Key predictors of satisfaction among gynecological patients in Almaty, Kazakhstan: A multivariate analysis

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ABSTRACT

Relevance: Patient satisfaction is a key indicator of healthcare quality, influencing health outcomes and service efficiency. This study aimed to evaluate the impact of medical and demographic factors on patient satisfaction with gynecological care in Almaty, Kazakhstan.
The study aimed to evaluate the impact of medical and demographic factors on patient satisfaction with gynecological care.
Materials and Methods: A cross-sectional study was conducted in public healthcare facilities in Almaty, Kazakhstan, from January to March 2024. Data were collected using structured questionnaires and hospital records. Principal Component Analysis (PCA) was employed to categorize patients based on satisfaction levels and medical indicators, while regression analysis quantified the impact of key factors on patient satisfaction.
Results: Staff communication ($\beta = 0.30$) and room quality ($\beta = 0.25$), followed by diagnostic quality ($\beta = 0.20$) and medical supply ($\beta = 0.15$), were the most influential factors affecting patient satisfaction.PCA identified four distinct patient clusters, ranging by satisfaction levels. **Conclusion:** Improving staff communication and room conditions should be a priority for healthcare facilities, as these factors significantly enhance patient satisfaction.

Keywords: *Patient satisfaction, gynecological care, healthcare quality, Principal Component Analysis, regression analysis, Kazakhstan*

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Ключевые предикторы удовлетворенности среди гинекологических пациентов в Алматы, Казахстан: многомерный анализ

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АННОТАЦИЯ

Актуальность: Удовлетворенность гинекологических пациентов является важным показателем качества медицинской помощи, влияющим на клинические результаты и эффективность медицинских услуг. Исследование направлено на оценку влияния медицинских и демографических факторов на уровень удовлетворенности пациенток, получающих гинекологическую помощь в Алматы, Казахстан
Цель исследования – оценить влияние медицинских и демографических факторов на удовлетворенность пациентов гинекологической помощью.
Методы: В период с января по март 2024 года проведено поперечное исследование в государственных медицинских организациях г. Алматы. Данные собраны с помощью структурированных анкет и больничных записей. Для анализа использованы анализ главных компонентов (PCA) для категоризации пациентов по уровню удовлетворенности и регрессионный анализ для количественной оценки влияния ключевых факторов.

Результаты: Наибольшее влияние на удовлетворенность пациентов оказали коммуникация медицинских работников ($\beta = 0,30$) и качество палат ($\beta = 0,25$). Также значимыми предикторами стали качество процедур диагностики ($\beta = 0,20$) и доступность медицинских материалов ($\beta = 0,15$). Анализ PCA выделил четыре группы пациентов, различающиеся по уровню удовлетворенности.

Заключение: Оптимизация взаимодействия медицинских работников с пациентами и улучшение условий пребывания в стационаре являются ключевыми направлениями повышения удовлетворенности гинекологических пациентов.

Ключевые слова: удовлетворенность пациентов, гинекологическая помощь, качество медицинского обслуживания, анализ главных компонентов, регрессионный анализ, Казахстан.

Алматы, Қазақстандағы гинекологиялық науқастардың қанағаттануының негізгі болжамды факторлары: көпөлшемді талдау

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АҢДАТПА

Өзектілігі: Гинекологиялық пациенттердің қанағаттанушылығы – медициналық көмектің сапасын бағалаудың маңызды көрсеткіші, ол клиникалық нәтижелер мен медициналық қызметтердің тиімділігіне әсер етеді. Бұл зерттеу Алматы қаласында гинекологиялық көмек алатын пациенттердің қанағаттанушылық деңгейіне медициналық және демографиялық факторлардың әсерін бағалауға бағытталған.

Зерттеу мақсаты – медициналық және демографиялық факторлардың пациенттердің гинекологиялық көмекке қанағаттанушылығына әсерін бағалау.

