Awareness, Appointment System Features, Patient Waiting Time, and Health Care Access at Niger Delta University Teaching Hospital, Okolobiri, Bayelsa State, Nigeria

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ABSTRACT

Efficient patient scheduling is a foundational element of health care delivery in tertiary institutions, where patient volumes are often substantial and resources constrained. This study assessed patients' awareness of the hospital appointment system, its operational features, and its effect on patient waiting time and access to health care services at Niger Delta University Teaching Hospital (NDUTH), Okolobiri, Bayelsa State, Nigeria. A descriptive research design was adopted. The population comprised 15,479 patients across four departments (General Outpatient Department, Medical Outpatient Department, Surgical Outpatient Department, and Obstetrics and Gynaecology). A sample of 390 patients was determined using the Taro Yamane (1967) formula, with proportionate allocation across departments using stratified and simple random sampling. Data were collected using a structured questionnaire and analysed using descriptive statistics and simple linear regression at the 0.05 level of significance. Findings revealed high patient awareness of the appointment system (mean = 2.94) and generally favourable perceptions of its operational features (mean = 2.86), including ease of booking and appointment communication, though only 2.55 (of 4.00) patients confirmed receiving reminders before scheduled appointments. Patients generally agreed that the system reduced waiting time (mean = 2.86) and improved access to health care services (mean = 2.63). Regression analysis showed that the appointment system significantly predicted patient waiting time ($R^2 = 0.460$, $\beta = 0.678$, $p < 0.05$) and access to health care services ($R^2 = 0.023$, $\beta = 0.152$, $p < 0.05$). The study concludes that the appointment system meaningfully improves operational efficiency at NDUTH but that appointment-reminder communication and access-related functions represent the weakest links in the system's current operation, and recommends targeted investment in automated reminder systems and flexible scheduling options to further reduce waiting time and expand access to care.

Keywords: Hospital appointment system, patient awareness, waiting time, access to healthcare, NDUTH, Nigeria

INTRODUCTION

Efficient health care delivery constitutes a foundational element of any operational health system and holds particular significance within tertiary health care institutions, where patient volumes are frequently substantial and available resources may be constrained. A key factor influencing effective health care delivery is the hospital appointment system, which denotes the organised mechanism by which patients are assigned to receive medical services at designated times. This mechanism is intended to optimise patient movement through the system, decrease waiting durations, increase the productivity of health care personnel, and ultimately enhance patient satisfaction and health-related outcomes.

In this study, the pathway to health care access is conceptualised as follows: Awareness → Appropriate use of the appointment system → Efficient operations → Reduced waiting time → Improved health care access. When patients understand the appointment system and the hospital provides functional, reliable booking and patient-flow processes, demand can be distributed more evenly across available staff and time slots. This, in turn, increases the likelihood that patients receive services promptly, conveniently, and with less congestion. Online and flexible scheduling systems may further enhance access by allowing patients to book, cancel, or reschedule appointments with greater ease. Outpatient waiting times remain a major challenge in health systems seeking to achieve universal health coverage.

Evidence indicates that many patients experience prolonged delays in accessing specialist care, particularly in public health systems, owing to capacity constraints and high demand. As a result, patients are frequently placed on waiting lists unless they can access private care. Extended waiting times for non-emergency services may adversely affect health outcomes and reduce the expected benefits of care. Access to specialist outpatient clinics commonly requires a referral from a general practitioner, after which referrals are triaged according to clinical urgency to prioritise appointments and manage waiting times effectively (Naiker et al., 2018).

Naiker et al. (2018) further emphasise that resource alignment, operational efficiency, and streamlined outpatient processes are central strategies for reducing waiting times and improving timely access to specialist services. The appointment system represents an essential organisational approach within health care facilities that coordinates patient visits, streamlines operational procedures, and elevates the efficiency of service provision (Seyedi et al., 2024). It assigns particular time intervals to patients, thereby minimising waiting periods, improving the utilisation of resources, and increasing patient contentment.

A hospital appointment system may assume multiple configurations, including walk-in arrangements (first-come, first-served basis), pre-scheduled appointments (designated time slots), and, more contemporarily, digital or web-based appointment platforms (Seyedi et al., 2024). Health care appointment systems are categorised into in-person and online modalities (Paré et al., 2021). In-person systems require patients to physically attend a facility to schedule appointments, frequently occurring in rural or less-developed regions with restricted technological access (Moulaei et al., 2023), while online systems enable patients to arrange appointments remotely through digital interfaces, offering convenience and round-the-clock availability but facing barriers related to digital literacy and technology access (Kitsios et al., 2023).

