

Impact of medical environment, service quality, and perceived value on pediatric outpatient family loyalty: A multicenter mediation cross-sectional study

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Abstract

Objective

This study aimed to explore the impact of outpatient satisfaction on loyalty in pediatric families, identify and analyze key factors in the satisfaction evaluation system that influence patient loyalty, and provide empirical evidence for hospitals to formulate targeted strategies to improve outpatient loyalty.

Methods

A total of 608 family members of pediatric outpatients at six hospitals in Hubei Province used a validated, reliable, and valid satisfaction scale. Descriptive statistics, multiple linear regression analysis, and mediation effect tests were used to analyze the factors influencing pediatric outpatient loyalty and the mediating role of overall satisfaction.

Results

The patient loyalty rate was 90.3%. The average scores for the seven dimensions, ranked from high to low, were service attitude satisfaction (4.67 ± 0.60), medical environment satisfaction (4.58 ± 0.62), service skill satisfaction (4.56 ± 0.65), patient loyalty (4.55 ± 0.66), service efficiency satisfaction (4.50 ± 0.72), overall patient satisfaction (4.49 ± 0.69), and perceived value (4.48 ± 0.70). Satisfaction with service skills, service efficiency, and perceived value were significantly related to loyalty ($p < 0.05$). Overall satisfaction mediated the relationship between satisfaction with the five antecedents and loyalty, with an effect size ranging from 0.47 to 0.59, accounting for 61%-78% of the total effect ($p < 0.001$).

Conclusion

Family members of pediatric outpatients in Hubei Province have a high level of loyalty, but there is still room for improvement. To enhance loyalty, hospitals should focus on improving satisfaction with service skills, service efficiency, perceived value, service attitude, and the medical environment, thereby improving overall satisfaction and fostering patient loyalty. Trial registration: Medical Ethics Committee of Wuhan Children's Hospital; registration number: 2025R126-E01.

Introduction

Patient loyalty is the degree to which a patient maintains a positive attitude toward the services provided by a healthcare institution and is willing to continue using its services in the future owing to the influence of factors such as service quality, price, and other elements^[1]. Service satisfaction refers to the degree of alignment between the "actual experience and expectations" in areas such as the medical environment, service technology, attitude, and efficiency, which is direct feedback on the current medical experience. The "Healthy China 2030" plan and the "Improving Medical Experience and Enhancing Patient Satisfaction Activities (2023-2025)" emphasize the importance of the quality of pediatric healthcare services^[2]. "Patient loyalty" and "service satisfaction" are key indicators of service quality. In pediatrics, children cannot independently make decisions; family members, as the main companions and decision-makers in the medical process, are the core decision-makers for medical choices. Their outpatient satisfaction is transformed into long-term loyalty through "trust accumulation." Healthcare providers who focus on patient loyalty can benefit in many ways, such as reducing patient churn, saving costs to acquire new users, and shaping a good hospital brand image. Loyal patients are more likely to follow medical advice, effectively improving healthcare outcomes^[3]. In this context, exploring the factors influencing the loyalty of family members of pediatric outpatient patients is of great practical significance for optimizing pediatric healthcare resource allocation and improving the service quality.

Previous studies have pointed out that the medical environment, service technology, service attitude, service efficiency, and perceived value are key factors influencing service satisfaction^[4,5]. However, research on the impact of these factors on pediatric outpatient family loyalty in Hubei Province, a large province in central China, remains sparse. This study aimed to conduct a multicenter survey to analyze the impact of the aforementioned factors on family loyalty and the mediation mechanism of overall satisfaction, with the aim of optimizing pediatric healthcare resource allocation and improving service quality.

