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A Comparative Study of Hospital KPI Formulation Models Empowered by Artificial Intelligence — An Analysis Based on Traditional Manual Formulation and Intelligent Formulation Paths

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Abstract: Hospital Key Performance Indicators (KPIs) are important management tools that connect strategic objectives with operational execution. Traditional hospital KPI formulation mainly relies on managerial experience and historical statistical data, which in practice suffers from problems such as static indicator structures, strong subjectivity, and slow response speed. With the widespread application of artificial intelligence technologies in healthcare management, intelligent KPI formulation methods based on big data analytics and machine learning models have gradually become a new development direction. This study takes traditional manual KPI formulation and AI-assisted KPI formulation as research objects. Through literature analysis and case comparison, the differences between the two models are systematically compared from the perspectives of formulation logic, data sources, dynamic adjustment capability, and management effectiveness. The results indicate that AI-driven KPI formulation models demonstrate significant advantages in accuracy, timeliness, and predictive capability, while still facing certain challenges in data governance and organizational adaptation.

Keywords: Artificial intelligence; Hospital management; KPI formulation; Performance management; Smart healthcare

1. Introduction

Against the backdrop of continuously growing healthcare service demand and increasing complexity of

hospital operations, performance management has become a core management tool for promoting high-quality hospital development (Ziat et al., 2024). As an important component of performance management systems, KPIs are widely applied in hospital resource allocation, performance evaluation, and strategic implementation processes (Fallahnezhad et al., 2024).

With the rapid development of artificial intelligence, big data, and smart healthcare technologies, hospital management models are gradually shifting from experience-driven management to data-driven management (Fatema et al., 2021). As a key component of hospital governance systems, the formulation approach of KPIs directly affects healthcare service quality, resource allocation efficiency, and organizational operational performance (Hadian et al., 2024). Traditional manual KPI formulation has long dominated hospital management practices in China. However, with increasing business complexity, this model has gradually exposed problems such as low data utilization efficiency, delayed adjustments, and insufficient decision-support capability (Hu et al., 2022).

In recent years, AI-based data analysis platforms have been gradually introduced into hospital performance management, making KPI formulation processes more intelligent and dynamic (Maleki Varnosfaderani & Forouzanfar, 2024). However, existing studies mainly focus on technical functions or individual application effects of AI systems, while systematic comparisons of management mechanisms between AI-assisted and traditional manual KPI formulation remain limited (El Arab et al., 2025).

Therefore, this study takes hospital performance management practice as the research background and selects domestic public hospital intelligent performance system applications and the AI management practice of the international Apollo Hospitals Group as research cases. Focusing on five core dimensions—formulation logic, data processing methods, dynamic adjustment capability, feedback mechanisms, and management effectiveness—this study systematically compares traditional manual KPI formulation and AI-assisted KPI formulation models. The purpose is to reveal the impact mechanism of AI technology on hospital performance management transformation and provide theoretical support and practical references for hospital performance management reform and intelligent development.

2. Literature Review

In recent years, with the continuous integration of information technology and artificial intelligence into healthcare, hospital performance management models have gradually shifted from traditional manual management to intelligent management (Zamlynskyi et al., 2025). Related research mainly focuses on three aspects: limitations of traditional performance management models, application value of AI in hospital management, and practical effects of intelligent performance systems (Li et al., 2023).

First, regarding traditional hospital

performance management, many scholars believe that manual KPI formulation has advantages such as low implementation cost and operational flexibility, but lacks scientific rigor and stability (Liu et al., 2025). Adawiyah (2024) pointed out that traditional performance indicator formulation mainly relies on managerial experience and historical statistics, lacking systematic analysis of real-time operational data, which easily leads to misalignment between indicators and actual business needs. Amos (2022) further indicated that under the background of public hospital performance reform, manually set indicators find it difficult to balance multiple objectives such as medical quality, operational efficiency, and patient satisfaction, resulting in fragmented performance management systems.

Second, research on AI applications in hospital management has gradually increased. Al-Dmour et al. (2025) noted that AI technologies use machine learning algorithms to model and analyze massive healthcare operational data, effectively identifying key factors affecting hospital performance and providing data support for KPI weight allocation. Topol (2019) demonstrated that AI not only improves diagnostic efficiency but also plays an auxiliary decision-making role in hospital operations, promoting a shift from experience-driven to data-driven management (Maleki Varnosfaderani & Forouzanfar, 2024).

Regarding practical applications of performance management systems, domestic and international case studies show that intelligent performance systems significantly improve hospital management efficiency. Gomes and Romão (2025) indicate that after introducing intelligent performance platforms, many hospitals achieved automatic data collection, dynamic indicator adjustment, and real-time feedback, greatly shortening performance accounting cycles. Kumar et al. (2025) reported that Apollo Hospitals in India reduced administrative workloads for medical staff through AI systems, indirectly improving efficiency-related KPI performance.