Patient waiting time has two important dimensions, namely indirect waiting time (the period between requesting an appointment and the actual appointment date) and direct waiting time (the period spent at the hospital between the scheduled/arrival time and the time the patient is seen). Long indirect waiting time may delay diagnosis, treatment, follow-up, or specialist consultation. Long direct waiting times impose financial costs, lost work time, travel burdens, fatigue, and dissatisfaction and may discourage patients, particularly those with limited income or long travel distances, from seeking care when needed (Isaruk et al., 2024). Thus, waiting time is a practical indicator of the accessibility, responsiveness, and patient-centredness of health care services, according to Noeske et al. (2026).

Equally, patient waiting duration represents a critical performance indicator in assessing the quality of health care delivery, influencing patient satisfaction, health outcomes, and system-wide efficiency (Mostafa & El-Atawi, 2024), while access to care concerns the ease with which patients can obtain timely health care services once they seek them. In developing nations such as Nigeria, challenges including overcrowding, insufficient staffing, inadequate infrastructure, and inefficient administrative procedures frequently impede optimal health care delivery. These challenges are particularly apparent in tertiary institutions such as the Niger Delta University Teaching Hospital (NDUTH), Okolobiri, which functions as a major referral centre and training institution for future health professionals in Bayelsa State and beyond.

This study examines how NDUTH's existing appointment system shapes patient awareness, is operationally structured, and influences waiting time and access to care. The foundational dimensions of appointment-system performance before its effects on satisfaction and perceived health care-delivery effectiveness, examined in a companion study, can be meaningfully interpreted. NDUTH's specific institutional profile is directly relevant to interpreting this study's findings. As a teaching hospital, NDUTH must balance clinical

service delivery with academic and research obligations, a dual mandate that can complicate scheduling in ways not present in purely service-orientated facilities: consultant availability may be constrained by teaching commitments, and outpatient clinics may need to accommodate student and resident training alongside routine patient care.

Statement of the Problem

The scheduling mechanism for hospital visits constitutes a fundamental component of medical service frameworks, particularly within tertiary care settings, where it facilitates the orderly movement of patients, curbs facility overcrowding, and guarantees prompt accessibility to clinical services. Nevertheless, numerous tertiary medical institutions across Nigeria, including NDUTH, have historically operated with limited structured scheduling mechanisms, frequently resulting in operational inefficiencies. Within NDUTH, persistent difficulties continue to surround visit scheduling and the regulation of patient movement: informal accounts and grievances submitted by patients frequently emphasise recurring problems, including extensive waiting lines, insufficient notification regarding scheduled visit times, and rigid procedures for rearranging cancelled or deferred consultations.

Currently, there exists a notable absence of empirical investigations that examine the operational effectiveness of hospital scheduling mechanisms specifically, patient awareness of the system, its operational features, and its measurable effects on waiting time and access to care within the specific environment of NDUTH or comparable medical centres located in Nigeria's South-South geopolitical zone. This deficiency in scholarly evidence complicates the ability of institutional leadership to design and execute focused strategies intended to enhance patient coordination and optimise service efficiency. This study addresses that gap.

Objectives of the Study

The objectives of this study were to:

- examine the level of awareness of patients' hospital appointment systems at NDUTH;
- assess the effect of the hospital appointment system on patient waiting time at NDUTH; and
- determine how the appointment system influences access to care for patients.

Research Questions

- What is the level of awareness of patients' hospital appointment systems at NDUTH?
- How does the hospital appointment system affect patient waiting time at NDUTH?
- To what extent does the appointment system influence patients' access to healthcare services?

Hypotheses

The following null hypotheses were tested at the 0.05 level of significance:

H_{01}: There will be no significant relationship between the hospital appointment system and patient waiting time.

H_{02}: The hospital appointment system will not significantly affect access to healthcare services.

LITERATURE REVIEW

Concept of Appointment Systems

In health care settings, appointment scheduling (AS) is crucial for maximising resource utilisation and reducing patient wait times. Effective scheduling services face obstacles in outpatient scheduling. To increase

service quality, hospitals must locate bottlenecks and adjust to various patient needs using decision support systems. Improving access to healthcare facilities is always a top goal despite financial constraints because prompt service is essential for patient safety and general satisfaction (Ala & Chen, 2022). Therefore, a hospital appointment system improves access to health care not merely by assigning patients a date or time, but by combining patient awareness with efficient operational procedures that minimise both indirect and direct waiting times.

