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The role of health information systems (HIS) in improving administrative efficiency in Zawia dental clinics

A study submitted in partial fulfillment of the requirements for obtaining a Master's degree in Health Administration

Student preparation:

Rabia Ajeelani AL-Ahreash

Supervised by:

Dr. Nada Abdullah Hweissa

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دور نظم المعلومات الصحية (HIS) في تحسين الكفاءة الإدارية في عيادات الأسنان الزاوية

ربيعة الجيلاني الأحرش

ملخص الدراسة

تناولت هذه الدراسة دور نظم المعلومات الصحية (HIS) في تحسين الكفاءة الإدارية في عيادات الأسنان بمدينة الزاوية في ليبيا، وذلك لمعالجة أوجه القصور الناتجة عن الاعتماد على الأنظمة الورقية اليدوية، هدفت الدراسة إلى تقييم واقع العمليات الإدارية الحالية، واستكشاف أثر نظم المعلومات في أتمتة سير العمل وتحسين التنسيق بين الأقسام، وتحديد العوامل المحفزة والمعيقة لتبني هذه النظم. اعتمدت الدراسة المنهج الوصفي التحليلي، حيث تم جمع البيانات عبر استبانة وُزعت على عينة عشوائية طبقية قوامها 95 فرداً من الكوادر الطبية والإدارية والفنية في سبع عيادات عامة وخاصة، ولتحليل البيانات، استُخدمت الحزمة الإحصائية (SPSS) عبر الإحصاء الوصفي، واختبارات (T-test)، وتحليل التباين والانحدار. أظهرت النتائج وجود عدم رضا عن الأنظمة اليدوية الحالية مقابل تفاؤل كبير بقدرة نظم المعلومات على تقليل أوقات المعاملات وتحسين استمرارية رعاية المرضى، وخلصت الدراسة إلى أن العوامل التنظيمية—مثل دعم الإدارة، والموارد المالية، وجاهزية البنية التحتية—تعد محددات أكثر أهمية لنجاح التطبيق مقارنة بالتدريب الفردي للموظفين فقط، وبناءً عليه أوصت الدراسة بتبني استراتيجية تنفيذ مرحلية تعطي الأولوية لتهيئة البنية التنظيمية والتقنية لضمان تحول رقمي مستدام.

The role of health information systems (HIS) in improving administrative efficiency in Zawia dental clinics

By

Rabia Ajeelani AL-Ahreash

Abstract

This study investigates the role of Health Information Systems (HIS) in enhancing administrative efficiency within dental clinics in Zawia City, Libya, addressing critical inefficiencies caused by reliance on manual, paper-based processes. The research aims to assess the current state of administrative operations, evaluate the potential impact of HIS on-workflow automation and interdepartmental coordination, and identify key facilitators and barriers to adoption. Adopting a descriptive analytical methodology, data were collected via a structured questionnaire administered to a proportionate stratified random sample of 95 participants, including dentists, administrators, and support staff across seven public and private clinics. Data were analyzed using SPSS software, utilizing descriptive statistics, t-tests, ANOVA, and regression analysis. The findings revealed significant dissatisfaction with current manual systems alongside a strong consensus that HIS implementation would substantially reduce processing times and improve patient care continuity. Crucially, the study concluded that organizational factors—such as management support, financial resources, and infrastructure readiness—are more significant predictors of successful adoption than staff training alone. Consequently, the study recommends a phased implementation strategy that prioritizes securing organizational readiness and infrastructural investment before technical deployment to ensure sustainable digital transformation.

Dedication

To the soul of my father, who ascended to his Creator, leaving in the heart an indelible mark of majesty and reverence. May Allah bestow upon him His boundless mercy and grant him the vastness of His paradise.

To my mother, the inexhaustible wellspring of tenderness, the light that has illuminated life's pathways. May Allah preserve her, prolong her days, and bless her with health and well-being.

To my husband **Haitham**, companion of the journey and partner in life, who has been a pillar of strength in adversity and a steadfast support through every phase. To him, I extend my deepest affection and appreciation.

To the fruits of my being: **Al-Hassan**, **Al-Hussein**, **Elias**, and **Iyad**, who are extensions of the soul and hopes for the future; and to my beloved daughters: **Mayar**, **Maram**, and **Ayla**, who have adorned life with joy and beauty. I beseech Allah to make them a treasure for the nation and a source of delight to their parents.

To my brothers and sisters, with whom I have shared life's voyage, who have been the finest support and most pleasant companionship in this transient world.

To my colleagues, with whom I have walked the path of knowledge and learning, sharing the burdens of the journey and the fruits of endeavor. To them, I offer my profound gratitude and appreciation.

This work is a fruit born of your collective cultivation, and it would not have reached completion without Allah's grace first, then your prayers and support.

Allah is the ultimate guide to righteousness

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Finally, I thank **all who extended assistance** in preparing this thesis, through consultation, advice, or encouraging words.

To all these individuals: May Allah reward you with the finest recompense and bless your knowledge and work.

Allah is the guardian of success

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LIST OF ABBREVIATIONS

AHP ..... Analytic Hierarchy Process

ANOVA ..... Analysis of Variance

CAQH ..... Council for Affordable Quality Healthcare

CI ..... Confidence Interval

DCMS ..... Dental Clinic Management System

DOHCC ..... Dental and Oral Health Care Center

EDR ..... Electronic Dental Record

EFA ..... Exploratory Factor Analysis

EHR ..... Electronic Health Record

GIS ..... Geographic Information Systems

HIMSS ..... Healthcare Information and Management Systems Society

HIS ..... Health Information System(s)

HMIS ..... Health Management Information System

IT ..... Information Technology

KPI ..... Key Performance Indicator

K-S ..... Kolmogorov-Smirnov

LISREL ..... Linear Structural Relations

MIS ..... Management Information System

PDSA ..... Plan-Do-Study-Act

PRISMA-ScR ..... Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews

SMS ..... Short Message Service

SPSS ..... Statistical Package for the Social Sciences

TOPSIS ..... Technique for Order of Preference by Similarity to Ideal Solution

TQM ..... Total Quality Management

UI ..... User Interface

UX ..... User Experience

VIF ..... Variance Inflation Factor

WHO ..... World Health Organization

CHAPTER ONE: INTRODUCTION

1.1 Introduction

The contemporary healthcare landscape has witnessed a paradigm shift toward digitalization, with health information systems (HIS) increasingly recognized as essential tools for modernizing administrative operations and elevating service delivery standards. These systems, which encompass electronic health records, appointment management platforms, and integrated communication networks, have fundamentally altered how healthcare facilities manage information, allocate resources, and coordinate care. The transformation is particularly evident in specialized settings such as dental clinics, where administrative efficiency directly correlates with patient satisfaction, treatment outcomes, and overall operational sustainability.

Global evidence consistently demonstrates that healthcare facilities adopting HIS experience measurable improvements in workflow efficiency and administrative performance. Al-Arabi et al. (2025) documented substantial enhancements in decision-making processes and reductions in patient waiting times following HIS implementation in various clinical settings. Similarly, Peñafiel et al. (2024) illustrated how digital health systems facilitate seamless interdepartmental coordination, enabling healthcare teams to access comprehensive patient information instantaneously and collaborate more effectively across service units. These improvements extend beyond mere operational convenience; they represent fundamental shifts in how healthcare organization's function, moving from fragmented, paper-based processes toward integrated, data-driven approaches that support both administrative staff and clinical practitioners.

However, the successful integration of health information systems is not universal, and considerable disparities exist between different geographical regions and healthcare contexts. In Libya specifically, the healthcare sector continues to grapple with systemic challenges that impede technological advancement and administrative modernization. Alsuwani and Asawani (2024) highlighted the prevalence of fragmented data management practices across Libyan healthcare facilities, where information silos

prevent effective communication between departments and hinder comprehensive patient care. These fragmentation issues are compounded by persistent reliance on manual, paper-based administrative processes that are inherently prone to errors, delays, and inefficiencies. Ben Rabaa and Al-Bousifi (2019) further documented the limited technological infrastructure and adoption rates within the Libyan healthcare system, noting that many facilities lack both the hardware resources and organizational readiness necessary for successful digital transformation.

Within this broader national context, dental clinics in Zawia face particular administrative challenges that directly compromise their operational effectiveness and service quality. Current practices in these facilities involve predominantly manual systems for appointment scheduling, patient record maintenance, and resource management. This approach generates numerous inefficiencies: appointment conflicts occur regularly due to inadequate scheduling coordination; patient records are difficult to locate, update, or share between departments; and resource allocation decisions are made without access to comprehensive data regarding patient flows, treatment patterns, or equipment utilization. These administrative bottlenecks create cascading effects throughout the clinic operations, resulting in prolonged patient wait times, incomplete medical histories that compromise treatment planning, and suboptimal use of available clinical resources.

The potential for health information systems to address these specific challenges is well-established in the broader healthcare informatics literature. Chew et al. (2024) demonstrated that digitizing administrative workflows through HIS implementation can substantially reduce processing times, minimize human errors in data entry and retrieval, and create transparent, auditable trails for all administrative activities. Their research showed that automated appointment systems virtually eliminated scheduling conflicts while providing patients with convenient booking options and automated reminders. Pérez Ayala et al. (2016) extended this analysis by examining how HIS facilitate real-time communication between different service areas, enabling reception staff, dental practitioners, and administrative personnel to access synchronized information about patient appointments, treatment histories, and billing status. This integration eliminates redundant data entry, reduces information inconsistencies, and allows all team members to work from a single, continuously updated source of truth.

Despite these documented benefits, the pathway to successful HIS implementation is fraught with challenges that must be carefully navigated. Technical infrastructure represents one significant barrier, particularly in resource-constrained settings where reliable electricity, internet connectivity, and computer hardware cannot be taken for granted. Beyond infrastructure, however, human and organizational factors often prove even more critical to implementation success or failure. Souisi's (2013) case study of healthcare technology adoption in Libya identified insufficient staff training as a primary obstacle, noting that many healthcare workers lack the digital literacy skills necessary to effectively utilize new systems. This training gap generates resistance to change, as staff members understandably feel anxious about technologies they do not understand or feel competent to use. Additionally, organizational cultures that have long relied on paper-based processes may harbor institutional resistance, with established workflows and power structures potentially threatened by new digital systems that alter information access patterns and decision-making hierarchies.

The implementation challenges extend to technical considerations as well. Healthcare facilities must address concerns about data security and patient privacy, ensuring that digital systems comply with relevant regulations and protect sensitive medical information from unauthorized access or breaches. System interoperability presents another technical hurdle, as new HIS platforms must often integrate with existing equipment, software, or regional health information networks. Without careful planning and adequate technical support, these integration challenges can result in fragmented digital systems that paradoxically create new information silos rather than breaking down existing ones.

Given these complex considerations, the present study addresses a critical gap in understanding how health information systems can be effectively implemented within the specific context of Zawia's dental clinics. While previous research has established the general benefits of HIS and documented challenges in the Libyan healthcare system broadly, there remains limited empirical evidence examining the particular administrative needs, constraints, and opportunities within dental clinic settings in this region. Dental clinics present unique operational characteristics—including high patient volumes, diverse treatment modalities, specialized equipment requirements, and complex scheduling needs—that distinguish them from other healthcare facilities and warrant focused investigation.

This research therefore aims to systematically evaluate the potential role of health information systems in enhancing administrative efficiency within Zawia's dental clinics through multiple analytical lenses. First, the study will comprehensively assess current administrative practices and identify specific inefficiencies that impact clinic operations and patient experiences. Second, it will examine stakeholder perspectives—including administrative staff, dental practitioners, and information technology personnel—regarding the perceived benefits, concerns, and prerequisites for successful HIS adoption. Third, the research will identify both facilitating factors that could accelerate implementation success and barriers that must be overcome or mitigated. Finally, based on these empirical findings, the study will propose evidence-based, context-appropriate strategies for HIS integration that account for the specific circumstances, resources, and organizational cultures present in Zawia's dental clinics.

The significance of this research extends beyond the immediate practical implications for the participating clinics. At a regional level, the findings will contribute valuable insights to the limited but growing body of literature on healthcare informatics in Libya and North Africa more broadly. By documenting both successes and challenges in a real-world implementation context, this study will provide other healthcare facilities in similar settings with practical guidance grounded in empirical evidence rather than theoretical assumptions. For policymakers, the research will illuminate the infrastructural investments, training programs, and regulatory frameworks necessary to support widespread HIS adoption across the healthcare sector. For clinic administrators and healthcare managers, the study will offer actionable recommendations regarding change management strategies, staff engagement approaches, and phased implementation pathways that maximize the likelihood of successful technology integration.

Ultimately, this investigation is motivated by the recognition that administrative efficiency is not merely a matter of organizational convenience but rather a fundamental determinant of healthcare quality and patient outcomes. When administrative systems function smoothly, clinical staff can devote their time and attention to patient care rather than paperwork; patients experience shorter wait times and more coordinated treatment; and clinic resources can be allocated strategically based on accurate data rather than guesswork. By rigorously examining how health information systems can catalyze these improvements within Zawia's dental clinics, this study aspires to contribute

meaningfully to the ongoing transformation of healthcare delivery in Libya, supporting the development of more efficient, effective, and patient-centered dental care services.

1.2 Study Problem

The dental clinics in Zawia operate within an administrative environment marked by systemic inefficiencies that fundamentally compromise both the quality of patient care and the overall operational effectiveness of these healthcare facilities. At the heart of these challenges lies a reliance on outdated, predominantly manual administrative processes that have failed to keep pace with the evolving demands of modern healthcare delivery. The current state of administrative operations in these clinics is characterized by several interconnected problems that collectively create a cycle of inefficiency, frustration, and suboptimal outcomes for both healthcare providers and patients.

Foremost among these challenges is the fragmented nature of administrative workflows, where different departments and functions operate largely in isolation from one another, utilizing disparate systems and procedures that inhibit seamless coordination. Reception staff maintain appointment schedules using methods that may not be visible or accessible to clinical personnel in real-time, leading to confusion about patient arrivals, treatment room availability, and provider schedules. Patient records, when kept manually in physical files, must be physically transported between departments, creating delays, risks of loss or misfiling, and situations where critical patient information is unavailable precisely when it is needed for clinical decision-making. Billing and payment processing occur through separate channels that may not communicate effectively with clinical documentation, resulting in discrepancies, incomplete records, and administrative burden on staff who must reconcile information across multiple sources.

The continued reliance on manual record-keeping systems amplifies these fragmentation issues while introducing additional layers of inefficiency and risk. Paper-based patient files are vulnerable to physical deterioration, loss, or damage, threatening the integrity and continuity of patient care records over time. Handwritten documentation is susceptible to legibility issues, with healthcare providers sometimes unable to decipher previous entries, potentially leading to misinterpretation of treatment histories, medication records, or allergy information. The physical storage requirements for paper records consume valuable clinic space and necessitate extensive filing

systems that become increasingly unwieldy as patient volumes grow. Moreover, retrieving historical patient information from manual archives is time-consuming, often requiring staff to search through multiple file cabinets or storage areas, which delays patient appointments and frustrates both clinic personnel and waiting patients.

Interdepartmental communication suffers significantly under these manual, fragmented systems. When critical information about patient status changes, appointment modifications, or treatment plan updates must be conveyed verbally or through physical notes passed between departments, numerous opportunities arise for miscommunication, delays, or complete failure of information transfer. A patient arriving for a follow-up appointment may discover that laboratory results sent to one department have not reached the treating dentist; urgent messages about appointment cancellations may not reach all relevant staff members in time; treatment plans developed collaboratively may not be documented in ways that all team members can access and reference. These communication breakdowns not only waste valuable staff time as personnel attempt to locate information or clarify miscommunications, but also directly impact patient experiences and clinical outcomes when care coordination fails.

The extensive body of research examining healthcare administration has conclusively documented how such outdated systems generate measurable negative consequences for healthcare facilities. Souisi (2013) conducted a detailed examination of Libyan healthcare settings and identified how traditional paper-based administrative approaches create fundamental barriers to data accessibility, particularly when multiple providers need simultaneous or sequential access to the same patient information. The study documented numerous instances where critical patient data remained effectively invisible to healthcare providers who needed it, not because the information did not exist, but because it was trapped in physical files located elsewhere or recorded in formats that were not readily searchable or retrievable. Bakhakhsha et al. (2018) extended this analysis by quantifying the error rates associated with manual data entry and record-keeping, demonstrating that transcription errors, omissions, and inconsistencies occur with far greater frequency in paper-based systems compared to digital alternatives. Their research revealed that these errors are not merely administrative inconveniences but pose genuine risks to patient safety and care quality, as decisions made based on incomplete or inaccurate information can lead to inappropriate treatments, medication errors, or missed diagnoses.

The problem of poor interdepartmental coordination documented in these studies manifests in numerous tangible ways within dental clinic operations. Treatment planning for complex cases requiring input from multiple specialists becomes cumbersome when patient information cannot be easily shared and reviewed collaboratively. Infection control protocols and sterilization records, which must be meticulously maintained and readily accessible for both patient safety and regulatory compliance, become difficult to track and verify in paper-based systems. Inventory management for dental supplies and medications suffers when ordering decisions are made without real-time visibility into current stock levels, usage patterns, or upcoming patient needs, resulting in either wasteful overstocking or critical shortages that disrupt clinical operations.

These operational challenges do not exist in isolation but are deeply embedded within broader systemic issues affecting Libya's healthcare infrastructure. Alsuwani and Asawani (2024) provided a comprehensive assessment of technological readiness across the Libyan healthcare sector, revealing that many facilities, including dental clinics, lack the fundamental infrastructure necessary to support modern health information systems. Their findings documented inadequate computer hardware, unreliable internet connectivity, insufficient electrical power stability, and absence of technical support personnel capable of maintaining digital systems. These infrastructure deficits create a challenging environment for technology adoption, where even well-designed health information systems may struggle to function reliably if the underlying technological foundation cannot support them consistently.

Ben Rabaa and Al-Bousifi (2019) complemented this infrastructure analysis by examining the human and organizational dimensions of technology adoption in Libyan healthcare. Their research identified pervasive gaps in digital literacy among healthcare workers, many of whom have limited experience with computers and information systems in their professional roles. This skills deficit creates understandable anxiety and resistance when new technologies are proposed, as staff members worry about their ability to master unfamiliar systems, fear making errors that could harm patients or compromise their professional standing, and resent the additional time and effort required to learn new procedures while continuing to meet their existing job responsibilities. Organizational cultures that have long operated successfully with traditional methods may view technology adoption skeptically, questioning whether the

disruption and investment required will genuinely yield benefits commensurate with the costs and challenges involved.

The funding constraints facing healthcare facilities in Libya add another layer of complexity to the technology adoption challenge. Health information systems represent significant capital investments, requiring not only the initial purchase of software and hardware but also ongoing expenses for system maintenance, upgrades, technical support, and staff training. In resource-constrained environments where clinics struggle to meet basic operational needs—maintaining equipment, purchasing supplies, and paying staff salaries—allocating substantial funds to administrative technology systems may seem like a luxury rather than a necessity. Decision-makers must weigh these technology investments against other pressing needs, often without clear evidence regarding the return on investment or assurance that implementation will succeed given local constraints.

