiation oncology should therefore be viewed as an iterative policy process requiring ongoing assessment of costs, clinical practice, quality, access, and provider sustainability rather than as a one-time transition from fee-for-service reimbursement.

An important lesson from the literature is that the effects of reimbursement reform may extend beyond short-term changes in utilization or clinical outcomes. A payment model may leave headline indicators apparently unchanged while creating financial disincentives for hypofractionation, increasing pressure on lower-volume centers, or limiting access to technically complex but clinically appropriate treatments. Such indirect effects should therefore be considered alongside conventional measures of cost, utilization, and outcomes when evaluating payment reform.

Policy Relevance for Iran

For Iran, the available international evidence does not support either maintaining an unmodified fee-for-service model or adopting episode-based reimbursement without appropriate safeguards. Instead, any transition toward prospective or episode-based payment in radiotherapy should incorporate clinical differentiation, realistic costing, risk adjustment, and mechanisms for periodic reassessment.

Iran's experience with global tariffs in other areas of healthcare, particularly surgery, provides a relevant policy context [17-27]. Previous domestic studies have reported concerns regarding tariff adequacy, discrepancies between reimbursement and actual service costs, and financial pressures on hospitals and providers. However, these experiences should not be interpreted as direct evidence of how episode-based reimbursement would perform in radiotherapy. Rather, they highlight the importance of careful costing, appropriate adjustment for service complexity, and mechanisms for timely revision when considering similar reforms in radiotherapy.

A disease-site- and treatment-complexity-based framework may be more appropriate than a model determined primarily by fraction number. Such an approach could better accommodate evidence-based variation in treatment regimens while accounting for differences in target delineation, immobilization, image guidance, motion management, treatment planning, adaptive replanning, and quality assurance. Without adequate complexity adjustment, a uniform episode payment could underestimate the resources required for technically demanding cases and potentially create incentives to avoid or limit resource-intensive treatments.

The Iranian economic context further increases the importance of payment flexibility. Persistent inflation and currency depreciation can rapidly increase the costs of radiotherapy equipment, imported components, maintenance contracts, software, dosimetry equipment, and other technical inputs. Consequently, a tariff that adequately reflects costs at the time of implementation may become insufficient as economic conditions change. Inadequate reimbursement may ultimately affect not only provider finances but also equipment maintenance, workforce stability, preventive servicing, calibration, quality assurance, and continuity of service.

Regular tariff review should therefore be considered an integral component of radiotherapy payment design. Rather than prescribing a fixed revision interval without empirical justification, Iran could establish a transparent recalibration mechanism based on relevant cost indicators, including inflation, exchange-rate movements, technology and maintenance costs, staffing expenses, and changes in treatment patterns. More frequent interim reviews may be warranted during periods of substantial economic

volatility. Such a mechanism would help reduce the risk of prolonged divergence between reimbursement and the actual cost of delivering safe and evidence-based radiotherapy.

The Iranian policy discussion should also explicitly address hypofractionation. When shorter regimens are supported by clinical evidence, reimbursement should not create financial disincentives to their adoption. However, this requires careful calibration. Episode-based or global tariffs that do not adequately account for treatment complexity, planning requirements, and fixed infrastructure costs may undermine the financial sustainability of providers even when shorter regimens improve system efficiency. Payment design should therefore support evidence-based hypofractionation while preserving the resources required for appropriate imaging, treatment planning, quality assurance, and follow-up care.

The experience of global tariffs in other areas of Iranian healthcare also highlights the potential consequences of inadequate payment calibration. In radiotherapy, where service delivery depends on capital-intensive equipment and specialized personnel, persistent underpayment could place pressure on equipment maintenance, workforce retention, quality assurance, and service capacity. These effects may be particularly relevant for public-sector and lower-volume centers, where fixed costs are distributed across fewer patients. Accordingly, payment reform should be evaluated not only in terms of aggregate expenditure but also in terms of provider sustainability and equitable access.

Any reform should therefore incorporate prospective monitoring of key clinical, operational, and financial indicators. Relevant measures include waiting time for simulation and treatment initiation, treatment interruptions, appropriate use of image-guided radiotherapy, availability of adaptive treatment, treatment-related toxicity, equipment downtime, and the financial performance of public and lower-volume centers. Monitoring should also assess geographic variation in access. Such surveillance would allow unintended effects of reimbursement reform to be identified before they result in persistent reductions in service capacity or quality. A formal mechanism for periodic tariff review and correction should accompany implementation, particularly during periods of substantial economic or technological change.