Some scholars have also warned about potential risks of AI applications. Chen et al. (2023) pointed out that AI systems still face issues such as inconsistent data quality and insufficient algorithm transparency, which may affect fairness in management decisions if not properly regulated. Therefore, institutional governance and ethical standards must accompany AI-assisted performance management promotion.

Overall, existing research generally affirms the potential of AI in hospital performance management, but systematic comparative studies between AI-assisted and traditional manual KPI formulation remain limited. Therefore, structured comparisons are necessary to provide more practical references for performance management transformation.

3. Research Method

This study adopts a comparative case analysis method.

To ensure practical applicability and representativeness, this study selects

intelligent performance system applications in Chinese public hospitals and AI management practices of Apollo Hospitals Group as research objects.

First, the intelligent performance system application in public hospitals is highly representative. Public hospitals occupy a dominant position in China's healthcare system, and their performance management reforms reflect national healthcare policy directions. Moreover, many tertiary hospitals have completed information infrastructure construction and introduced intelligent performance platforms, accumulating mature experience in data integration, dynamic indicator adjustment, and management process optimization (Li et al., 2025). Therefore, this case reflects typical characteristics of AI-based performance management in China.

Second, Apollo Hospitals Group, one of Asia's largest healthcare chains, has advantages in healthcare informatization and intelligent management. Its AI-based optimization of operational processes and administrative workload reduction has been widely reported by international media (Kumar et al., 2025), making it internationally representative. This case provides a global perspective and comparative reference for domestic practices.

By adopting a dual-case structure of "Chinese public hospitals + international healthcare group," this study enhances the generalizability and explanatory power of research conclusions.

3.1 Case Descriptions

3.1.1 Case 1: Intelligent Performance Systems in Chinese Public Hospitals

According to reports (2025), many tertiary hospitals introduced AI-based data analysis platforms to realize automatic KPI generation and dynamic weight adjustment (Wang et al., 2024). The systems integrate data from HIS, EMR, and financial systems, incorporating service volume, patient satisfaction, and departmental operational efficiency into unified performance evaluation systems.

Results show that performance accounting cycles were shortened from monthly manual statistics to real-time system updates. Management could monitor key indicator trends via visual dashboards and adjust resource allocation in a timely manner.

This case demonstrates that AI not only changes KPI formulation methods but also transforms performance management from result-oriented evaluation to process-oriented monitoring (Tavares & Vaz, 2025).

3.1.2 Case 2: AI Management Applications in Apollo Hospitals Group

Kumar et al. (2025) reported that Apollo Hospitals introduced AI systems to optimize hospital operational processes and reduce administrative burdens on medical staff. AI systems assisted management in monitoring workload, bed utilization rates, and patient flow efficiency, integrating these data into performance evaluation indicators.

Results showed reduced non-clinical workload time and improved efficiency-related KPI performance, indicating that AI-assisted

KPI formulation enhances management efficiency and indirectly improves healthcare service quality (Maswadi & Alhazmi, 2026).

4. Research Results

Based on the above cases, this study compares traditional manual KPI formulation and AI-assisted KPI formulation across five dimensions: formulation logic, data processing methods, dynamic adjustment capability, feedback mechanisms, and management effectiveness.

(1) Formulation Logic

Traditional KPI formulation relies on managerial experience and historical statistics, making it highly subjective. In contrast, AI-assisted formulation uses multi-source data modeling and algorithm-based identification of key performance drivers, making indicator setting more objective and scientific.

(2) Data Processing Methods

Traditional models require manual data aggregation across multiple systems, resulting in long processing cycles and errors. AI-assisted models enable automated multi-source data collection and real-time updates, significantly improving management efficiency.

(3) Dynamic Adjustment Capability

Manual KPI formulation usually uses fixed annual or quarterly indicators with slow adjustments. AI-assisted models enable dynamic weight optimization according to workload changes, enhancing system flexibility.

(4) Feedback Mechanisms

Traditional performance management focuses on post-event evaluation, causing delayed problem identification. AI-assisted systems provide real-time monitoring and early warning mechanisms, enabling timely managerial intervention.

(5) Management Effectiveness

AI-assisted KPI formulation improves refined management levels. Domestic cases show shorter performance accounting cycles and improved resource allocation efficiency, while international cases indicate improved service efficiency KPIs and overall operational performance.