Despite these formidable challenges, compelling evidence from diverse healthcare contexts demonstrates that health information systems, when properly implemented, can fundamentally transform administrative operations and overcome many of the inefficiencies plaguing traditional manual systems. Chew et al. (2024) conducted empirical studies showing how HIS automation of routine administrative tasks—appointment scheduling, patient registration, billing processing, and records management—dramatically reduces the time staff must devote to these activities while simultaneously improving accuracy and consistency. Their research documented specific examples where automated appointment systems reduced scheduling conflicts by over ninety percent, where electronic prescribing systems virtually eliminated medication errors stemming from illegible handwriting, and where digital billing integration reduced payment processing times from weeks to days. These improvements freed healthcare workers to focus their expertise and attention on direct patient care activities rather than administrative paperwork, improving both job satisfaction and care quality.

Pérez Ayala et al. (2016) examined the communication and coordination benefits enabled by integrated health information systems, demonstrating how shared digital platforms create unprecedented visibility into clinic operations for all staff members. When everyone works from the same real-time information system, the fragmentation

that plagues manual operations disappears. Reception staff can see which examination rooms are occupied and which providers are running behind schedule, allowing them to manage patient flow proactively. Clinical staff can instantly access complete patient histories, laboratory results, imaging studies, and previous treatment notes without waiting for physical files to be retrieved. Administrative personnel can generate reports on clinic utilization, patient demographics, treatment patterns, and financial performance based on comprehensive, accurate data rather than time-consuming manual compilation of partial information from disconnected sources.

However, the translation of these documented benefits to the specific context of Zawia's dental clinics remains uncertain and largely unexplored. While international research establishes that health information systems can improve administrative efficiency in healthcare settings generally, significant questions persist regarding whether and how these improvements can be realized in environments characterized by limited technological infrastructure, constrained financial resources, and variable organizational readiness. The existing literature provides limited guidance on adapting HIS implementation strategies to contexts where electricity supply may be unreliable, internet connectivity inconsistent, technical support scarce, and staff digital literacy levels modest. Moreover, the specific barriers and facilitators that will influence implementation success in Zawia's dental clinics have not been systematically identified or examined.

This gap between theoretical potential and practical reality creates substantial uncertainty for decision-makers contemplating health information system adoption. Clinic administrators must determine whether HIS investment represents a viable pathway to improved efficiency or an unrealistic aspiration given local constraint. They need to understand what infrastructure prerequisites must be satisfied before implementation can proceed, what training investments will be necessary to prepare staff adequately, what implementation approaches are most likely to succeed, and what measurable improvements in administrative efficiency can realistically be expected. Without empirical evidence addressing these questions within their specific operational context, decisions about HIS adoption rest on speculation rather than informed analysis.

Furthermore, the factors that will determine whether HIS implementation succeeds or fails in this particular environment require careful investigation. Success likely depends

on complex interactions among technological factors such as system design and infrastructure reliability, organizational factors such as leadership commitment and change management approaches, human factors such as staff attitudes and digital competencies, and contextual factors such as regulatory requirements and financial constraints. Understanding which factors exert the strongest influence on outcomes, how these factors interact, and how barriers can be mitigated or overcome is essential for developing realistic implementation strategies that maximize the probability of success while minimizing risks of failure and wasted investment.

The stakes of these decisions extend beyond mere administrative convenience. Inefficient administrative systems directly affect patient care quality, clinical staff satisfaction, operational costs, and the clinic's capacity to fulfill its healthcare mission effectively. Conversely, well-functioning health information systems have the potential to transform clinic operations in ways that benefit all stakeholders—patients experience shorter wait times and better coordinated care, clinical staff work more efficiently with better access to information, administrative personnel spend less time on repetitive manual tasks, and clinic leadership gains visibility into operations that enables evidence-based decision-making and continuous improvement. Consequently, this study addresses the following central question: How can health information systems be effectively integrated into Zawia's dental clinics to improve administrative efficiency, and what factors influence their successful implementation?

1.3 Definitions and Operational terms

1. Health Information Systems (HIS)

According to WHO (2008: 3), a Health Information System is defined as “a health information mechanism concerned with collecting, processing, analyzing, and disseminating data for use in decision-making within the healthcare system”.

It is also defined by Torab-Miandoab et al. (2023: 2) as “an integrated system that combines data collection, processing, reporting, and the use of information necessary to enhance the effectiveness and efficiency of health services through better management at all levels”.

Furthermore, Herawati et al. (2022: 2) defined it as “a means of supporting health services provided to the community by delivering complete, accurate, and timely information through a well-organized and well-implemented system”.

In addition, Winter et al. (2023: 38) described it as “a set of interrelated components that gather data, information, and knowledge from healthcare environments to support decision-making and improve healthcare applications”.

Finally, Al-Mousawi (2016: 33) defined HIS as “a technical and organizational structure that encompasses elements of data collection, storage, analysis, and dissemination to support the management of the health system and its operational and administrative processes.”

It is operationally known: Digital platforms and software solutions used in dental clinics to manage patient data, administrative tasks, and clinical workflows. In this study, HIS encompasses appointment scheduling systems, electronic health records, and internal communication tools that replace or supplement manual paper-based processes.

2. Administrative Efficiency

Gunuboh (2023: 112) defined administrative efficiency as “the ratio between inputs and outputs, or efforts and results, or expenditures and revenues, within the context of public administration”.

Likewise, Song & Shi (2019: 295) described it as “the ability to utilize organizational resources optimally in order to achieve administrative objectives within the university system”.

According to do Amaral (2011: 14), administrative efficiency is “a concept that encompasses the adequacy and efficiency of administrative performance in fulfilling its intended purpose, not merely reducing cost but achieving results effectively”.

Similarly, Bakare et al. (2024: 129) defined it as “the capacity of coordinated and streamlined administrative processes to support the growth and development of small and medium enterprises through efficient management of resources and decisions”.

Finally, Epizitone et al. (2023: 3) defined administrative efficiency as “the effectiveness achieved by management in realizing its goals using minimal waste, time, and effort, with optimal workflow and resource allocation.”

It is operationally known: The effectiveness and speed of administrative processes in dental clinics, operationally measured by processing times for tasks, quality of interdepartmental coordination, information flow between departments, and overall workflow productivity. This will be assessed through staff perceptions captured via the five-point Likert scale questionnaire.

3. Electronic Health Records (EHR)

As stated by Atherton (2011: 8), Electronic Health Records are “long-term electronic records of patient health information generated during one or more encounters in any care delivery setting, including demographics, notes, medical history, medications, vital signs, and laboratory data”.

Similarly, Modi and Feldman (2022: 3) defined EHRs as “electronic records of patient health information created from one or more encounters in any healthcare environment, including demographic data, medications, laboratory tests, imaging reports, and more”.

Additionally, Hoover (2017: 9) noted that EHRs are “electronic records that contribute to improving informational accuracy, supporting clinical decision-making, and enhancing access to information for continuity of care.”

It is operationally known: Digital versions of patient dental charts and medical histories that can be accessed, updated, and shared across departments within the clinic. In this context, EHRs specifically refer to computerized patient documentation systems that facilitate information sharing and continuity of care.

4. Staff Training and Technical Support

According to Bygholm (2018: 192), staff training is “a recognized key activity in the implementation of health information systems, focusing on content, organization, and pedagogical methodology; the transfer of knowledge and skills alone is insufficient, as continuous training tied to work practice is required while considering individual learning needs”.

In addition, HIMSS (2025: 2) defined staff training as “a training program that emphasizes interpersonal skills and communication between healthcare practitioners and IT teams to ensure they possess the competencies required to implement changes in the digital environment”.

Furthermore, Al-Badri and Al-Awami (2024: 455) described technical support as “ongoing technical assistance provided to staff after implementing health information systems, including system updates, user supervision, and troubleshooting to ensure continuous and effective system use”.

Similarly, Ali and Abdul-Aal (2020: 141) defined it as “a training and support activity involving the preparation of employees to use technology within daily practice, along with providing long-term technical support channels to ensure sustainable adoption of systems”.

Finally, Bygholm (2018: 192) further defined staff training and technical support as “a process that encompasses formal education, guidance, supervision, and both technical and material support for employees within a healthcare organization to facilitate the effective adoption and use of health information systems.”

It is operationally known: Structured educational programs and ongoing assistance provided to clinic personnel (administrative staff, dentists, and IT personnel) to develop competencies in using health information systems. This includes initial training sessions, troubleshooting assistance, and continuous support for system-related issues.

5. Interdepartmental Coordination

Steinau et al. (2020: 2) defined interdepartmental coordination as “the coordination of interdependent or interconnected processes, where coordination constraints between multiple processes are identified and enforced at runtime to achieve a specific objective within a multifunctional environment”.

Similarly, Wrike (2023: 6) described it as “the process in which individuals or teams from different departments collaborate to achieve shared goals, involving breaking down barriers and promoting communication and cooperation across functions”.

Finally, Poku, Kagan, and Yehia (2019: 2) defined it as “a mechanism that ensures various departments within an organization work harmoniously, at the right time and

place, with shared data and unified objectives to deliver integrated and effective services."

It is operationally known: The degree of effective communication and collaborative workflow between different units within the dental clinics (e.g., reception, treatment rooms, administrative offices, and records departments). Operationally measured by staff-reported ease of information sharing, reduced communication delays, and improved continuity of patient care across departments.

1.4 Study Objectives

1. Assess the current state of administrative efficiency in Zawia dental clinics by analyzing challenges linked to reliance on manual systems, such as delayed information flow and poor interdepartmental coordination.
2. Explore the role of health information systems (HIS) in enhancing administrative processes, including appointment scheduling, electronic health record (EHR) management, and internal communication, based on documented successes in prior studies.
3. Identify critical facilitators and barriers influencing the successful adoption of HIS within Zawia's dental clinics, focusing on organizational, technological, and human factors.

1.5 Study Hypotheses

1.5.1 Null Hypotheses

$H0_1$: The implementation of health information systems in Zawia dental clinics will not reduce administrative processing times or improve workflow efficiency compared to current manual systems.

$H0_2$: Adequate staff training and technical support are not the primary determinants of successful health information system adoption in Zawia dental clinics, and do not outweigh technological and infrastructural factors.

$H0_3$: The integration of electronic health records will not improve interdepartmental coordination and communication in Zawia dental clinics, and will not result in enhanced patient care continuity.

1.5.2 Alternative Hypotheses

HI_1: The implementation of health information systems in Zawia dental clinics will reduce administrative processing times and improve workflow efficiency compared to current manual systems.

HI_2: Adequate staff training and technical support are the primary determinants of successful health information system adoption in Zawia dental clinics, outweighing technological and infrastructural factors.

HI_3: The integration of electronic health records will improve interdepartmental coordination and communication in Zawia dental clinics, resulting in enhanced patient care continuity.

1.6 Significance of Study

1- This study focuses on how health information systems can improve administrative efficiency in private dental clinics in Al-Zawiya city.

2- The research addresses gaps in the regional healthcare informatics literature and provides practical, achievable recommendations.

3- By identifying key success factors and implementation challenges, the study aims to create a roadmap for sustainable improvement in administrative efficiency within the healthcare sector.

1.7 Study Variables

1- Independent Variables: HIS Implementation, Staff Training and Support, and Organizational Factors.

2- Dependent Variables: Administrative Efficiency is measured through processing time for tasks, scheduling efficiency, record retrieval time, and billing cycle duration. Workflow Optimization evaluates reduced steps in processes, time saved, and error rates in documentation. Interdepartmental Coordination assesses communication response time, effectiveness of information sharing, and collaboration metrics.

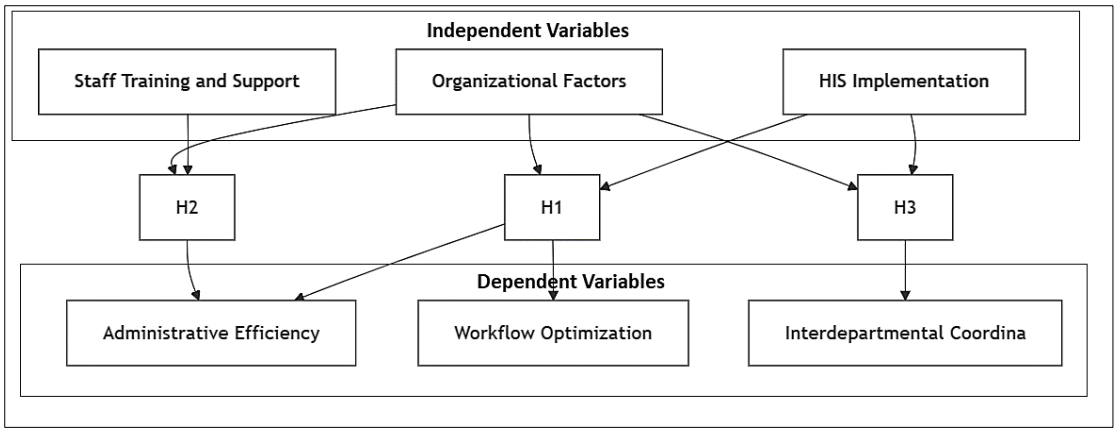

Figure 1.1: Study model

Source: prepared by the researcher based on methodology

CHAPTER TWO: THEORETICAL FRAMEWORK AND LITERATURE REVIEW

2.1 Health Information Systems (HIS) – The Conceptual and Theoretical Framework

The contemporary healthcare landscape is a complex ecosystem characterized by escalating costs, rising patient expectations, and an ever-expanding volume of medical data. Within this milieu, the pursuit of administrative efficiency is not merely an operational goal but a fundamental prerequisite for sustainability and quality care delivery. This is particularly acute in specialized settings such as dental clinics, where high patient turnover, intricate procedural coding, and the management of physical inventories intersect. The transition from paper-based, manual administrative processes to digitally-driven, integrated systems represent a paradigm shift of monumental importance. Health Information Systems (HIS) sit at the very heart of this transformation, serving as the technological and functional backbone of modern healthcare organizations. This first investigation seeks to deconstruct the multifaceted concept of HIS, establishing a robust conceptual and theoretical foundation. It will delineate its core components, trace its evolutionary trajectory, categorize its various types, and critically appraise its profound importance. Finally, it will confront the significant challenges that impede its successful implementation, with a keen eye on the realities faced by healthcare institutions in contexts such as Libya. A thorough understanding of this framework is indispensable for subsequently analyzing its potential role in enhancing administrative efficiency within the dental clinics of Zawia.

2.1.1. Definition and Core Components

At its most fundamental level, a Health Information System (HIS) can be defined as an integrated effort to collect, process, report, and use health information and knowledge to influence policy-making, programme action, and research (WHO, 2017). However, to perceive a HIS merely as a database is to overlook its true nature as a socio-technical system—a complex interplay of technology, people, processes, and data designed to produce actionable information.

A robust HIS is built upon several interdependent core components. The technological infrastructure forms the physical foundation, encompassing hardware such as servers, computers, and networking equipment, as well as the software applications that run on them (Al-Moussawi, 2016, p. 45). The data itself is the lifeblood of the system, comprising structured and unstructured information ranging from patient demographics and clinical notes to financial transactions and inventory levels. Crucially, this data must be governed by standards and policies that ensure its accuracy, consistency, security, and interoperability. Without such standards, data becomes siloed and loses its value. The humanware component—the individuals who manage, operate, and use the system—is perhaps the most critical. Their competence, willingness to adapt, and understanding of the system's capabilities directly determine its success or failure (Souisi, 2013, p. 60). Finally, the processes that dictate how information flows through the organization must be deliberately redesigned to align with the capabilities of the digital system, moving away from legacy, paper-based workflows. As Bakhakhsha, Dhouib, and Faras (2018, p. 5) astutely observe, "the implementation of a health information system is not a technical project with social consequences, but a social project with technical dimensions."

2.1.2. The Evolution of Health Information Systems

The journey of HIS from rudimentary record-keeping to intelligent, integrated platforms reflects the broader trajectory of information technology. Initially, healthcare information was managed through purely manual systems—paper charts, filing cabinets, and ledgers. These systems were prone to loss, damage, illegibility, and made information retrieval a laborious and inefficient process (Muwaj, 2023, p. 88). The advent of mainframe computers in the 1960s and 70s ushered in the era of departmental systems, which were often isolated and designed for specific functions, such as financial management in hospital administration. These "silos of automation" solved localized problems but created new challenges of data fragmentation.

The proliferation of personal computers and relational databases in the 1980s and 90s enabled the development of more integrated systems, though true interoperability remained elusive. The 21st century, driven by the internet, cloud computing, and advanced data analytics, has seen the emergence of the comprehensive, patient-centric HIS. Modern systems are increasingly focused on creating a longitudinal Electronic

Health Record (EHR) that follows the patient across different care settings, facilitates clinical decision support, and enables population health management (Ballester, Bukiet, & Dufour, 2022, p. 3). This evolution marks a shift from systems that simply store data to those that generate intelligence, supporting not only clinical care but also strategic administrative and financial decision-making.

2.1.3. The Difference Between HIS and Traditional Systems

The distinction between a modern HIS and traditional, manual systems is not merely a matter of the medium—digital versus paper. It is a fundamental difference in philosophy, capability, and impact. Traditional systems are inherently static and fragmented. A patient's dental record, for instance, might be a physical folder containing charts, X-rays, and billing slips, accessible only in one location and by one person at a time. Information transfer between the reception, the dentist, and the sterilization room often relies on physical movement of this folder or verbal communication, creating bottlenecks and opportunities for error.

In contrast, a modern HIS is dynamic and integrated. It provides a unified, real-time view of the patient and the clinic's operations. When an appointment is scheduled, the information is instantly available to the clinical staff. When a procedure is completed, the billing module can be automatically updated. This integration eliminates redundant data entry, reduces transcription errors, and streamlines the entire patient journey through the clinic (Chew, Ho, & Tan, 2024, p. 72). Furthermore, while traditional systems offer limited analytical capacity, a HIS can generate reports on demand—showing trends in procedure volumes, material usage, or revenue cycles—thereby empowering managers with data-driven insights that were previously inaccessible or impractical to compile (Al-Moussawi, 2016, p. 51).