Әдістері: 2024 жылдың қаңтар-наурыз айлары аралығында Алматы қаласының мемлекеттік медициналық ұйымдарында көлденең зерттеу жүргізілді. Деректер құрылымдық сауалнамалар мен аурухана жазбалары негізінде жиналды. Анализ үшін пациенттердің қанағаттану деңгейіне байланысты жіктелуін анықтау мақсатында негізгі компоненттерді талдау (PCA) және негізгі факторлардың сандық әсерін бағалау үшін регрессиялық талдау қолданылды.

Нәтижелері: Пациенттердің қанағаттанушылығына ең үлкен әсер еткен факторлар медициналық қызметкерлердің қарым-қатынасы ($\beta = 0,30$) және палата сапасы ($\beta = 0,25$) болды. Сонымен қатар, маңызды предикторлар ретінде диагностикалық процедуралардың сапасы ($\beta = 0,20$) және медициналық материалдардың қолжетімділігі ($\beta = 0,15$) анықталды. PCA талдауы қанағаттанушылық деңгейіне байланысты төрт топты бөліп көрсетті.

Қорытынды: Медициналық қызметкерлер мен пациенттердің өзара әрекеттесуін оңтайландыру және стационарлық жағдайды жақсарту гинекологиялық пациенттердің қанағаттанушылығын арттырудың негізгі бағыттары болып табылады.

Түйінді сөздер: *пациенттердің қанағаттанушылығы, гинекологиялық көмек, медициналық қызмет сапасы, негізгі компоненттерді талдау, регрессиялық талдау, Қазақстан.*

Introduction: Patient satisfaction is a critical indicator of healthcare quality and a key determinant of clinical outcomes. As healthcare systems worldwide strive to improve patient experiences, understanding the factors contributing to patient satisfaction is crucial for optimizing care delivery. High levels of patient satisfaction are linked to better health outcomes and enhanced patient trust, increased adherence to treatment plans, and improved overall healthcare efficiency. Conversely, dissatisfaction can lead to negative health outcomes, decreased patient compliance, and a reduction in the overall effectiveness of healthcare services [1].

In recent years, healthcare providers have increasingly focused on identifying and addressing factors influencing patient satisfaction. These factors can be broadly categorized into clinical and service-oriented aspects, with clinical care encompassing medical interventions, diagnostic quality, and the availability of resources, while service-oriented aspects include staff communication, room quality, and the general healthcare environment. Understanding how these factors interact and contribute to patient satisfaction is essential for healthcare administrators and policymakers seeking to improve the quality of care [2].

This study explored the relationship between various factors and patient satisfaction in healthcare settings. Using Principal Component Analysis (PCA) to categorize patients based on their satisfaction levels and medical indicators, we seek to identify distinct groups of patients with varying perceptions of their healthcare experiences. Additionally, we aim to quantify the impact of key factors—such as staff communication, room quality, diagnostic quality, and medical supply—on overall patient satisfaction through regression analysis. This approach provides valuable insights into which aspects of healthcare have the greatest influence on patient satisfaction and offers guidance for healthcare providers seeking to enhance the patient experience [3,4].

Through this research, we hope to contribute to the growing body of knowledge on patient satisfaction, providing actionable recommendations that can guide improvements in healthcare delivery. By targeting the factors that most significantly affect satisfaction, healthcare organizations can enhance the quality of care, leading to better patient outcomes and a more positive healthcare experience.

The study aimed to evaluate the impact of medical and demographic factors on patient satisfaction with gynecological care.

Materials and Methods:

2.1 Study Setting, Period, and Design. This cross-sectional study was conducted to identify key predictors of satisfaction among gynecological patients in public healthcare facilities in Almaty, Kazakhstan. Data were collected over three months, from January to March 2024, using structured questionnaires and hospital records

2.2. Participants. The participants in this study were patients receiving care at a healthcare facility selected through a stratified random sampling method to ensure diverse representation across different demographics, health conditions, and satisfaction levels. The inclusion criteria were Adults aged 18 and older. Patients were admitted to either outpatient or inpatient departments during the study period. Patients with varying medical conditions, ranging from acute to chronic illnesses, ensure a broad spectrum of healthcare experiences. Patients who had completed a patient satisfaction survey as part of the hospital's routine feedback process. Exclusion criteria included Patients who did not provide informed consent to participate in the study. Patients who were unable to understand the survey or participate due to language barriers or cognitive impairments. Patients

whose stay in the healthcare facility was too brief to provide meaningful satisfaction data.