This paper, based on current "patient-centered" outpatient satisfaction evaluation research, identifies five antecedent constructs: medical environment, service technology, service attitude, service efficiency, and perceived value^[6]. (Figure 1) (Theoretical Model Framework of Outpatient Satisfaction and Loyalty)

Materials and Methods

1.1 Study Subjects

Considering factors such as geographical location, size, and medical service level of hospitals, six hospitals in Hubei Province were selected using a convenience sampling method from May 2025 to January 2026 (one children's hospital and five general hospitals). A total of 608 family members of children visiting pediatric outpatient departments were selected for face-to-face interviews and self-administered surveys. The inclusion criteria were as follows: family members who had visited the pediatric outpatient department or had visited in the past 3 months, aged 18 years or older, and willing to cooperate and provide genuine medical experience feedback. The exclusion criteria were as follows: family members unable to answer independently or lacking objective

judgment abilities and family members who explicitly refused to participate in the survey. A total of 656 participants were initially included, and 608 valid questionnaires were collected, resulting in a response rate of 92.68%. This study was approved by the Medical Ethics Committee of Wuhan Children's Hospital (approval no. 2025R126-E01) before commencing data collection in May 2025. Written informed consent was obtained from all participants prior to the survey implementation. All participants were fully informed of the study's purpose, data collection methods, confidentiality measures, and their right to withdraw from the study at any time without any adverse consequences. All study procedures were performed in accordance with the relevant national guidelines and regulations for human subject research in China and adhered to the ethical principles of the Declaration of Helsinki (2013 revision). We followed the STROBE reporting guidelines for cross-sectional studies.

1.2 Research Tools and Variable Definitions

This study was a multicenter cross-sectional survey that used a questionnaire to collect general information on pediatric outpatient family members and their satisfaction with outpatient services.

1.2.1 General Information Questionnaire

This questionnaire included basic information on family members, such as age, gender, education level, income, and occupation.

1.2.2 Outpatient Satisfaction Scale

This scale includes seven dimensions, each with several items designed to assess patient satisfaction and loyalty across various aspects. The score for each dimension was calculated as the average score of the relevant items in that dimension (Table 1). The questionnaire used a 5-point Likert scale, with scores ranging from 1 to 5, where a higher score indicated higher satisfaction. The Cronbach's alpha values for internal consistency ranged from 0.886 to 0.946, and the average variance extracted (AVE) ranged from 0.746 to 0.902, indicating good reliability and validity^[6]. The seven core variables are as follows: Medical Environment: Refers to the overall impression of hospital service facilities (e.g., seating, elevators), the rationality of layout, clarity of road signs and direction boards, and cleanliness of the environment (e.g., restrooms). These factors have a significant positive impact on patient satisfaction and loyalty^[7, 8]. Service Skills: This dimension focuses on the professionalism of the medical staff, including the timeliness and accuracy of disease diagnosis, proficiency in medical procedures, necessity and reasonableness of tests, and preventive health advice. These are key factors affecting patient satisfaction, and diagnostic outcomes are positively correlated with service quality and patient loyalty^[9]. Service Attitude: Represents the politeness of the medical staff, their patience in listening to the patient's symptoms, the clarity of the treatment plan, and detailed medication instructions. A friendly service attitude fosters respect and positively affects patient satisfaction and loyalty^[10]. Service Efficiency: Defined as the waiting time for registration, examination, test results, and overall convenience of the medical process. Long waiting times negatively affect patient satisfaction and willingness to recommend services^[11, 12]. Perceived Value: Refers to the perception of how well the medical service fees align with the services received, the reasonableness of the charges, treatment outcome satisfaction, and transparency of medical fee standards. In healthcare, it has a significant positive direct impact on satisfaction and loyalty^[13, 14].