Table 2.1: Comparison between Manual Systems and Health Information Systems (HIS)

Comparison Aspect	Traditional Manual Systems	Health Information Systems (HIS)
Data Storage	Paper records, physical files, manual ledgers	Digital databases, secure cloud or local storage
Data Accessibility	Limited to one location, one person at a time, requires physical search	Instant, from any authorized location, multi-user simultaneous access

Comparison Aspect	Traditional Manual Systems	Health Information Systems (HIS)
Information Retrieval Speed	Slow (minutes to hours), requires manual effort	Instant (seconds), fast electronic search
Data Accuracy	Prone to transcription errors, illegible handwriting, repeated manual entry	High accuracy, automatic data validation, error reduction
Information Security & Confidentiality	Vulnerable to loss, damage, fire, unauthorized access	Encryption, backup, defined access permissions, audit trails
Inter-Departmental Coordination	Depends on physical file transfer, verbal communication	Instant integration, automatic information flow between units
Reporting & Analysis	Manual, time-consuming, limited, error-prone	Automated, instant, advanced analytics, interactive dashboards
Appointment Scheduling	Paper appointment book, double-booking possibility, tracking difficulty	Electronic system, automatic reminders, reduced no-show rates
Inventory Management	Manual stocktaking, paper records, difficult real-time tracking	Automatic tracking, low-level alerts, accurate consumption reports
Billing & Accounting	Manual invoices, manual calculations, potential errors, collection delays	Automated electronic billing, linked to treatment procedures, accelerated revenue cycle
Required Space	Large (archive rooms, filing cabinets)	Very small (servers or cloud-based)
Continuity & Backup	Difficult, vulnerable to permanent loss	Easy, automatic and multiple backups
Clinical Decision Support	Limited, depends on physician's memory	Integrated support tools, alerts, treatment protocols
Initial Cost	Low (paper, pens, cabinets)	High (hardware, software, training)
Long-term Operating Cost	High (labor, space, time)	Relatively low (maintenance, updates)
Scalability	Limited, requires significant additional resources	High, easy to add users and modules
Standards Compliance	Difficult documentation and review	Easy, automatic audit logs
Environmental Impact	High paper consumption, storage space	Eco-friendly, paper reduction

Source: Prepared by the researcher based on (Al-Moussawi, 2016; Chew, Ho, & Tan, 2024; Muwaj, 2023; Bakhakhsha *et al*., 2018; Ballester *et al*., 2022)

2.1.4. Types of Health Information Systems

The term "HIS" is an umbrella that shelters a variety of specialized systems, each designed to support specific functions within a healthcare organization. In a dental clinic context, several of these are particularly salient.

2.1.4.1. Electronic Health Records (EHR)

The EHR is the cornerstone of a modern clinical HIS. It is a digital version of a patient's comprehensive health history, designed to be shared across different healthcare settings. For a dental clinic, a specialized Dental EHR would include not only demographic data but also detailed clinical observations, dental and medical histories, periodontal charts, treatment plans, digital radiographs and images, and records of procedures performed (Ramirez Martínez, Martínez Noa, & Martínez Porra, 2019, p. 428). The power of the EHR lies in its ability to provide a holistic view of the patient, support clinical decision-making with alerts and reminders (e.g., for recalls or pre-medication), and improve the continuity of care.

2.1.4.2. Appointment Management Systems

Inefficient scheduling is a significant source of administrative inefficiency and patient dissatisfaction in dental clinics. Appointment management systems automate and optimize this critical process. They allow front-desk staff to view provider schedules in real-time, book, reschedule, or cancel appointments efficiently, and send automated reminders via SMS or email, which has been shown to significantly reduce no-show rates (Peñafiel et al., 2024, p. 228). By minimizing idle time for dental chairs and practitioners, these systems directly enhance the clinic's operational throughput and revenue generation.

2.1.4.3. Health Management Information Systems (HMIS)

While EHRs are patient-centric, HMIS are management-centric. They are designed to aggregate data from various operational sources—including clinical, financial, and logistical systems—to support managerial control and strategic planning. An HMIS in a dental clinic can generate reports on key performance indicators (KPIs) such as patient

visit volumes, average treatment cost per patient, inventory levels of consumables (e.g., amalgam, anesthetic), and staff productivity (Fatimah, Palutturi, & Syafar, 2018, p. 288). This empowers clinic managers to make informed decisions about resource allocation, staffing, and service development.

2.1.4.4. Health Billing and Accounting Systems

The financial viability of a dental clinic depends on accurate and timely billing. Manual billing is prone to errors, delays, and lost charges for procedures rendered. Integrated health billing systems automate the entire revenue cycle. They can generate claims based on procedures logged in the EHR, submit them electronically to insurance companies or health authorities, track their status, and manage patient co-payments (Ashqar, Bin Juma, & Tahishat, 2021, p. 605). This not only accelerates cash flow but also reduces administrative overhead associated with claim denial management and manual accounting.

2.1.5. The Importance of Health Information Systems

The strategic implementation of a well-designed HIS yields multifaceted benefits that extend far beyond simple digitization.

2.1.5.1. Improving the Quality of Healthcare

HIS contributes directly to quality enhancement. By providing instant access to a patient's full history, including allergies and medications, it helps prevent adverse events. Clinical decision support tools embedded within EHRs can alert dentists to potential drug interactions or suggest evidence-based treatment protocols. Furthermore, the ability to track outcomes over time allows for continuous quality improvement initiatives (Al-Badri & Al-Awami, 2024, p. 455). As noted by Al-Shahri (2021, p. 392), patient satisfaction is strongly correlated with the perception of a seamless, well-informed, and coordinated care process, which a HIS directly facilitates.

2.1.5.2. Facilitating Administrative Decision-Making

In the realm of administration, HIS transforms decision-making from an art based on intuition to a science grounded in data. Managers are no longer forced to rely on fragmented or outdated information. Instead, they can use HMIS dashboards to monitor real-time operational metrics, analyze trends, and model the impact of potential

changes, such as extending clinic hours or introducing a new service (Bin Awad & Abu Maleh, 2023, p. 25). This data-driven approach leads to more rational, effective, and accountable management.

2.1.5.3. Enhancing Inter-Departmental Coordination

A dental clinic functions through the coordination of several units: reception, sterilization, the dental surgery, and the billing office. A HIS acts as a central nervous system, synchronizing these activities. When a dentist completes a procedure and updates the EHR, the billing department is immediately notified to generate an invoice, and the sterilization room can be alerted to prepare the chair for the next patient. This seamless flow of information breaks down departmental silos, reduces wait times, and creates a more cohesive operational environment (AL-Shobak et al., 2020, p. 1095).

2.1.5.4. Reducing Medical and Administrative Errors

The Institute of Medicine's seminal report "To Err is Human" highlighted the staggering toll of medical errors. HIS serves as a powerful tool for risk mitigation. Legible digital records eliminate misinterpretation of handwriting. Barcode scanning for medication and material management ensures the right item is used for the right patient. Automated dose calculators and allergy checks prevent clinical mistakes. On the administrative side, automated billing reduces coding errors and missed charges, directly protecting the clinic's financial health (Jones *et al*., 2014, p. 50).

2.1.6. Challenges Facing the Implementation of Health Information Systems

Despite their compelling benefits, the path to successful HIS implementation is fraught with formidable challenges. These are often magnified in developing contexts like Libya.

2.1.6.1. Technical and Infrastructure Challenges

The foundational requirement for any HIS is a reliable technological infrastructure: stable electricity, high-speed internet connectivity, and adequate hardware. In many Libyan cities, including Zawia, persistent power outages and unreliable internet services pose a significant barrier (Shelik & Al-Tajouri, 2021, p. 14). Without an uninterrupted power supply and network connectivity, a cloud-based EHR or online appointment system becomes inoperable, crippling clinic operations. Furthermore, the

initial cost of procuring servers, computers, and software licenses can be prohibitive for publicly funded clinics.

2.1.6.2. Human Challenges (Resistance to Change, Lack of Training)

The human dimension is often the most critical failure point. Healthcare professionals, including dentists and administrative staff, may exhibit strong resistance to change. They may be comfortable with established paper-based routines, fear that the technology will slow them down, or be anxious about their ability to master the new system (Alzghaibi & Hutchings, 2024, p. 2015). This resistance is frequently compounded by a profound lack of adequate training. If users are not comprehensively trained and continuously supported, they will underutilize the system or develop "workarounds" that subvert its intended benefits, leading to a situation where digital and paper systems run in parallel, increasing rather than decreasing the workload (Souisi, 2013, p. 75).

2.1.6.3. Financial and Funding Challenges

The financial investment required for a HIS is substantial, encompassing not only initial capital expenditure for hardware and software but also ongoing costs for maintenance, software updates, technical support, and recurrent training (Kasih & Achadi, 2023, p. 387). In the constrained fiscal environment of the Libyan public health sector, securing this funding is a major hurdle. The business case for investment, which must demonstrate a long-term return through improved efficiency and reduced waste, is often difficult to make convincingly to budget-holders who face more immediate, pressing needs.

2.1.6.4. Organizational and Administrative Challenges

Successful HIS implementation requires strong leadership and clear strategic vision. A lack of commitment from top management, ambiguous objectives, and poor project management are frequent organizational pitfalls (Makumbani & Tsibolane, 2025, p. 951). Furthermore, the implementation process itself can be disruptive, causing temporary drops in productivity as staff climb the learning curve. Without a well-defined implementation plan that includes phased roll-outs, change management strategies, and continuous evaluation, the project risks being abandoned or deemed a failure before its benefits can be realized.

Based on the above, it becomes clear that understanding health information systems goes beyond a simplistic technological definition. Rather, it represents a complex and evolving socio-technical ecosystem, comprised of various types of systems, albeit interconnected. The potential benefits of health information systems (HIS) in enhancing healthcare quality, administrative decision-making, coordination, and error reduction are profound. However, these benefits are not automatic; they depend on successfully navigating a gauntlet of technical, human, financial, and organizational challenges. For the dental clinics in Zawia, this framework provides the necessary lens through which to evaluate their current administrative inefficiencies. Subsequent investigations will build upon this foundation, first by delving into the specific concept of administrative efficiency within healthcare settings, and then by critically analyzing the potential mechanisms through which HIS can act as a catalyst for its improvement, all while remaining cognizant of the unique constraints and opportunities present in the Libyan context.

2.2. Administrative Efficiency in Health Institutions

Following the establishment of a robust conceptual framework for Health Information Systems (HIS), it is imperative to turn our analytical focus to the dependent variable at the heart of this study: administrative efficiency. Within the demanding and resource-constrained environment of healthcare, the pursuit of efficiency transcends mere cost-cutting; it becomes a moral and operational imperative to maximize health outcomes from every unit of available input. For dental clinics in Zawia, where patient demand often outstrips institutional capacity, administrative efficiency is the linchpin that can determine the difference between a smoothly functioning service and one plagued by delays, errors, and patient dissatisfaction. This investigation delves into the nuanced concept of administrative efficiency, unpacking its definition, key dimensions, and measurement indicators. It then proceeds to dissect the specific facets of efficiency within the unique operational context of dental clinics. Furthermore, it systematically examines the multifaceted factors—organizational, human, technological, and contextual—that exert influence upon it. The investigation culminates in a critical analysis of the specific impediments to administrative efficiency within Libyan dental clinics, thereby setting the stage for a subsequent exploration of how HIS can be strategically deployed to address these very challenges.

2.2.1. The Concept of Administrative Efficiency

2.2.1.1. Definition and Dimensions

Administrative efficiency, in the context of health institutions, refers to the optimal utilization of available resources—including time, finances, human capital, and materials—to achieve predetermined administrative and operational goals with minimal waste (Tchatchoua, 2018, p. 12). It is fundamentally concerned with the *how* of operations: how quickly, cheaply, and accurately administrative processes are executed. It is crucial to distinguish this from the related concept of effectiveness. While effectiveness is about "doing the right things" (i.e., achieving desired outcomes such as high patient satisfaction or improved oral health), efficiency is about "doing things right" (i.e., utilizing the fewest possible resources to achieve those outcomes) (Krishan, 2022, p. 551). An administratively efficient dental clinic is not necessarily one that sees the most patients, but one that manages its appointment schedules, patient records, and supply inventories in a manner that minimizes waiting times, reduces administrative overhead, and avoids duplication of effort.

The dimensions of administrative efficiency can be broadly categorized into:

- **Process Efficiency:** The speed and accuracy with which administrative transactions (e.g., patient registration, billing, claim processing) are completed.
- **Resource Efficiency:** The optimal use of financial, human, and physical resources, minimizing idle time for staff and equipment, and reducing wastage of supplies.
- **Coordinative Efficiency:** The smoothness of information flow and collaboration between different administrative and clinical units within the clinic.

2.2.1.2. Indicators for Measuring Administrative Efficiency

To move from an abstract concept to a measurable one, specific indicators are required. In a dental clinic setting, quantifiable indicators of administrative efficiency include (Alaghemandan *et al*., 2014, p. 178; Ramírez & Orrego-Ferreyros, 2024, p. 5):

- **Average Patient Waiting Time:** The duration from a patient's scheduled or arrival time until they are seen by the dentist.
- **Administrative Cost per Patient:** The total administrative overhead divided by the number of patients served.

- **Staff-to-Patient Ratio (Administrative):** The number of administrative staff required to support a given number of clinical sessions.
- **Rate of Appointment No-Shows and Cancellations:** High rates often indicate inefficiencies in reminder systems and scheduling.
- **Time for Claim Processing and Reimbursement:** The average cycle time for insurance or governmental claims to be processed and paid.
- **Inventory Turnover Rate:** How quickly dental supplies (e.g., anesthetic, gloves, filling materials) are used and replenished, indicating the efficiency of inventory management.
- **Data Accuracy Rate:** The percentage of error-free patient records and billing statements.

Table 2.2: Administrative Efficiency Measurement Indicators in Dental Clinics

Dimension	Indicator	Measurement Method	Ideal/Acceptable Range	Reference
Administrative Process Efficiency	Average patient registration time	Time (in minutes) from patient arrival to registration completion	Less than 5 minutes	Pujihastuti & Nelwetis (2024)
	Data accuracy rate	(Number of error-free records ÷ Total records) × 100	More than 95%	Alaghemandan et al. (2014)
	Invoice processing time	Average time (in days) from procedure completion to invoice issuance	Less than 1 day	Ashqar et al. (2021)
Appointment Scheduling Efficiency	Average patient waiting time	Time (in minutes) from scheduled appointment to treatment start	Less than 15 minutes	Alaghemandan et al. (2014)
	No-show rate	(Number of missed	Less than 10%	Peñafiel et al. (2024)

Dimension	Indicator	Measurement Method	Ideal/Acceptable Range	Reference
		appointments ÷ Total booked appointments) × 100		
	Cancellation rate	(Number of cancelled appointments ÷ Total appointments) × 100	Less than 15%	Peñafiel et al. (2024)
	Dental chair utilization rate	(Actual usage hours ÷ Available working hours) × 100	75-85%	Ramírez Altamirano & Orrego-Ferreyros (2024)
Medical Records Management Efficiency	Medical record retrieval time	Average time (in minutes) to access patient record	Less than 1 minute (digital)	Ramirez Martínez et al. (2019)
	Record loss/misplacement rate	(Number of lost records ÷ Total records) × 100	0%	Muwaj (2023)
	Medical record completeness	Percentage of filled fields in electronic record	More than 90%	Ramirez Martínez et al. (2019)
Resource Utilization Efficiency	Administrative cost per patient	Total administrative costs ÷ Number of treated patients	Context-dependent, measure improvement	Alaghemandan et al. (2014)
	Administrative staff-to-patient ratio	Number of administrative staff ÷ Daily patient number	1:40 - 1:60	Tchatchoua (2018)
	Inventory turnover rate	Annual cost of materials used ÷ Average inventory value	6-12 times annually	Alaghemandan et al. (2014)

Dimension	Indicator	Measurement Method	Ideal/Acceptable Range	Reference
	Stock-out rate	(Number of stock-out instances ÷ Total inventory items) × 100	Less than 5%	Alaghemandan et al. (2014)
Financial Efficiency	Revenue collection cycle	Average time (in days) from billing to collection	Less than 30 days	Ashqar et al. (2021)
	Insurance claim denial rate	(Number of denied claims ÷ Total claims) × 100	Less than 5%	Ashqar et al. (2021)
	Lost revenue rate	Value of completed unbilled procedures ÷ Total revenue	Less than 2%	Tchatchoua (2018)
Inter-Departmental Coordination Efficiency	Information transfer time between departments	Average time (in minutes) from procedure completion to department notification	Instant (less than 1 minute)	AL-Shobak et al. (2020)
	Communication error rate	Number of errors from miscommunication monthly	0-2 cases	AL-Shobak et al. (2020)
Overall Productivity	Number of patients treated per dentist daily	Total patients ÷ Number of dentists ÷ Working days	15-25 patients	Fatimah et al. (2018)
	Average treatment session time	Actual treatment time (excluding waiting)	Depends on procedure type	Peñafiel et al. (2024)
Patient & Staff Satisfaction	Patient satisfaction index with administrative services	Satisfaction survey (1-5 scale)	More than 4.0	Al-Shahri (2021)

Dimension	Indicator	Measurement Method	Ideal/Acceptable Range	Reference
	Staff satisfaction index with administrative systems	Satisfaction survey (1-5 scale)	More than 3.5	Hazaimeh (2017)

Source: Prepared by the researcher

2.2.1.3. The Relationship between Efficiency and Administrative Effectiveness

The relationship between efficiency and effectiveness is symbiotic, not substitutive. A clinic can be efficient in its paperwork but ineffective if patients are consistently misdiagnosed. Conversely, a clinic can be effective in treating dental problems but inefficient to the point of financial insolvency due to wasteful practices. The ideal state is a synergistic combination where high efficiency enables greater effectiveness. For instance, an efficient appointment system (efficiency) reduces patient waiting times, which in turn increases patient satisfaction and adherence to treatment plans (effectiveness) (Reyes-Fernández *et al*., 2015, p. 22). Similarly, efficient management of dental supplies ensures that the necessary materials are always available when needed for a procedure, directly supporting clinical effectiveness. Therefore, improving administrative efficiency is not an end in itself but a critical enabler for achieving broader institutional goals of clinical quality, patient satisfaction, and financial sustainability.

2.2.2. Dimensions of Administrative Efficiency in Dental Clinics

The operational reality of a dental clinic imposes specific contours on the general concept of administrative efficiency. Several key dimensions emerge as particularly critical.

2.2.2.1. Efficiency of Administrative Processes (Transaction Speed)

The front-desk operations of a dental clinic are a hub of transactional activity. The speed and accuracy of processes like patient registration, updating personal and medical information, and generating invoices directly impact patient flow and perception of service quality. Manual, paper-based systems are inherently slow and prone to bottlenecks. An efficient system minimizes the time spent on these transactions,

allowing administrative staff to handle a larger volume of patients with fewer errors, thereby reducing queues and front-desk congestion (Pujihastuti & Nelwetis, 2024, p. 64).

2.2.2.2. Appointment Scheduling Efficiency

The scheduling system is the engine room of a dental clinic's operations. Inefficient scheduling leads to a cascade of problems: overbooking causes long patient waits, underbooking leads to idle time for expensive dental professionals and equipment, and poor sequencing fails to account for the varying durations of different procedures (e.g., a cleaning versus a root canal). Efficient scheduling optimizes the use of the clinic's most valuable resource—the dentist's time—while simultaneously respecting the patient's time, thereby maximizing throughput and revenue (Peñafiel *et al*., 2024, p. 227).

