

The Effect of Appointment System Efficiency on Patient Visit Punctuality and Waiting Time at Dentalife Dental Clinic

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ABSTRACT

Patient waiting time is one of the key indicators of healthcare service quality, as it can influence patient satisfaction and perceptions of the services. Long waiting times remain a common issue in dental practice settings. Irregular patient arrival patterns and suboptimal appointment systems may reduce service efficiency and affect patient experiences. This study aimed to analyze the effect of appointment system efficiency on patient visit punctuality and patient waiting time at Dentalife Dental Clinic. This study employed a quantitative approach using a cross-sectional design. A purposive sampling technique was used, involving 85 patients as respondents. Data were collected using a five-point Likert scale questionnaire and analyzed using the SEM-PLS. The findings showed that appointment system efficiency had a positive and significant effect on patient visit punctuality and a significant negative effect on patient waiting time. Patient visit punctuality did not show a significant effect on waiting time and was not found to mediate the relationship between appointment system efficiency and waiting time. The novelty of this study lies in integrating appointment system efficiency with patient visit punctuality as a behavioral mechanism within the context of independent dental clinics, an area that has received limited attention in Indonesia. This study concludes that appointment system efficiency plays an important role in improving the effectiveness of clinical service management, while patient visit punctuality has not been proven to be a primary mechanism affecting patient waiting time.

Keywords: *Appointment Efficiency, Waiting Time, Dental Clinic, Healthcare Service Quality, Patient Punctuality*

1. INTRODUCTION

In Indonesia, prolonged patient waiting time remains a common challenge in healthcare services, particularly in outpatient care. According to the minimum service standards established by the Ministry of Health, outpatient waiting time should not exceed 60 minutes calculated from patient arrival until entry into the examination room. However, several previous studies have reported that actual waiting times frequently exceed the recommended standard, reaching more than 70 to 150 minutes in some healthcare facilities (Laeliyah & Subekti, 2017; Torry et al., 2016). Bleustein et al. (2014) emphasized that waiting time is one of the most important factors influencing patients' perceptions of healthcare service quality. Previous studies have shown that waiting time can influence patients' perceptions of service effectiveness, trust in healthcare facilities, and their likelihood of returning for future visits (Sun et al., 2017).

Patient waiting time is one of the key indicators in evaluating healthcare service quality. Long waiting times frequently become a source of patient dissatisfaction and may influence both patient satisfaction and their perception of the services received. Delays in service delivery remain a common issue, particularly in outpatient healthcare settings. Previous studies have demonstrated a significant relationship between waiting time and patient satisfaction in healthcare facilities, showing that longer waiting times tend to reduce patient satisfaction and negatively affect perceptions of healthcare service quality (Rizany et al., 2021). In addition, waiting time and the effectiveness of healthcare services have been found to play important roles in shaping patient satisfaction toward healthcare delivery (Amalina et al., 2025).

Healthcare services operate as a system designed to provide effective, efficient, and high-quality care for patients. The quality of healthcare services is not determined solely by the competence of healthcare professionals but also by service management systems, including patient flow organization and time management processes (Marquis & Huston, 2012; Nursalam, 2020). In modern healthcare services, patient flow management has increasingly become an essential component of quality improvement, as it contributes to operational efficiency, reduces waiting times, and enhances the overall patient experience (Samadbeik et al., 2024).

One potential solution to address prolonged waiting times is the implementation of an appointment system. Niu et al. (2024) explained that optimizing appointment scheduling can improve operational efficiency and reduce waiting times in healthcare services. Appointment systems allow patients to schedule their visits in advance, creating a more organized and efficient service flow. Previous studies have also reported that technology-based appointment systems can help reduce waiting times and improve patient satisfaction (Zhao et al., 2017). Alsaf et al. (2024) explained that appointment scheduling is no longer viewed merely as a scheduling mechanism, but has evolved into a core operational strategy used to optimize resource allocation, improve patient flow, and enhance clinical service efficiency. Previous studies have shown that the integration of digital appointment systems and reminder systems can improve patient punctuality and reduce the rates of appointment delays and cancellations in healthcare services (Kammrath Betancor et al., 2025).

