Next Scientists
EUROPEAN INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH AND MANAGEMENT STUDIES

Check for updates

TYPE Original Research
PAGE NO. 165-174

Professional Preference–Driven Evaluation of Financial Metrics in Surgical Management of Jaw Deformities

OPEN ACCESS

SUBMITTED 01 October2025
ACCEPTED 15 November 2025
PUBLISHED 30 November 2025
VOLUME Vol. 05 Issue 11 2025

Dr. Liam Williams, PhD

Faculty of Medical Sciences University College London (UCL)

London, United Kingdom

Abstract Surgical management of jaw deformities, particularly orthognathic procedures, represents a complex intersection of clinical precision, workflow efficiency, and financial sustainability. In contemporary healthcare systems, variability in surgical cost structures and operational efficiency has become a critical concern for hospital administrators and surgical teams. This research paper investigates how professional preference–driven decision-making influences the evaluation of financial metrics in surgical management of jaw deformities, with a focus on optimizing cost-effectiveness, resource allocation, and operational workflow.

The study synthesizes insights from healthcare workflow optimization models, operating room (OR) efficiency literature, and cost-analysis frameworks to construct a multidimensional evaluation structure. It draws upon established findings that surgical time variability, anesthesia complexity, and workflow design significantly influence cost per procedure and institutional financial performance (Strum et al., 2000; Dexter et al., 2003; Schuster et al., 2004). Furthermore, it integrates evidence suggesting that surgeon-dependent variability and institutional scheduling systems play a pivotal role in determining both clinical outcomes and economic efficiency (Eijkemans et al., 2010; May et al., 2011).

A central analytical dimension of this paper is the incorporation of professional preference variability, particularly among surgical specialists, which directly affects consumption of resources, operative duration, and cost-of-goods-sold (COGS) in orthognathic surgery. Prior perspective-based studies highlight that specialist preferences significantly alter surgical cost structures even within standardized procedural frameworks (Lone et al., 2023). This variability is examined in relation to workflow automation systems and predictive modeling tools that aim to reduce inefficiencies and enhance scheduling accuracy.

The research adopts a structured analytical methodology grounded in comparative literature synthesis and conceptual modeling of financial-performance indicators. It identifies key determinants of cost variability, including surgical time, anesthesia utilization, postoperative care requirements, and hospital utilization review mechanisms.

Findings suggest that integrating professional preference data into workflow-based financial models can improve predictive accuracy for surgical cost estimation and enhance operational decision-making. However, limitations persist due to variability in clinical judgment, institutional constraints, and incomplete standardization of orthognathic procedure pathways.

This study contributes to the growing field of healthcare operations research by linking clinical preference heterogeneity with financial performance metrics, offering a framework for improving cost efficiency without compromising surgical quality.

Keywords: Orthognathic surgery; financial metrics; cost analysis; operating room efficiency; workflow systems; surgical scheduling; professional preference; healthcare operations; anesthesia cost drivers; hospital resource optimization.

1. Introduction

1.1 Background

Surgical correction of jaw deformities, commonly referred to as orthognathic surgery, is a highly specialized domain within maxillofacial surgery that involves complex preoperative planning, multidisciplinary coordination, and significant resource utilization. These procedures are not only clinically demanding but also financially intensive due to extended operating times, anesthesia requirements, imaging needs, and postoperative care demands. As healthcare systems worldwide transition toward value-based care models, the financial efficiency of surgical interventions has become as critical as their clinical outcomes.

Operating room (OR) management has long been recognized as one of the most resource-intensive components of hospital operations. Studies have consistently demonstrated that variability in surgical duration, staffing efficiency, and anesthesia management contributes significantly to cost fluctuations across procedures (Strum et al., 2000; Dexter et al., 2003). In this context, orthognathic surgery presents a particularly challenging case due to its inherent procedural variability and dependence on surgeon-specific preferences.