Operational features are the practical components that enable an appointment system to function effectively. These features include booking procedures, appointment-slot allocation, clinic start times, staff availability, reminder systems, cancellation and rescheduling processes, patient-record retrieval, triage arrangements, and coordination among registration, consultation, laboratory, pharmacy, and billing units (Ansell et al., 2017). Appointment scheduling is vital to healthcare management because it significantly affects patient experience and service efficiency. Efficient scheduling reduces waiting times, thereby improving patient satisfaction and minimising frustration associated with delays. It also improves access to care, particularly for patients with urgent needs, by facilitating timely appointments and better use of providers' schedules.

In addition, an effective scheduling system can reduce missed appointments through automated reminders, enhance communication between patients and health care providers, and support personalised care through integration with electronic health records. An appointment system in health care is a structured scheduling mechanism that manages how patients access medical services by setting specific times for consultations, procedures, or other interactions with health care providers (Paré et al., 2021). It serves as a critical link between healthcare demand and supply, aiming to improve efficiency, accessibility, and patient satisfaction. Its main goals are to reduce waiting time, improve clinical workflow efficiency, minimise overcrowding, streamline service delivery, and ensure equitable access to health care services by prioritising fairness in patient scheduling (Niu et al., 2023).

The distinction between these goals – efficiency (reducing waiting time and overcrowding), accessibility (ensuring equitable access), and satisfaction maps directly onto the structure of this study and its companion analysis: the present article examines the efficiency- and accessibility-related goals of appointment systems specifically (Research Questions 1 through 4), while the companion study examines the satisfaction-related goal and its downstream connection to perceived health care delivery effectiveness. This division reflects a deliberate analytical choice: rather than treating "appointment system performance" as a single undifferentiated construct, this two-part study structure allows each of the distinct goals identified in the foundational appointment-systems literature to be examined with the depth and specific empirical attention it warrants.

Appointment scheduling systems in healthcare manage service access in clinics and hospitals. They encompass unplanned contacts like walk-ins and emergencies in addition to scheduled appointments for primary care, specialty treatments, and elective operations. Therefore, the goal of a well-designed appointment system is to give every patient prompt and easy access to medical services. Variability in patient arrival times and patient preferences are two examples of issues that affect these systems' performance. Gupta and Denton (2008) stated that healthcare delivery systems present scheduling issues and considerations, including criteria for prioritising access to treatments. Efficient scheduling is critical for guaranteeing timely access, which influences medical outcomes and patient satisfaction. Awareness, operational features, patient waiting time, and access to health care services are interrelated components that determine the overall effectiveness of a hospital appointment system. In essence, patients must know about and understand the system before its operational benefits can reduce waiting time and improve timely access to care (Betancor et al., 2025).

Major types of appointment systems include the fixed appointment system, where patients are scheduled for specific time slots with a defined consultation period, creating predictable patient flow but limited adaptability for walk-ins or emergencies (Niu et al., 2023); the walk-in system, which eliminates prior booking requirements and offers flexibility but can lead to long waiting times and crowding (Wing & Vanberkel, 2022); the open booking (open access) system, which allows patients to visit during a broad time window but may lead to overcrowding at peak times (Ala & Chen, 2022); the wave and modified wave appointment systems, which stagger multiple patients within an hour to balance workload and reduce idle time; the double booking

system, which schedules multiple patients for the same slot to offset anticipated no-shows, at the risk of increased patient dissatisfaction; and the triage appointment system, which prioritises appointments based on medical need (Ala et al., 2021).

An effective appointment system comprises several components: a scheduling platform (digital or manual, ranging from paper ledgers to advanced systems such as OpenEMR, Epic, Meditech, and Hospital Management Information Systems); trained staff management for handling bookings and triage (Norwood, 2023); multi-modal communication channels, including phone calls, SMS/email reminders, and online portals to reduce missed appointments (Mia et al., 2022); clear policy frameworks for cancellations and rescheduling (Ala & Chen, 2022); and structured feedback mechanisms for continuous system refinement. Common operational challenges include no-shows and late arrivals, overbooking, systemic technological barriers contributing to a digital divide (particularly for rural, elderly, or low-literacy populations), and poor communication about appointment changes or delays.

A well-designed appointment system aligns appointment slots with the anticipated consultation duration, patient category, provider capacity, and daily service demand. Overall, investment in robust scheduling systems improves the quality of patient care, increases patient satisfaction, and promotes the efficient use of healthcare resources. Evidence from a systematic review further indicates that scheduling interventions, prompt clinic start times, appropriate appointment allocation, and effective time-management practices can reduce outpatient waiting times (Srivastava et al., 2024).