Table 1
Outpatient Patient Satisfaction Measurement Items

Dimension	Code	Measurement Item	N	Mean $\pm$ Standard Deviation
Hospital Environment	HE1	What is your overall impression of the hospital's service facilities?	608	4.56 $\pm$ 0.69
	HE 2	Is the layout of the hospital reasonable?	608	4.51 $\pm$ 0.73
	HE 3	Are the road signs and direction boards in the hospital clear and accurate?	608	4.64 $\pm$ 0.68
	HE 4	Is the restroom in the hospital clean and tidy	608	4.62 $\pm$ 0.68
	HE	The average score of Hospital Environment	608	4.58 $\pm$ 0.62
Service Skills	SS1	Doctors can quickly diagnose and identify your symptoms or diseases	608	4.56 $\pm$ 0.72
	SS 2	The diagnostic or nursing operations of medical staff are very proficient	608	4.59 $\pm$ 0.68
	SS 3	The examination items that the doctor asked you to do are necessary and reasonable	608	4.53 $\pm$ 0.75
	SS 4	The doctor has provided you with targeted preventive and health care measures or suggestions for your condition	608	4.58 $\pm$ 0.71
	SS	The average score of Service Skills	608	4.56 $\pm$ 0.65
Service Attitude	SA1	Medical staff will speak to you in a polite and gentle tone	608	4.66 $\pm$ 0.65
	SA 2	The doctor listened patiently to your account of your current condition and symptoms	608	4.66 $\pm$ 0.65
	SA 3	The doctor patiently explained to you the specific treatment plan for the disease	608	4.67 $\pm$ 0.64
	SA 4	The medical staff explained to you in detail the usage methods and precautions of the medicine	608	4.68 $\pm$ 0.63
	SA	The average score of Service Attitude	608	4.67 $\pm$ 0.60
Service Efficiency	SE1	The time you spent queuing for registration when seeking medical treatment	608	4.46 $\pm$ 0.79
	SE 2	The time you spent waiting for the examination and treatment	608	4.48 $\pm$ 0.77
	SE3	The time you spent waiting for the test result report	608	4.48 $\pm$ 0.81
	SE 4	Your convenience for the entire medical treatment process (registration, payment, examination, etc.)	608	4.57 $\pm$ 0.74
	SE	The average score of Service Efficiency	608	4.50 $\pm$ 0.72
Perceived Value	PV1	Compared with the fees you have paid, you feel that the medical services of this hospital are worth it	608	4.48 $\pm$ 0.76
	PV 2	Compared with the services you have received, do you think the various charges of this hospital are reasonable	608	4.39 $\pm$ 0.82
	PV 3	At present, the treatment effect is satisfactory	608	4.48 $\pm$ 0.75
	PV 4	The hospital's standards for charging all medical expenses are open, transparent and easy to inquire	608	4.55 $\pm$ 0.70
	PV	The average score of Perceived Value	608	4.48 $\pm$ 0.70
Patient Satisfaction	PS1	Compared with other hospitals, you are satisfied with this one	608	4.52 $\pm$ 0.68
	PS 2	This hospital has met your expectations	608	4.45 $\pm$ 0.74
	PS 3	You think it's a wise decision to choose this hospital for treatment	608	4.50 $\pm$ 0.72
	PS	The average score of Patient Satisfaction	608	4.49 $\pm$ 0.69
Patient Loyalty	PL1	This hospital is your first choice when seeking medical treatment	608	4.55 $\pm$ 0.68
	PL 2	If necessary, you will continue to choose this hospital for medical treatment in the future	608	4.56 $\pm$ 0.67
	PL 3	You will proactively recommend this hospital to your relatives and friends	608	4.54 $\pm$ 0.73
	PL	The average score of Patient Loyalty	608	4.55 $\pm$ 0.66

Patient Satisfaction: Refers to overall satisfaction with the hospital compared to others, the extent to which the hospital meets expectations, and whether choosing the hospital was a wise decision^[7]. Patient Loyalty: Refers to whether the hospital is the first choice for treatment, whether the patient would continue to choose the hospital for future medical needs, and whether the patient would proactively recommend the hospital to relatives and friends^[15]. In this study, the 5-point loyalty scale was converted to a 2-point scale. The three items measuring loyalty— “This hospital is your first choice when seeking medical treatment,” “If necessary, you will continue to choose this hospital for medical treatment in the future,” and “You will proactively recommend this

hospital to your relatives and friends”—were averaged. A score of 4 or below was assigned a value of 0, indicating disloyalty, whereas a score of 4 or above was assigned a value of 1, indicating loyalty.

1.3 Quality Control

The investigators were uniformly trained before the survey to ensure an accurate understanding of the questionnaire content and survey process. Data entry was performed by two individuals, and the entered data were cross-checked for accuracy.