However, the implementation of appointment systems also faces several challenges, including patient non-adherence to scheduled appointments, delays in healthcare provider arrival, and suboptimal schedule management by the clinic. Irregular patient arrival patterns and inefficient appointment systems may reduce service efficiency, lower adherence to scheduled visit times, and increase patient waiting times (Niu et al., 2024). Therefore, further investigation is needed to better understand the effect of appointment system efficiency on patient visit punctuality and waiting time, particularly in dental care settings such as Dentalife Dental Clinic.

This study aims to analyze the effect of appointment system efficiency on patient visit punctuality and patient waiting time at Dentalife Dental Clinic. In addition, the study seeks to examine the mediating role of visit punctuality in the relationship between appointment system efficiency and patient waiting time. Four hypotheses are proposed in this study: H1: appointment system efficiency positively affects patient visit punctuality; H2: appointment system efficiency negatively affects patient waiting time; H3: patient visit punctuality negatively affects patient waiting time; and H4: patient visit punctuality mediates the relationship between appointment system efficiency and patient waiting time. The findings of this study are expected to provide practical implications for optimizing clinical service management, improving operational efficiency, and enhancing the overall patient experience.

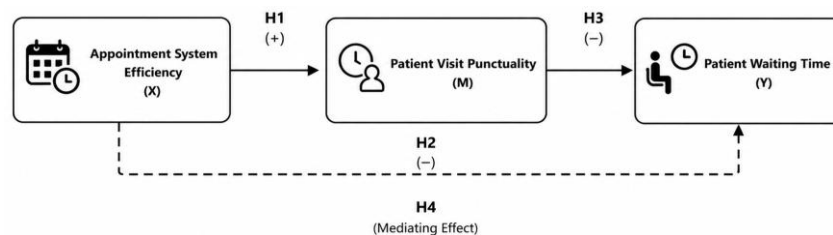


Figure 1. Research Hypothesis

2. RESEARCH METHODS

This research employed a quantitative approach with a cross-sectional design. This research was conducted at Dentalife Dental Clinic and involved all patients who visited the clinic during the study period. This clinic was selected because it has implemented an appointment system; however, several challenges are still observed, including patient lateness, inconsistencies in service scheduling, and increased patient waiting times. These conditions make Dentalife Dental Clinic a relevant setting for this study.

The research population consisted of all patients who visited Dentalife Dental Clinic during the period. A purposive sampling technique was employed. The inclusion criteria included patients aged at least 13 years, willing to participate as respondents, and able to complete the questionnaire independently. Patients aged 13–17 years were allowed to complete the questionnaire independently with parental consent, while for patients under 13 years old, the questionnaire could be completed by parents or legal guardians who met the study requirements. Based on these criteria, a total of 85 respondents met the inclusion requirements and were included in the study.

Research variables consisted of an independent variable, appointment system efficiency (X) refers to the effectiveness of managing patient service schedules, a mediating variable, patient visit punctuality (M) reflects patient behavior in attending visits according to the scheduled appointment time, and a dependent variable, patient waiting time (Y) refers to the duration experienced by patients from their arrival until receiving dental care services.

Data were collected using a questionnaire developed based on the theoretical frameworks proposed by Haryati (2014), Marquis & Huston (2012), and Nursalam (2020). The questionnaire employed a five-point Likert scale ranging from strongly disagree to strongly agree. Prior to hypothesis testing, the research instrument was evaluated through

measurement model (outer model) assessment procedures, including convergent validity testing using outer loading values and Average Variance Extracted (AVE), discriminant validity testing using cross-loading values and the Fornell–Larcker criterion, as well as reliability testing using Cronbach’s Alpha and Composite Reliability. Variables were considered valid when the outer loading values exceeded 0.70 and AVE values were greater than 0.50, while reliability was considered acceptable when Cronbach’s Alpha and Composite Reliability values exceeded 0.70.