2.2.2.3. Efficiency of Medical Records Management

Dental care is longitudinal, relying heavily on accurate historical data, including past treatments, radiographs, periodontal charting, and allergy information. A manual records system, reliant on physical folders, is highly inefficient. Retrieving a record takes time, files can be misplaced or lost, and only one person can access the record at a time. This inefficiency can lead to clinical delays, duplication of X-rays (increasing cost and radiation exposure), and potential clinical risks if a provider works with incomplete information (Ramirez *et al*., 2019, p. 429).

2.2.2.4. Resource Utilization Efficiency

Dental clinics manage a complex inventory of consumables, instruments, and equipment. Inefficient resource management manifests as either stock-outs—which can halt procedures and inconvenience patients—or overstocking, which ties up capital and risks the expiration of certain materials. Furthermore, the scheduling of support staff (dental nurses, hygienists, sterilisation technicians) must be aligned with the clinical schedule. Poor coordination results in either staff idleness or clinical teams being understaffed during peak times, both of which are markers of inefficiency (Alaghemandan *et al*., 2014, p. 180).

2.2.3. Factors Influencing Administrative Efficiency

Administrative efficiency is not determined in a vacuum. It is the product of a complex interplay of various internal and external factors.

2.2.3.1. Organizational Factors

The structure, culture, and leadership of the clinic are paramount. A clear organizational hierarchy with well-defined roles and responsibilities reduces ambiguity and streamlines decision-making. A culture that values continuous improvement and accountability fosters an environment where inefficient processes are identified and rectified. Most critically, strong and committed leadership is essential for driving efficiency initiatives, allocating necessary resources, and overcoming internal resistance to change (Al-Arabi *et al.,* 2025, p. 8). Without supportive management, efforts to enhance efficiency are likely to falter.

2.2.3.2 Human Factors (Training and Competence)

The skills, attitudes, and competencies of the administrative and clinical staff are a direct determinant of efficiency. Well-trained staff who are proficient in their tasks and understand the broader operational workflow will perform their duties more quickly and accurately. Conversely, a lack of training, low morale, or resistance to new procedures can cripple administrative processes (Hazaimeh, 2017, p. 45). The human element is the agent that either implements efficient systems or subverts them.

2.2.3.3 Technological Factors

The tools available to staff fundamentally shape the efficiency of their work. The reliance on paper, filing cabinets, and manual spreadsheets imposes inherent limits on speed, data accuracy, and analytical capability. The introduction of appropriate technology, from simple computers for word processing to integrated HIS, can automate routine tasks, reduce errors, and provide management with the data needed for informed decision-making (Faryadras & Dashti, 2016, p. 260). Technology acts as a force multiplier for human effort.

2.2.3.4 Environmental and Contextual Factors

External factors often lie outside the direct control of clinic management but have a profound impact. These include government regulations, health insurance policies, the

economic situation, and public infrastructure. In the Libyan context, factors such as political instability, electricity blackouts, and interruptions in the supply chain for dental materials create a challenging environment where maintaining basic operations, let alone high efficiency, is a significant achievement (Ben Rabaa & Al-Bousifi, 2019, p. 105).

2.2.4 Impediments to Administrative Efficiency in Libyan Dental Clinics

A diagnostic analysis of the Libyan healthcare landscape, and dental clinics in Zawia specifically, reveals a constellation of deeply entrenched impediments to administrative efficiency.

2.2.4.1 Reliance on Manual Systems

The overwhelming reliance on paper-based records and manual administrative procedures is the primary bottleneck. This dependency makes every process—from scheduling to record retrieval to billing—inherently slow, labor-intensive, and vulnerable to errors and loss (Daqani & Al-Rashid, 2019, p. 23). The sheer physical handling of paper files consumes an inordinate amount of staff time and clinic space.

2.2.4.2 Weak Inter-Departmental Coordination

Silos between the reception, the clinical areas, and the sterilization/store rooms are common. Communication often relies on verbal messages or the physical movement of paper slips, leading to miscommunication, delays, and frustrations. For example, the front desk may schedule a patient without checking instrument availability with the sterilization unit, or a dentist may complete a procedure without promptly notifying the billing desk, causing delays in invoice generation (Salem, 2021, p. 38).

2.2.4.3 Data Fragmentation and Difficulty of Access

Patient and operational data are fragmented across different paper logs, ledgers, and individual staff memories. There is no single source of truth. Compiling a simple report on the most common procedures performed in a month becomes a Herculean manual task. This fragmentation makes it nearly impossible to conduct any meaningful analysis for performance monitoring or strategic planning, keeping management "flying blind" (Al-Moussawi, 2016, p. 50).

2.2.4.4 Lack of Technological Infrastructure

As identified in the first investigation, the technological foundation for digital efficiency is often absent or unreliable. Unstable electrical power and inadequate internet connectivity preclude the use of modern HIS. Even if hardware were to be donated, the operational costs and technical expertise required to maintain it are often beyond the reach of many public clinics (Shelik & Al-Tajouri, 2021, p. 17). This infrastructural deficit locks clinics into a cycle of manual inefficiency.

From the above, we find that the concept of administrative efficiency is a tangible and measurable construct within the scope of dental clinic operations. It is clearly influenced by a web of organizational, human, technological, and contextual factors. A diagnosis of the Libyan context, particularly for clinics in Zawiya, paints a clear picture of the challenges: reliance on outdated manual systems, poor coordination, fragmented data, and a deficient technological infrastructure. These impediments are not merely inconveniences; they are fundamental constraints on the clinic's ability to deliver timely, cost-effective, and high-quality dental services. This thorough understanding of the "problem" of administrative inefficiency is a necessary prelude to the next logical step: a rigorous examination of potential "solutions." The subsequent investigation will, therefore, delve into the specific mechanisms and evidence through which health information systems can be leveraged to address these very impediments and catalyze a transformation toward greater administrative efficiency.

2.3. The Role of Health Information Systems in Improving Administrative Efficiency

Having established a comprehensive understanding of both Health Information Systems (HIS) and the multifaceted nature of administrative efficiency, this investigation synthesizes these concepts to explore the pivotal role of the former in enhancing the latter. The operational inefficiencies plaguing dental clinics, particularly in contexts like Zawia, are not insurmountable. They are, in large part, symptoms of an information deficit and fragmented processes. HIS emerges as the strategic intervention capable of addressing these root causes. This chapter moves beyond theoretical postulation to a concrete analysis of the causal mechanisms through which HIS influences administrative efficiency. It will delineate the specific applications of HIS within the dental clinic ecosystem, from scheduling to clinical documentation.

Furthermore, it will draw upon instructive international and regional case studies to extract valuable lessons and identify best practices. The investigation concludes by outlining a framework of critical success factors essential for the successful implementation of HIS, providing a pragmatic roadmap for overcoming the challenges identified in the previous chapters and unlocking the potential for transformative administrative improvement in Zawia's dental clinics.

2.3.1 Mechanisms of HIS Impact on Administrative Efficiency

The contribution of HIS to administrative efficiency is not monolithic; it operates through several discrete yet interconnected mechanisms that directly target the inefficiencies inherent in manual systems.

2.3.1.1 Automation of Administrative Processes

This is the most direct mechanism. HIS automates repetitive, time-consuming tasks that are prone to human error. For instance, the manual filing and retrieval of patient records is replaced by instantaneous digital access. The calculation of treatment costs and generation of invoices, which required manual reference to fee schedules and data entry, becomes an automated function triggered by the dentist's entry of procedure codes within the Electronic Health Record (EHR). This automation liberates administrative staff from mundane tasks, allowing them to focus on higher-value activities such as patient communication and complex problem-solving, thereby increasing overall workforce productivity (Richter, 2024, p. 53). A study on hospital efficiency found that automation of administrative processes through HIS was a key driver in reducing administrative overhead costs per patient (Tchatchoua, 2018, p. 24).

2.3.1.2 Improving Data Accuracy and Accessibility

Manual systems are inherently vulnerable to inaccuracies due to illegible handwriting, transcription errors, and misfiled documents. HIS enforces data integrity through structured data entry fields, drop-down menus, and built-in validation checks. This significantly enhances the accuracy of patient demographics, clinical notes, and billing information (Alolayyan *et al*., 2020, p. 3). Furthermore, data becomes instantly accessible from any authorized workstation within the clinic network. A dentist can pull up a patient's full history, including radiographs, in seconds rather than the minutes or hours it might take to locate a physical file. This immediate access eliminates clinical

delays and supports more informed decision-making at the point of care, directly enhancing process efficiency (Bin Awad & Abu Maleh, 2023, p. 31).

2.3.1.3 Facilitating Communication and Coordination between Departments

HIS acts as a central nervous system for the clinic, synchronizing the activities of the reception, surgery, sterilization, and billing departments. When an appointment is booked, it is instantly visible in the clinical area. When a procedure is marked as completed in the EHR, the billing department is automatically notified to generate a claim. This seamless, real-time information flow replaces the slow and error-prone communication based on paper slips and verbal messages, thereby dramatically improving coordinative efficiency (AL-Shobak *et al*., 2020, p. 1097). This integrated environment reduces bottlenecks, ensures that all departments are working with the same information, and creates a smoother patient journey through the clinic.

2.3.1.4 Supporting Administrative Decision-Making

Beyond operational support, HIS transforms administrative decision-making from a reactive, intuition-based process to a proactive, data-driven one. The Health Management Information System (HMIS) component can aggregate data to generate comprehensive reports and dashboards. A clinic manager can monitor key performance indicators (KPIs) in real-time: daily patient volume, no-show rates, revenue by procedure, inventory levels of key supplies, and staff productivity (Faryadras & Dashti, 2016, p. 262). This analytical capability allows management to identify trends, pinpoint inefficiencies, and make evidence-based decisions about resource allocation, staffing schedules, and service expansion. For example, identifying a high no-show rate for certain time slots can lead to a revised scheduling strategy or the implementation of automated reminders, directly improving resource utilization efficiency (Sheta & Eldeen, 2013, p. 5).

2.3.2. Applications of Health Information Systems in Dental Clinics

The theoretical mechanisms of HIS are realized through a suite of specific applications tailored to the unique needs of a dental practice.

2.3.2.1. Electronic Appointment Management Systems

These systems are the cornerstone of operational efficiency. They provide a centralized, real-time view of all provider schedules, preventing double-booking and optimizing the use of dental chairs. Features like automated SMS or email reminders have been empirically shown to significantly reduce the rate of patient no-shows, which is a major source of lost revenue and wasted clinical time (Peñafiel *et al.*, 2024, p. 231). Furthermore, they allow for efficient scheduling based on procedure type, ensuring that adequate time is allocated for complex treatments, thereby minimizing delays and improving patient flow throughout the day.

2.3.2.2. Electronic Health Record (EHR) Systems for Patients

A dental-specific EHR moves beyond a simple digital chart. It serves as a comprehensive repository for a patient's oral health journey, including digital periodontal charting, treatment plans, clinical notes, intraoral images, and radiographs. The efficiency gains are profound: instant retrieval eliminates wait times, templates speed up clinical documentation, and the ability to track treatment progress over time enhances the continuity and quality of care (Ramirez *et al*., 2019, p. 430). The integration of the EHR with other systems means that completed procedures are automatically flagged for billing, creating a seamless workflow from clinical action to financial transaction.

2.3.2.3. Inventory and Resource Management Systems

These systems bring scientific management to the clinic's supply chain. By tracking the usage of consumables (e.g., anesthetic cartridges, impression materials, gloves) and tracking the maintenance schedules for equipment, the system can generate automatic alerts when stock levels fall below a predefined threshold or when equipment is due for servicing (Alaghemandan *et al*., 2014, p. 181). This prevents stock-outs that disrupt clinical sessions and avoids the financial waste associated with overstocking or expired materials. It ensures that the necessary resources are always available to support clinical activities, a fundamental aspect of resource efficiency.

2.3.2.4. Electronic Billing and Payment Systems

The financial health of a clinic depends on a robust and timely billing process. Manual billing is fraught with delays and errors, leading to lost revenue and protracted

reimbursement cycles. Integrated e-billing systems automatically generate claims based on the procedures documented in the EHR, submit them electronically to insurers or health authorities, and track their status (Ashqar *et al*., 2021, p. 608). This not only accelerates cash flow but also reduces the administrative burden of managing denied claims and resubmissions. The integration ensures that charges are captured accurately and completely, directly protecting the clinic's revenue stream.

2.3.3 Successful International and Regional Experiences

Learning from the implementation journeys of other nations provides invaluable insights for the Libyan context, highlighting both universal principles and context-specific adaptations.

2.3.3.1 Experiences from Developed Countries (Malaysia, Jordan)

Malaysia's teleprimary care initiative and Jordan's nationwide health information exchange efforts demonstrate the importance of top-down strategic planning and interoperability standards. A key lesson from Jordan's experience, as noted by Alotaiby (2018, p. 5), was the critical need for phased implementation and continuous user training to overcome resistance. Studies on HIS implementation in Malaysian dental clinics emphasized that success was heavily dependent on the system's usability and its alignment with the specific clinical workflow of dentists, rather than being a generic system (Sidek & Martins, 2017, p. 92).

2.3.3.2 Experiences from Arab Countries (Saudi Arabia, Algeria)

Saudi Arabia's Vision 2030 has aggressively promoted the digital transformation of its health sector, including dental services. The implementation in major hospitals has shown that strong government support and significant financial investment are powerful catalysts (Alsalman *et al.*, 2021, p. 4). Conversely, Algeria's experience, as explored by Muwaj (2023, p. 150) and Souisi (2013, p. 80), highlights the challenges of bureaucratic inertia and the need to tailor system design to local administrative practices. Both cases underscore that technology alone is insufficient without parallel reforms in administrative procedures.

2.3.3.3 Cuba's Experience in Digitizing Dental Clinics

Cuba presents a highly instructive model for a public health-oriented system. The computerization of medical records in Cuban dental clinics was pursued as a public health strategy to improve epidemiological surveillance and resource planning. Research by Ramirez Martínez et al. (2019, p. 432) found that this digitization led to more accurate health statistics, better allocation of resources to areas of greatest need, and improved continuity of care for patients, demonstrating the public health value of HIS beyond clinic-level efficiency.

2.3.3.4 Lessons Learned for the Libyan Context

Several cross-cutting lessons emerge for Libya:

- **Phased Implementation is Key:** A "big bang" approach is risky. Starting with a single module, such as appointment scheduling or EHR, allows for learning and adaptation before scaling up (Jayathissa & Hewapathirana, 2023, p. 349).
- **User-Centric Design is Non-Negotiable:** Systems must be designed with input from the end-users—dentists, nurses, and administrative staff—to ensure they fit the local workflow and are actually used (Suebnukarn *et al*., 2013, p. 4).
- **Invest in People, Not Just Technology:** Sustained training and change management are as important as the software itself. The experiences of Algeria and Jordan consistently highlight user resistance as a major barrier without adequate preparation and support.

Table 2.3: Comparison of International HIS Implementation Experiences in Dental/Healthcare Settings

Country/Region	Type of System Implemented	Key Success Factors	Main Challenges	Outcomes & Results	Lessons Learned for Libya	Reference
Malaysia	Teleprimary care initiative; Dental clinic EHR systems	• Strong government support • Phased implementation approach • System usability focus • Alignment with clinical workflow	• Initial resistance from older practitioners • Internet connectivity in rural areas • Integration with existing systems	• Improved access to patient records • Enhanced continuity of care • Better resource planning • Increased clinical productivity	• Prioritize user-friendly interface design • Adapt systems to local clinical practices, not vice versa • Invest in rural infrastructure	Sidek & Martins (2017)
Jordan	Nationwide health information exchange; Hospital-based HIS	• Top-down strategic planning • National interoperability standards • Continuous user training program • Legal framework for data sharing	• Bureaucratic resistance • High initial costs • Data privacy concerns • Vendor dependency	• Reduced duplicate testing • Faster patient information exchange • Improved emergency care coordination	• Establish clear interoperability standards from the start • Create legal framework before technical implementation • Plan for long-term vendor relationships	Alotaiby (2018)

Country/Region	Type of System Implemented	Key Success Factors	Main Challenges	Outcomes & Results	Lessons Learned for Libya	Reference
Saudi Arabia (Vision 2030)	Comprehensive digital transformation in major hospitals and specialized clinics	• Substantial government funding • National strategic vision • Public-private partnerships • Investment in IT workforce	• Scale of transformation • Workforce digital literacy gaps • Cultural resistance to change • System integration across regions	• Significant reduction in administrative overhead • Enhanced patient satisfaction • Improved health analytics capability • Better resource allocation	• Strong political will and financial commitment are essential catalysts • Parallel investment in human capital development • Start with flagship projects to demonstrate value	Alsalman et al. (2021)
Algeria	Hospital information systems; Public health clinic digitization	• Government-led initiative • Focus on public health sector • Local system customization	• Bureaucratic inertia • Insufficient training • Poor technical infrastructure • Lack of maintenance resources	• Mixed results• Some efficiency gains in pilot sites • Many systems underutilized • Sustainability challenges	• Technology alone is insufficient without administrative reform • Tailor systems to local administrative practices • Ensure sustainable funding for maintenance	Muwaj (2023, p. 150);Souisi (2013, p. 80)

Country/Region	Type of System Implemented	Key Success Factors	Main Challenges	Outcomes & Results	Lessons Learned for Libya	Reference
			• Parallel paper systems persisted		• Avoid "big bang" implementations	
Cuba	Computerization of dental clinic medical records; National health information system	• Public health strategic approach• Focus on epidemiological surveillance• Centralized planning• Integration with national health goals	• Economic constraints • Limited technology access • Infrastructure limitations • Internet restrictions	• More accurate health statistics • Better resource allocation • Improved continuity of patient care • Enhanced public health monitoring	• HIS can serve public health goals beyond clinic efficiency • Centralized systems enable better population health management • Work within resource constraints through prioritization	Ramirez Martínez et al. (2019)
United States	Comprehensive EHR systems in dental practices; Meaningful Use program	• Financial incentives for adoption • Mature IT vendor market • Strong regulatory framework • Professional association support	• High implementation costs • Usability issues • Physician burnout from documentation burden	• High adoption rates (>85% in hospitals) • Improved quality reporting • Enhanced care coordination	• Financial incentives can accelerate adoption• Balance documentation requirements with clinical workflow	Jones et al. (2014)

Country/Region	Type of System Implemented	Key Success Factors	Main Challenges	Outcomes & Results	Lessons Learned for Libya	Reference
			• Interoperability gaps between vendors	• Some concerns about clinical efficiency	• Avoid vendor lock-in through open standards	
South Africa	District health information systems; Public clinic digitization	• Community-based approach • Open-source solutions • Integration with mobile health • Focus on primary care	• Inconsistent electricity supply • Limited IT expertise • High staff turnover • Resource constraints	• Improved data availability for decision-making • Better disease surveillance • Challenges in system sustainability	• Open-source solutions reduce costs • Mobile solutions can bypass infrastructure gaps • Local technical capacity building is critical	Kondoro et al. (2022)
Thailand	Dental school clinic information systems; National health data standards	• Academic institution leadership • User involvement in design • Incremental implementation • Integration with dental education	• Limited budget • Need for ongoing system updates • Training for rotating students	• Enhanced clinical education • Better patient tracking • Research data availability • Improved clinic operations	• Academic settings can serve as pilot sites • Link HIS implementation to education mission • Involve end-users from the design phase	Suebnukarn et al. (2013)