In conclusion, the evidence reviewed in this article suggests that prospective and episode-based payment models can contribute to expenditure control, but their effects on utilization, quality, and clinical outcomes are less consistent and depend substantially on payment design and implementation. In oncology, and particularly in radiation oncology, reimbursement categories should therefore reflect clinically meaningful episodes, treatment complexity, and the actual resources required to deliver safe and effective care. Radiation oncology presents a particular challenge because substantial fixed infrastructure and technical requirements coexist with increasingly shorter evidence-based treatment regimens. Payment systems that rely excessively on treatment volume or fraction number may therefore create unintended financial incentives and undermine the adoption or sustainability of appropriate care. Conversely, well-calibrated episode-based models may improve efficiency while preserving clinical flexibility, provided that they incorporate adequate complexity adjustment, realistic costing, quality safeguards, and periodic recalibration. For Iran, the available evidence supports a cautious and phased approach rather than either maintaining unmodified fee-for-service reimbursement or adopting episode-based payment without safeguards. Any reform should explicitly accommodate hypofractionation, account for inflation and technology-related costs, protect provider sustainability, and monitor access, quality, and financial outcomes. Pilot implementation with predefined evaluation criteria and mechanisms for timely tariff adjustment may provide a more appropriate pathway toward sustainable radiotherapy payment reform

Acknowledgments

Statement of Transparency and Principles

• The authors declare no conflict of interest.

• All authors contributed to the implementation of this research.

References

1. Falit BP, Chernew ME, Mantz CA. Design and implementation of bundled payment systems for cancer care and radiation therapy. Int J Radiat Oncol Biol Phys. 2014;89(5):950-3. https://doi.org/10.1016/j.ijrobp.2014.04.023
2. Aviki EM, Schleicher SM, Mullangi S, Matsoukas K, Korenstein D. Alternative payment and care-delivery models in oncology: a systematic review. Cancer. 2018;124(16):3293-306. https://doi.org/10.1002/cncr.31367
3. McPherson E, Hedden L, Regier DA. Impact of oncologist payment method on health care outcomes, costs, quality: a rapid review. Syst Rev. 2016;5(1):160. https://doi.org/10.1186/s13643-016-0341-2
4. Bach PB, Mirkin JN, Luke JJ. Episode-based payment for cancer care: a proposed pilot for Medicare. Health Aff (Millwood). 2011;30(3):500-9. https://doi.org/10.1377/hlthaff.2010.0752
5. Nejati M, Razavi M, Harirchi I, Zendehdel K, Nejati P. The impact of provider payment reforms and associated care delivery models on cost and quality in cancer care: a systematic literature review. PLoS One. 2019;14(4):e0214382. https://doi.org/10.1371/journal.pone.0214382
6. Mitchell AP, Rotter JS, Patel E, Richardson D, Wheeler SB, Basch E, Goldstein DA. Association between reimbursement incentives and physician practice in oncology: a systematic review. JAMA Oncol. 2019;5(6):893-9. https://doi.org/10.1001/jamaoncol.2018.6196
7. Cutler DM, Ghosh K. The potential for cost savings through bundled episode payments. N Engl J Med. 2012;366(12):1075-7. https://doi.org/10.1056/NEJMp1113361
8. Pérez-Acevedo JJ, Manrique-Hernández EF, Licht-Ardila M, Hurtado-Ortiz A, Ochoa S, Castaño-Yepes RA, García-Ubaque JC, et al. Impact of prospective payment models on cancer patient care: a systematic review. Health Policy. 2026;171:105651. https://doi.org/10.1016/j.healthpol.2026.105651

