Influence of Weekday on Demand Patterns for Restorative Dental Treatment: A Retrospective Cross-Sectional Study

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ABSTRACT

Background: Restorative dental treatments are essential for maintaining oral health. However, the demand for these services can vary throughout the week, impacting clinic operations and patient care. This descriptive analytical study aimed to investigate the influence of weekdays on the pattern of demand for restorative dental treatment and to identify peak and low-demand days.

Methods: The study involved a secondary analysis of 4,200 patient records from the Conservative Clinic of the University of Benin Teaching Hospital (January 2022 - April 2023). Data on the day of the week, patient sex, visit status (new or recall), and monthly distribution were collected. Data analysis employed descriptive statistics, generalized linear mixed models (GLMM), and analysis of variance (ANOVA), with p-values used to assess significant differences.

Study Design: This retrospective cross-sectional study examined secondary data from clinic records. A total of 4,350 records were retrieved, but 4,200 were analyzed after excluding incomplete entries.

Results: The highest attendance was recorded on Tuesday, followed closely by Wednesday, while Friday had the lowest. Statistically significant variations in attendance were found across weekdays. Monday's attendance was significantly higher than Friday's (Mean Difference: -3.21, 95% CI: -4.66 to -1.76, $p<0.001$). Female patients (58.1%) consistently demonstrated higher attendance than males.

Conclusion: This study provides valuable insights to help healthcare providers optimize scheduling and resource allocation, thereby improving overall service efficiency and patient care. Understanding these daily attendance patterns can inform decisions to reduce wait times and enhance patient satisfaction.

Keywords: Restorative treatment, Demand patterns, Clinic attendance, Day-of-week effect, Demand variability

INTRODUCTION

Restorative dental treatments are a crucial aspect of oral healthcare, aimed at repairing or replacing damaged, decayed, or missing teeth. These procedures, which range from simple fillings to crowns and root canal treatments, seek to restore function, maintain health, improve aesthetics, and prevent further complications.[1,2] A global increase in demand for dental services, driven by greater awareness, improved insurance access, and the appeal of aesthetic dentistry,[3,4] has increased pressure on clinics, leading to longer wait times and resource management challenges.[5] This demand varies not only by demographic and geographic factors but also by the day of the week.[3,5-9] A recognized trend shows patients often schedule appointments earlier in the week, with demand decreasing towards Fridays and weekends.[10] Understanding these patterns is essential for optimizing clinic operations, reducing wait times, and improving both service delivery and satisfaction.[11–14]

Despite growing interest in dental service utilization, little research exists on the specific influence of weekdays on the demand for restorative treatment, particularly in African or low-to-middle-income countries. We hypothesized that weekdays significantly influence demand patterns. This study therefore aimed to analyze the influence of the weekday on demand for restorative dental treatment to better inform clinic resource allocation and scheduling efficiency, ultimately improving patient access and satisfaction.

METHODS

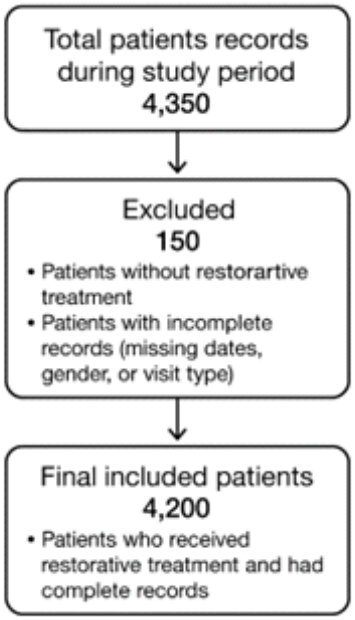
This retrospective, descriptive study analyzed secondary data from the records of patients who

received restorative dental treatment at the Conservative Clinic of the University of Benin Teaching Hospital over a 16-month period (January 2022 to April 2023). The clinic serves a broad range of patients across various age groups and socioeconomic backgrounds. A total of 4,350 records were retrieved, but 4,200 were included in the final analysis after excluding those with missing information. All data were anonymized and handled in accordance with the ethical principles of the Helsinki Declaration (2013).