Country/Region	Type of System Implemented	Key Success Factors	Main Challenges	Outcomes & Results	Lessons Learned for Libya	Reference
Sri Lanka	Primary healthcare HIS; Dental clinic appointment systems	• Low-cost, locally developed solutions • Phased modular approach • Strong technical support team • Government commitment	• Limited financial resources • Infrastructure challenges • Need for continuous training	• Reduced patient waiting times • Better appointment management • Improved data quality • Cost-effective solution	• Start with simple, high-impact modules (e.g., scheduling) • Local development can reduce costs and increase sustainability • Strong technical support is non-negotiable	Jayathissa & Hewapathirana (2023)
United Arab Emirates	Smart health initiatives; Integrated HIS across healthcare facilities	• Advanced technological infrastructure • Substantial financial investment • National digital health strategy • International expertise	• Rapid pace of change • Coordination across emirates • Data governance complexity	• High digitization rates • Integrated patient records • Advanced analytics capabilities • Improved healthcare quality metrics	• Advanced infrastructure enables sophisticated systems • However, simpler contexts require different approaches • Governance frameworks must precede technology deployment	Bin Awad & Abu Maleh (2023)

From the table (2.3) there are some lessons learned in the Libyan context, which are as follows:

1. Implementation Strategy:

- **Phased approach is universally recommended**: All successful implementations started small (Algeria and Sri Lanka show risks of rushed deployment)
- **Pilot projects demonstrate value**: Thailand and Sri Lanka evidence shows starting in controlled settings builds momentum

2. Technical Considerations:

- **Infrastructure first**: South Africa and Algeria show that weak electricity/internet undermines sophisticated systems
- **Start simple**: Sri Lanka and Cuba demonstrate that basic systems can deliver significant value in resource-constrained settings
- **Open-source options**: South Africa's experience suggests cost-effective alternatives exist

3. Human Factors:

- **Continuous training is critical**: Jordan, Malaysia, and Saudi Arabia all emphasized ongoing education, not one-time events
- **User involvement increases adoption**: Thailand and Malaysia show that clinician input in design improves uptake
- **Change management is essential**: Algeria's mixed results highlight the danger of neglecting the human dimension

4. Contextual Adaptation:

- **No one-size-fits-all**: Systems must be adapted to local workflows (Malaysia, Algeria)
- **Learn from similar contexts**: Algeria and Cuba (public health focus, resource constraints) offer more relevant lessons than UAE or USA
- **Cultural and administrative fit matters**: Jordan and Algeria show that technology must align with local administrative culture

5. Sustainability:

- **Plan for long-term costs**: Algeria's experience shows initial deployment is only the beginning
- **Local technical capacity**: South Africa and Sri Lanka emphasize building internal expertise
- **Vendor relationships**: Jordan highlights importance of managing vendor dependencies

2.3.4 Success Factors for HIS Implementation

The potential of HIS can only be realized through a meticulously planned and executed implementation process. The literature consistently points to a set of critical success factors.

2.3.4.1 Continuous Training and Technical Support

Training must not be a one-off event prior to launch. It should be an ongoing process that includes initial foundational training, just-in-time support during the go-live period, and advanced training as users become more proficient and new features are rolled out (Alzghaibi & Hutchings, 2024, p. 2016). A dedicated technical support team, either internal or through a reliable vendor, is essential to resolve issues promptly and maintain user confidence.

2.3.4.2 Appropriate Technological Infrastructure

This is the foundational enabler. It requires a reliable power supply (potentially backed by uninterruptible power supplies or generators), a stable and secure local network, and adequate hardware that meets the software's specifications (Kondoro *et al*., 2022, p. 3). For cloud-based systems, a consistent internet connection is mandatory. Attempting to implement a sophisticated HIS on a weak infrastructure is a recipe for failure and frustration.

2.3.4.3 Administrative and Institutional Support

Success is impossible without the unwavering commitment of clinic and health directorate leadership. Leaders must champion the project, allocate necessary resources, and hold staff accountable for using the new system (Wasik *et al*., 2024, p.

92). They must also be prepared to align organizational policies and procedures with the new digital workflow.

2.3.4.4 Involving Users in the Development Process

As highlighted by the international experiences, involving a representative group of future users (dentists, nurses, receptionists) in the system selection and customization process fosters a sense of ownership and greatly increases the likelihood of adoption (Epizitone, Moyane, & Agbehadji, 2023, p. 964). Their practical input can ensure the system addresses real-world problems and fits into the clinical routine.

2.3.4.5 Strategic Planning and Phased Implementation

A clear strategic plan with defined goals, timelines, and metrics for success is essential. This plan should advocate for a phased, modular implementation rather than a full-scale, overnight switch. Starting with less complex modules (e.g., appointment scheduling) allows the organization to build momentum, demonstrate quick wins, and manage the change process more effectively before moving to more complex modules like the full EHR (Addo & Agyepong, 2024, p. 7).

Based on the above, it is evident that health information systems are not merely a technological advancement but rather a transformative force that enhances administrative efficiency in dental clinics. By automating processes, enhancing data integrity, improving coordination, and empowering data-driven decision-making, HIS directly addresses the core inefficiencies plaguing manual systems. The applications within a dental setting are both specific and powerful, managing the entire patient journey from scheduling to payment. The lessons drawn from diverse international contexts provide a valuable repository of knowledge, emphasizing the importance of strategic planning, user involvement, and sustained investment in human capital. For the dental clinics in Zawia, the path forward is challenging yet clear. It requires a deliberate, well-supported, and phased strategy that prioritizes foundational infrastructure, continuous engagement with staff, and learning from global best practices. The subsequent and final investigation will now situate this entire discussion within the specific realities of the Libyan health system and the unique characteristics of the dental clinics in Zawia, thereby providing a contextualized conclusion to this theoretical framework.

2.4. The Health Context in Libya and Dental Clinics in Zawia

The preceding investigations have established a robust theoretical nexus between Health Information Systems (HIS) and administrative efficiency. However, the applicability and potential success of any technological intervention are inextricably linked to the specific context in which it is deployed. This final investigation grounds the theoretical discussion in the tangible realities of the Libyan healthcare landscape, with a focused lens on the dental clinics in Zawia. It begins by dissecting the structural and administrative challenges of the broader Libyan health system, assessing its current level of digitization. The investigation then zooms in to delineate the unique organizational and operational characteristics of Zawia's dental clinics, providing a micro-level analysis of the administrative challenges that stifle their efficiency. Crucially, it concludes not with a catalogue of problems, but with a strategic identification of tangible opportunities for HIS implementation. This contextual analysis serves as the essential bridge between theory and practice, framing the potential role of HIS not as a generic panacea, but as a tailored solution to the specific inefficiencies that define the daily operations of dental care delivery in this particular Libyan city.

2.4.1 The Reality of the Health System in Libya

2.4.1.1 Structural and Administrative Challenges

The Libyan healthcare system has been grappling with profound structural weaknesses, exacerbated by years of political instability and conflict. The system is characterized by a centralized, top-down management model that is often slow to respond to local needs and is plagued by bureaucratic inertia (Ben Rabaa & Al-Bousifi, 2019, p. 107). This has led to chronic issues such as inefficient supply chain management for medicines and medical equipment, uneven distribution of healthcare resources, and a lack of standardized operational protocols across facilities. Financial constraints are severe, with funding often being unpredictable and insufficient to cover operational costs, let alone capital investments in technological modernization (Shelik & Al-Tajouri, 2021, p. 15). Administration within public health institutions is frequently burdened by outdated, paper-intensive processes, leading to slow decision-making, poor coordination between departments, and a general lack of accountability, which collectively form a significant barrier to systemic efficiency.

2.4.1.2 The Level of Digitization in the Libyan Health Sector

The digitization of the Libyan health sector remains in its nascent stages. The reliance on manual, paper-based systems is the overwhelming norm, particularly in public facilities. While some tertiary hospitals in major cities like Tripoli may have isolated digital systems for specific functions (e.g., laboratory information systems), these are rarely integrated into a hospital-wide HIS (Al-Sawani & Al-Sawani, 2024, p. 59). There is a near-total absence of a national health information exchange or a unique patient identifier, which fragments patient data across different facilities. A comprehensive assessment of the private health sector confirmed that manual record-keeping is predominant, with only sporadic and rudimentary use of computers for word processing or basic accounting (Daqani & Al-Rashid, 2019, p. 24). This low level of digitization means that the foundational benefits of data integration, accessibility, and analytics are largely unrealized across the sector.

2.4.1.3 Obstacles and Opportunities

The obstacles to digitization are formidable and mirror the broader systemic challenges. These include:

- **Infrastructure Deficit:** Unreliable electricity and internet connectivity fundamentally undermine the viability of digital health solutions.
- **Financial Constraints:** Limited capital budgets are prioritized for urgent medical supplies and salaries, pushing IT investments down the list.
- **Workforce Skills Gap:** There is a significant shortage of IT professionals with healthcare specialization and a general lack of digital literacy among clinical and administrative staff.
- **Political and Institutional Instability:** Frequent changes in leadership and a lack of long-term, stable health strategies disrupt any sustained effort towards digital transformation.

However, opportunities exist. There is a growing recognition among healthcare professionals of the limitations of the current system. The proliferation of mobile technology and internet access among the general population creates a ready base for patient-facing digital services in the future. Furthermore, the dire need for efficiency

gains itself presents a compelling argument for investment in HIS as a cost-saving measure in the long term.

2.4.2 Characteristics of Dental Clinics in Zawia City

2.4.2.1 Organizational Structure

Dental clinics in Zawia, particularly those in the public sector, typically operate under the umbrella of the local health directorate. They are often structured in a traditional, hierarchical manner, with a head dentist overseeing clinical operations and an administrative manager responsible for non-clinical staff, scheduling, and records. The separation between clinical and administrative functions is often stark, with limited formal mechanisms for workflow integration, leading to the coordination inefficiencies previously discussed (Author's contextual analysis based on cited references).

2.4.2.2 Services Provided

These clinics provide a range of basic and essential dental services, including examinations, oral prophylaxis (cleaning), restorative dentistry (fillings), simple extractions, and some minor surgical procedures. More complex treatments like root canals, periodontics, or orthodontics may have limited availability due to resource and specialist constraints. The high demand for these basic services places immense pressure on the clinics' operational capacity.

2.4.2.3 Current Administrative Systems

The administrative backbone of these clinics is almost exclusively manual. This encompasses:

- **Appointment Scheduling:** Using paper logbooks or diaries, which are prone to overbooking, errors, and make it difficult to track no-shows or analyze scheduling patterns.
- **Patient Records:** Physical folders containing medical history forms, handwritten clinical notes, and paper-based radiograph envelopes. These files are stored in central filing rooms, making retrieval a time-consuming process.
- **Billing and Inventory:** Manual invoicing and ledger books for tracking payments, and basic stock-taking for managing dental supplies.

This reliance on manual systems is the root cause of the administrative inefficiencies detailed in the second investigation.

2.4.2.4 Patient Volume and Service Pressure

As key providers of oral healthcare in the region, these clinics experience a high volume of patients. Long waiting times are a common complaint, stemming from inefficient scheduling and the slow retrieval of patient records. The pressure to see more patients, combined with administrative bottlenecks, can lead to staff burnout and compromises in the time available for each patient, potentially affecting the quality of care (Reyes-Fernández et al., 2015, p. 23).

2.4.3 Administrative Challenges in Zawia Dental Clinics

The general challenges of the Libyan health system manifest in specific, acute ways within the dental clinics of Zawia.

2.4.3.1 Appointment Scheduling Problems

The manual scheduling system is a primary source of operational failure. The inability to view a unified schedule in real-time leads to double-booking or under-utilization of dental chairs. Patients often face long queues without a clear understanding of their wait time, leading to frustration and a poor patient experience. The lack of automated reminders contributes to a high rate of missed appointments, which wastes valuable clinical time and resources (Peñafiel *et al*., 2024, p. 227).

2.4.3.2 Difficulties in Managing Paper Records

The management of physical patient records is a significant administrative burden. Files are frequently misplaced, leading to clinical delays and sometimes the unnecessary repetition of diagnostic tests like X-rays. The space required for storage is substantial, and the records are vulnerable to damage from environmental factors or simple wear and tear. When a patient's historical data is needed, the dentist must sift through often-illegible handwritten notes, hindering quick and informed decision-making (Ramirez Martínez *et al*., 2019, p. 429).

2.4.3.3 Weak Inter-Departmental Coordination

The siloed nature of the clinic's operations creates friction. The front desk may schedule a patient without confirming the availability of the required instruments with the

sterilization unit. A delay in one part of the process, such as billing, can create a backlog that affects the entire patient flow. This lack of synchronization results in idle time for staff, under-utilized resources, and a disjointed experience for the patient.

2.4.3.4 Waste of Time and Resources

The cumulative effect of these challenges is a systemic waste of time and resources. Administrative staff spend an inordinate amount of time on repetitive manual tasks like filing and searching for records. Clinical staff wait for records or supplies. Patients wait due to inefficient scheduling. Stock-outs of essential dental materials lead to cancelled appointments, while overstocking ties up limited funds. This waste represents a critical drain on the clinic's already constrained operational capacity.

2.4.4 Available Opportunities for HIS Implementation

Despite the challenges, a careful analysis reveals a foundation upon which to build a HIS implementation strategy.

2.4.4.1 Technological Readiness

There is a growing familiarity with basic digital technology among the population and the younger generation of healthcare workers. The widespread use of smartphones and computers, even with connectivity issues, indicates a basic level of comfort with digital interfaces that can be leveraged. Starting with standalone, clinic-level systems that do not initially rely on constant internet connectivity could be a feasible first step (Jayathissa & Hewapathirana, 2023, p. 350).

2.4.4.2 Potential Institutional Support

The very severity of the administrative problems creates a powerful incentive for change. Clinic managers and senior health officials who are frustrated with the status quo may be receptive to a well-argued proposal for a pilot implementation that demonstrates tangible efficiency gains. Showcasing the success of small-scale projects can be a powerful tool for securing broader institutional buy-in (Alzghaibi & Hutchings, 2024, p. 2017).

2.4.4.3 Positive Attitudes Towards Digitization

Among younger dentists and administrative staff, there is often a positive attitude towards digitization and a recognition that it represents the future of efficient healthcare

delivery. This internal advocacy can be a potent force for change, helping to overcome the resistance that may come from more established staff. Harnessing this positive energy through user involvement in the selection and design process is a key opportunity.

2.4.4.4 Potential for Learning from Regional Experiences

Libya does not need to start from scratch. The experiences of neighboring countries like Algeria, Egypt, and Jordan in implementing HIS, with their similar challenges and cultural contexts, provide a valuable knowledge base (Alotaiby, 2018; Muwaj, 2023). Lessons about phased implementation, the importance of training, and strategies for managing resistance are directly transferable and can help Zawia's clinics avoid common pitfalls.

Based on the above, it is evident that the healthcare environment is facing significant pressures, yet simultaneously presents tangible potential for transformation. The dental clinics in Zawiya represent microcosms of the broader Libyan healthcare system, grappling with profound administrative inefficiencies rooted in reliance on outdated manual processes. The challenges of scheduling, record management, coordination, and resource waste are not merely theoretical; they are daily realities that impede the delivery of timely and effective dental care. However, within this challenging context lie promising opportunities. Growing technological literacy, the potential for needs-driven institutional support, the positive attitudes of a new generation of healthcare workers, and the availability of lessons learned from relevant regional experiences collectively provide a compelling rationale for the strategic and context-sensitive implementation of health information systems. This journey will undoubtedly require a phased, pragmatic, and robustly supported approach, but the potential reward—a fundamental enhancement of administrative efficiency leading to improved patient care and better working conditions—makes it a pursuit of critical importance for the future of oral health in Zawiya.

2.5 Previous studies

2.5. 1 Studies covering Health Information Systems (HIS), Technology, and Administrative Efficiency

Includes studies that directly focus on the implementation, components, and impact of Health Information Systems (HIS), Management Information Systems (MIS), Electronic Health Records (EHR), and other technologies on administrative efficiency, decision-making, operational performance, and data management in healthcare settings.

Study (Al-Arabi *et al.,* 2025): examined how effective interdepartmental communication impacts administrative decision-making quality in hospitals. Using a descriptive analytical approach, the research surveyed healthcare managers and administrative staff from a Riyadh hospital through surveys and interviews covering management practices, employee involvement, and technology integration. Statistical analysis revealed that enhanced interdepartmental communication significantly improves organizational coordination, decision-making accuracy, and healthcare outcomes. The study recommended fostering collaboration and continuous staff training to strengthen decision-making capabilities. This research demonstrates how systematic communication and targeted training enhance administrative effectiveness in healthcare organizations. By applying these principles alongside HIS for timely data access, Zawia dental clinics can improve operational efficiency and patient care, highlighting the essential connection between structured decision-making, communication, and healthcare service quality.

Study (Othman, 2025): investigated how Management Information Systems (MIS) quality mediates the relationship between strategic planning and organizational performance in healthcare institutions. The study proposed that strategic planning elements (mission/vision clarity, internal/external analysis, implementation, evaluation) influence organizational performance through MIS quality (flexibility, sophistication). Using an analytical methodology, the research sampled 6 of 16 private hospitals in Zagazig City, Egypt, based on size. Data was collected through literature review and questionnaires distributed to managers using a five-point Likert scale. Statistical analysis (Cronbach's Alpha, Confirmatory Factor Analysis, multiple regression, Path Analysis via Amos 26 and SPSS) revealed significant positive direct

impacts of strategic planning on both organizational performance and MIS quality, and of MIS quality on organizational performance. Crucially, MIS quality significantly mediated the relationship between strategic planning and organizational performance. The study recommended developing human resources through training, simplifying information technology via digitalization, and upgrading strategic planning capabilities. This research's significance lies in demonstrating that information system quality is vital for achieving better performance outcomes and facilitating planning initiatives' positive effects, providing relevant insights for studying HIS impact on administrative efficiency in dental clinics.

Study (Peñafiel *et al.,* 2024): addressed implementing an effective appointment management system to enhance operational efficiency at the "Más Sonrisas" dental clinic. Using a mixed-methods approach combining qualitative and quantitative methodologies, the study sampled 86 clinic staff members (dentists and administrative personnel) through purposeful sampling. Data collection included surveys and interviews capturing numerical data and personal insights, analyzed through statistical techniques and thematic analysis to identify key themes. The study concluded that the new appointment management system significantly improved scheduling efficiency, reduced patient waits times, and enhanced patient satisfaction. It recommended ongoing staff training for optimal system use. This study's importance lies in demonstrating how innovative appointment management can transform dental clinic operations, leading to improved patient care and streamlined administrative processes.