Table 1. Five-Dimensional Comparison of KPI Formulation Models

Dimension	Traditional Manual KPI	AI-Assisted KPI	Transformation Direction
Formulation Logic	Experience-based, subjective	Data-driven modeling, objective	Experience-driven → Data-driven
Data Processing	Manual aggregation, inefficient	Automated real-time integration	Fragmented → Integrated
Dynamic Adjustment	Fixed indicators	Dynamic optimization	Static → Agile
Feedback Mechanism	Post-event evaluation	Real-time monitoring and alerts	Reactive → Proactive
Management Effectiveness	Extensive management	Refined management	Extensive → Precision governance

As indicated in Table 1, the traditional manual KPI formulation approach is primarily based on experiential judgment and historical statistical data, and suffers from substantial limitations in data processing efficiency, dynamic adaptability, and feedback timeliness. By contrast, the AI-assisted KPI formulation model leverages multi-source data integration and algorithm-driven analytics to achieve a more objective and dynamic indicator design process. Specifically, AI systems enhance formulation logic by identifying key performance drivers and minimizing subjective human bias; improve data processing through automated data acquisition and real-time updating; strengthen dynamic adjustment capability by enabling adaptive optimization of KPI weights in response to operational changes; upgrade feedback mechanisms by shifting from ex-post evaluation to real-time monitoring and early-warning management; and ultimately enhance management outcomes by significantly improving hospital operational efficiency and resource allocation precision. Overall, AI-assisted KPI formulation not only optimizes the performance indicator design process but also facilitates the transition of hospital performance management from static assessment toward an intelligent, process-oriented management paradigm.

5. Discussion

This study finds that AI-assisted KPI formulation significantly outperforms traditional methods in data processing efficiency, dynamic adjustment capability, and feedback timeliness. These findings align with Arun Kumar Reddy (2025), while extending prior research by systematically comparing KPI formulation mechanisms.

Theoretically, this study introduces AI into hospital KPI formulation research and constructs a multi-dimensional comparative framework, enriching performance governance theory. Practically, results show that AI-assisted KPI formulation shortens accounting cycles, improves decision accuracy, optimizes resource allocation, and indirectly improves healthcare service quality.

Limitations include reliance on literature and case analysis rather than large-scale empirical data, contextual dependency across hospitals, and unresolved issues such as data quality and algorithm transparency. Future studies may incorporate quantitative modeling and governance perspectives.

6. Conclusion

This study systematically compares traditional manual and AI-assisted KPI formulation models. Results show that although traditional methods offer flexibility, they suffer from low efficiency and limited dynamic capability. AI-assisted KPI formulation enables dynamic optimization and real-time feedback, enhancing scientific decision-making and operational efficiency. Overall, AI is reshaping hospital performance management from static evaluation toward intelligent, process-based decision support.

7. New Knowledge

The innovative contributions of this

study are mainly reflected in three aspects. First, from the perspective of "KPI formulation pathways," this study systematically compares manual and AI-driven formulation models, thereby extending the analytical scope of existing research on hospital performance management. Second, a comparative analytical framework centered on formulation logic, dynamic capability, and managerial feedback is constructed, providing a theoretical foundation for subsequent empirical investigations. Finally, this study proposes the concept of a "human–machine collaborative KPI formulation model," which offers a new development direction for performance management practices in smart hospitals.

References

Adawiyah, A. (2024). Unraveling the Dynamics of Performance Measurement: A Qualitative Study on Adopting Continuous and Datadriven Approaches in Performance Management. *Golden Ratio of Human Resource Management*, *4*(1), 30-41.https://doi.org/10.52970/grhrm.v4i1.407

Al-Dmour, R., Al-Dmour, H., Basheer Amin, E., & Al-Dmour, A. (2025). Impact of AI and big data analytics on healthcare outcomes: An empirical study in Jordanian healthcare institutions. *Digital Health*, *11*, 20552076241311051. https://doi.org/10.1177/20552076241311051

Amos, D. (2022). A practical framework for performance measurement of facilities management services in developing countries' public hospitals. *Journal of Facilities Management*, *20*(5), 713-731. https://doi.org/10.1108/JFM-03-2021-0034

Arun Kumar Reddy, A. (2025). AI Tools for Data Performance Enhancement: A Comprehensive Review. *Journal of Computer Science and Technology Studies*, *7*(6), 639-648. https://doi.org/10.32996/jcsts.2025.7.74

Chen, P., Wu, L., & Wang, L. (2023). AI fairness in data management and analytics: A review on challenges, methodologies and applications. *Applied Sciences*, *13*(18), 10258. https://doi.org/10.3390/app131810258

El Arab, R. A., Abu-Mahfouz, M. S., Abuadas, F. H., Alzghoul, H., Almari, M., Ghannam, A., & Seweid, M. M. (2025). Bridging the Gap: From AI Success in Clinical Trials to Real-World Healthcare Implementation-A Narrative Review. *Healthcare (Basel)*, *13*(7), 701. https://doi.org/10.3390/healthcare13070701