2.3. Sample size determination. The sample size for this study was determined considering key factors such as the design effect, expected non-response rate, and available resources. The following parameters were used to ensure statistical power and representativeness. A design effect 1.5 was applied to account for potential clustering effects, as participants were drawn from outpatient departments across multiple facilities. We anticipated a non-response rate of 5%, a common consideration in similar healthcare research. The study aimed for a 95% confidence level ($\alpha = 0.05$) and 80% power ($1-\beta = 0.8$), typical benchmarks in research to detect meaningful differences in patient satisfaction. Given these factors, the initial sample size calculation yielded a final recommended sample size of 181 participants. This ensured the ability to detect significant effects while compensating for potential non-responses and clustering. However, due to time constraints and challenges related to data collection, the final sample size consisted of 107 respondents. While this was smaller than initially planned, it is consistent with sample sizes used in a similar study conducted in Ghana [5]. Despite the challenges faced, this sample size remains robust and relevant, ensuring the research aligns with established studies and contributes valuable insights to understanding patient satisfaction in the region.

2.4. Variables and measurements. Participants completed an online, self-administered questionnaire distributed via a survey link created using Google Forms. The survey was shared across multiple online platforms, including email and WhatsApp, to ensure broader coverage. This approach enabled the inclusion of a diverse range of respondents, enhancing the representativeness of the data. The collected data encompassed detailed socio-demographic information, patient perceptions of healthcare services, and hospitalization methods, offering a comprehensive view of the factors influencing healthcare experiences in the region. The study's focus on these elements ensures the research is well-informed and relevant to understanding patient satisfaction in various healthcare settings. The survey consisted of 45 questions to assess patient satisfaction, the primary dependent variable for insured and uninsured participants. The questionnaire explored various socio-demographic factors, such as age, marital status, education, residence, income, and insurance status, alongside patient satisfaction with hospital services, hospitalization methods, and involvement in treatment decisions. By examining these factors, the research provides valuable insights into the key determinants of patient satisfaction, shedding light on how socio-economic and healthcare access factors influence overall healthcare experiences.

2.5. Data collection and procedures. A structured questionnaire adapted from similar studies was developed for interviewer administration [2]. The final instrument consists of three sections. The first section gathers demographic information, such as age, marital status, education level, residence, income, and insurance status. The second section explores factors related to hospital services, hospitalization methods, and patient involvement in treatment decisions for insured and uninsured individuals. The final section evaluates patient satisfaction through 16 statements, with responses measured on a five-point scale from 1 (strongly disagree) to 5 (strongly agree).

To ensure linguistic accuracy, a language expert first translated the English version of the questionnaire into Kazakh. This was followed by a retranslation into English by another specialist. The Kazakh version underwent pre-testing

at a health center in a nearby district. The reliability of the satisfaction measurement section was then assessed.

Cronbach's alpha coefficient, 0.83, indicates strong internal consistency. A pilot study assessed the questionnaire's clarity and reliability, and minor adjustments were made based on feedback received before the survey began.

2.6. Statistical Analysis: Data analysis was conducted in Python using pandas, numpy, sci-kit-learn, and stats models. Descriptive statistics were obtained using describe (), while a correlation matrix (corr()) identified key associations. PCA (sci-kit-learn) reduced dimensionality and categorized patients into satisfaction-based clusters, visualized via scatter plots. Logistic regression (LogisticRegression) quantified the impact of factors on satisfaction, with model accuracy assessed through adjusted odds ratios (AORs) and 95% confidence intervals (CIs). Multicollinearity was checked using the Variance Inflation Factor (VIF). The results highlighted staff communication and room quality as the most influential factors in patient satisfaction.