Data analysis was performed using the SEM-PLS approach through SmartPLS software. SEM-PLS was selected because it allows the analysis of both direct and indirect relationships among variables, including mediation models, while accommodating relatively small sample sizes without requiring strict assumptions of normal data distribution. Structural model (inner model) evaluation was conducted using R-Square (R^2), Effect Size (f^2), Predictive Relevance (Q^2), and hypothesis testing through the bootstrapping procedure. The proposed hypotheses were considered significant when the T-statistic value exceeded 1.96 and the p-value was below 0.05.

3. RESULTS AND DISCUSSIONS

3.1. Respondent Characteristics

Respondent characteristics were analyzed based on gender, age, and frequency of visits to Dentalife Clinic. Based on data collected from 85 respondents, the majority were female for 46 respondents (54.1%). This finding indicates that women tend to pay greater attention to oral health and dental care, including preventive and aesthetic treatment needs. Based on age distribution, most respondents were in the 18 – 40 year age group, comprising 55 respondents (64.7%). The predominance of respondents in the productive age group suggests that Dentalife Dental Clinic services are primarily utilized by active adult patients who have higher mobility and tend to require more efficient healthcare services, including appointment-based scheduling systems. Regarding visit frequency, respondents with more than five visits represented the largest group showed with 32 respondents or 37.6% of respondents, relatively high proportion of returning patients suggests that respondents had sufficient experience with the clinic’s service system, enabling them to provide more evaluations regarding appointment system efficiency, patient visit punctuality, and patient waiting time.

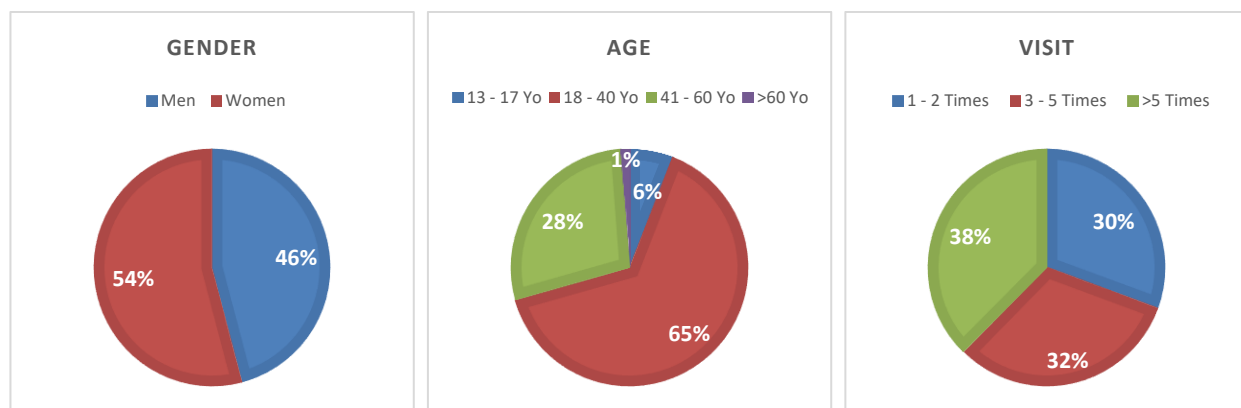


Figure 2. Respondent Segmentation Chart

3.2. Respondent Responses Toward Variables X, M, and Y

Overall, the analysis results showed that the percentage of respondent responses for variable X reached 94.16%, variable M reached 93.57%, and variable Y reached 93.80%. These findings indicate that respondents generally provided highly positive evaluations for all study variables. Therefore, the variables of appointment system efficiency, patient visit punctuality, and patient waiting time were categorized as being in the very good category.

3.3. Validity Testing

Validity demonstrates whether the instrument, technique, or process used to measure a concept truly reflects the intended construct being measured (Sekaran & Bougie, 2010). Discriminant validity testing measures the extent to which a construct is empirically distinct from other constructs within the structural model (Hair et al., 2021). Convergent validity was assessed using outer loading values and the results showed that 21 out of 23 indicators had outer loading values greater than 0.70, while two indicators (X6 and X10) had values below the recommended threshold. Further evaluation using AVE was conducted to strengthen the convergent validity assessment. The results indicated that all

variables achieved AVE values above the recommended threshold, with appointment system efficiency showing an AVE value of 0.548, patient visit punctuality 0.710, and patient waiting time 0.803.