Inclusion criteria: All patients who received any form of restorative dental treatment during the study period and had complete records, including date of visit, sex, and visit type (new or recall).

Exclusion criteria: Patients with incomplete or missing records, or those who did not receive restorative treatment, were excluded from the analysis.

STROBE FLOWCHART



Sample Size

The study retrospectively analyzed all available eligible patient records from the study period, resulting in a total sample size of 4,200 patients. As this represents a complete census of all eligible records rather than a sample drawn from a larger population, formal sample size or power calculations were not performed. However, the large number of records included (N=4,200) provides a robust dataset that is likely to ensure sufficient statistical power to detect meaningful differences and associations, while also enhancing the precision and reliability of the study.

Data Collection and Variables

Data extracted from the records included:
* Day of the week the patient was seen
* Sex of the patient
* Visit status (**New** = first visit for treatment; **Recall** = scheduled follow-up visit)
* Monthly distribution of visits

The specific variables used in the analysis were:
* Mean number of patients per week (a numerical documentation of patient load)
* Day of the week
* Sex of the patient
* Visit status (new or recall)
* Monthly distribution of visits

Data Management & Bias Control

Data were cleaned and entered into SPSS version 26.0. A frequency table was generated for all categorical variables. Descriptive statistics (means, standard deviations, frequencies) were used to summarize overall patient attendance patterns. A Generalized Linear Mixed Model (GLMM) was employed to assess the effect of weekday on the number of patients, accounting for repeated measures across time. The model used a Gaussian (normal) distribution with an identity link function. Weekday was entered as a fixed effect, and the week number was included as a random intercept (`(1 | Week)`) to account for clustering. This model was justified as the outcome variable (number of patients per day) was treated as a continuous measure, and the model outputs (estimated means, standard errors, and confidence intervals) are consistent with a Gaussian model.

Analysis of Variance (ANOVA) was used to compare mean patient loads across time periods and weekdays. Post hoc pairwise comparisons were conducted using the Least Significant Difference (LSD) test to identify specific differences between weekdays. The LSD test was selected for its higher power to detect true differences, acknowledging its increased risk of Type I error compared to more conservative methods. The Shapiro-Wilk test was used to test normality ($W = 0.972$, $p = 0.112$), and Levene's test was used to assess homogeneity of variance ($F = 1.842$, $p = 0.089$). A p-value < 0.05 was considered statistically significant. To minimize errors from data entry, holiday closures, and missing data, a standard protocol was applied to all record retrievals to ensure that only patients with complete records were included. Selection bias was considered negligible since only 150 of over 4,350 records were excluded due to incomplete entries. The large sample size and 16-month study duration were deemed robust enough to minimize the potential effects of holidays and other closures.

Ethical Considerations

Ethical approval was sought and obtained from the Research and Ethics Committee of the University of Benin Teaching Hospital (Approval Number: ADM/E24/A/VOL.VII/148312990).

RESULTS

A total of 4,350 records were retrieved from the secondary data of the conservative dental clinic. Of these, 150 case notes did not contain all the data of interest and were therefore excluded. The study results are based on the analysis of 4,200 records. Of the analyzed records, 58.1% of patients were female, yielding a male-to-female ratio of approximately 1:1.39. There were 1,632 new patients and 2,568 recall visits, reflecting the chronic nature of the conditions managed in the clinic (Table 1a).

Table 1a. Baseline Characteristics of the Study Population (N=4200)

Characteristic	Number (n)	Percentage (%)
Sex		
Female	2441	58.1
Male	1759	41.9
Visit Type		
New Patients	1632	38.9
Recall Visits	2568	61.1

Percentages are based on the total study population (N=4200).