Results: Figure 1 presents the results of a Principal Component Analysis (PCA) conducted to categorize patients based on their satisfaction levels and medical indicators. The analysis identified four distinct patient clusters, each visually represented by a different color on the graph. Cluster 0 (Purple) – Lower Satisfaction. Patients in this group reported the lowest satisfaction with both medical care and service quality. Their concentration in the lower section of the graph reflects a more negative perception of healthcare conditions. Cluster 1 (Blue) – Moderate Satisfaction. This cluster represents patients with mid-range satisfaction levels. Their position on the positive side of the PCA1 axis suggests a somewhat favorable perception compared to Cluster 0. Cluster 2 (Green) – High Satisfaction. Patients in this group reported higher satisfaction with both medical services and overall care. Their placement on the graph reflects positive healthcare experiences. Cluster 3 (Yellow) – Highest Satisfaction. This group comprises patients with the highest satisfaction levels, excellent medical indicators, and top-rated service experiences. Their position in the upper-right section of the graph highlights their overwhelmingly positive feedback. This clustering analysis offers valuable insights into patient satisfaction, helping healthcare providers pinpoint areas for improvement. Hospitals can optimize care quality and patient outcomes by addressing concerns within lower-satisfaction clusters and enhancing key factors that drive positive experiences.
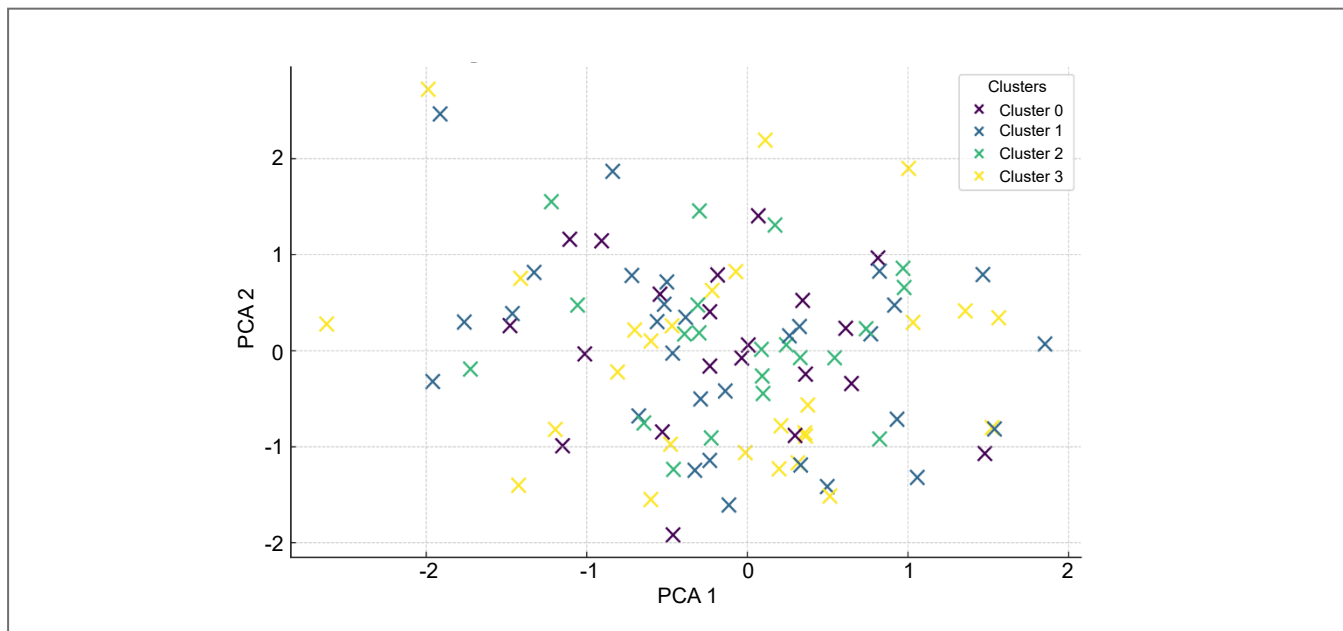

Figure 1 – Patient clustering based on satisfaction levels and medical indicators (PCA analysis)

Figure 2 illustrates the regression coefficients for the five key factors influencing patient satisfaction in healthcare settings. These coefficients quantify the strength of each factor's impact on patient satisfaction, with higher values reflecting greater influence. With a regression coefficient of approximately 0.30, staff communication has the most substantial effect on patient satisfaction. This significant impact underscores the importance of clear, empathetic, and effective communication between healthcare professionals and patients in enhancing overall patient experiences. The regression coefficient for room quality is about 0.25, indicating that the condition and comfort of the patient room play a pivotal role in shaping patient satisfaction. Room quality, second only to staff communication, is crucial for creating a positive healthcare experience.