On the other hand, poorly coordinated operational processes can create delays even when a patient has booked an appointment. For example, late arrival of clinicians, understaffing, long registration procedures, variable consultation times, equipment shortages, and bottlenecks in supporting departments may extend the time between a patient's scheduled appointment and actual consultation. Awareness refers to patients' knowledge that an appointment system exists, its purpose, the available booking channels, the required procedures, and the benefits of booking before visiting the hospital. When awareness is high, patients are more likely to use the system appropriately, arrive at scheduled times, comply with registration requirements, and reschedule or cancel appointments they cannot keep (Betancor et al., 2025).

However, in low-resource countries, patient access to health care is often hampered by several challenges, including a shortage of providers, ineffective scheduling systems, high no-show rates, administrative bottlenecks, and limited use of technology. These factors contribute to longer appointment waiting times and may reduce the timely availability of health care services. Low awareness can further exacerbate these problems by causing patients to bypass appointment procedures and present as walk-ins, often at peak periods, which may produce overcrowding, uneven patient arrivals, missed appointment slots, and delays in receiving services, thereby weakening access even where an appointment system is available (McIntyre & Chow, 2020).

To address these challenges, health care providers can implement patient education, improved scheduling systems (including online appointment scheduling), telemedicine services, patient engagement technologies, process optimisation through Lean Six Sigma, and team-based care (Isaruk et al., 2021). Additional measures include digital check-in options, flexible scheduling, secure messaging services, and telehealth for follow-up consultations. Evidence on online scheduling supports these measures: online appointment scheduling can improve flexibility, reduce unused appointment slots, and lower no-show rates in some settings, while SMS reminders are particularly useful for reducing missed appointments in hospital settings. By addressing these issues, physicians in ambulatory and outpatient settings can reduce appointment waiting times, improve patient engagement, and enhance access to healthcare services (Betancor et al., 2025).

These component-level distinctions matter directly for interpreting this study's findings. NDUTH's comparatively strong performance on scheduling-platform and staff-management-related items (Table 3: booking method ease, mean = 2.97; clear time/date communication, mean = 2.97) suggests these particular components are functioning adequately, while the comparatively weak performance on the communication-channel component specifically (reminders, mean = 2.55) isolates precisely which of the several components identified in this conceptual review requires the most urgent attention, a level of diagnostic precision that a single, undifferentiated "Is the appointment system working?" assessment would not provide. Emerging

technology-driven innovations are reshaping appointment systems globally, including Electronic Appointment Systems (EAS) integrated with electronic medical records; Mobile Health (mHealth) applications enabling 24/7 self-service booking; Artificial Intelligence and Machine Learning tools that predict peak patient load times and identify high-risk no-show patients; and Telemedicine, which expanded significantly following the COVID-19 pandemic by enabling remote consultation booking.

Theoretical Framework: The Donabedian Model

This study is anchored on the Donabedian Model, developed by Avedis Donabedian, a widely used framework for evaluating healthcare quality (Yang et al., 2026), consisting of three components: structure, process, and outcome (Tossaint-Schoenmakers et al., 2021). Structure refers to the design and availability of the appointment system, including technology, staff, and policies directly corresponding to this article's examination of patients' awareness of the system and its operational features (Research Questions 1 and 2).

Process focuses on how appointments are scheduled, managed, and communicated to patients, as well as how patients adhere to appointment times and access care — corresponding to this article's examination of waiting time and access to care (Research Questions 3 and 4). Outcome measures the impact of the appointment system on patient satisfaction, quality of care, and overall health care delivery effectiveness the focus of this study's companion analysis.

The Donabedian Model is relevant to this study because it provides a comprehensive lens through which the entire health care delivery system can be analysed, linking appointment-system structure and process directly to downstream outcomes. Applied here, the model predicts that deficiencies at the structure level (for instance, low awareness or poorly designed booking methods) will propagate through the process level (longer waiting times, restricted access) and ultimately affect outcomes (satisfaction, perceived effectiveness) a sequential logic this article's four research questions are designed to trace empirically, from awareness and features through to waiting time and access.

It is worth noting that the Donabedian Model has itself been subject to methodological critique in recent health-services literature, particularly regarding the assumption of strict linearity between structure, process, and outcome (Tossaint-Schoenmakers et al., 2021). Critics note that outcomes can, in practice, feed back into structural conditions for instance, patient dissatisfaction with waiting times (an outcome) may prompt hospital management to revise scheduling policy (a structural change), creating a cyclical rather than strictly linear relationship.

This study's application of the model is consistent with this more nuanced reading: rather than assuming that structure and process alone determine outcome in one direction, this article and its companion analysis of satisfaction and perceived effectiveness together allow the full structure-process-outcome cycle to be examined, with the present article establishing the structure and process baseline against which the companion study's outcome-level findings can be interpreted.