Workflow optimization frameworks have been introduced to address inefficiencies in hospital systems. Early conceptualizations of workflow management systems in healthcare emphasized the importance of integrating data-driven scheduling and resource allocation models to improve operational efficiency (Dwivedi et al., 2001; Workflow Reference Model, 1994). These frameworks have since evolved into sophisticated predictive systems capable of modeling surgical durations and cost outcomes based on historical and real-time data.

1.2 Problem Statement

Despite advancements in healthcare workflow systems and predictive modeling, financial inefficiencies persist in surgical management of jaw deformities. A primary contributing factor is the variability introduced by professional preferences among surgeons and anesthesiologists. Differences in surgical technique, instrumentation selection, and intraoperative decision-making significantly influence cost structures, often in ways that are not captured by standardized financial models.

Furthermore, existing cost estimation frameworks frequently fail to incorporate nuanced behavioral and preference-driven variables. As a result, hospital administrators often rely on incomplete or static models that do not accurately reflect real-world variability in orthognathic procedures. This leads to suboptimal resource allocation, scheduling inefficiencies, and unpredictable financial outcomes.

1.3 Research Relevance

The relevance of this study lies in its attempt to bridge the gap between clinical decision-making and financial analytics. By integrating professional preference–driven variables into financial evaluation frameworks, the study aims to enhance predictive accuracy and operational efficiency in surgical management systems. Prior research has highlighted the importance of surgeon-specific variability in determining procedural time and cost outcomes, but limited attention has been given to integrating these variables into structured financial models (Eijkemans et al., 2010; May et al., 2011).

Additionally, orthognathic surgery provides an ideal case study for examining these dynamics due to its multi-stage procedural nature and dependency on interdisciplinary coordination. Recent perspective-based research further underscores that cost-of-goods-sold (COGS) analysis in such procedures is highly sensitive to specialist preferences, reinforcing the need for more adaptive financial modeling approaches (Lone et al., 2023).

1.4 Objectives of the Study

The primary objectives of this research are:

1. To analyze the role of professional preference variability in influencing financial metrics in orthognathic surgery.

2. To evaluate existing workflow and OR management frameworks in relation to surgical cost efficiency.

3. To identify key cost drivers associated with jaw deformity surgical procedures.

4. To propose an integrated conceptual framework linking professional preferences with financial performance metrics.

5. To assess the implications of workflow-based predictive systems in reducing cost variability.

1.5 Scope and Significance

The scope of this study is limited to elective orthognathic surgical procedures and associated hospital financial systems, including operating room management, anesthesia planning, and postoperative care pathways. Emergency maxillofacial procedures are excluded due to fundamentally different workflow structures.

The significance of this research lies in its interdisciplinary approach, combining healthcare operations research, surgical practice variability, and financial modeling. By focusing on preference-driven evaluation, the study introduces a novel lens through which hospital efficiency can be understood and optimized. This approach is particularly relevant in modern healthcare systems that emphasize cost transparency, efficiency, and outcome-based reimbursement models.

2. Literature Review

2.1 Workflow Systems and Healthcare Efficiency

The concept of workflow management in healthcare emerged as a response to increasing complexity in hospital operations. Early frameworks emphasized structured coordination of tasks, data flow, and resource allocation to minimize inefficiencies (Dwivedi et al., 2001). The Workflow Reference Model further formalized these ideas by defining standardized components for process execution and monitoring (Workflow Reference Model, 1994).

In surgical environments, workflow systems aim to optimize operating room scheduling, reduce idle time, and improve patient throughput. Malamateniou and Vassilacopoulos (2003) expanded this concept by integrating XML-based systems to enable virtual patient records, thereby improving information accessibility and procedural coordination. Similarly, Chang and Yang (2003) demonstrated that large-scale hospital systems benefit significantly from workflow integration, particularly in reducing administrative delays.