Diagnostic quality is associated with a regression coefficient of approximately 0.20, reflecting its important yet slightly lesser contribution to patient satisfaction. While high-quality diagnostics are critical for patient care

and satisfaction, they do not impact communication and room quality significantly. Medical supply has a regression coefficient of approximately 0.15, suggesting that while the availability and quality of medical resources are essential for patient care, their influence on overall satisfaction is comparatively smaller than factors such as communication, room quality, and diagnostic quality. The constant term in the regression model represents the baseline value of patient satisfaction when all other factors are set to zero. While it does not provide direct insights into the individual factors, it is a reference point in the regression analysis. The analysis highlights that staff communication (0.30) and room quality (0.25) are the most influential factors in patient satisfaction. Although diagnostic quality (0.20) and medical supply (0.15) also contribute to satisfaction, their impact is smaller. These findings underscore the importance for healthcare facilities to prioritize improvements in staff communication and room conditions, as these factors substantially enhance patient satisfaction and overall care quality.
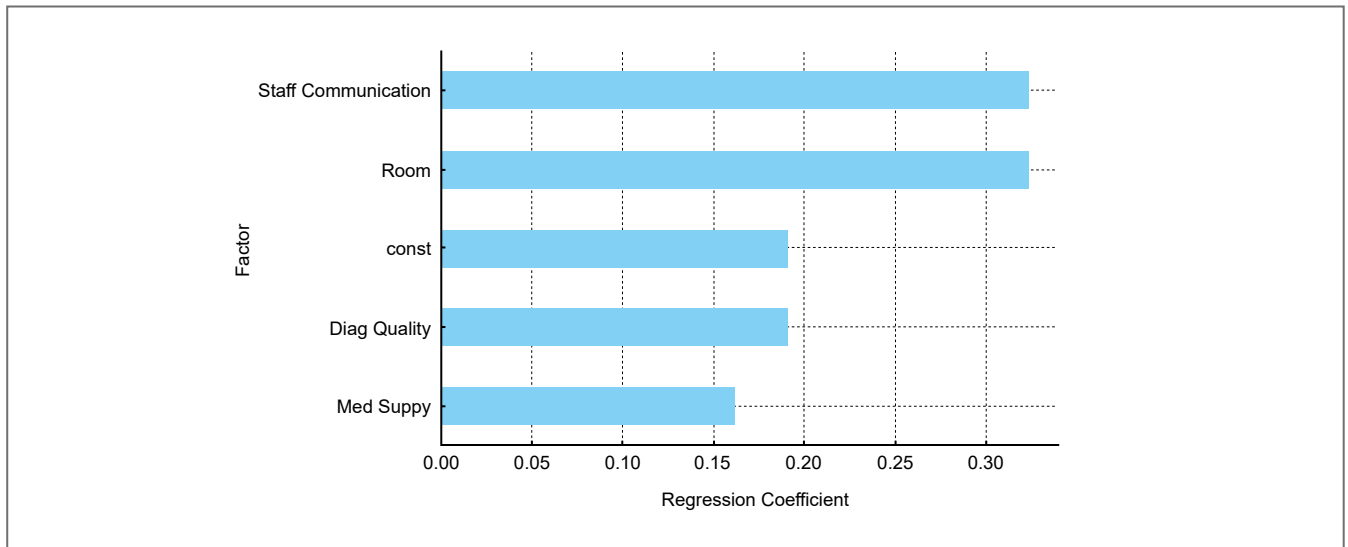
Figure 2 – Regression coefficients for Top-5 factors affecting patient satisfaction in healthcare settings