Weekday Distribution of Patient Visits

The highest total attendance was recorded on Tuesday (866), followed closely by Wednesday (863), while Friday had the lowest attendance (794). Monday had the highest average patient load (mean = 16.02, SD = 0.812). This was followed by Tuesday (mean = 14.20), Wednesday (mean = 13.92), and Thursday (mean = 13.84). Friday recorded the lowest average (mean = 12.81, SD = 0.736). (Table 1b).

Table 1b: Distribution of total number of patients seen by time periods (week days)

Weekday	No. of week-days	Total No. of Patients/week-day	Minimum No./week-day	Maximum No./week-day	Mean No. of Patients/week-day	SD	95% CI
Monday	52	833	2	26	16.02*	.812	15.80-16.24
Tuesday	61	866	3	25	14.20	.623	14.04-14.36
Wednesday	62	863	1	29	13.92*	.700	13.75-14.09
Thursday	61	844	3	24	13.84*	.657	13.67-14.01
Friday	62	794	1	26	12.81*	.736	12.63-12.99
Total	298	4200	1	29	14.09	.318	14.03-14.15

* = statistically significant difference from Friday (LSD post hoc, $p<0.05$). Post-hoc tests revealed that Monday's attendance was significantly higher than all other weekdays (all $p < 0.05$). A significant linear trend was identified ($F = 8.567$, $p = 0.004$), suggesting weekday attendance follows a consistent pattern. GLMM analysis confirmed a significant effect of weekday on attendance ($\beta = -1.72$, SE = 0.63, 95% CI: -2.95 to -0.49, $p = 0.006$ for Friday relative to Monday). A Generalized Linear Mixed Model (GLMM) was fitted with weekday as a fixed effect and week as a random effect. Patient attendance on Mondays was significantly higher compared to other weekdays ($p < 0.01$). The ICC was 0.66, indicating that 66% of the variance in patient numbers was attributable to week-level clustering. Marginal and conditional R^2 were 0.27 and 0.81, respectively, suggesting that the model explains a substantial portion of variance when accounting for both fixed and random effects. (Table 2).

Table 2: Model: Patients per_day ~ Weekday + (1 | Week)

Fixed Effects	Estimate (β)	Std. Error	95% CI	p-value
Intercept (Monday)	16.02	0.81	[14.43, 17.61]	<0.001
Tuesday	-1.82	0.64	[-3.07, -0.57]	0.004
Wednesday	-2.10	0.70	[-3.47, -0.73]	0.003
Thursday	-2.18	0.66	[-3.47, -0.89]	0.001
Friday	-3.21	0.74	[-4.66, -1.76]	<0.001

ANOVA analysis showed a statistically significant difference in patient attendance across weekdays ($F = 2.559$, $p = 0.039$). There was a statistically significant difference in the number of patients across weekdays, $F(4, 293) = 2.559$, $p = 0.039$, with a small effect size (partial $\eta^2 = 0.034$). The test for linearity was significant ($F(1, 293) = 8.567$, $p = 0.004$), suggesting a linear trend in patient attendance across weekdays. (Table 3).

Table 3: Analysis of Variance (ANOVA) for Total Number by Day

Source	Sum of Squares	df	Mean Square	F	p-value	partial η^2
Between Groups						
(Combined)	302.114	4	75.529	2.559	.039	0.034
Linearity	252.891	1	252.891	8.567	.004	
Deviation from Linearity	49.223	3	16.408	.556	.645	
Within Groups	8649.255	293	29.520			
Total	8951.369	297				

Monthly Distribution of Visits

Attendance varied across months, with May 2022 (398 patients) being the highest and June 2023 (159 patients) the lowest (Table 4).