Based on the Fornell–Larcker assessment, all constructs demonstrated satisfactory discriminant validity. Furthermore, the Fornell–Larcker criterion was evaluated to assess discriminant validity. Based on the analysis results, the diagonal values represented the square root of the AVE for each construct, while the values below the diagonal represented the correlations among constructs. Since all square root AVE values were higher than the correlations between constructs, it can be concluded that the constructs demonstrated satisfactory discriminant validity.

Table 1. Fornell–Larcker Discriminant Validity Results

	M	X	Y
M	0.843		
X	0.731	0.740	
Y	0.610	0.787	0.896

3.4. Structural Model Evaluation (Inner Model)

The structural model evaluation showed that patient visit punctuality (M) had an R-Square value of 0.534, indicating that appointment system efficiency explained 53.4% of the variance in patient visit punctuality. Meanwhile, patient waiting time (Y) had an R-Square value of 0.626, meaning that appointment system efficiency and patient visit punctuality collectively explained 62.6% of the variance in patient waiting time.

The f^2 analysis demonstrated that appointment system efficiency had a large effect on patient visit punctuality ($f^2 = 1.146$) and patient waiting time ($f^2 = 0.647$). In contrast, the effect of patient visit punctuality on patient waiting time ($f^2 = 0.011$) and the mediating effect ($f^2 = 0.010$) were categorized as small. These findings indicate that appointment system efficiency played a more dominant role in the proposed research model.

Furthermore, the Q-Square Predictive Relevance (Q^2) results showed values of 0.372 for patient visit punctuality and 0.462 for patient waiting time, both exceeding 0. This indicates that the proposed research model had adequate predictive relevance and was capable of explaining the relationships among the study variables.

3.5. Reliability Testing

Meanwhile, reliability testing aims to assess the internal consistency of the research instrument to determine whether the questionnaire items produce consistent responses from participants (Willems et al., 2023). Reliability testing was conducted using Cronbach's Alpha and Composite Reliability values. The results of the reliability analysis are presented in Table 2. The analysis showed that all variables achieved Cronbach's Alpha and Composite Reliability values above the recommended threshold of 0.70. The results of the reliability analysis are presented in Table 2.

Table 2. Cronbach's Alpha and Composite Reliability Results

Variable	Cronbach's Alpha	Composite Reliability	Results
X	0,914	0,929	Reliable
M	0,948	0,956	Reliable
Y	0,877	0,924	Reliable

3.6. Hypothesis Testing

A hypothesis was considered supported when the T-statistic exceeded 1.96 and the p-value was below 0.05. Path coefficient values were used to determine the direction of relationships among variables, where positive values indicate a positive relationship and negative values indicate an inverse relationship.

The hypothesis testing results showed that not all relationships among variables in the proposed research model demonstrated significant effects. Based on the direct effect analysis, appointment system efficiency was found to have a significant effect on patient visit punctuality and patient waiting time. These findings were supported by p-values below 0.05 and T-statistic values greater than 1.96, resulting in the acceptance of H1 and H2. In contrast, the effect of patient visit punctuality on patient waiting time, as well as the indirect effect through the mediating variable, did not demonstrate statistical significance. Therefore, H3 and H4 were rejected.

These findings suggest that appointment system efficiency plays a more dominant role in influencing service outcomes compared to the indirect mechanism through patient visit punctuality. Furthermore, these results imply that healthcare providers, particularly dental clinics, should prioritize optimizing appointment management systems to improve service flow efficiency and enhance the overall patient experience.