Empirical Review

Küçük et al. (2021) evaluated Turkey's central physician appointment system (CPAS) and found utilisation increased from 22.1% (2013) to 34.6% (2018), predominantly via the Hello 182 call centre, though challenges regarding sustainability persisted due to insufficient policy support. Luxenburg et al. (2022), studying Israel's public health care system, found extended waiting durations constituted a major obstacle, with younger and more educated patients demonstrating greater proactivity in securing appointments, while vulnerable populations encountered navigation difficulties a finding with direct relevance to this study's demographic profile (Section 4.2), which similarly draws on a predominantly young adult sample.

This pattern — in which younger, more digitally and educationally engaged patients navigate appointment systems more readily than older or more vulnerable populations — carries a specific interpretive caution for this study's own findings. Because NDUTH's sample, like Luxenburg et al.'s (2022) Israeli sample, is heavily weighted toward the 26–35 age group (74.4% of respondents, Table 1), the generally favourable awareness

and access findings reported here may not fully generalise to older or less digitally engaged patient populations who are underrepresented in this study's achieved sample despite the proportionate stratified sampling procedure employed (Section 3.3), which stratified by department rather than by age or digital-literacy level. Future research disaggregating findings by age group would help determine whether NDUTH's appointment system serves all patient demographics equally well, or whether consistent with the international pattern identified in the literature older and less digitally engaged patients experience the system differently from the pattern reported in this study's aggregate findings.

Atinga et al. (2021), studying appointment scheduling in Ghana, found that system effectiveness in enhancing satisfaction and adherence depended on compatibility with patient preferences and ease of use, with complexity discouraging utilisation directly relevant to this study's examination of appointment-booking ease (Table 2). Paré et al. (2021) reported that family medicine clinics in Quebec achieving deeper integration of Medical Appointment Scheduling (MAS) systems with electronic medical records delivered more available and accessible care, though smaller clinics faced adoption barriers, while Steenland et al. (2019) documented that a simple appointment intervention in Mozambican maternity clinics reduced antenatal waiting times by 100 minutes and increased completion of four or more visits by 16 percentage points.

Cao et al. (2011) found that web-based booking at a Chinese hospital reduced total waiting time and improved satisfaction, yet digital literacy gaps and trust concerns limited uptake, while Free et al. (2013), in a systematic review, concluded that SMS reminders modestly improve appointment attendance (RR = 1.06) a finding directly relevant to this study's observation that only 2.55 of 4.00 patients at NDUTH confirmed receiving appointment reminders (Table 2), identifying a specific, comparatively low-cost intervention opportunity.

Collectively, this body of empirical evidence spanning Turkey, Israel, Ghana, Canada, Mozambique, and China demonstrates that appointment-system effectiveness is shaped by a consistent set of structural and process factors: ease of use and compatibility with patient preferences (Atinga et al., 2021), depth of integration with broader health records infrastructure (Paré et al., 2021), and the specific presence or absence of systematic reminder communication (Free et al., 2013; Cao et al., 2011).

This convergence across geographically diverse health care systems lends confidence that the specific structural and process factors examined in this study awareness, operational features, and their downstream effects on waiting time and access represent genuinely consequential, rather than merely locally idiosyncratic, determinants of appointment-system performance, and that the recommendations advanced in Section 7 are grounded in a well-established, cross-nationally replicated evidence base rather than NDUTH-specific speculation alone.

METHODOLOGY

Research Design

The study adopted a descriptive research design, appropriate for analysing the current state of a hospital's appointment system and assessing patient perceptions through a single-point-in-time data collection from a cross-section of patients, providing a snapshot of the system's functioning and impact on healthcare delivery.

Population of the Study

The population of this study comprised all patients aged 18 years or older attending NDUTH, totalling 15,479 patients across four departments, as provided by the records unit of NDUTH (2025): General Outpatient Department (GOPD, 13,626), Medical Outpatient Department (MOPD, 681), Surgical Outpatient Department (SOPD, 113), and Obstetrics and Gynaecology (O&G, 1,059).

Sample Size and Sampling Techniques

The sample size was determined using the Taro Yamane (1967) formula for finite populations: $n = N / [1 + N(e^2)]$, yielding a sample of 390 participants. Proportionate allocation across departments was calculated using

ni = (N/Ni) × n, yielding: GOPD = 343, MOPD = 17, SOPD = 3, and O&G = 27, for a total of 390. Data were collected using a stratified sampling technique, with all four departments selected as strata, and a simple random sampling procedure used to identify available and willing individuals within each stratum.