Table 4: Distribution of total number of patients seen by time periods (months)

Month	No. of days /month	Total No. of Patients/ month	Minimum No./ month	Maximum No./ month	Mean No. of Patients/month	SD	95% CI
May-2022	20	398	10	26	19.90	4.678	17.75-22.05
Jun-22	21	378	10	29	18.00	4.583	16.04-19.96
Jul-22	19	288	7	22	15.16	5.069	12.78-17.54
Aug-22	23	383	7	26	16.65	4.987	14.61-18.69
Sep-22	22	300	4	22	13.64	4.895	11.59-15.69
Oct-22	19	298	8	23	15.68	3.987	13.89-17.47
Nov-22	21	327	5	24	15.57	5.278	13.31-17.83
Dec-22	20	284	5	22	14.20	4.607	12.18-16.22
Jan-2023	20	247	4	21	12.35	3.897	10.64- 14.06
Feb-23	20	214	3	16	10.70	3.526	9.15-12.25
Mar-23	23	276	4	19	12.00	4.210	10.28-13.72
Apr-23	16	240	7	21	15.00	4.676	12.71-17.29
May-23	18	166	1	17	9.22	5.397	6.75-11.69
Jun-23	17	159	1	20	9.35	4.987	6.98-11.72
Jul-23	19	242	2	22	12.74	6.261	9.93-15.55
Total	**298**	**4200**	**1**	**29**	**14.09**	**5.490**	13.5914.59

The mean monthly attendance was 14.09 ± 5.49. ANOVA revealed significant differences across months ($F = 7.898$, $p < 0.001$) with both linear and nonlinear trends (Table 5).

Table 5: Analysis of Variance (ANOVA) for Total Number by Time

Source	Sum of Squares	df	Mean Square	F	Sig.
Between Groups					
(Combined)	2514.859	14	179.633	7.898	<.001
Linearity	1730.934	1	1730.934	76.106	<.001
Deviation from Linearity	783.924	13	60.302	2.651	.002
Within Groups	6436.510	283	22.744		
Total	8951.369	297			

partial $\eta^2 = 0.274$

A visual trend in monthly patient numbers is shown in Figure 1, illustrating peaks in May and August 2022 and dips in July and September 2022, and February 2023.

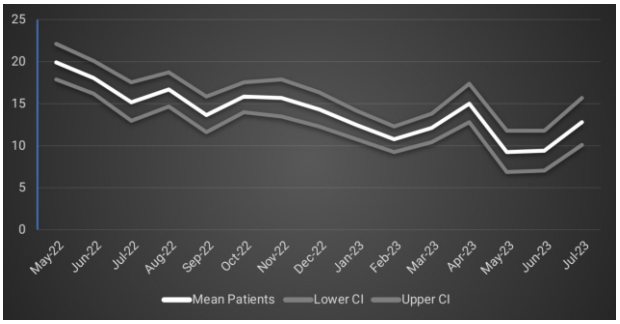


Figure 1: total number of patient over time (by month)

Sex Distribution

As seen in Figure 2, female patients consistently outnumbered males on all weekdays ($p < 0.001$, Chi-square test for independence). For instance: On Tuesday, 512 females and 354 males attended. On Friday, 463 females and 331 males were seen.

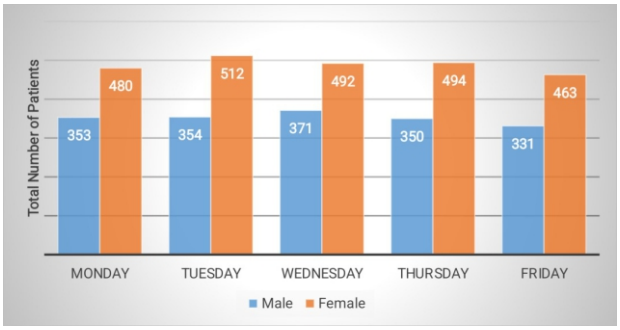


Fig 2-weekly distribution of total male and female patients visits by day

Visit Type by Weekday

Across all weekdays, recall visits outnumbered new visits, with the largest gap on Wednesday (544 recall vs. 319 new) and the smallest on Friday (519 recall vs. 275 new) (Figure 3). The consistency of this trend across the week reinforces the clinic's role in ongoing dental care.