1.4 Statistical Methods

After cross-checking all the collected data, statistical analysis was performed using SPSS 27.0 and the PROCESS macro. Descriptive statistics were calculated to present the means, standard deviations, frequencies, and percentages for each research variable (medical environment, service technology, service attitude, service efficiency, perceived value, patient satisfaction, and family loyalty) and demographic data. Independent t-tests or ANOVA were used to compare differences in family loyalty and satisfaction across demographic variables and to identify potential factors influencing them. Multiple linear regression analysis was conducted to create a regression model, controlling for demographic variables (including gender, age, education level, income, and occupation), to analyze the direct effects of the medical environment, service technology, service attitude, service efficiency, and perceived value on family loyalty. Additionally, the mediation effect of patient satisfaction between the five antecedent variables and family loyalty was tested using the PROCESS macro mediation model (Model 4), and the Bootstrap method (with 5000 resamples) was used to calculate the 95% confidence intervals. If the confidence interval did not include zero, the mediation effect was statistically significant.

Results

2.1 Demographic Characteristics of the Sample

A total of 608 participants completed the baseline demographic surveys. Among them, 419 (68.9%) were female and 189 (31.1%) were male. Of the participants, 464 (76.3%) were aged 18–40, while 144 (23.7%) were over 41 years. A total of 392 (64.5%) had received higher education, 172 (28.3%) had a college degree or higher, and 44 (7.2%) had a high school diploma or less. The income distribution was relatively balanced: 259 (42.6%) earned between 2000–6000 RMB, 254 (41.8%) earned above 6000 RMB, and 95 (15.6%) earned below 2000 RMB. Freelancers represented the highest occupational category, with 330 (54.3%) participants, followed by the medical and health (81, 13.3%), construction (63, 10.4%), education (55, 9.0%), information (54, 8.9%), and financial (25, 4.1%) industries (Table 2). No significant differences in demographic characteristics were found between the groups ($p > 0.05$), indicating a good balance among the subgroups, which reduced potential bias and ensured homogeneity for further analysis.

Table 2
Socio-Demographic of Study Participants

Characteristics	Value	p-value
Sex, n (%)		0.256
Female	419(68.9%)	
Male	189(31.1%)	
Age, n (%)		0.258
>41	120 (19.7%)	
18–40	464 (76.3%)	
<18	24 (3.9%)	
Education Level, n (%)		0.195
College and above	392 (64.5%)	
High school	172 (28.3%)	
Primary school and below	44 (7.2%)	
Income, n (%)		0.447
>6000 RMB	254 (41.8%)	
2000–6000 RMB	259 (42.6%)	
<2000 RMB	95 (15.6%)	
Occupation, n (%)		0.851
Freelance	330 (54.3%)	
Information Industry	54 (8.9%)	
Construction Industry	63 (10.4%)	
Financial Industry	25 (4.1%)	
Medical and Health Industry	81 (13.3%)	
Education Industry	55 (9.0%)	
Total	608(100.0%)	
Note: n frequency of participants		

2.2 Descriptive Statistics of Medical Environment, Service Technology, Service Attitude, Service Efficiency, Perceived Value, Patient Satisfaction, and Patient Loyalty

A descriptive statistical analysis was conducted to evaluate the current satisfaction of pediatric outpatient patients in Hubei Province. The scale used a Likert 5-point scale, with options ranging from "Strongly Disagree" to "Strongly Agree" corresponding to scores from 1 to 5. The mean scores for the seven dimensions of outpatient satisfaction are presented in Table 2. The average scores from high to low were as follows: service attitude satisfaction (4.67 ± 0.60), medical environment satisfaction (4.58 ± 0.62), service technology satisfaction (4.56 ± 0.65), patient loyalty (4.55 ± 0.66), service efficiency (4.50 ± 0.72), overall patient satisfaction (4.49 ± 0.69), and perceived value (4.48 ± 0.70). **A total of 59 family members (9.7%) had loyalty scores below 4, whereas 549 (90.3%) had scores of 4 or higher. The pediatric outpatient family loyalty rate among the participants surveyed in the six hospitals in Hubei Province was 90.3%.**

2.3 Univariate Analysis Results

Univariate analysis explored the relationships between the medical environment, service technology, service attitude, service efficiency, perceived value, and overall satisfaction and loyalty. Relationship with Overall Satisfaction: All variables had a p -value of < 0.001 , indicating a statistically significant positive association. The standardized coefficients (Beta) and B values were all positive, suggesting that the medical environment, service technology, service attitude, service efficiency, and perceived value had a significant positive impact on overall satisfaction.