9. Lievens Y, Defourny N, Corral J, Gasparotto C, Grau C, Borras JM, ESTRO-HERO Consortium Collaborators. How public health services pay for radiotherapy in Europe: an ESTRO-HERO analysis of reimbursement. Lancet Oncol. 2020;21(1):e42-e54. https://doi.org/10.1016/S1470-2045(19)30794-6
10. Lievens Y, Borras JM, Grau C, Aggarwal A. Value-based radiotherapy: a new chapter of the ESTRO-HERO project. Radiother Oncol. 2021;160:236-9. https://doi.org/10.1016/j.radonc.2021.05.007
11. Borras JM, Corral J, Aggarwal A, Audisio R, Espinas JA, Figueras J, Naredi P, et al. Innovation, value and reimbursement in radiation and complex surgical oncology: Time to rethink. Radiotherapy and Oncology. 2022;169:114–23. https://doi.org/10.1016/j.radonc.2021.08.002
12. Suryanegara FDA, Iskandar D, Ekaputra E, Kuntjoro E, Setiawan D, Postma MJ, de Jong LA. Costs analysis of radiotherapy for breast cancer in Indonesia: a comparison between reimbursement tariffs and actual costs. BMC Health Serv Res. 2025;25(1):766. https://doi.org/10.1186/s12913-025-12849-9
13. Loy BA, Shkedy CI, Powell AC, Happe LE, Royalty JA, Miao MT, Smith GL, et al. Do case rates affect physicians' clinical practice in radiation oncology?: an observational study. PLoS One. 2016;11(2):e0149449. https://doi.org/10.1371/journal.pone.0149449
14. Patel KM, Thomas T, Heron DE, Mantz CA. A threat to quality cancer care, accessibility, and sustainability: Medicare payment policies and changing utilization patterns in radiation oncology. Cureus. 2025;17(3):e80064. https://doi.org/10.7759/cureus.80064
15. Wilding JA, Clifford JS, Heron DE, Jahraus CD, McKitrick J, Benitez CM, Thomas TO. General consensus on implementing an episode-based payment model: results from the American College of Radiation Oncology (ACRO) payment reform survey. Cureus. 2025;17(4):e81557. https://doi.org/10.7759/cureus.81557
16. Gracie J, Jimenez R, Winkfield KM. The burden of insurance prior authorization on cancer care: a review of evidence from radiation oncology. Adv Radiat Oncol. 2025;10(1):101654. https://doi.org/10.1016/j.adro.2024.101654
17. Arab M, Zeraati H, Ravangard R, Gholinejad A, Rasooli A. Comparing global-operations reimbursements with their actual costs in the Cancer Institute, Tehran. J Sch Public Health Inst Public Health Res. 2008;6(2):59-66.
18. Gholamzadeh Nikjoo R, Dadgar E, Jannati A, Hosseini Asl M, Salek Z. Comparison of global and actual cost of kidney transplant in Imam Reza Hospital, Tabriz. Hakim Res J. 2014;17(1):22-8.
19. Chatruz A, Javadinasab H, Amini MK, Biglar M, Goudarzi N, Javad J. A comparison of the cost of global surgery bills with approved tariffs in hospitals affiliated to Tehran University of Medical Sciences. Payavard Salamat. 2015;9(1):67-80.
20. Hosseini-Eshpala R, Khorramy F, Baniasadi T, Azarmehr N, Mohammady F, Hayavy Haghighi MH, et al. The comparison of the cost of patient records in a global system with corresponding retrospective reimbursement system: a case study in Iran. J Mod Med Inform Sci. 2015;1(1):65-74.
21. Fattahpour A, Ebrahimi Dourcheh R, Rahimi M, Rafiee N. Comparison of hoteling cost of global surgery with real cost in Isfahan public hospitals, 2012. Evid Based Health Policy Manag Econ. 2017;1(1):47-53.
22. Behzadi A, Rashidian A, Arab M, Mahmoudi M, Jaafaripooyan E. A trend analysis of surgical operations under a global payment system in Tehran, Iran (2005-2015). Electron Physician. 2018;10(3):6506-15. https://doi.org/10.19082/6506
23. Rashidian A, Radinmanesh M, Afshari M, Arab M, Shahinfar Z. The Comparison of the Global Surgery Fees and the Actual Cost in Two Educational Hospitals Affiliated to Tehran University of Medical Sciences. Evidence Based Health Policy, Management & Economics. 2018;2(4):239–48. https://doi.org/10.18502/jebhpme.v2i4.275
24. Aboutorabi A, Radinmanesh M, Rezapour A, Afshari M, Taheri G. A comparison of global surgery tariffs and the actual cost of bills at Hazrate Rasoole Akram educational and medical center. Cost Eff Resour Alloc. 2020;18:38. https://doi.org/10.1186/s12962-020-00232-w
25. Dorrani M, Zangoui S, Alborzi R. Comparison of the Actual Cost of Global Surgeries in the Hospitals Affiliated to Birjand University of Medical Sciences With the Government-approved Tariffs in 2021. Journal of Modern Medical Information Sciences. 2024;9(4):382–99. https://doi.org/10.32598/JMIS.9.4.7
26. Sadeghifar J, Eyvani N, Rajabi Vasukolai G, Farhamand Moghadam N, Ekhtyari S. Comparing the global tariff and actual costs of surgeries at Imam Khomeini Hospital affiliated with Kermanshah University of Medical Sciences. Hospital. 2024;23(1):54-63.
27. Zarei E, Hashemi M, Farrokhi P. The gap between the actual cost and tariffs of global surgical procedures: a retrospective cross-sectional study in Qazvin Province, Iran. Arch Iran Med. 2024;27(10):580-7. https://doi.org/10.34172/aim.31106