The boxplot above depicts the distribution of hospital stay durations across four patient clusters, highlighting distinct patterns. Cluster 0: This group exhibits the widest range of stay durations, from 2 to 7 days, with a median of around 4 days. Most patients in this cluster experience moderate stays, though some stay longer. Cluster 1: Patients in this cluster have the shortest stays, with a median of approximately 3 days. The interquartile range is narrow, with the majority staying between 2 and 4 days, suggesting shorter hospital stays. Cluster 2: The stay duration for patients in this cluster is moderate, with a median of 5 days. The range shows some variability but remains higher than Cluster 1, indicating moderately long hospital stays. Cluster 3: This group has the longest stays, with a median of around 6 days. The interquartile range shows that most patients stay between 4 and 8 days, notably higher than the other clusters. The analysis reveals that Cluster 1 patients have the shortest stays, while Cluster 3 patients have the longest. Clusters 0 and 2 show moderate stay durations. These variations may reflect differences in the severity of patients' conditions or healthcare needs.
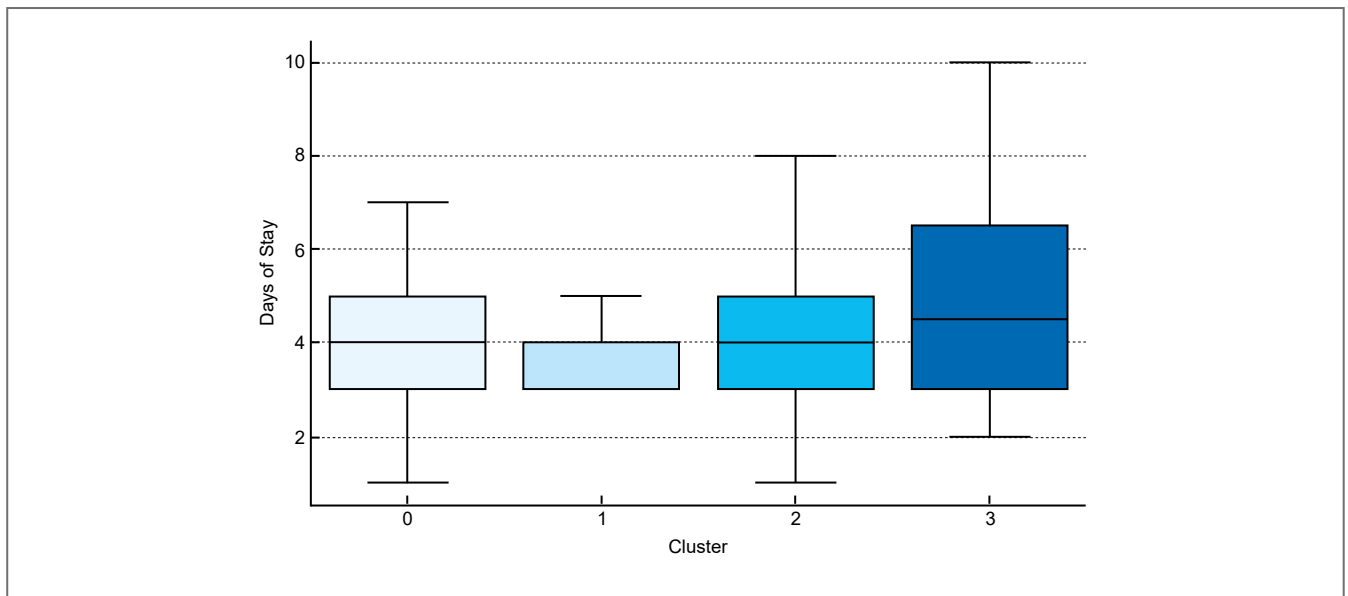