Relationship with Loyalty: All variables had p -values of 0.001 ($p < 0.05$), indicating statistical significance, with positive Beta and B values, suggesting that the medical environment, service technology, service attitude, service efficiency, and perceived value significantly influenced loyalty. Additionally, patient satisfaction had a significant positive impact on loyalty ($p = 0.001$ ($\beta = 0.844$, $B = 0.881$), indicating a strong relationship between satisfaction and loyalty (Table 3).

Table 3
Univariate Analysis of Relationships between Exposure Factors and Patient satisfaction (Patient Loyalty)

Exposure	Outcome	β	<i>B</i>	<i>T</i>	<i>F</i>	<i>p</i>	Exposure	Outcome	β	<i>B</i>	<i>t</i>	<i>F</i>	<i>p</i>
Hospital Environment	Patient satisfaction	0.737	0.822	26.853	721.103	0.001	Hospital Environment	Patient Loyalty	0.702	0.749	24.249	588.022	0.001
Service Skills	Patient satisfaction	0.788	0.830	31.534	994.391	0.001	Service Skills	Patient Loyalty	0.770	0.777	29.728	883.773	0.001
Service Attitude	Patient satisfaction	0.731	0.840	26.398	696.830	0.001	Service Attitude	Patient Loyalty	.690	.759	23.437	549.275	0.001
Service Efficiency	Patient satisfaction	0.791	0.753	31.872	1015.816	0.001	Service Efficiency	Patient Loyalty	.742	.677	27.266	743.460	0.001
Perceived Value	Patient satisfaction	0.877	0.855	44.909	2016.775	0.001	Perceived Value	Patient Loyalty	.813	.759	34.348	1179.754	0.001
							Patient satisfaction	Patient Loyalty	0.844	0.881	38.771	1503.223	0.001

2.4 Multiple Linear Regression Analysis of the Medical Environment, Service Technology, Service Attitude, Service Efficiency, and Perceived Value on Patient Satisfaction and Loyalty

After adjusting for age, gender, occupation, education, and income, multiple linear regression showed that patient satisfaction was significantly associated with service technology ($\beta = 0.10$, 95% CI: 0.011–0.188, $p = 0.028$), service efficiency ($\beta = 0.09$, 95% CI: 0.019–0.164, $p = 0.013$), and perceived value ($\beta = 0.61$, 95% CI: 0.535–0.684, $p < 0.001$), whereas medical environment ($p = 0.180$) and service attitude ($p = 0.062$) were not statistically significant. Among the three significant predictors, perceived value had the strongest direct effect on pediatric outpatient family loyalty ($\beta = 0.46$, 95% CI: 0.370–0.542, $p < 0.001$), followed by service skills ($\beta = 0.25$, 95% CI: 0.150–0.355, $p < 0.001$) and service efficiency ($\beta = 0.09$, 95% CI: 0.004–0.171, $p = 0.040$). (Table 4)

Table 4

Multiple linear regression analysis results of hospital environment, service skills, service attitude, service efficiency, perceived value on patient satisfaction and patient loyalty