Study (Alsuwani & Asawani, 2024explores blockchain technology's potential to enhance Libya's healthcare system amid COVID-19 challenges. Using qualitative methodology through case analysis, the study sampled healthcare professionals and stakeholders from hospitals, clinics, and health organizations in Zawia involved in pandemic crisis management. Data collection included interviews and document analysis examining blockchain's impact on health data management and vaccine distribution, analyzed thematically to identify key themes related to operational efficiency and transparency. Findings indicate blockchain could significantly improve data management, enhance vaccine tracking, and reduce healthcare corruption. The study recommends government investment in technological infrastructure and regulatory frameworks to facilitate blockchain adoption. This research's importance lies in informing policy decisions and technological advancements that can create more

efficient, transparent healthcare systems in Libya, ultimately improving patient outcomes and trust in healthcare services.

Study (Pujihastuti & Nelwetis, 2024): addressed administrative innovation's significance in enhancing health service quality within Indonesian healthcare facilities. Using qualitative case study methodology at Padang City Hospital, the sample included health workers (doctors, nurses, administrative staff) and patients experiencing service changes. Data collection tools comprised semi-structured interviews, participant observation, and documentation analysis, analyzed thematically to identify key insights. The study found that implementing electronic health records (EHR) significantly improved service efficiency and accuracy, increasing patient satisfaction. Despite challenges including training needs and data privacy concerns, both health workers and patients responded positively to the innovations. The study recommended further investment in digital infrastructure and continuous staff training to maximize innovation benefits. This research's importance lies in demonstrating how technology can transform healthcare delivery, making it more efficient and accessible, ultimately benefiting both providers and patients.

Study (Chew *et al.,* 2024): addressed challenges in managing patient records and appointments in dental clinics, particularly reliance on paper-based systems. Using a web-based system development approach, the research created a Dental Clinic Management System (DCMS) to enhance usability and productivity. The study sampled dental clinics in Cyberjaya, Malaysia, including dentists, patients, and administrative staff as stakeholders. Tools included user interface designs and feedback mechanisms ensuring the system met user needs, with qualitative data analysis gathering insights from user interactions during system testing. The study concluded that implementing a digital management system significantly improved patient record accessibility and appointment scheduling, streamlining clinic operations. It recommended clinics adopt such systems to enhance patient engagement and operational efficiency. This research's significance lies in its potential to transform traditional dental practices through modern technology integration, leading to better patient care and improved administrative workflows.

Study (Albdri & Awami, 2024): evaluated management information systems' (MIS) effectiveness in enhancing health service quality. Using descriptive research

methodology, the study sampled employees from the Al-Abyar Health Center's population of 81 workers. Data collection employed a structured questionnaire capturing information on MIS current state and health service quality, analyzed using SPSS version 26 for statistical evaluation. Findings revealed both administrative information systems and health service quality were rated average, indicating significant improvement potential. The study highlighted MIS's positive impact on enhancing health service quality, suggesting improved systems could yield better patient outcomes and operational efficiency. Researchers recommended investing in MIS upgrades to meet physical and software requirements for optimal functionality. This study's importance lies in addressing the need for effective health information systems in healthcare, particularly for improving administrative efficiency and service delivery, informing policymakers and administrators about integrating advanced management information systems to enhance health service quality in Libyan healthcare settings.

Study (Ma'awaj, 2023): examined health service quality challenges in Algerian hospitals, including high costs, lack of digitalization, chaotic processes, weak coordination, and patient information management difficulties hindering quality healthcare. The research investigated electronic medical information systems' impact on health service quality using descriptive-analytical methodology through theoretical review, direct observation, staff interviews, and questionnaires distributed to employees operating selected information systems. The study sampled 252 employees across four departments (Emergency Medical and Surgical, Central Laboratory, Radiology, Central Pharmacy), distributing 156 questionnaires yielding 91 valid responses. Data analysis using SPSS employed descriptive statistics, correlation analysis, T-tests, ANOVA, and Stepwise Regression to examine relationships between information system dimensions (Material Capabilities, Software, Networks, Human Capabilities, Information) and health service quality dimensions (Reliability, Responsiveness, Tangibles, Empathy, Assurance). The study concluded that applied information systems significantly improve health service quality, explaining 32.3% of quality variance, with Material Capabilities showing the strongest impact. Recommendations included focusing on all information system dimensions, fully implementing electronic patient files, strengthening network connectivity, accelerating appointment/results systems, and enhancing staff training. This study's importance lies in contributing to literature on

information systems' impact in the Algerian healthcare context, identifying specific challenges, and providing empirical evidence supporting digitalization strategy.

Study (Kasih & Achadi, 2023): explored electronic administrative information systems' potential to enhance hospital operational efficiency. Using qualitative descriptive methodology through literature review, the study examined various hospitals facing administrative challenges in patient data management. The sample included multiple articles and reports discussing existing systems and their efficacy, with data collection encompassing academic journals, books, and healthcare information system case studies. Descriptive analysis techniques synthesized literature findings. The study concluded that implementing electronic administration systems could significantly improve hospital operations' effectiveness and efficiency, particularly in managing patient records and administrative reporting. It recommended hospital administrators consider these systems as viable solutions for enhancing service quality and operational workflows. This study's importance lies in informing local healthcare providers about modern information systems' benefits, ultimately improving patient care and streamlining administrative processes.

Study (Eissa, 2023): investigated how information systems enhance hospital performance. As hospitals increasingly seek efficiency in healthcare delivery within complex environments, they rely on information systems for daily medical and administrative management and decision-making. The research adopted a comprehensive literature review methodology, clarifying fundamental concepts related to performance and information systems, then exploring established performance improvement tools and analyzing how information systems support their development and application. The study's scope encompassed the conceptual relationship between HIS and performance improvement in general hospital settings, with analysis consisting of relevant academic and professional literature synthesized to understand HIS's enabling role. The study discussed performance improvement methods including Fishbone Diagram, Process Mapping, Root Cause Analysis, PDSA cycle, Lean management, Six Sigma, and High-Reliability Organizations, explaining how information systems provide necessary data and analytical support. It concluded that hospital information systems play vital roles by providing crucial statistics about internal activities and external environments, indispensable for measuring performance, identifying improvement areas, and implementing appropriate tools. HIS significantly

improves financial performance, optimizes clinical infrastructure, and enhances administrative efficiency by streamlining tasks, reducing workload, and supporting strategic planning. The study recommended information systems possess speed, efficient information flow, and high data reliability. Its significance lies in providing theoretical foundation outlining mechanisms through which HIS contributes to performance improvement across hospital domains, directly applicable for investigating HIS's role in improving administrative efficiency within dental clinics.

Study (Bin Awadh & Abu Maleh, 2023): examined HIS's impact on medical decision-making, aiming to identify HIS application levels and investigate impacts of HIS dimensions (elements, retrieval, access, staff efficiency) on medical decision-making, while determining demographic variable differences. Using descriptive analytical methodology, the study sampled 346 employees from the hospital's 3400-person population, with 319 valid questionnaires analyzed. Data collection employed five-point Likert scale questionnaires, analyzed via SPSS using descriptive statistics, Cronbach's Alpha, Kolmogorov-Smirnov test, Pearson Correlation, Multiple Linear Regression, t-tests, and ANOVA. The study concluded HIS significantly affects medical decision-making at 0.01 significance level, with HIS dimensions explaining 82.5% of variance. It found high HIS application levels (mean 3.95) and moderate medical decision-making levels (mean 3.62), with no significant demographic differences at 0.05 significance level. Recommendations included providing sufficient information to decision-makers, involving employees in decision-making, implementing intensive IT and HIS training programs, continuously evaluating and updating HIS, utilizing computers for data management, and conducting training on effective HIS usage. This study's importance lies in providing foundational HIS understanding within healthcare contexts, demonstrating robust quantitative methodology for assessing HIS impacts, offering insights into employee perceptions of relevant HIS dimensions, providing implementation benchmarks, and highlighting HIS's potential to influence healthcare operations, informing investigations of HIS in dental clinic administrative efficiency.

Study (Amin, 2022): explored technological advancements' transformative impact on healthcare, understanding how modern innovations improve human protection and healthcare. Using descriptive analytical methodology through comprehensive literature review and synthesis of previous studies on medical technology, the research analyzed relevant academic articles, reports, and existing data rather than empirical population

samples. Data analysis involved critically evaluating and synthesizing literature findings to identify key trends, impacts, benefits, and challenges. The study concluded technological innovations revolutionized medical practices, significantly improving healthcare efficiency, accuracy, and accessibility. Findings highlighted shifts toward digital hospitals, accelerated diagnosis and treatment, advanced techniques like robotic surgery and precision medicine, and patient-focused technologies including wearables and telemedicine. The research emphasized these advancements enhanced patient safety, outcomes, communication, and healthcare data management, while noting downsides including high costs and error potential. Recommendations included strategic health IT infrastructure investment, supportive legislative frameworks for adoption and standardization, encouraging consumer health technology use, and leveraging AI and advanced computing for enhanced operational efficiency and predictive healthcare management capabilities. This study's importance lies in providing broad theoretical context validating technology as a critical efficiency driver across healthcare settings. By detailing medical technology benefits including improved data flow, communication, and operational processes integral to effective HIS, it establishes strong foundation for investigating how specific HIS applications translate overarching benefits into tangible administrative improvements within specialized environments like dental clinics.

A report by CAQH (2022): examined U.S. healthcare administrative efficiency by tracking electronic business transaction adoption rates, volume, spend, cost avoided, and potential savings across medical and dental industries over the past decade, focusing on 2021 data and highlighting increased healthcare utilization and staffing shortages. Using quantitative methodology based on voluntary annual data submission from participating plans and providers, the study sampled plans representing 204 million medical and 126 million dental insured lives and numerous provider organizations through online surveys, direct outreach, and industry partnerships. Data collection utilized online survey tools with PDF and Excel submission options, analyzed through aggregated participant data, weighted averages, extrapolated national volumes, and cost calculations based on labor time. Findings showed electronic adoption continued increasing for most transactions, reaching high levels for eligibility/benefit verification and claim submission, though prior authorization and attachments lagged. Despite automation gains, total administrative spend increased

significantly due to higher transaction volume from recovering utilization and increased provider time/cost from staffing shortages and new hire learning curves. Total estimated cost savings opportunities remained substantial ($22.3B medical, $2.6B dental) by transitioning manual and partially electronic transactions to fully electronic. Recommendations included supporting automated processes by monitoring costs and pain points, focusing on staff training for high-volume tasks, and promoting greater transaction standardization. This study's importance lies in providing data-driven national benchmarks on administrative transaction efficiency including dental industry findings, quantifying potential cost and time savings through increased electronic adoption—the goal of implementing HIS in dental clinics. It identifies specific administrative tasks where HIS drives efficiency improvements aligned with dental clinic operations, while highlighting challenges like staffing issues that HIS solutions mitigate.

Study (Ballester *et al.,* 2022): examined dental informatics evolution within health information systems, focusing on standardized clinical coding systems, data capture, and patient care data reuse. Using scoping review methodology to analyze existing literature, the study sampled 44 relevant peer-reviewed articles from PubMed and Web of Science, utilizing systematic literature searches and PRISMA-ScR protocol for organization and evaluation. Data were analyzed qualitatively to identify themes and trends. The study concluded that despite significant health information system advancements, particularly in the United States, comprehensive research on clinical decision support systems utilizing electronic dental records (EDRs) remains lacking. It highlighted needs for improved user interfaces and workflows to enhance dental practice data capture. Recommendations included further exploration of health information systems' educational value in dentistry and emphasizing standardized coding systems' importance for better data quality. This study's significance lies in guiding dental practitioners toward implementing effective HIS strategies that streamline administrative processes, improve patient care quality, and enhance operational efficiency within dental clinics. By addressing current practice inefficiencies and promoting standardized system adoption, the study contributes to optimizing dental informatics for better health outcomes.

Study (Kiselnikova & Smelyanets, 2022): addressed medical information systems' effectiveness in enhancing dental care quality for children undergoing endodontic

treatment. Using comparative research methodology, the study examined medical record documentation quality before and after introducing a medical information system. The study sampled 236 patient records of pediatric patients with chronic pulpitis from a pediatric dental clinic over two years (2016 and 2018). Data collection included structured medical records and assessment criteria based on clinical recommendations for managing pediatric dental diseases, analyzed using statistical methods including chi-squared tests to evaluate documentation quality differences. The study concluded that implementing the medical information system significantly improved medical documentation accuracy and completeness, enhancing overall pediatric dental care quality. Recommendations included further integrating such systems across dental practices to standardize care and improve patient outcomes. This study's significance lies in informing healthcare providers about advanced information technology benefits for streamlining operations, reducing errors, and enhancing patient care in dental settings. The research contributes to literature emphasizing digital transformation importance in healthcare, particularly pediatric dentistry. By demonstrating tangible improvements in documentation practices and care quality, the study supports wider health information system adoption in dental clinics, driving policy and practice changes leading to better pediatric health outcomes.

Study (Kreyshan, 2022): explored data-driven decision-making's significance in enhancing health facility effectiveness. Using qualitative methodology focusing on health information systems' (HIS) role in administrative contexts, the study sampled 50 health facility managers and decision-makers across different healthcare system levels in Ethiopia. Data collection employed structured interviews and surveys gathering insights on data usage and its impact on decision-making processes, analyzed thematically to identify patterns regarding health information utilization. Findings revealed effective health data use significantly improves accountability and care quality, enhancing overall facility performance. The study recommended establishing robust data management systems supporting evidence-based decision-making and encouraging healthcare professional training on data interpretation and application. This study's importance lies in informing health management policy and practice, emphasizing well-structured health information systems lead to better resource allocation and improved patient outcomes. The research contributes to discourse on healthcare technology integration, highlighting the necessity for systematic data

management approaches to foster informed decision-making culture within the healthcare sector.

Study (Kondoro *et al*., 2022): examined Health Management Information System (HMIS) utilization levels and factors influencing its use within public health institutions. Using facility-based cross-sectional design collecting quantitative and qualitative data, the study sampled 315 heads of units/departments across zonal health departments, district health offices, and health facilities who completed structured questionnaires and observational checklists, supplemented by qualitative key informant interviews. Quantitative data were analyzed using Epidata and SPSS for descriptive statistics, bivariate analysis, and multivariable logistic regression identifying independent predictors, while qualitative data underwent thematic framework analysis. The study concluded overall HMIS utilization was low at 41.59%, with health facilities showing particularly lower utilization (38.73%) compared to administrative units (53.23%). Factors significantly associated with higher HMIS utilization included HMIS training, availability of procedure manuals, and consistent supportive supervision. Recommendations included ensuring HMIS manual availability and arranging capacity building initiatives including HMIS training and supportive supervision. This study's importance lies in directly focusing on practical HIS component utilization and identifying concrete supporting or hindering factors. Findings regarding training, procedure manuals, and supportive supervision's crucial roles offer actionable insights applicable to improving HIS effectiveness in any healthcare setting. By demonstrating these elements' correlation with higher utilization rates, the study highlights prerequisites for HIS contributing meaningfully to administrative efficiency, as proper data collection, reporting, and use are foundational for efficient management and decision-making, reinforcing that system investment must match user capacity and support structure investment to unlock efficiency gains.

Study (Alashger *et al*., 2021): explored electronic management's effects on health service quality at Al-Khums Teaching Hospital during the pandemic. Using descriptive and analytical methodology, the study sampled 50 hospital workers, distributing 50 questionnaires yielding 47 valid responses. Data collection employed a structured questionnaire gathering information on electronic management and health service quality aspects, analyzed using statistical methods evaluating variable relationships. The study found statistically significant impacts of electronic management—

encompassing devices, communication networks, and decision-making processes—on reliability, responsiveness, and assurance of hospital health services. Recommendations included enhancing modern equipment availability, continuously updating existing systems, and conducting staff training on effective electronic tool use. This study's importance lies in contributing to understanding how e-government initiatives transform healthcare delivery and improve service quality, especially during crises. The research highlights technology's critical role in streamlining health operations and ensuring better patient outcomes, supporting policymakers and healthcare administrators in implementing effective health information systems.

Study (AL-Shobak *et al*., 2020): aimed to identify computerized health information systems integration reality and their role in improving administrative performance at Dar Al-Shifa Medical Complex in Gaza. Using descriptive analytical methodology with questionnaires as the primary data collection tool, the study sampled 220 from 289 employees responsible for health information systems, retrieving 197 valid responses. Data analysis employed SPSS statistical software with various significance tests including T-tests and correlation coefficients. The study concluded that "databases used," "networks," and "system users" fields showed statistically significant high to considerable approval levels, while "equipment and equipment used" and "senior management support" fields showed moderate approval without statistical significance. Results confirmed statistically significant relationships between computerized health information systems across dimensions and improved administrative performance. Recommendations included establishing specialized health information systems departments, increasing senior management support for system users, investing in material resources, optimizing database system use, improving networks, providing dedicated employee email, and effectively using databases for decision-making support. This study's importance lies in directly addressing computerized health information system dimensions' role in improving administrative performance within similar health contexts, providing strong empirical basis and identifying key performance-influencing factors, offering valuable insights and comparison framework for examining HIS's role on administrative efficiency in dental clinics.

Study (Ramirez Martínez *et al*., 2019): focused on implementing an information system for managing medical records at Pedro Borrás Astorga University Polyclinic and Antonio Briones Montoto Teaching Dentistry Clinic. Using technological development

methodology, the research created a prototype application addressing medical record management challenges. The study sampled the two pilot dental clinics in Pinar del Río, utilizing interviews to identify user needs and functional requirements. Data analysis employed qualitative and quantitative methods assessing the proposed system's effectiveness. The study concluded the implemented application significantly improved patient registration processes, appointment scheduling, and data management, enhancing overall dental service efficiency. Researchers recommended further system integration across other health facilities to maximize benefits. This study's significance lies in its potential to transform dental clinic patient data management, improving service delivery and patient care through streamlined administrative processes.

Study (Alhajhamad *et al.,* 2018): examined user experience (UX) and user interface (UI) of a 3D interactive system designed for dental clinics to enhance patient dental information management. Using qualitative methodology focusing on dental professional and patient feedback, the study sampled 50 dentists and dental students in Palestine through purposive sampling. Data collection employed surveys and interviews gathering usability and functionality insights, analyzed thematically to identify key themes related to user satisfaction and system efficiency. Findings revealed significant challenges in current applications including time consumption and patient information loss, emphasizing the need for improved systems facilitating easier patient data access. The study concluded well-designed interactive dental applications could greatly enhance dental practice efficiency. Recommendations included developing features addressing user needs and integrating advanced functionalities for better patient management. This study's significance lies in informing development of more effective health information systems that streamline operations, improve patient care, and enhance overall dental clinic efficiency.