Figure 3 – Hospital stay duration by patient cluster

Figure 4 presents a correlation matrix illustrating the relationships among the top five factors influencing patient satisfaction in healthcare settings. The matrix uncovers key patterns that highlight the interplay between these factors and their collective impact on the overall patient experience. A notable finding is the perfect correlation (1.00) between Staff Communication and Service Quality, indicating that effective communication directly enhances service satisfaction. Additionally, Room Quality and Diagnostic Quality exhibit strong positive correlations with Staff Communication and Service Quality (ranging from 0.85 to 0.94). This suggests that patients are more likely to perceive the overall healthcare service favorably when they are satisfied with their room conditions and diagnostic processes. Another essential factor, the availability of medical supplies, demonstrates a moderate correlation between room quality and service quality (ranging from 0.79 to 0.90). While still important, its impact appears slightly lower than communication, room quality, and diagnostic quality. These correlations confirm that multiple interconnected factors shape patient satisfaction. Enhancements in one area, such as communication or diagnostic services, tend to have a positive ripple effect across other aspects, ultimately leading to higher overall patient satisfaction.
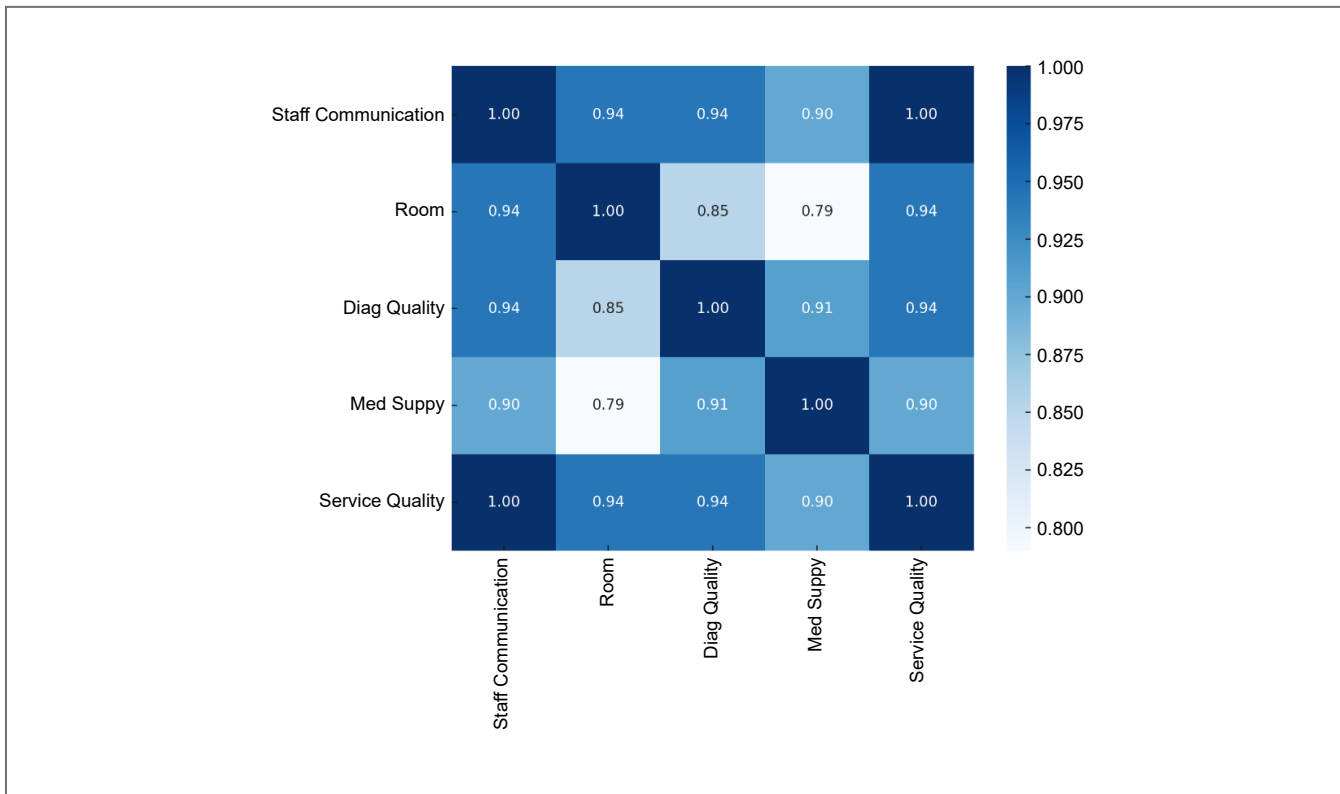
Figure 4 – Correlation matrix of Top-5 factors affecting patient satisfaction in healthcare settings

Discussion: The findings of this study provide crucial insights into the factors that drive patient satisfaction in healthcare settings. The PCA clustering analysis identified four distinct groups of patients based on their satisfaction levels and medical indicators. It clearly explains how different patient perceptions of healthcare services are related to various factors such as communication, room quality, diagnostic quality, and medical supplies.