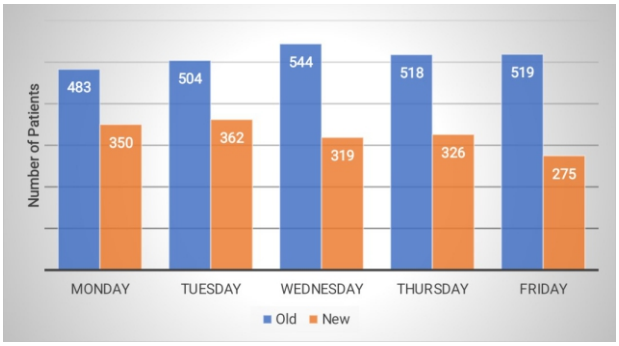


Figure 3: Distribution of total number of patients by visits and days of the week (number of new patients vs returning patients across weekday)

Time Trends

Figure 4 displays weekday-specific attendance trends over time, with an overall decline from May 2022 to early 2023, followed by relative stabilization. Mondays started with consistently high attendance, declining gradually and leveling off in mid-2023.

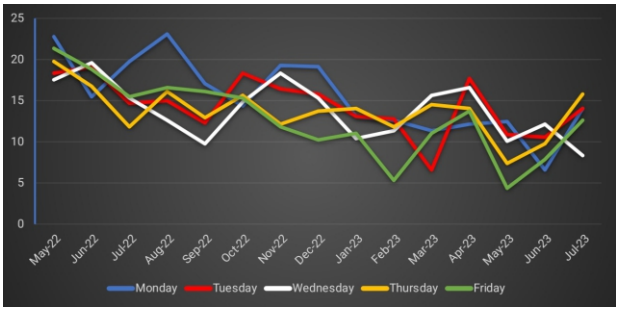


Figure 4: Time trend /fluctuation of total number of patients by days of the week

DISCUSSION

Findings: This study provides valuable insights into the weekly pattern of demand for restorative dental treatment in a tertiary dental clinic. Several significant patterns were identified in relation to patient demographics, visit types, and temporal variations. Female patients attended clinics more frequently than males, aligning with observations from previous studies conducted in Nigerian tertiary clinics,[9,15,16] indicating that women tend to exhibit stronger healthcare-seeking behavior. Studies from Romania[17] and Saudi Arabia[18] have also reported higher dental service utilization among females. Notably, the analysis of patient distribution by sex across weekdays showed that female patients consistently outnumbered males, with Tuesdays recording the highest attendance for both sexes and Fridays having the lowest. This persistent sex-based disparity aligns with prior findings suggesting that females are more inclined to regularly seek healthcare services.[15] The higher frequency of follow-up (recall) visits over new cases reflects the chronic nature of oral diseases such as dental caries and periodontitis, which require ongoing care and make up restorative dental care.[19] This pattern is corroborated by observations from studies[4,5,8] in both Nigerian and global literature.

The weekday variation in attendance, with Mondays and Tuesdays being the busiest days and Fridays the least busy, suggests that patients prefer to seek dental treatment earlier in the week. This trend may be driven by patients who experience discomfort over the weekend seeking prompt treatment once the clinic reopens. Scheduling appointments early in the week also allows patients to avoid disruptions to their work or academic schedules later on, contributing to the initial surge in demand. By addressing dental issues early, patients can focus on other priorities without the burden of pending treatment. This trend aligns with findings from both local and international studies on dental service scheduling preferences.[6,10]

The observed monthly fluctuations in patient volume, with peaks in May and August 2022 and a dip in June 2023, are likely influenced by factors such as holidays, academic calendars, and economic conditions. Specifically, patients may seek dental care during school breaks or when they have more disposable income, while holidays and extreme weather may cause a decline in visits. These fluctuations reflect the complex interplay between patient needs and external factors and represent seasonal trends commonly observed in healthcare settings. The statistically significant variation in attendance across both weekdays and time periods (ANOVA, $p < 0.05$) reinforces the need for clinics to align staffing and resource allocation with demand patterns. More personnel may be needed on high-attendance days to minimize wait times and optimize patient flow.