Fallahnezhad, M., Langarizadeh, M., & Vahabzadeh, A. (2024). Key performance indicators of hospital supply chain: a systematic review. *BMC Health Services Research*, *24*(1), 1610. https://doi.org/10.1186/s12913-024-11954-5

Fatema, N., Malik, H., & Ahmad, W. (2021). Data driven intelligent model for quality management in healthcare. *Journal of Intelligent & Fuzzy Systems*, *42*(2), 1155-1169.https://doi.org/10.3233/JIFS-189779

Gomes, J., & Romão, M. (2025). Evaluating Maturity Models in Healthcare Information Systems: A Comprehensive Review. *Healthcare (Basel)*, *13*(15). https://doi.org/10.3390/healthcare13151847

Hadian, S. A., Rezayatmand, R., Shaarbafchizadeh, N., Ketabi, S., & Pourghaderi, A. R. (2024). Hospital performance evaluation indicators: a scoping review. *BMC Health Services Research*, *24*(1), 561. https://doi.org/10.1186/s12913-024-10940-1

Hu, M., Chen, W., & Yip, W. (2022). Hospital management practices in county-level hospitals in rural China and international comparison. *BMC Health Serv Res*, *22*(1), 64. https://doi.org/10.1186/s12913-021-07396-y

Kumar, R., Singh, A., Kassar, A. S. A., Humaida, M. I., Joshi, S., & Sharma, M. (2025). Adoption challenges to artificial intelligence literacy in public healthcare: an evidence based study in Saudi Arabia. *Frontiers in Public Health*, *13*, 1558772. https://doi.org/10.3389/fpubh.2025.1558772

Li, L., Jiang, S., Yuan, J., Zhang, L., Xu, X., Wang, J., Zhou, Y., Li, Y., & Xu, J. (2025). From data silos to seamless integration and coordination: a data-asset centric approach to smart hospital facility management. *Engineering, Construction and Architectural Management*, *32*(11), 7804-7831. https://doi.org/10.1108/ECAM-03-2024-0274

Li, P., Bastone, A., Mohamad, T. A., & Schiavone, F. (2023). How does artificial intelligence impact human resources performance. evidence from a healthcare institution in the United Arab Emirates. *Journal of Innovation & Knowledge*, *8*(2), 100340. https://doi.org/10.1016/j.jik.2023.100340

Liu, W., Chan, A. P., Chan, M. W., Darko, A., & Oppong, G. D. (2025). Key performance indicators for hospital planning and construction: a systematic review and meta-analysis. *Engineering, Construction and Architectural Management*, *32*(5), 3375-3406. https://doi.org/10.1108/ECAM-10-2023-1060

Maleki Varnosfaderani, S., & Forouzanfar, M. (2024). The Role of AI in Hospitals and Clinics: Transforming Healthcare in the 21st Century. *Bioengineering (Basel)*, *11*(4). https://doi.org/10.3390/bioengineering11040337

Maswadi, K., & Alhazmi, A. (2026). Towards Sustainable Health Management in the Kingdom of Saudi Arabia: The Role of

Artificial Intelligence—A Systematic Review, Challenges, and Future Directions. *Sustainability*, *18*(2), 905. https://doi.org/10.3390/su18020905

Tavares, M. C., & Vaz, M. (2025). Rethinking Performance Evaluation: Strategic Alignment in the Service Sector Through a Case-Based Framework. *Administrative Sciences*, *15*(10), 390.https://doi.org/10.3390/admsci15100390

Wang, Y., Fu, W., Zhang, Y., Wang, D., Gu, Y., Wang, W., Xu, H., Ge, X., Ye, C., Fang, J., Su, L., Wang, J., He, W., Zhang, X., & Feng, R. (2024). Constructing and implementing a performance evaluation indicator set for artificial intelligence decision support systems in pediatric outpatient clinics: an observational study. *Scientific Reports*, *14*(1), 14482. https://doi.org/10.1038/s41598-024-64893-w

Zamlynskyi, V., Kalinichenko, S., Kniazkova, V., Skrypnyk, N., & Avriata, A. (2025). 1 - Healthcare management using artificial intelligence. *Revolutionizing Medical Systems using Artificial Intelligence,8*,1-24.https://doi.org/10.1016/B978-0-443-32862-6.00001-8

Ziat, A., Sefiani, N., Azzouzi, H., & Reklaoui, K. (2024). A generic sustainable performance management system for hospital supply chain: design & analysis. *Health Systems*, *13*(2), 97-108. https://doi.org/10.1080/20476965.2022.2155256