2.2 Operating Room Time Variability and Cost Implications

A significant body of literature focuses on variability in OR time as a primary cost driver. Strum et al. (2000) demonstrated that surgeon identity and anesthesia type are strong predictors of surgical duration variability. This variability directly influences staffing costs, resource allocation, and scheduling efficiency.

Dexter et al. (2003) further expanded on this by showing how OR information systems can predict the financial impact of turnover times and staffing adjustments. Their findings suggest that even minor inefficiencies in OR transitions can result in substantial cumulative financial losses.

Schuster et al. (2004) highlighted that anesthesia cost per minute varies significantly across subspecialties, reinforcing the importance of accounting for procedural heterogeneity in financial models. These findings collectively underscore the importance of integrating time-based variability into surgical cost estimation frameworks.

2.3 Predictive Modeling in Surgical Scheduling

Predictive modeling has become a central component of modern OR management. Eijkemans et al. (2010) developed models that incorporate individual surgeon characteristics and subjective estimates to predict surgical duration more accurately. These models represent a shift from static scheduling systems to dynamic, data-driven approaches.

May et al. (2011) further emphasized that surgical scheduling is an optimization problem involving multiple constraints, including resource availability, case complexity, and surgeon preferences. Their work highlights the need for adaptive systems capable of handling uncertainty and variability.

2.4 Financial Efficiency and Hospital Resource Utilization

Litvak and Bisognano (2011) examined the paradox of increasing patient volume alongside declining reimbursement rates, emphasizing the need for hospitals to improve efficiency rather than expand capacity. Similarly, McManus et al. (2003) demonstrated that variability in surgical caseload affects ICU resource availability, further complicating financial planning.

Coley et al. (2002) and Fleisher et al. (2007) highlighted the cost implications of unanticipated admissions following outpatient surgery, reinforcing the importance of accurate preoperative risk assessment.

2.5 Professional Preference and Cost Variability

A critical but underexplored dimension in surgical cost analysis is the role of professional preference. Preferences in surgical technique, instrumentation, and perioperative management can significantly alter cost structures even within standardized procedures. Lone et al. (2023) provide a perspective-based analysis of cost-of-goods-sold in orthognathic surgery, demonstrating that differences between specialist preferences result in measurable cost variability.

This finding is particularly important because it introduces a behavioral dimension into financial modeling. Unlike structural cost drivers such as equipment or staffing, preference-driven variability is less predictable and often excluded from traditional models.

2.6 Research Gap Identification

While existing literature extensively addresses workflow optimization, OR efficiency, and predictive modeling, there remains a significant gap in integrating professional preference data into financial evaluation frameworks. Most models assume homogeneity in surgical practice, which is inconsistent with real-world variability observed in clinical settings.

Additionally, there is limited research on how preference-driven variability interacts with workflow systems to influence overall hospital financial performance. This gap is particularly pronounced in specialized procedures such as orthognathic surgery, where multidisciplinary coordination and individualized surgical planning are essential.

3. Methodology

3.1 Research Design

This study adopts a qualitative–analytical research design based on structured literature synthesis and conceptual modeling. The approach integrates findings from healthcare operations research, surgical workflow systems, and financial analytics to construct a multidimensional evaluation framework.

3.2 Analytical Framework Development

The proposed framework consists of four interdependent layers:

1. Clinical Layer – Surgical technique, procedural complexity, and patient-specific factors.

2. Behavioral Layer – Professional preferences of surgeons and anesthesiologists.

3. Operational Layer – Workflow systems, OR scheduling, and resource allocation.

4. Financial Layer – Cost drivers including OR time, anesthesia cost, staffing, and postoperative care.

These layers interact dynamically, influencing overall cost outcomes and operational efficiency.

3.3 Key Variables Considered

- Surgical duration variability
- Anesthesia complexity index
- Surgeon preference index (SPI)
- Workflow efficiency coefficient
- Postoperative resource utilization
- Cost-of-goods-sold (COGS) metrics

The Surgeon Preference Index is conceptually derived from variations in procedural choices, informed by findings in orthognathic surgery cost variability research (Lone et al., 2023).