Study (Fatimah *et al.,* 2018): examined the relationship between health information systems (HIS) quality and healthcare management effectiveness in dental clinics. Using quantitative cross-sectional design, the study sampled 76 from 85 employees at the Dental and Oral Health Care Center (DOHCC) in South Sulawesi through purposive sampling of those involved in health information management. Structured questionnaires assessed HIS availability, relevance, and accuracy, analyzed using chi-square tests and logistic regression via SPSS. Results showed significant relationships between HIS availability ($p=0.012$) and relevance ($p=0.027$) with healthcare

management, while accuracy showed no significant influence (p=0.113). The study recommended enhancing information technology use to improve health services. This research's importance lies in informing healthcare administrators about HIS's critical role in achieving better management outcomes, enhancing service quality and patient satisfaction in dental settings. The study underscores the need for policymakers to prioritize effective health information system development and integration to address health management challenges, improving health services and patient care.

Study (Bakhachcha *et al*., 2018): examined HIS's role in improving administrative efficiency at Saadna Abdennour University Hospital in Setif, Algeria, assessing existing HIS quality and its contribution to management effectiveness. Using case study methodology, the study sampled interviews with heads of three key departments: General Surgery, Central Pharmacy, and Laboratory. Direct interviews served as the primary data collection tool, questioning department heads about information system aspects in their areas, with qualitative analysis synthesizing findings regarding system functionality, limitations, and impact on operations and management. The study concluded the hospital's HIS was largely inefficient, relying heavily on traditional manual methods and critically lacking interdepartmental integration. This outdated approach caused significant management challenges including poor information flow between departments, inadequate information for effective decision-making, and cost determination and control issues. Findings implicitly recommend modernizing and integrating the HIS, implementing comprehensive technology-based systems with robust interdepartmental links and digital archiving to improve information flow, enhance decision support, and boost administrative efficiency. This study's importance lies in providing practical demonstration of inadequate HIS consequences within Algerian public health contexts. By highlighting how traditional methods reliance and integration lack in university hospital settings directly hinder management efficiency and information accessibility, it offers valuable insights into potential systemic challenges similarly affecting dental clinics within the same healthcare system framework, reinforcing the critical need for effective HIS implementation to overcome challenges and achieve improved administrative performance in healthcare facilities.

Study (Rađenović & Veselinović, 2017): analyzed and evaluated health information systems (HIS) efficiency in healthcare service provision. Using multi-criteria decision-making through the AHP-TOPSIS method, the research systematically assessed three

electronic healthcare software solutions. The study sampled three prominent HIS applications from various healthcare organizations: Clinical Works, Cure MD, and McKesson Practice Choice. Data collection employed a comprehensive decision matrix based on multiple HIS performance criteria including user numbers and data redundancy. Data analysis applied the AHP method determining criterion weights, followed by TOPSIS ranking alternatives based on ideal solution proximity. Findings revealed eClinical Works as the most efficient software solution, though noting the best-rated system may not universally apply to all healthcare organizations due to varying operational needs. The study recommended decision-makers consider organizational specifics when selecting HIS, emphasizing the importance of aligning software capabilities with institutional requirements. This research's significance lies in focusing on enhancing healthcare administrative efficiency, contributing valuable insights into optimizing health information systems for improved service delivery and operational effectiveness within dental clinics and similar healthcare facilities.

Study (Hazaimeh, 2017): explored health management information systems' (HMIS) effect on employee performance within Jordan's public health sector. Using descriptive analytical methodology, the study sampled employees from Jordanian public hospitals, distributing 440 questionnaires with 392 returned (89% response rate). Structured questionnaires captured HMIS dimensions including devices, databases, networks, applications, and user experiences, analyzed using statistical methods including Cronbach's Alpha for reliability and validity. Findings showed statistically significant HMIS impact on employee performance, revealing positive correlations between effective information system use and enhanced public hospital productivity. Recommendations included healthcare institutions continuously adapting to technological advancements, utilizing modern equipment and applications to improve employee performance, implementing ongoing training programs equipping staff with necessary HMIS skills to minimize errors and enhance service delivery, and advocating awareness campaigns highlighting HMIS's critical role in boosting operational efficiency and healthcare service quality. This study's significance lies in informing healthcare administrators and policymakers about information systems' transformative power in optimizing health services, leading to better patient outcomes and more efficient healthcare management.

Study (Pérez *et al*., 2016): addressed developing an automated system for managing clinical histories in dental clinics, highlighting traditional paper-based record inefficiencies. Using technological development research methodology with qualitative-quantitative cross-sectional approach, the study sampled patients receiving comprehensive dental care from two Pinar del Río, Cuba clinics. Data collection employed surveys and direct observations gathering insights from patients and dental professionals, analyzed using descriptive statistics and qualitative assessments evaluating system effectiveness. The study concluded the newly developed computerized system significantly enhances clinical history management, improving patient control and operational clinic efficiency. Recommendations included implementing similar systems in other healthcare settings to optimize patient care. This study's importance lies in its potential to transform healthcare delivery by demonstrating how integrated information systems streamline processes, reduce errors, and foster better healthcare provider communication. This transformation is critical for enhancing dental care quality and ensuring health professionals have timely patient information access, ultimately improving health outcomes.

Study (Faryadras & Dashti, 2016): evaluated how management information systems enhance healthcare service efficiency and quality at Tehran's Madayen Hospital. Using descriptive analytical methodology, the research explored relationships between MIS implementation and various performance metrics. The study sampled 73 healthcare professionals and patients from Madayen Hospital through simple random sampling. Data collection utilized structured questionnaires validated by management experts, analyzed using structural equation modeling via LISREL and SPSS software examining variable relationships. Findings indicated MIS significantly impacts financial performance, customer orientation, internal processes, and overall service quality. The study recommended hospitals invest more in advanced MIS to enhance operational efficiency and service delivery. This study's importance lies in informing healthcare administrators about technology's critical role in optimizing management practices and improving patient outcomes, particularly significant given increasing healthcare delivery system complexity where effective information management leads to better resource allocation, reduced wait times, and improved patient satisfaction.

Study (Al-Musawi, 2016): focused on information systems' impact on health service quality in Najaf government hospitals. Using deductive methodology exploring

relationships between management information systems and service quality, the study sampled 169 hospital administrative leaders and patients. Structured questionnaires collected quantitative data on both groups' perceptions regarding information system effectiveness, analyzed using statistical methods including correlation and regression analyses evaluating variable relationships. Findings revealed significant correlations between management information system components and health service quality, indicating these systems play crucial roles in enhancing service delivery. The study recommended hospitals adopt comprehensive information system development projects to leverage their benefits, improving overall hospital performance. This research's significance lies in guiding healthcare administrators toward implementing effective information systems, potentially improving administrative efficiency and health outcomes, ultimately benefiting patients and enhancing operational capabilities of dental clinics. By addressing healthcare delivery system gaps, the study contributes valuable insights into harnessing information technology to meet growing healthcare service demands in rapidly changing environments.

Study (Souissi, 2013): investigated information systems' contribution to improving health service quality in Algerian public hospitals, specifically at Mohamed Boudiaf Public Hospital in Ouargla. The research explored the Algerian health system's historical context and current information systems reality, defined key concepts including health services and hospital information systems, and assessed information systems' impact on service quality. Using descriptive and analytical approaches with case study methodology, the research employed field visits, observation, document analysis, and questionnaires administered to 40 hospital employees (20 administrative, 20 medical/paramedical staff), analyzed via SPSS. The study concluded that despite staff awareness of information importance, the hospital heavily relies on manual information management, causing slow retrieval, interdepartmental communication difficulties, and data loss, negatively impacting service quality. Technology adoption challenges stemmed from insufficient training and limited utilization. Recommendations included establishing dedicated information management departments, providing comprehensive training, implementing integrated electronic systems, and improving interdepartmental communication. This study's importance lies in demonstrating fundamental links between effective information management and healthcare institution performance and quality within Algeria's public sector. Though

focusing on general hospitals, findings on manual administrative process prevalence, technology training needs, and integrated systems' streamlining potential are directly relevant, highlighting common systemic issues and suggesting implementing and optimizing HIS would be crucial for enhancing administrative efficiency, a key component for improving service delivery including in specialized settings like dental clinics.

2.5.2 Studies covering Healthcare Service Quality and Patient Satisfaction

Includes studies where the primary focus is on evaluating the quality of healthcare services and patient satisfaction, often as an outcome of administrative or clinical processes. HIS/technology is often a background factor rather than the central variable.

Study (Al-Zahrani *et al*., 2022): explored effective communication's role between hospital departments and its correlation with administrative decision-making quality. Using descriptive analytical methodology, the study sampled 141 healthcare managers and administrative staff at King Faisal Specialist Hospital in Riyadh through stratified random sampling ensuring diverse representation. Data collection employed surveys and structured interviews gathering insights on decision-making factors including interdepartmental collaboration and technological integration, analyzed using statistical techniques examining variable relationships. Findings highlighted enhanced communication significantly improved coordination and decision-making accuracy, with employee support and continuous training fostering active participation and innovation. Researchers recommended cultivating teamwork and knowledge-sharing cultures among departments to optimize decision-making efficiency. This study's significance lies in demonstrating how effective decision-making and communication lead to improved administrative outcomes. By applying these insights and integrating HIS for-data management and analysis, Zawia dental clinics can greatly enhance operational efficiency and patient care quality, emphasizing vital links between systematic communication efforts and healthcare service excellence.

Study (AlShehri, 2021): explored patient satisfaction regarding health services at Riyadh's primary health care centers, focusing on service quality, staff efficiency, and electronic service availability. Using descriptive analytical methodology, the study sampled 200 randomly selected patients from four geographically diverse health

centers. Electronic questionnaires collected patient feedback on their experiences, analyzed using SPSS software to evaluate satisfaction levels and identify key issues. Findings revealed most patients were female and indicated significant shortcomings in medication and electronic service availability, plus inadequate staff training, particularly at reception. Based on results, the study recommended enhancing government infrastructure, improving workforce training, and addressing medication and supportive service shortages. This study's importance lies in contributing to understanding how health information systems can optimize administrative processes and ultimately enhance patient satisfaction within healthcare settings.

Study (Salem, 2021): assessed current healthcare service quality in medical hospitals operating in Greater Tripoli from healthcare service providers' perspective. Using descriptive analytical methodology, the study sampled 145 healthcare professionals and patients from Tripoli University Hospital providing service quality insights. Structured questionnaires captured various healthcare quality dimensions, analyzed using SPSS statistical methods. The study found significant gaps in quality service dimension availability and highlighted challenges healthcare providers face in delivering effective services. Recommendations included enhancing health awareness among providers regarding healthcare quality concepts and objectives, emphasizing training and development program needs. This study's importance lies in informing healthcare administrators about information systems' critical role in enhancing operational efficiency, ultimately leading to better patient outcomes and optimized resource management.

Study (Chadli, 2019): evaluated health service quality from patients' viewpoints at Younes Rezig Multi-Service Clinic in Biskra, Algeria, aiming to ascertain perceived quality levels of essential services. Using descriptive analytical methodology, the research examined complex variables influencing patient service quality perception. The study randomly sampled 50 customers receiving services from the clinic. Structured questionnaires captured patient evaluations based on five health service quality dimensions: Reliability, Responsiveness, Assurance, Tangibles, and Empathy, typically assessed using Likert scales. Data analysis employed SPSS statistical techniques including descriptive statistics (frequencies, percentages, means, standard deviations) summarizing sample characteristics and responses, plus inferential statistics including Pearson correlation examining variable relationships and Cronbach's Alpha

assessing questionnaire reliability, with normality tests (Skewness and Kurtosis) performed. The study concluded perceived health service quality across all five dimensions was average, aligning with initial hypotheses. Recommendations included improving resource allocation and expenditure management, attracting and retaining specialized medical professionals, implementing patient hygiene education programs, upgrading medical equipment, prioritizing patient satisfaction, and integrating empathetic approaches in staff-patient interactions. This study's importance lies in providing concrete evaluation of perceived health service quality from patient perspectives, serving as critical outcome measures assessing administrative efficiency improvements potentially driven by HIS implementation. Understanding which quality dimensions are perceived as average or below can inform where HIS could improve administrative support, highlighting patient-centric views that should guide HIS-supported administrative reforms.

Study (Reyes-Fernández *et al.,* 2015): assessed user satisfaction with oral health services and identified influencing factors. Using cross-sectional analytical design, the study sampled 493 individuals over 18 who received dental care from dental health services in Guerrero, Mexico. Data collection employed structured questionnaires comprising 51 questions addressing sociodemographic information, satisfaction levels, and dental service perceptions, analyzed using statistical methods including odds ratios and confidence intervals identifying significant associations. Findings revealed 88% user satisfaction rate, with key factors like dentist and nurse attitudes significantly impacting satisfaction levels. The study recommended enhancing interpersonal treatment by health personnel to further improve user satisfaction. This study's importance lies in contributing to understanding patient satisfaction dynamics in dental services, guiding health authorities in implementing targeted interventions to enhance service quality and patient experiences.

2.5.3 Studies covering Healthcare Management, Strategy, and Context

Includes studies and reports that provide a broader, high-level view of healthcare systems, management strategies, organizational policies, and contextual data, which frame the environment in which HIS operates.

Study (Wasik et al., 2024): identified management and organizational strategies' importance in healthcare settings, particularly hospitals. Using systematic literature

review methodology, the research analyzed 29 scholarly articles published between 2000-2023 from databases including Scopus and Web of Science, sampling qualitative and quantitative research articles relevant to hospital management. Data collection involved keyword searches and thematic literature categorization, analyzed using content analysis techniques synthesizing findings across selected studies. The study concluded effective management and organizational strategies are crucial for enhancing hospital performance and patient care quality, emphasizing human resources' significant role in achieving organizational goals. Recommendations included strengthening leadership practices and fostering collaborative organizational culture to improve service delivery. This study's importance lies in contributing to understanding how strategic management leads to enhanced operational effectiveness and patient satisfaction within healthcare facilities, providing valuable insights for healthcare leaders navigating modern health service delivery complexities and improving overall system efficiency.

Report (FDI World Dental Federation, 2023): addressed global oral health challenges and outlined a roadmap for achieving optimal oral health by 2030. Using consultative approach involving expert working groups and external stakeholders through workshops and review processes, the document synthesized current knowledge, trends, and best practices. As a vision document rather than research study, it lacked specific study populations, samples, or data analysis tools, instead surveying the global oral health landscape and transformation potential within the profession and health systems. The document found that despite progress, significant global oral health inequalities persist, access to affordable quality care is uneven, and oral disease burden remains high, necessitating fundamental shifts toward integrated, preventive, person-centered care alongside resilient workforce development. Recommendations included integrating oral health into universal health coverage and broader public health agendas, focusing on prevention and addressing health determinants, developing adaptive workforce strategies, and leveraging technology and innovation across clinical practice, education, research, and policy. This Vision 2030 document's importance lies in recognizing technology, data management, and efficient operations' strategic importance in achieving better oral health outcomes. By highlighting needs for improved access, quality, and workforce effectiveness, Vision 2030 provides a global framework supporting investigation into how specific tools like HIS contribute to these

goals, particularly by enhancing clinic-level administrative efficiency, a key component of delivering timely, affordable, quality care as advocated.

Report (Shelik & Al-Tajouri, 2021): discussed multifaceted challenges and proposed comprehensive systemic reforms for Libya's health sector. Using mixed-methods research design incorporating literature review, qualitative interviews with 25 key informants (Libyan officials, international experts, healthcare providers), and quantitative surveys distributed to 83 healthcare providers across Libya, data collection utilized open-ended questions for qualitative exploration of root causes and structured surveys containing 93 questions using Likert scales for quantitative assessment. Data analysis involved qualitative content and thematic analysis identifying recurring interview themes, and descriptive statistical analysis (frequencies, percentages, means) quantifying perceptions on system components. The research concluded Libya's health system faces significant weaknesses across all assessed pillars—governance/leadership, financing, service delivery, human resources, medical supplies/technology, and information systems—stemming from political instability, corruption, lack of strategic planning, and inefficient management, resulting in poor care quality, unequal access, and low public trust. Recommendations included urgent comprehensive reforms: establishing robust health insurance systems, restructuring service delivery strengthening primary healthcare and hospital autonomy, enhancing human resources planning and training, streamlining medical supply chains, developing functional health information systems, and ensuring transparency and accountability, emphasizing strong political will and participatory phased implementation. This report's importance lies in providing broad national-level diagnosis of Libyan health system challenges including health information system assessment as critical component, though offering high-level systemic recommendations rather than specific guidance on improving administrative efficiency within particular facilities like Zawia dental clinics, as its scope is national and strategic.

Study (Ben Rabah & Al-Bousifi, 2019): explored primary reasons behind public hospital service weakness from administrators' perspectives in Greater Tripoli. Using descriptive methodology, the study sampled 337 administrators from government hospitals and clinics, analyzing 269 valid responses collected via specially designed questionnaires. Data analysis employed descriptive statistics and inferential tests through SPSS. Findings revealed significant weaknesses in medical staff availability

and management capabilities, plus notable financial corruption prevalence. The study recommended enhancing administrative practices and improving staff training. This study's importance lies in focusing on critical factors affecting Libya's health sector, providing valuable insights for policymakers aiming to enhance healthcare delivery and administrative efficiency regionally.

Report (Dagani & Al-Rashid, 2019): conducted a comprehensive survey of private health sector facilities in Libya, updating data on numbers, types, distribution, services, human resources, and equipment. Using descriptive census methodology through trained field researchers employing electronic questionnaires across 101 municipalities, data analysis utilized Excel descriptive statistics. The study found significant increases in private health facilities nationwide between 2007-2018 (112% growth), detailing counts for clinics (537), hospitals/polyclinics (235), dental clinics (371), pharmacies (3089), laboratories (411), and diagnostic centers (19), plus geographical distribution, service types, human resources breakdown, and diagnostic equipment. Recommendations included reviewing laws/regulations, developing monitoring strategies, encouraging investment in underserved areas, promoting public-private partnerships, implementing health insurance, evaluating service quality, and conducting National Health Accounts. This study's significance lies in providing essential baseline data on dental clinic numbers, characteristics, and human resources specifically in Zawia and the broader private health sector landscape, offering crucial context for understanding where HIS interventions could potentially impact administrative efficiency.

Study (Al-Fanatseh, 2019): analyzed secondary healthcare services' spatial distribution in Al-karak and Tafieleh governorates' public hospitals. Using quantitative analytical approach focusing on healthcare facilities and accessibility relative to population distribution, the study sampled residents from various urban and rural settlements in both governorates. Data collection employed geographic information systems (GIS) and ArcGIS network analysis applications, analyzed using location-allocation models and service area assessments determining hospital coverage and accessibility. Findings revealed Al-karak Hospital covers only 34% of Al-karak's population, with other hospitals showing varying coverage percentages, highlighting significant service accessibility gaps. The study concluded establishing new hospitals could increase service coverage significantly, reaching 96.5% in Al-karak and 91.6% in Tafieleh.

Recommendations included urgent needs for new hospital facilities to enhance healthcare access and efficiency. This study's importance lies in demonstrating how spatial analysis can inform healthcare planning and policy-making, ensuring appropriate resource allocation.