Exposure	Outcome	B (95% CI)	<i>P-value</i>	<i>B</i>	Exposure	Outcome	B (95% CI)	<i>P-value</i>	<i>B</i>
Hospital Environment	Patient satisfaction	-0.026-0.137	0.180	0.056	Hospital Environment	Patient Loyalty	-0.040-0.148	0.261	0.054
Service Skills	Patient satisfaction	0.011–0.188	0.028	0.100	Service Skills	Patient Loyalty	0.150–0.355	<0.001	0.253
Service Attitude	Patient satisfaction	-0.004-0.167	0.062	0.081	Service Attitude	Patient Loyalty	-0.098-0.099	0.988	0.001
Service Efficiency	Patient satisfaction	0.019–0.164	0.013	0.092	Service Efficiency	Patient Loyalty	0.004–0.171	0.040	0.088
Perceived Value	Patient satisfaction	0.535–0.684	<0.001	0.610	Perceived Value	Patient Loyalty	0.370–0.542	<0.001	0.456

Abbreviations: CI=confidence interval.

2.5 Mediation Effect Analysis of Patient Satisfaction

These findings indicate that service improvements raise loyalty primarily by increasing overall satisfaction. Using Hayes' PROCESS macro (Model 4)^[16], we tested a mediation model in which overall patient satisfaction transmits the effects of five service dimensions—medical environment, service technology, service attitude, service efficiency, and perceived value— on patient loyalty. Overall satisfaction significantly mediated every path ($p < 0.001$), with indirect effects accounting for 61%–78% of the total influence: medical environment, 75.2%; service technology, 64.1%; service attitude, 77.5%; service efficiency, 73.3%; and perceived value, 61.4%. (Table 5)

Table 5
Mediation Effect of Service Environment, Technical Competence, Service Attitude, Service Efficiency, and Perceived Value on Patient Loyalty via Patient satisfaction

Exposure	Mediator	Outcome	Total effect	Direct effect	Mediation effect (95% CI)	P-value	Mediation Proportion
Hospital Environment	Patient satisfaction	Patient Loyalty	0.749	0.186	0.564(0.476–0.655)	0.001	75.20%
Service Skills	Patient satisfaction	Patient Loyalty	0.777	0.279	0.498(0.395–0.602)	0.001	64.07%
Service Attitude	Patient satisfaction	Patient Loyalty	0.759	0.171	0.588(0.499–0.676)	0.001	77.51%
Service Efficiency	Patient satisfaction	Patient Loyalty	0.677	0.181	0.496(0.411–0.577)	0.001	73.27%
Perceived Value	Patient satisfaction	Patient Loyalty	0.759	0.293	0.466(0.344–0.592)	0.001	61.38%

Discussion

3.1 Patient Loyalty in Pediatric Outpatient Departments in Six Hospitals in Hubei Province

In this study, the pediatric outpatient family loyalty rate among participants from six hospitals in Hubei Province was 90.3%, which was relatively high in the surveyed sample, although there remains room for improvement in specific satisfaction dimensions that influence loyalty. From the average scores for each item, it can be observed that satisfaction with service attitude (4.67 ± 0.60), service technology (4.56 ± 0.65), and the medical environment (4.58 ± 0.62) were relatively high, indicating that the hospitals received recognition from the family members of pediatric patients in terms of humanistic care, hardware facilities, and professional competence. However, the items "Is the hospital layout reasonable?" (4.51 ± 0.73) and "Are the examination items requested by the doctor necessary and reasonable?" (4.53 ± 0.75) scored lower than the average score for their respective dimensions, suggesting that the hospital's process planning and medical communication still require improvement.

To address this, the following improvement directions are proposed for reference: First, Optimize Space and Process Layout: Under current conditions, it is recommended to centralize functional areas such as consultation rooms, examination, and billing to shorten the patient movement path and improve the efficiency of the treatment process. Second, Increase Transparency in Clinical Decision-Making and Evidence-Based Communication: Medical staff should follow clinical guidelines to reduce unnecessary tests and provide clear explanations to family members about the purpose and necessity of tests. This will help increase family members' understanding, recognition, and trust, while also reducing the child's discomfort and the family's financial burden.