3.4 Conceptual Modeling Approach

The study uses a systems-based modeling approach to map interactions between workflow efficiency and financial outcomes. OR time is treated as a primary dependent variable influenced by both clinical and behavioral inputs. Financial cost is modeled as a function of time, resource utilization, and procedural complexity.

Mathematically, the relationship can be conceptualized as:

Total Cost = f (OR Time, Staffing Intensity, Anesthesia Duration, Preference Variability, Postoperative Demand)

3.5 Analytical Scope and Limitations

The methodology is constrained by its reliance on secondary literature and conceptual modeling rather than empirical hospital datasets. While this allows for broad theoretical integration, it limits direct statistical validation. Additionally, variability in institutional practices may affect the generalizability of the proposed framework.

4. Results

The synthesized analysis of workflow systems, operating room (OR) efficiency literature, and professional preference variability in orthognathic surgery reveals a structured set of findings regarding financial performance determinants in surgical management of jaw deformities. Across the evaluated studies, a consistent pattern emerges: financial outcomes are not solely dependent on fixed institutional costs but are strongly shaped by dynamic operational and behavioral variables, particularly surgical time variability and preference-driven clinical decisions.

A primary finding is that OR time remains the most influential cost driver in orthognathic surgical procedures. Evidence from surgical scheduling and anesthesia cost studies demonstrates that even marginal deviations in procedure duration significantly alter staffing requirements, anesthesia utilization, and downstream recovery resource allocation (Strum et al., 2000; Schuster et al., 2004). These effects are compounded in jaw deformity surgeries due to multi-stage procedural complexity, where intraoperative adjustments and individualized surgical approaches increase variability in predicted time-to-completion.

Another key observation is that workflow optimization systems improve financial predictability only when integrated with surgeon-specific behavioral data. Traditional scheduling systems, which rely on historical averages, fail to account for variability introduced by individual surgeon preferences and intraoperative decision-making patterns. Predictive models that incorporate surgeon-level characteristics demonstrate significantly higher accuracy in estimating OR utilization and cost distribution (Eijkemans et al., 2010; May et al., 2011). This indicates that behavioral modeling is essential for improving financial forecasting in surgical environments.

A third major finding concerns the impact of professional preference variability on cost-of-goods-sold (COGS) in orthognathic surgery. Preference differences in instrumentation selection, fixation methods, and surgical sequencing contribute to measurable cost divergence even when clinical outcomes remain equivalent. The perspective-based findings from orthognathic surgery cost analysis highlight that specialist-driven variability can lead to systematic cost differences across similar procedural cases (Lone et al., 2023). This reinforces the conclusion that financial models must move beyond purely procedural classification and incorporate behavioral variability indices.

Additionally, the integration of workflow management systems with real-time OR data improves resource allocation efficiency. Hospitals that implement structured workflow technologies report reduced idle time between procedures and improved utilization of surgical suites (Dwivedi et al., 2001; Dexter et al., 2003). However, the effectiveness of these systems is significantly moderated by the consistency of surgical practice patterns. High variability among surgeons reduces the predictive stability of workflow optimization models, limiting their effectiveness in cost containment.

The findings also indicate that postoperative resource utilization, including recovery unit admissions and unexpected inpatient stays, contributes substantially to total surgical cost variability. Cases with higher intraoperative complexity or extended OR duration tend to correlate with increased postoperative care requirements, amplifying total expenditure beyond initial surgical costs (Coley et al., 2002; Fleisher et al., 2007). This creates a cascading financial effect, where intraoperative variability indirectly influences downstream hospital resource consumption.

Overall, the results confirm that financial efficiency in surgical management of jaw deformities is a multi-layered construct shaped by operational systems, clinical complexity, and professional behavioral variability. Among these, professional preference emerges as a critical but under-modeled determinant of cost variability, requiring deeper integration into predictive financial frameworks.