Identifying these four clusters allows healthcare providers to target specific areas for improvement. Cluster 0 (Lower Satisfaction) represents a critical group where patient perceptions of healthcare services are significantly negative. These patients reported low satisfaction with the quality of medical care and the service received, indicating a need for intervention in their care's clinical and service aspects. In contrast, patients in Cluster 3 (Highest Satisfaction) expressed the highest satisfaction levels, with excellent medical outcomes and service experiences. The fact that Cluster 3 patients had overwhelmingly positive feedback emphasizes the importance of maintaining high standards in care delivery.

One key finding from the regression analysis is the dominant role of staff communication in shaping patient satisfaction. This is consistent with existing literature, highlighting the importance of clear, empathetic, and patient-centered communication in improving patient experiences. Staff communication received the highest regression coefficient (0.30), indicating its paramount importance in determining overall satisfaction. The substantial effect of communication can be linked to the growing recognition that patient engagement and understanding significantly influence their healthcare experience, including their trust in providers and their adherence to medical advice [6,7].

Regarding environmental factors, room quality emerged as a highly influential factor (regression coefficient of 0.25). This finding aligns with studies showing that the physical environment of healthcare settings, including room cleanliness, comfort, and privacy, significantly affects patient perceptions of care quality. Hospitals should prioritize improvements in physical facilities to enhance patient satisfaction, particularly since this factor is nearly as influential as staff communication.

Diagnostic quality (regression coefficient 0.20) and medical supply (regression coefficient 0.15) were also important, though they had a somewhat lesser impact on overall satisfaction than communication and room quality. This suggests that while high-quality diagnostics and the availability of medical supplies are critical for ensuring quality care, they may not always be perceived as directly influencing patient satisfaction as strongly as interpersonal and environmental factors [8]. However, it is important to note that poor diagnostic quality or shortages in medical supplies could still lead to dissatisfaction, which could manifest in other aspects of care, such as the overall healthcare process and outcomes.

The boxplot analysis of hospital stay durations across clusters suggests that the severity of patients' conditions or healthcare needs may be linked to their length of stay. Cluster 1 (Moderate Satisfaction) had the shortest stay durations, while Cluster 3 (Highest Satisfaction) had the longest stays. This could imply that patients with more complex medical conditions might experience longer stays but also report higher satisfaction due to better overall care and medical outcomes. On the other hand, patients in Cluster 0, who reported lower satisfaction, experienced more variable stay durations, possibly reflecting less favorable experiences or complications during their hospital stays.

Furthermore, the correlation matrix reinforces the interconnectedness of the factors influencing patient satisfaction [7]. The perfect correlation between staff communication and service quality underscores the reciprocal nature of improving communication, which enhances patient understanding and directly boosts perceptions of service quality [9,10]. Similarly, the strong correlations between room quality, diagnostic quality, and service quality suggest that improving one factor, such as room conditions or diagnostics, can have a cascading effect on other aspects of

care, ultimately leading to a more positive overall patient experience [11-14].

Conclusion: This study highlights several key areas for healthcare providers to focus on to improve patient satisfaction. Staff communication and room quality emerged as the most significant factors influencing satisfaction, emphasizing the importance of creating a supportive, empathetic environment and maintaining high standards of facility cleanliness and comfort. Diagnostic quality and medical supplies are also important, though their impact on satisfaction is somewhat smaller. By understanding these factors and implementing targeted improvements, healthcare organizations can enhance the quality of care, patient satisfaction, and, ultimately, patient outcomes.

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