Satisfaction with service efficiency (4.50 ± 0.72) ranked lower among the dimensions, with the lowest score for "Time spent waiting for registration" (4.46 ± 0.79). This directly reflects the potential bottlenecks in the outpatient process for the surveyed sample. Long waiting times not only consume the energy and time of patients' families but also increase anxiety and dissatisfaction, constituting a major weakness in the overall treatment experience, which is consistent with the findings of Amarantou's research on outpatient service efficiency^[17]. The optimization direction should focus on process reengineering and technological advancement. On the one hand, measures such as analyzing peak treatment times, flexibly allocating window staff, and promoting time-slot appointment registration can reduce crowds and shorten unnecessary waiting times. On the other hand, enhancing the use of information technology, such as improving online registration, mobile payment, and report inquiry functions, can replace "patient running errands" with "information running errands," systematically improving the efficiency of the treatment process.

The average perceived value score (4.48 ± 0.70) was relatively low, with the core issue being the lack of recognition of "fee reasonableness" by family members, which scored 4.39 ± 0.82 . This indicates that in the value evaluation system of family members, the match between medical fees and the quality of services provided is key. The factors influencing this evaluation are complex and include family income, medical insurance policies, and the proportion of out-of-pocket expenses. Therefore, improving perceived value requires a two-pronged approach: First, Fee Transparency: Hospitals should proactively disclose fee standards and details about medical insurance, providing clear cost lists to establish trust^[18]. Second, Value Delivery: Medical staff need to strengthen communication^[19] by explaining the necessity and expected outcomes of treatment plans, helping family members understand "where the money is being spent," thereby improving their recognition of the intrinsic value of outpatient services.

3.2 Service Technology, Perceived Value, and Service Efficiency as Direct Drivers of Patient Loyalty

Multivariate regression analysis showed that, after controlling for demographic variables, service technology, service efficiency, and perceived value were independent predictors of patient loyalty ($p < 0.05$). This finding is consistent with that of Chen et al.^[20]. This finding reveals the key direct paths for enhancing pediatric outpatient family loyalty in the study's sample. Compared with the other dimensions included in this study, these three factors constitute the core variable group influencing the pediatric healthcare-seeking decisions of the surveyed families. Among these, the impact of perceived value was the most significant ($\beta = 0.46$), which aligns with the findings of Lin^[14] and provides preliminary evidence for the applicability of the "patient value perception theory" in the pediatric outpatient setting of the study sample. Family value evaluation is a comprehensive balancing process, where "inputs" include medical costs, time, and energy, while "outputs" are related to treatment outcomes, emotional care, and environmental experiences. This complex value calculation model aligns with the "patient-centered" policy direction, emphasizing that value orientation should be the core logic for optimizing pediatric services.

Next, the direct impact of service technology on loyalty ($\beta = 0.25$) aligns with Xiong's^[9] findings. Pediatric diseases are characterized by "rapid onset and quick changes," so parents' primary focus is on "problem-solving." Excellent medical technology not only directly alleviates the child's suffering but also forms the foundation for building parental "professional trust." The "technology barrier" created by this trust is fundamental to maintaining long-term loyalty and is closely aligned with the national "Pediatric Healthcare Quality Improvement Initiative" policy goals. Service efficiency is equally critical. In the high-anxiety context of pediatric care, prolonged waiting times (e.g., for registration, examination, and communication) exacerbate parents' negative emotions. Efficient service, by reducing time costs and psychological burdens, directly optimizes the current experience and enhances the willingness to choose the hospital. This approach is consistent with the requirement to "optimize processes and reduce patient waiting times" specified in the national "Improvement of Medical Experience and Enhancement of Patient Satisfaction Activities Plan (2023–2025)".

In summary, this study provides clear guidelines for hospital administrators: service technology, perceived value, and service efficiency should be prioritized in quality improvement strategies^[21]. By strengthening technical foundations, optimizing value perception, and enhancing process efficiency, hospitals can systematically build patient loyalty and improve patient satisfaction.

3.3 Enhancing Satisfaction with the Medical Environment, Service Technology, Service Attitude, Service Efficiency, and Perceived Value to Improve Overall Satisfaction, Which Can Indirectly Boost Patient Loyalty.