Research Area/Setting

The study was conducted at Niger Delta University Teaching Hospital (NDUTH), a tertiary health care institution in Bayelsa State, Nigeria, that offers specialised medical services and serves as a referral centre for secondary and primary health care facilities, using both manual and electronic appointment scheduling systems.

Data Collection Instrument

The instrument used was a self-developed structured questionnaire titled "Questionnaire on the Assessment of Hospital Appointment System on Healthcare Delivery in Niger Delta University Teaching Hospital Okolobiri, Bayelsa State, Nigeria."

The instrument comprised demographic data and sections addressing awareness of the appointment system, its features and operational structure, and its effect on waiting time and access to care, which this article draws on directly. Items were closed-ended, following a modified four-point Likert-type rating scale.

Data Collection Procedure

A letter of introduction was used to obtain permission from hospital authorities. Data collection was conducted by the researchers with the assistance of three trained research assistants, who helped distribute and collect the completed questionnaires from patients on the spot.

Validity and Reliability of the Instrument

The questionnaire draft was presented to two statisticians, measurement and evaluation officers and other experts to ensure content and face validity, with feedback incorporated to improve instrument quality. Reliability was assessed using 39 patients at another similar hospital, not part of the main study sample, with collected data subjected to the Cronbach's Alpha method to determine internal consistency.

Method of Data Analysis

Completed questionnaires were coded and analysed using descriptive statistics (frequency counts, percentages, means, and standard deviations) to summarise demographic data and responses to research questions, and simple linear regression to test the study's hypotheses at the 0.05 level of significance.

Ethical Considerations

Ethical approval was obtained from the School's Ethics Committee. Respondents were approached through the Medical Director of NDUTH, informed of the study's aims and benefits, and participation was voluntary, with consent forms provided to affirm respondents' willingness to participate. Equally, no conflict of interest in this study.

RESULTS

Demographic Characteristics of Respondents (N = 390)

Table 1: Distribution of Respondents by Selected Demographic Variables

Variable	Category	Frequency	Percentage (%)
Gender	Male	208	53.3

	Female	182	46.7
Age (years)	15–25	52	13.3
	26–35	290	74.4
	36–45	36	9.2
	46–55 / 56+	12	3.0
Marital Status	Single	336	86.2
	Married	42	10.8
Visit Frequency	Regular	244	62.6
	Occasional	113	29.0
	First time	33	8.5
Residence (LGA)	Yenagoa	287	73.6
	Southern Ijaw	28	7.2
Department Visited	Primary Care	320	82.1
	Medicine	40	10.3
Appointment Type Used	Scheduled	290	74.4
	Walk-in	100	25.6

Source: Researchers' Field Survey, 2026

The sample was 53.3% male and 46.7% female, with the 26–35 age group most heavily represented (74.4%), consistent with the economically active adult population most likely to seek routine outpatient care. The majority of respondents were single (86.2%) and regular visitors to NDUTH (62.6%), with most residing in Yenagoa (73.6%), the state capital nearest the hospital. The Primary Care department accounted for 82.1% of visits, and the majority of respondents (74.4%) used scheduled appointments rather than walk-in access (25.6%), providing a substantial base of appointment-system users on which to assess the research questions below.

Level of Awareness of the Hospital Appointment System

Table 2: Mean Ratings on Awareness of the Hospital Appointment System (N = 390)

Item	Mean	SD	Remark
Aware that NDUTH has an appointment system	3.06	0.42	High
Informed about the system by staff, posters, or other sources	2.93	0.44	High
Familiar with different appointment booking methods	2.85	0.43	High
Personally used one or more appointment methods	2.91	0.42	High
Average Mean	2.94		High

Source: Researchers' Field Survey, 2026

Table 2 reveals that the majority of participants are well-informed about the hospital's appointment system, with an average mean score of 2.94, indicating high awareness (decision rule: 1.00–2.49 = Low, 2.50–4.00 = High).

Operational Features of the Appointment System

Table 3: Mean Ratings on Features and Operational Structure of the Appointment System (N = 390)

Item	Mean	SD	Remark
Used one or more available booking methods	2.96	0.50	Agree
Booking method was easy and straightforward	2.97	0.53	Agree
Clearly informed of appointment time and date after booking	2.97	0.53	Agree
Received a reminder before scheduled appointment	2.55	0.74	Agree
System is well-organized and effectively coordinated	2.87	0.52	Agree
Average Mean	2.86		Agree

Source: Researchers' Field Survey, 2026

Table 3 shows that respondents generally found the system familiar, user-friendly, and clearly communicated, with an average mean score of 2.86. Notably, the reminder item recorded the lowest mean (2.55) and the highest standard deviation (0.74) among the five items, indicating both weaker average performance and more variable patient experience specifically around appointment reminders, relative to the other operational features assessed.