Awotile et al. found that weekday and monthly variations significantly influenced restorative dental care delivery in a Nigerian tertiary clinic, corroborating the present study's findings.[9] Several factors might contribute to these variations: weekday variations might be due to work/school schedules and patient preferences, while monthly variations could be influenced by academic calendars, holidays,

and economic conditions. The similarity between our findings and those of Awotile et al. (2022)[9] suggests this may be a pattern in some Nigerian tertiary clinics. Understanding these patterns can help clinics optimize scheduling, staffing, and resource allocation. In contrast, research from Europe and the Middle East has shown that accessibility and patient convenience, rather than day-of-week, were stronger predictors of clinic attendance. [17,18] These differences underscore the need for context-specific operational planning in dental service delivery.

Implications: This study's findings have significant implications for clinic operations, workforce planning, and resource management in dental healthcare services. By pinpointing high and low demand days, clinics can optimize staff allocation and appointment scheduling, ultimately enhancing service delivery and patient satisfaction. This strategic approach enables clinics to respond dynamically to fluctuating demand, ensuring more efficient and effective care.[14]

The findings can inform healthcare delivery in other Nigerian and low- and middle-income country (LMIC) settings in several ways:

- Resource allocation: Understanding patterns of restorative care demand across weekdays can help healthcare facilities optimize resource allocation
- Staffing and scheduling: Clinics should allocate more staff on high-demand days like Monday and Tuesday
- Healthcare planning: The findings can inform healthcare planning and policymaking in LMICs, enabling more effective distribution of resources and services
- Clinic managers can use weekday trends to develop appointment systems that reduce crowding and improve service efficiency
- The study can serve as a reference point for comparative analysis with other LMICs
- The findings can help contextualize healthcare delivery in LMICs, taking into account local factors that influence healthcare utilization and access
- The results can inform the development of targeted interventions aimed at improving restorative care access and utilization in similar settings
- Public health messaging can encourage patient flow on low-demand days (e.g., Fridays) to improve utilization balance

Trade-Offs (Limitations): This study has several limitations that impact the generalizability of its findings. The single-center design, reliance on secondary data, and focus on a single dental clinic in Nigeria may limit applicability to other settings or countries. The quantitative approach did not capture qualitative factors such as patients' age, motivation, and socioeconomic variables, which could provide valuable insights. Data quality might have been compromised due to potential entry errors or missing records. The absence of data on appointment cancellations and no-shows restricts a comprehensive understanding. Potential biases include weekday closures, holiday periods, and data entry issues. Weekday closures and holidays can impact attendance patterns, with clinics potentially operating reduced services or being closed on certain days, artificially lowering patient numbers. Future research should consider a multicenter approach and mixed-methods design to address these limitations.

Take-Home (Conclusion): Patient demand for restorative dental treatment is not uniform throughout the week. Mondays and Tuesdays experience the highest volume of patients, with Friday being the least busy. Clinics must tailor staffing and appointment scheduling to align with these predictable attendance patterns.

Expectations for Future Research: Future studies should include multi-center data from diverse geographical settings to improve external validity. Incorporating qualitative methods may provide deeper insights into behavioral and motivational factors influencing clinic attendance. Seasonal trends and the impact of public holidays on service demand should also be investigated.

Recommendations

Dental institutions should increase staffing levels on high-demand days (Monday-Tuesday) to reduce wait times. They should also encourage utilization of low-demand days (e.g., Fridays) through public health messaging or flexible scheduling.

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Availability of data: The datasets used during this study are available on reasonable request..

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