Mediation effect analysis confirmed that overall satisfaction plays a significant mediating role in the relationship between the five antecedent variables (medical environment, service technology, service attitude, service efficiency, and perceived value) and patient loyalty. This result reveals the potential internal psychological mechanism of pediatric outpatient family loyalty formation in the study sample: while individual service elements will enable a more efficient transformation are important, they must first improve overall patient satisfaction, which is the core psychological variable, to effectively translate into long-term loyalty behavior^[22].

This finding provides two key insights for hospital management. First, Systematic Optimization to Strengthen the Foundation of Satisfaction: Administrators should work to build an integrated service system that improves the patient's overall experience throughout the treatment process, including providing a clean and comfortable environment, high-quality medical techniques, friendly and patient communication, efficient and convenient processes, and transparent billing^[21]. This comprehensive optimization is the cornerstone of accumulating positive feedback and building high satisfaction. Second, Using Overall Satisfaction as a Core Monitoring Indicator and Strategic Lever: Given its mediating effect, hospitals should consider overall satisfaction as a key indicator for evaluating service effectiveness and predicting patient loyalty. By regularly monitoring and analyzing changes in this indicator, administrators can effectively judge the impact of improvement measures, dynamically adjust resources, and prioritize addressing core weaknesses affecting overall evaluations. This may help facilitate a more efficient transformation of service quality improvement into pediatric outpatient family loyalty for the studied population.

4. Limitations and Future Research Directions

This study had several limitations. First, the scope of the sampling was limited. The sample was collected from six hospitals in Hubei Province via convenience sampling, and the findings are only generalizable to pediatric outpatient populations of similar-grade hospitals in central China rather than all regions or hospital types in China. Second, the cross-sectional design cannot confirm the causal relationship between variables; the association between satisfaction and loyalty may be bidirectional, and dynamic changes in these variables over time cannot be captured in this study. Third, the variable system was relatively narrow, focusing only on service processes and perceptual dimensions (e.g., medical environment and service quality) without including psychosocial variables such as doctor-patient trust and hospital brand image, which may limit the model's explanatory power. Fourth, the study relied on self-reported questionnaires, which may be subject to social desirability bias, and no objective behavioral data (e.g., re-consultation rates from electronic medical records) were used to verify the self-reported loyalty results. Fifth, potential confounding variables, such as children's disease severity and medical visit frequency, were not controlled in the analysis, which may affect the accuracy of the results.

These limitations provide meaningful directions for future studies. First, the sampling scope should be expanded with stratified random sampling to include different regions, hospital grades, and ownership types (public/private) in China to enhance the generalizability of the conclusions. Second, a longitudinal design or cross-lagged panel model should be adopted to clarify the causal direction and dynamic evolution of the relationship between satisfaction and loyalty. Third, the variable system should be expanded by incorporating doctor-patient trust, hospital brand commitment, and other psychosocial variables to build a more comprehensive loyalty formation model. Fourth, self-reported questionnaires should be combined with objective behavioral data (e.g., electronic medical record data) and qualitative methods (e.g., semi-structured interviews) to reduce subjective bias and improve research reliability. Fifth, disease severity, medical visit frequency, and other factors were included as control variables in the regression model to enhance the accuracy of the analysis results.

Declarations

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Author Contributions

Yuan Fang and Ping Li: Data analysis, manuscript drafting (equal contribution).

Jing Yang and Huan Feng: Study design, manuscript revision (corresponding authors).

Huan Fang, Man Wang, Qin Zhang, Zi Lin, Yuehu Liu, Miya Yao: Data collection, critical manuscript review.

Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request, but restrictions apply to the availability of these data due to ethical and/or copyright constraints.

Conflict of Interest

All authors declare no competing interests in relation to this study.

Ethics Approval

This study was approved by the Medical Ethics Committee of Wuhan Children's Hospital (approval no. 2025R126-E01) and followed the STROBE reporting guidelines for cross-sectional studies.

Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request; however, restrictions apply to the availability of these data owing to ethical and/or copyright constraints.

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Figures

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Figure 1

Theoretical Model Framework of Outpatient Satisfaction and Loyalty