Effect on Patient Waiting Time

Table 4: Mean Ratings on Effect of the Appointment System on Patient Waiting Time (N = 390)

Item	Mean	SD	Remark
Arrived on the exact scheduled appointment date	2.96	0.50	Agree
Attended to within a reasonable time after arrival	2.89	0.63	Agree
Waiting time was shorter due to scheduled appointment	2.79	0.59	Agree
Satisfied with time waited before receiving care	2.80	0.70	Agree
Average Mean	2.86		Agree

Source: Researchers' Field Survey, 2026

Table 4 shows an average mean score of 2.86, indicating that participants generally agreed that the appointment system positively affects their waiting time experience.

Influence on Access to Health care Services

Table 5: Mean Ratings on Influence of the Appointment System on Access to Health care Services (N = 390)

Item	Mean	SD	Remark
System has made it easier to access healthcare services	3.28	0.68	Agree
Denied access to care due to lack of prior appointment	1.89	0.91	Disagree
System has reduced unnecessary hospital visits	2.64	0.67	Agree
System effectively accommodates urgent/emergency cases	2.72	0.67	Agree
Average Mean	2.63		Agree

Source: Researchers' Field Survey, 2026

Table 5 shows an average mean score of 2.63, indicating a generally positive impact of the appointment system on healthcare access. Notably, respondents disagreed (mean = 1.89) that they had been denied access to care due to lack of a prior appointment, suggesting the system does not function as an exclusionary barrier for patients without pre-booked appointments a favourable finding for equitable access.

Test of Hypotheses

Table 6: Regression Summary Hospital Appointment System, Patient Waiting Time, and Access to Health care Services

Outcome Variable	R	R^2	F	df	β	Sig.	Decision
Patient waiting time	0.678	0.460	330.804	1, 388	0.678	0.000	Reject H_{01}
Access to healthcare services	0.152	0.023	9.209	1, 388	0.152	0.003	Reject H_{02}

Source: Researchers' Field Survey, 2026

Table 6 shows that the hospital appointment system significantly predicted patient waiting time, accounting for 46.0% of its variance ($F(1,388) = 330.804$, $p = 0.000 < 0.05$; $\beta = 0.678$), and access to health care services, accounting for 23.0% of its variance ($F(1,388) = 9.209$, $p = 0.003 < 0.05$; $\beta = 0.152$). Both null hypotheses were therefore rejected. The considerably stronger relationship with waiting time ($R^2 = 0.460$) relative to access ($R^2 = 0.023$) indicates that the appointment system's structural and process features, as measured in this study, are a substantially more powerful lever for managing waiting time than for expanding access to care a distinction with direct implications for how NDUTH should prioritise future system enhancements, discussed in Section 5.

DISCUSSION OF FINDINGS

Awareness and Operational Features

Patients at NDUTH demonstrate high awareness and generally positive perceptions of the hospital's appointment system, citing its intuitive design and reasonably clear communication of appointment times. This aligns with Atinga et al. (2021), who emphasised that system compatibility with patient preferences and

ease of use fosters engagement and treatment adherence. However, the comparatively low mean score for appointment reminders (2.55, the lowest of all operational-feature items) indicates a specific, identifiable weakness in the system's communication infrastructure. This finding is consistent with Free et al. (2013), whose systematic review found that SMS reminders modestly but consistently improve appointment attendance, suggesting that NDUTH's current reminder mechanism whatever form it currently takes is underperforming relative to what the wider evidence base suggests is achievable through more systematic reminder protocols.

It is worth noting that the reminder item also recorded the highest standard deviation (0.74) among all items examined in Tables 2.2 through 2.5, indicating substantially more variable patient experience on this specific item than on any other measured in this study. This pattern is consistent with an unevenly or inconsistently applied reminder practice some patients may be receiving reminders through informal or ad hoc channels (a phone call from a familiar staff member, for instance) while others receive none at all rather than a uniformly weak or uniformly absent reminder system across the entire patient population. This distinction matters for the recommendation advanced in Section 7: the goal is not necessarily to introduce reminder communication where none currently exists, but to standardise and systematise a practice that may already exist informally and inconsistently for a subset of NDUTH's patients.

Effect on Patient Waiting Time

The appointment system significantly predicts patient waiting time, accounting for 46.0% of its variance a strong predictive relationship consistent with evidence linking structured or technology-enhanced scheduling to substantial delay reductions (Atnafu et al. 2015; Li et al., 2021). This finding is further corroborated by Mardiah and Basri (2013), who emphasised that poorly managed appointment schedules result in inefficient resource utilisation and prolonged waiting periods, underscoring that the reverse a well-managed schedule, as NDUTH's patients broadly report experiencing supports smoother hospital operations and reduced service bottlenecks.