5. Discussion

The findings of this study highlight a fundamental tension in modern surgical management systems: the coexistence of standardized workflow optimization models and inherently variable human clinical decision-making. While healthcare systems increasingly rely on predictive analytics and structured scheduling frameworks, the evidence indicates that professional preference variability remains a dominant factor influencing financial outcomes in orthognathic surgery.

From a theoretical standpoint, the results reinforce systems-based models of healthcare operations, where cost efficiency is not an isolated variable but the product of interacting clinical, behavioral, and operational subsystems. Workflow theories suggest that structured processes should reduce variability and improve predictability (Workflow Reference Model, 1994). However, in practice, surgical environments demonstrate persistent deviations due to surgeon-specific preferences and intraoperative adaptability. This divergence between theoretical workflow uniformity and real-world variability is particularly pronounced in complex maxillofacial procedures.

The integration of predictive scheduling models offers partial resolution to this issue. Studies demonstrate that incorporating surgeon-level behavioral data improves estimation accuracy for OR duration and resource utilization (Eijkemans et al., 2010; May et al., 2011). However, these models still struggle to fully capture qualitative aspects of professional preference, such as intraoperative decision thresholds or material selection habits. As a result, financial forecasting remains probabilistic rather than deterministic.

A key implication of this study is the identification of professional preference as a latent cost driver. Unlike visible cost components such as staffing or anesthesia, preference-driven variability operates indirectly through procedural decisions. The orthognathic surgery context illustrates this clearly, where equivalent clinical outcomes can be achieved through different surgical techniques with varying cost implications (Lone et al., 2023). This suggests that financial optimization in healthcare cannot rely solely on structural efficiency improvements but must also address behavioral standardization or alignment strategies.

From a practical perspective, integrating preference data into workflow systems presents both opportunities and challenges. On one hand, such integration enables more accurate budgeting, improved OR scheduling, and better resource allocation. On the other hand, excessive standardization risks reducing clinical autonomy, which may negatively affect surgical adaptability in complex cases. Therefore, hospitals must balance efficiency-driven constraints with the need for individualized clinical judgment.

Another important consideration is the cascading effect of intraoperative variability on downstream healthcare services. Extended OR times and unpredictable procedural complexity increase the likelihood of postoperative admissions and resource utilization, amplifying total costs beyond initial surgical estimates (Coley et al., 2002; Fleisher et al., 2007). This highlights the interconnected nature of surgical systems, where inefficiencies in one phase propagate throughout the care continuum.

The limitations of this study include its reliance on conceptual synthesis rather than empirical validation. While the integration of literature provides strong theoretical grounding, the absence of patient-level or hospital-level datasets restricts the ability to quantify effect sizes. Future research should incorporate real-world surgical data to validate the proposed preference-driven financial model.

Overall, the discussion confirms that achieving financial efficiency in orthognathic surgery requires a hybrid approach combining workflow optimization, predictive analytics, and behavioral modeling. The evolution of hospital management systems must therefore move beyond static efficiency metrics toward adaptive systems capable of incorporating human variability as a core analytical dimension.

6. Conclusion

This study examined the role of professional preference–driven variability in shaping financial metrics within the surgical management of jaw deformities, with a specific focus on orthognathic surgery. By synthesizing literature from healthcare workflow systems, operating room (OR) efficiency modeling, and surgical cost analysis, the research establishes that financial performance in complex surgical environments is determined by a multilayered interaction between clinical complexity, operational workflow design, and behavioral decision-making patterns.

A central conclusion is that operating room time remains the most significant determinant of total surgical cost. Variability in OR duration—driven by differences in surgeon technique, anesthesia management, and intraoperative decision-making—directly influences staffing requirements, resource allocation, and downstream postoperative care costs. This reinforces established findings in surgical operations research that even minor inefficiencies in procedural timing can result in substantial cumulative financial impact over time (Strum et al., 2000; Dexter et al., 2003).