Table 3. Direct Effects Hypothesis Testing Results

Hypothesis	Standard Deviation (STDEV)	T Statistics (O/STDEV)	p-Values	Path Coefficient	Results
[H3] $M \rightarrow Y$	0.154	0.645	0.519	0.099	Rejected
[H1] $X \rightarrow M$	0.080	9.156	0.000	0.731	Accepted
[H2] $X \rightarrow Y$	0.186	4.119	0.000	-0.765	Accepted
[H4] $X \rightarrow M \rightarrow Y$	0.125	0.577	0.564	0.072	Rejected

3.6.1. The Effect of Appointment System Efficiency on Patient Visit Punctuality (H1)

The analysis results showed that appointment system efficiency had a positive and significant effect on patient visit punctuality, with a T-statistic value of 9.156, p-value of 0.000, and path coefficient of 0.731. Since the T-statistic exceeded 1.96 and the p-value was below 0.05, H1 was accepted. These findings indicate that greater appointment system efficiency is associated with higher patient visit punctuality. A well-organized appointment system may help patients better understand and follow their schedules, and improving punctuality in attending clinic visits.

Implications of these findings suggest that clinics should maintain and further optimize structured appointment systems. Strategies such as implementing automated reminders through WhatsApp, appointment confirmations before visit, and delivering clearer scheduling information to patients may improve adherence to appointment times. These initiatives could support better patient compliance and contribute to a more organized and efficient service flow.

3.6.2. The Effect of Appointment System Efficiency on Patient Waiting Time (H2)

The results indicated that appointment system efficiency had a significant negative effect on patient waiting time, with a T-statistic value of 4.119, p-value of 0.000, and path coefficient of -0.765. Since the T-statistic exceeded 1.96 and the p-value was below 0.05 meaning H2 was accepted. These findings recommend that a more efficient appointment system contributes to better management of patient flow, reducing queue and improving overall clinical service efficiency.

From a practical perspective, these findings indicate that Dentalife Dental Clinic should optimize service time slot allocation, estimate treatment duration based on the type of procedure, and implement more flexible scheduling adjustments according to operational conditions within the clinic. More accurate schedule management may help reduce patient congestion during peak hours and improve overall service efficiency.

3.6.3. The Effect of Patient Visit Punctuality on Patient Waiting Time (H3)

The results showed that patient visit punctuality did not have a significant effect on patient waiting time, with T-statistic value of 0.645, p-value of 0.519, and path coefficient of 0.099. Since the T-statistic was below 1.96 and the p-value exceeded 0.05 showed H3 was rejected. These findings suggest that punctual patient arrival does not directly influence waiting time. This result may be explained by other factors beyond the proposed research model, such as treatment duration, variations in procedures, or operational factors within the clinic that may also affect waiting time.

These results indicate that the clinic should not focus on patient punctuality, but also consider other operational factors such as workflow management, clinical procedure duration, physician scheduling, and service capacity. Addressing these aspects may contribute to more efficient service delivery and improve overall clinic performance.

3.6.4. The Mediating Role of Patient Visit Punctuality in the Relationship Between Appointment System Efficiency and Patient Waiting Time (H4)

The indirect effect analysis showed that the indirect relationship between appointment system efficiency and patient waiting time through patient visit punctuality produced a T-statistic value of 0.577, a p-value of 0.564, and a coefficient value of 0.072. Since the T-statistic was below 1.96 and the p-value exceeded 0.05, H4 was rejected. These findings indicate that patient visit punctuality was not able to mediate the relationship between appointment system efficiency

and patient waiting time. Therefore, the influence of appointment system efficiency on patient waiting time in this study appears to occur more directly rather than through a mediating mechanism.

From this perspective, these findings suggest that improvements in appointment system quality should focus directly on operational service aspects, including schedule management, patient distribution, and service process efficiency, rather than relying heavily on changes in patient behavior as the primary mechanism for reducing waiting times.

4. CONCLUSION

The findings of this study demonstrate that appointment system efficiency has a positive and significant effect on patient visit punctuality and a significant negative effect on patient waiting time. These results indicate that a well-managed appointment system can improve patient punctuality and support more efficient clinical service flow. In contrast, patient visit punctuality was not found to significantly affect patient waiting time and did not mediate the relationship between appointment system efficiency and patient waiting time. These findings suggest that patient waiting time may also be influenced by other factors beyond the proposed research model, including treatment duration, variations in service types, and operational factors within the clinic. Overall, appointment system efficiency plays an important role in improving service management quality and enhancing patient experiences in dental practice settings.

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