The magnitude of this relationship ($R^2 = 0.460$) is particularly notable when considered alongside the standardised beta coefficient reported in the regression analysis ($\beta = 0.678$), among the strongest single-predictor relationships reported anywhere in this study's four hypothesis tests (Table 3.6 and its companion analysis). This suggests that, among the various structural and process factors that could in principle influence patient waiting time at a tertiary Nigerian teaching hospital, the appointment system as operationalised in this study's instrument (Section 3.5) captures a substantial share of the factors patients themselves associate with their waiting-time experience lending confidence to the practical recommendations for further strengthening the system's process-level features advanced.

Influence on Access to Health care Services

The appointment system also significantly predicts access to health care services, though the relationship ($R^2 = 0.023$) is considerably weaker than that observed for waiting time ($R^2 = 0.460$). This asymmetry is a specific and actionable finding: it suggests that while NDUTH's appointment system functions well as a waiting-time management tool, its capacity to expand access to care for instance, by reaching patients who might otherwise not seek care at all, or by accommodating urgent walk-in needs remains comparatively underdeveloped. This is broadly consistent with Paré et al. (2021), who found that deeper integration of scheduling systems with electronic medical records was necessary to meaningfully expand care accessibility, beyond what basic scheduling functionality alone can achieve, and suggests that NDUTH's system, in its current form, may be functioning more as an internal patient-flow management tool than as a mechanism for actively expanding the hospital's reach to underserved patients.

This interpretation is further supported by the specific pattern of responses within Table 3.5 itself: while patients broadly agreed that the system made accessing care easier (mean = 3.28, the highest-rated item in the table) and firmly disagreed that they had been denied care for lack of an appointment (mean = 1.89), they were comparatively more equivocal about whether the system reduced unnecessary visits (mean = 2.64) or effectively accommodated urgent and emergency cases (mean = 2.72). This suggests that NDUTH's system

succeeds at its core access function not excluding patients who lack a prior appointment but has more room to grow in the specific functions of visit-reduction efficiency and emergency-case accommodation.

CONCLUSION

This study assessed patients' awareness of NDUTH's hospital appointment system, its operational features, and its effects on patient waiting time and access to healthcare services. The findings show that patients are highly aware of the appointment system (mean = 2.94) and generally view its operational features favourably (mean = 2.86), though appointment-reminder communication is a specific, identifiable weakness. The system significantly and substantially reduces patient waiting time ($R^2 = 0.460$) and significantly, though more modestly, improves access to healthcare services ($R^2 = 0.023$). The considerable asymmetry between the system's strong effect on waiting time and its comparatively weak effect on access indicates that NDUTH's appointment system currently functions more effectively as an internal patient-flow management tool than as a mechanism for actively expanding healthcare access to the broader patient population. Addressing this asymmetry alongside the specific reminder-communication weakness identified in Section 4.3 represents the most direct, evidence-based path toward strengthening the system's overall contribution to healthcare delivery at NDUTH.

The comparative international analysis in Section 2.4 further situates these findings within a broader pattern: the magnitude of NDUTH's waiting-time improvement is consistent with intervention effects documented in Ethiopian, Mozambican, and Chinese health care settings, while the comparatively modest access effect mirrors Luxenburg et al.'s (2022) finding that access barriers can persist even within functioning appointment systems. This consistency suggests that NDUTH's experience, while specific to its own institutional context, reflects patterns common to appointment-system implementation in resource-constrained healthcare settings more broadly, lending confidence to the recommendations advanced.

Recommendations

Based on the findings of this study, the following recommendations are made:

- NDUTH should maintain and strengthen patient awareness campaigns regarding the appointment system, given the already-high but improvable awareness levels documented in this study.

- The hospital should introduce automated SMS or call-based reminder systems, directly addressing the lowest-rated operational feature identified in this study (appointment reminders, mean = 2.55), consistent with international evidence that such reminders modestly but reliably improve attendance and patient experience.

- Given the weaker relationship between the appointment system and access to care relative to waiting time, NDUTH should specifically evaluate and strengthen the system's capacity to accommodate urgent and emergency cases and to actively expand reach to underserved patients, rather than assuming that waiting-time improvements alone will translate into broader access gains.

- The hospital should introduce flexible scheduling options, including staggered and off-peak appointments, to further reduce waiting time and improve access for patients with time or transportation constraints.

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