However, the study extends this understanding by demonstrating that OR time variability itself is not purely structural but is significantly influenced by professional preference. Differences in surgical approaches, material selection, fixation strategies, and procedural sequencing introduce measurable divergence in cost-of-goods-sold (COGS), even when clinical outcomes remain comparable. The perspective-based evidence in orthognathic surgery cost analysis strongly supports this conclusion, showing that specialist preference patterns produce consistent cost differentials across similar procedural categories (Lone et al., 2023). This highlights the importance of recognizing behavioral dimensions in financial modeling frameworks.

Another key conclusion is that workflow management systems and predictive scheduling models, while effective in improving baseline efficiency, are insufficient when applied without behavioral integration. Systems designed under the workflow reference model improve coordination and reduce administrative inefficiencies (Workflow Reference Model, 1994), yet their predictive accuracy declines when confronted with high variability in surgeon behavior. This indicates that operational efficiency tools must evolve from static optimization systems to adaptive, data-informed platforms capable of integrating individual practitioner profiles.

The integration of surgeon-level behavioral data into predictive models represents a significant advancement in addressing this limitation. Studies show that incorporating individual surgeon characteristics improves OR scheduling accuracy and cost prediction reliability (Eijkemans et al., 2010; May et al., 2011). Nonetheless, such models still require refinement to fully capture qualitative aspects of clinical preference that are difficult to quantify, such as intraoperative adaptability and decision thresholds.

The research also concludes that financial inefficiencies in orthognathic surgery are not isolated to the intraoperative phase but extend across the entire care continuum. Variability in surgical duration and complexity increases the likelihood of extended postoperative care, unplanned admissions, and higher resource utilization in recovery units. This cascading effect significantly amplifies total treatment costs beyond initial surgical expenditure, reinforcing the importance of comprehensive lifecycle cost modeling in surgical management systems (Coley et al., 2002; Fleisher et al., 2007).

From a systems perspective, the study establishes that financial optimization in surgical environments requires a triadic integration of workflow engineering, predictive analytics, and behavioral modeling. Each component addresses a distinct dimension of variability: workflow systems reduce structural inefficiencies, predictive models improve temporal accuracy, and behavioral integration captures human-driven variability. The absence of any one component limits the overall effectiveness of cost optimization strategies.

The primary research contribution lies in framing professional preference as a measurable and structurally relevant determinant of surgical financial performance. By linking behavioral variability with cost outcomes, this study extends traditional healthcare operations research beyond structural efficiency models into a more comprehensive behavioral-operational hybrid framework.

Future research should focus on empirical validation of the proposed conceptual model using hospital-level datasets, incorporating machine learning techniques to quantify preference variability and its financial impact. Additionally, longitudinal studies are needed to evaluate how standardization efforts in surgical practice influence both cost efficiency and clinical outcomes over time.

In conclusion, achieving sustainable financial efficiency in the surgical management of jaw deformities requires moving beyond traditional cost-control strategies toward integrated systems that explicitly account for professional preference variability. Such an approach enables more accurate financial forecasting, improved resource utilization, and ultimately a more balanced alignment between clinical autonomy and economic efficiency.

7. References

1. Dwivedi, R. K. Bali, and A. E. James, “Workflow management systems: the healthcare technology of the future Annual ”, Reports of the Research Reactor Institute, No. 4, pp 3887–3890, 2001.
2. D. P. Strum, A. R. Sampson, J. H. May, and L. G. Vargas, “Surgeon and type of anesthesia predict variability in surgical procedure times.” Anesthesiology, vol. 92, pp 1454–1466, 2000.
3. E. Litvak and M. Bisognano, “More patients, less payment: Increasing hospital efficiency in the aftermath of health reform.” Health Aff (Millwood), vol. 30, pp 76–80, 2011.

4. F. Dexter, A. Macario, D. H. Penning, and P. Chung, "Development of an appropriate list of surgical procedures of a specified maximum anesthetic complexity to be performed at a new ambulatory surgery facility." Anesth Analg, vol. 95, pp 78–82, 2002.

5. F. Dexter, A. E. Abouleish, R. H. Epstein, C. W. Whitten, and D. A. Lubarsky, "Use of operating room information system data to predict the impact of reducing turnover times on staffing costs." Anesth Analg, Vol. 97, pp. 1119–1126, 2003.

6. L. O'Neill and F. Dexter, "Tactical increases in operating room block time based on financial data and market growth estimates from data envelopment analysis." Anesth Analg, vol. 104, pp. 355–368, 2007.

7. F. Malamateniou, and G. Vassilacopoulos, "Developing a virtual patient record using XML and web-based workflow technologies ", International International Journal of Medical Informatics, vol. 70, pp 131–139, 2003.

8. J. B. Dimick, D. O. Staiger, O. Baser, and J. D. Birkmeyer, "Composite measures for predicting surgical mortality in the hospital." Health Aft (Millwood), vol. 28, pp 1189–1198, 2009.

9. J. H. May, W. E. Spangler, D. P. Strum, and L. G. Vargas, "The surgical scheduling problem: Current research and future opportunities." Production and Operations Management, vol. 20. PP. 392–405. 2011.

10. K. C. Coley, B. A. Williams, S. V. DaPos, C. Chen, and R. B. Smith, "Retrospective evaluation of unanticipated admissions and readmissions after same day surgery and associated costs." J Clin Anesth, vol. 14, pp 349–353, 2002.

11. L. A. Fleisher, L. R. Pasternak, and A. Lyles, "A novel index of elevated risk of inpatient hospital admission immediately following outpatient surgery." Arch Surg, vol. 142, pp 263–268, 2007.

12. Lei Chang and Shaojun Yang, "Workflow Based Large Scale Hospital Integrated System ", Computer Integrated Manufacturing Systems, vol. 9, pp 178–181, 2003.

13. Lone, P. A., Arshad, F., Kumar, J., & Parwaiz, S. (2023). Variable's of COGS analysis for orthognathic surgery based on preferences of two specialists-a perspective based study. IP Indian Journal of Anatomy and Surgery of Head, Neck and Brain, 8(2), 65-71.

14. M. A. Jianmin and Xiaolong Xing, "the Application of Workflow in Modern Hospital Management Information System ", Hospital Management Forum, No. 1, pp 51–56, 2003.

15. M. J. C. Eijkemans, M. Van Houdenhoven, T. Nguyen, E. Boersma, E. W. Steyerberg, and G. Kazemier, "Predicting the unpredictable: A new prediction model for operating room times using individual characteristics and the surgeon's estimate." Anesthesiology, vol. 112, pp 41–49, 2010.

16. M. L. McManus, M. C. Long, A. Cooper, J. Mandell, D. M. Berwick, M. Pagano, and E. Litvak, "Variability in surgical caseload and access to intensive care services." Anesthesiology, Vol. 98, pp 1491–1496, 2003.

17. M. Poulymenopoulou, and F. Malamateniou, "Emergency healthcare process automation using workflow technology and web services :". MED. INFORM, vol. 28, pp 195–207, 1993.

18. M. Schuster, T. Standl, J. A. Wagner, J. Berger, H. Reimann, and J. S. Am Esch, "Effect of different cost drivers on cost per anesthesia minute in different anesthesia subspecialties." Anesthesiology, vol. 101, pp 1435–1443, 2004.

19. Qingfa He, Guojie Li, "Relation-based Lightweight Workflow Engine [J], Journal of Computer Research & Development ", vol. 3, pp 129–13, 2001.

20. T. M. Wickizer, "Effect of hospital utilization review on medical expenditures in selected diagnostic areas: an exploratory study." Am J Public Health, vol. 81, pp 482–484, 1991.

21. Workflow C., “The workflow reference model[WfMC1003] ”, WFMC TC00–1003, 1994.

.