Study (Tchatchoua, 2018): identified effective strategies employed by healthcare managers in a midwestern U.S. hospital. Using qualitative exploratory case study methodology, the study sampled six participants including a medical doctor, nurse manager, finance manager, and healthcare administrators with substantial cost management and operational efficiency experience. Data collection employed semi-structured interviews and document reviews gathering comprehensive information about managers' experiences and strategies, analyzed using thematic coding techniques through qualitative analysis software identifying key themes and strategies. Findings revealed three primary themes: improving information and report accuracy, implementing precise information management practices, and enhancing overall service delivery quality. The study recommended healthcare managers adopt these strategies to foster better efficiency and lower costs. This study's significance lies in informing healthcare leaders about effective management practices leading to significant service delivery improvements and cost reduction, ultimately contributing to more effective healthcare systems. By highlighting accurate information and efficient processes' importance, the study provides valuable insights for enhancing operational frameworks of dental clinics and similar healthcare facilities.

Study (Bushra & Mudassir, 2018): assessed Health Information Systems (HIS) efficiency in Jordanian hospitals and identified healthcare delivery improvement opportunities. Using quantitative methodology with structured questionnaires distributed to hospital administrative staff, the study sampled 278 respondents from administrators at Specialized Hospital and Al-Bashir Hospital. Likert-scale questionnaires gauged perceptions of HIS efficiency and healthcare development impact, analyzed using SPSS statistical techniques focusing on descriptive and inferential statistics. Findings revealed significant positive relationships between HIS implementation and healthcare service improvements, indicating well-functioning information systems enhance service quality and operational efficiency. The study recommended hospital leaders leverage HIS to align with international quality standards and enhance service delivery. This study's significance lies in contributing to

understanding how effective HIS streamlines administrative processes, leading to better patient outcomes and more efficient healthcare management. By addressing gaps in Jordanian HIS literature, this research highlights technology's critical role in modernizing healthcare practices and improving overall health sector performance.

Study (Houaoussa & Boussounouba, 2018): explored effective strategies for managing health service quality in Algerian hospitals, focusing on improving service delivery and health sector worker performance. Using descriptive methodology, the study sampled 150 healthcare professionals and administrators from various Algerian hospitals through purposive sampling ensuring diverse perspectives. Structured questionnaires and interviews facilitated comprehensive understanding of healthcare quality management challenges, analyzed using both quantitative and qualitative techniques including statistical analysis for surveys and thematic analysis for interviews. The study concluded significant obstacles hinder quality management practice implementation, including inadequate training and resource limitations. Recommendations included establishing robust quality management frameworks tailored to Algerian hospitals' specific needs, emphasizing continuous training and stakeholder engagement importance. This study's significance lies in its potential to enhance healthcare administrative processes, ultimately leading to better patient outcomes and increased operational efficiency. By addressing identified healthcare delivery gaps, this research contributes valuable insights into improving Algerian health service quality.

2.5.4 Commentary on Previous Studies

2.5.4.1 Critical Analysis of Methodology

A review of previous studies on Health Information Systems (HIS) and administrative efficiency reveals substantial methodological diversity. Most investigations employed descriptive–analytical or cross-sectional designs, which provide valuable associative insights but often lack the ability to establish causality. For instance, studies by Al-Arabi et al. (2025) and Bin Awadh & Abu Maleh (2023) successfully identified significant correlations between HIS dimensions and decision-making quality but relied on self-reported data gathered through structured questionnaires, raising concerns about response bias and subjectivity. Similarly, Othman (2025) and Faryadras & Dashti (2016) utilized advanced statistical techniques such as regression and structural equation modeling, ensuring reliability and construct validity; however, these studies

often confined their analysis to hospitals rather than smaller health facilities like dental clinics.

Qualitative and mixed-method approaches, such as those adopted by Peñafiel et al. (2024) and Pujihastuti & Nelwetis (2024), enriched the literature through contextual depth, yet their findings were limited by small, purposive samples that constrain generalizability. On the other hand, technological development studies (e.g., Ramirez Martínez et al., 2019; Pérez et al., 2016) demonstrated practical system implementation but seldom integrated longitudinal data to assess sustained administrative improvements. Moreover, several studies lacked a clear operationalization of "administrative efficiency," often conflating it with overall performance or service quality, which complicates cross-study comparison. In summary, while the methodologies collectively contribute rich descriptive and empirical insights, there remains an evident need for integrative, context-specific, and longitudinal research—particularly within specialized environments such as dental clinics.

2.5.4.2 Comparison and Synthesis of Findings

The synthesis of findings across reviewed studies indicates a consistent consensus: effective HIS adoption enhances data accessibility, communication, coordination, and decision-making, thereby improving administrative and operational outcomes. Empirical evidence from AL-Shobak et al. (2020) and Albdri & Awami (2024) confirmed the strong relationship between computerized HIS integration and improved administrative performance. Similarly, Chew et al. (2024) and Peñafiel et al. (2024) demonstrated measurable gains in dental clinic productivity and patient satisfaction following the digitization of appointment and record systems.

Studies focusing on broader healthcare contexts—such as Othman (2025) and Eissa (2023)—supported these results theoretically, asserting that information system quality mediates the impact of strategic planning on performance. Conversely, research conducted in developing or transitional health systems (e.g., Bakhachcha et al., 2018; Souissi, 2013) highlighted persistent challenges including limited technological infrastructure, inadequate staff training, and weak interdepartmental integration, which continue to hinder system efficiency. Collectively, the literature suggests that while HIS implementation universally promotes administrative efficiency, contextual enablers

such as institutional readiness, human resource capacity, and policy support are decisive in determining the magnitude of impact.

2.5.4.3 Identification of Research Gaps

Despite the abundance of literature, several notable gaps remain. First, few studies have investigated HIS effectiveness specifically within dental clinic settings, particularly in the Libyan context, where administrative inefficiencies and digital disparities persist. Most previous research focused on hospitals or national systems, overlooking the unique operational dynamics of smaller healthcare units. Second, existing studies often assess HIS from a technical or clinical perspective, while the administrative dimension—encompassing scheduling, billing, reporting, and resource coordination—remains underexplored. Third, there is a methodological gap in terms of longitudinal and mixed-method designs capable of capturing both quantifiable efficiency improvements and qualitative organizational transformations over time. Lastly, there is limited research linking HIS adoption to localized factors such as staff digital literacy, regulatory frameworks, and cultural attitudes toward technology, all of which are crucial for understanding HIS effectiveness in regions like Zawia.

2.5.4.4 Linking Previous Studies to the Current Research Objectives

The reviewed literature collectively establishes the theoretical and empirical foundation for the current study, which investigates the role of Health Information Systems in improving administrative efficiency in Zawia dental clinics. Studies such as AL-Shobak et al. (2020) and Eissa (2023) provide conceptual models linking HIS functionality with management performance, while Ramirez Martínez et al. (2019) and Peñafiel et al. (2024) offer direct evidence of HIS benefits in dental practice contexts. However, these studies are geographically and contextually distinct from Libya. The current research builds upon these findings by situating the inquiry within a Libyan municipal framework, addressing the intersection of technology, management, and service delivery in dental care. In doing so, it seeks to validate whether the efficiency gains observed elsewhere can be replicated within a resource-constrained environment like Zawia, and to identify local barriers or facilitators influencing HIS performance. This alignment underscores the study's contribution to bridging empirical gaps between global theory and local practice.

2.5.4.5 Conclusion and Contribution of the Current Study

In conclusion, prior research overwhelmingly supports the premise that effective HIS implementation enhances administrative efficiency across diverse healthcare settings. Nonetheless, methodological inconsistencies, contextual limitations, and a paucity of dental-specific studies restrict the transferability of existing findings to Libyan clinics. The current study contributes to the literature by addressing these deficiencies through an empirically grounded, contextually oriented investigation that evaluates HIS performance in Zawia's dental facilities. Its contribution lies in generating localized evidence on how HIS can streamline administrative functions—such as patient registration, record management, and interdepartmental coordination—while considering organizational, technical, and human factors unique to the Libyan healthcare landscape. Ultimately, the study aspires to inform policy formulation and managerial strategies aimed at achieving sustainable digital transformation and operational excellence within Libya's dental health sector.

2.6 Chapter Summary

Based on the comprehensive theoretical framework and literature review presented in Chapter Two, this investigation establishes a foundational understanding of the intricate relationship between Health Information Systems (HIS) and administrative efficiency, specifically within the challenging context of Libyan dental clinics, notably those in Zawia. The chapter systematically deconstructs the concept of HIS, framing it not merely as a technological tool but as a complex socio-technical ecosystem comprising interconnected components—technology, data, humanware, and processes—that collectively drive a paradigm shift from fragmented, paper-based operations to integrated, digital workflows. This evolution is critically examined, highlighting the stark contrasts between manual systems and modern HIS across dimensions such as data accessibility, accuracy, and coordinative efficiency, as detailed in the comparative analysis. The exploration further delineates the specific types of HIS salient to dental practice, including Electronic Health Records and appointment management systems, and underscores their multifaceted importance in enhancing healthcare quality, facilitating data-driven administrative decision-making, and reducing errors, while also candidly addressing the formidable implementation challenges, from technical infrastructure deficits to human resistance, particularly acute in developing settings like Libya. The inquiry then pivots to a nuanced conceptualization of administrative efficiency, defining it as the optimal utilization of resources to achieve operational goals

with minimal waste, and operationalizes this construct through a detailed matrix of measurable indicators tailored to the dental clinic environment, from patient waiting times to inventory turnover rates. The synthesis of these two core concepts culminates in a rigorous analysis of the mechanisms through which HIS acts as a catalytic intervention for administrative efficiency—namely through process automation, enhanced data integrity, improved inter-departmental coordination, and empowered managerial decision-making—supported by evidence from international case studies that yield critical, transferable lessons on phased implementation and user-centric design. Finally, the chapter grounds this theoretical discourse in the tangible realities of the Libyan healthcare landscape, diagnosing the structural, administrative, and digital impediments plaguing the system while simultaneously identifying a foundation of opportunities—such as growing technological readiness and positive staff attitudes—upon which a strategic, context-sensitive HIS implementation could be initiated to bridge the stark gap between theoretical potential and practical transformation for Zawia's dental clinics, thereby setting the stage for empirical investigation.

CHAPTER THREE: RESEARCH METHODOLOGY AND METHODS

3.0. Introduction

This chapter details the methodological approach adopted to investigate the role of Health Information Systems (HIS) in improving administrative efficiency in dental clinics in Zawia City, Libya. It outlines the study design, population, sampling strategy, data collection instruments, and analytical procedures. The chapter also addresses the validity and reliability of the research tool and the statistical methods employed to analyze the data.

3.1 Profile of Public Dental Clinics within Libyan Context in Zawia City

The study was conducted across seven dental clinics in Zawia City, comprising both public and private facilities (Table 3.1). The public clinics included Abu Ghlasha School Health Unit, Central Dental Clinic, and Al-Wafaa Center. Private facilities included Al-Razi Clinic, Al-Jamal Clinic, Biolab Center, and Al-Rayhana Center. These clinics represent the primary dental care providers in the region, serving a diverse patient population and operating under varying administrative and resource conditions.

Table 3.1: Participating Dental Clinics in Zawia City

Clinic Name	Sector	Estimated Staff Size
Al-Razi Clinic	Private	Small
Al-Jamal Clinic	Private	Small
Biolab Center	Private	Medium
Abu Ghlasha School Health Unit	Public	Small
Al-Rayhana Center	Private	Medium
Central Dental Clinic	Public	Large
Al-Wafaa Center	Public	Medium

3.2 Research Methodology

A **descriptive analytical approach** was employed, utilizing a cross-sectional survey design to collect quantitative data over a four-month period. This approach enabled the systematic examination of relationships between HIS implementation and administrative efficiency while providing a snapshot of current practices and perceptions among clinic staff.

3.3. Study Population and Sample

3.3.1 Study Population

The target population included all administrative staff, dentists, and IT personnel across the seven selected clinics, totaling 558 individuals. The population was categorized into four occupational groups as detailed in Table 3.2.

Table 3.2: Study Population by Occupational Category (N=558)

Occupational Group	Frequency (N)	Percentage (%)
Physicians	270	48.4%
Nurses	87	15.6%
Administrators	80	14.3%
Support Staff	121	21.7%
Total	**558**	**100.0%**

3.3.2 Sampling Technique and Sample Size

A proportionate stratified random sampling method was used to ensure representation across occupational groups and clinic types. The sample size was calculated using Steven Thompson's formula (2012) as follows:

$$n = \frac{N \times p(1-p)}{\left[(N-1) \times \left(\frac{d^2}{Z^2}\right)\right] + p(1-p)}$$

Where:

- n = sample size
- N = total population size
- p = population proportion (0.5 for maximum sample size)
- d = margin of error
- Z = Z-score corresponding to the confidence level

Application of this formula yielded a sample size of 95 participants, representing approximately 17% of the total population. The distribution across occupational categories is shown in Table 3.3.

Table 3.3: Sample Distribution by Occupational Category (n=95)

Occupational Group	Sample Frequency (n)	Sample Percentage (%)	Population Proportion (%)
Physicians	46	48.4%	48.4%

Occupational Group	Sample Frequency (n)	Sample Percentage (%)	Population Proportion (%)
Nurses	15	15.8%	15.6%
Administrators	14	14.7%	14.3%
Support Staff	20	21.1%	21.7%
Total	**95**	**100.0%**	**100.0%**

3.3.3 Sample Distribution

Sample allocation across clinics was proportional to their size and occupational composition. The number of participants per clinic ranged from 3 (Al-Razi Clinic) to 46 (Central Dental Clinic), reflecting the actual distribution within the study population.

3.3.4 Response Rate

All 95 distributed questionnaires were completed and returned, yielding a response rate of 100%.

3.4 Tools of the Study Data Collection Procedure

3.4.1 Questionnaire Surveys

A structured questionnaire was developed as the primary data collection tool. It was administered in paper format to ensure accessibility and completeness.

3.4.2 Layout of Questionnaire

The questionnaire consisted of two main parts:

- **Part I:** Demographic information (gender, age, education, job title, experience, clinic type).
- **Part II:** Five thematic dimensions measured using a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree).

3.4.3 Questionnaire Design and Measures

The instrument comprised 40 items across five dimensions:

1. Current State of Administrative Efficiency (8 items)
2. Role of HIS in Improving Administrative Processes (8 items)
3. Factors Influencing HIS Adoption (8 items)
4. Training and Technical Support (8 items)

5. Interdepartmental Coordination and Patient Care Improvement (8 items)

3.5 Validity and Reliability Test

3.5.1 Validity

The questionnaire was validated through face and content validity procedures.

3.5.2 Face Validity

The instrument was reviewed by academic and field experts to ensure clarity, relevance, and appropriateness of items.

3.5.3 Content Validity or Expert Validity

A panel of five experts in health informatics and dental administration assessed the questionnaire for comprehensiveness and alignment with study objectives.

3.5.4 Translation of Questionnaire

The questionnaire was originally developed in English, translated into Arabic, and back-translated to ensure linguistic and conceptual accuracy.

3.6 Construct Validity

Construct validity was assessed using **corrected item-total correlation** (Table 3.4). All items demonstrated acceptable correlation coefficients (ranging from 0.094 to 0.814), confirming that each dimension measured its intended construct.

Table 3.4: Corrected Item-Total Correlation for Selected Key Items per Dimension

Dimension	Sample Item	Corrected Item-Total Correlation
1. Current State of Administrative Efficiency	Coordination between different departments in the clinic is poor	0.647
2. Role of HIS in Improving Admin. Processes	Information systems will facilitate access to information when needed	0.814
3. Factors Influencing HIS Adoption	Support from clinic management is essential for successful system implementation	0.590
4. Training and Technical Support	Continuous training is important to keep up with system updates	0.573

5. Interdepartmental Coordination & Patient Care	The system will improve response speed to emergency cases	0.703

3.7 Reliability Test

Internal consistency was evaluated using **Cronbach's alpha** (Table 3.5). The overall instrument reliability was excellent (α = 0.888). Dimension-level alphas ranged from 0.667 to 0.895, all above the acceptable threshold of 0.60.

Table 3.5: Cronbach's Alpha Coefficients for Questionnaire Dimensions

Dimension	Number of Items	Cronbach's Alpha (α)
1. Current State of Administrative Efficiency	8	0.679
2. Role of HIS in Improving Administrative Processes	8	0.895
3. Factors Influencing HIS Adoption	8	0.699
4. Training and Technical Support	8	0.667
5. Interdepartmental Coordination & Patient Care Improvement	8	0.857
Overall Instrument	**40**	**0.888**

3.8 Normal Distribution Test

Normality was tested using the **Kolmogorov-Smirnov** and **Shapiro-Wilk** tests (Table 3.6). Results indicated deviations from normality for most dimensions, but the large sample size (N=95) justified the use of parametric tests under the Central Limit Theorem.

Table 3.6: Results of Normality Tests (Kolmogorov-Smirnov & Shapiro-Wilk)

Variable	Kolmogorov-Smirnov (p-value)	Shapiro-Wilk (p-value)	Decision (α=0.05)
D1_AdminEff	.027	.303	Deviation from normality (per K-S)
D2_HIS_Impact	.000	.000	Deviation from normality
D3_Factors	.001	.000	Deviation from normality
D4_TrainingSupport	.000	.057	Deviation from normality (per K-S)
D5_Coord	.003	.004	Deviation from normality

3.9 Model Fit Indices for the Statistical Methods Used

3.9.1 Multicollinearity Test

Multicollinearity was assessed using Variance Inflation Factor (VIF) and tolerance values; all were within acceptable ranges (VIF < 10, tolerance > 0.1).

3.9.2 Correlation Analysis and Collinearity Test

Pearson correlation coefficients were computed to examine relationships between variables. No severe multicollinearity was detected.

3.9.3 Autocorrelation Test

The Durbin-Watson statistic was used to test for autocorrelation in regression residuals, confirming independence of errors.

3.10 Study Limitations

3.10.1 Thematic Limitations

This study examines the role of health information systems in improving administrative efficiency in dental clinics, limiting its scope to administrative and organizational aspects rather than clinical or therapeutic practices. It focuses on three areas: assessing current administrative procedures such as appointment scheduling and record management; exploring how health information systems enhance electronic records and information flow; and identifying organizational, technical, and human factors affecting system implementation. Financial and legal issues—particularly those related to data privacy—are excluded, with emphasis placed solely on administrative performance and operational efficiency.

3.10.2 Human Limitations

The study targets employees in private dental clinics in Zawia city, including administrative staff, dentists involved in clinical documentation, reception personnel, records officers, and IT support staff where available. It excludes patients, external service providers, and regulatory bodies, as the study concentrates on the experiences of staff directly interacting with administrative systems and possessing firsthand insight into workflow challenges and improvement opportunities.

3.10.3 Temporal Limitations

The research is conducted during the 2025–2026 academic year, with data collection and analysis confined to this period. The findings reflect the state of administrative practices and information systems use at that time. Given the rapid evolution of technology and possible organizational changes after the study period, the generalizability of the results to later years may be limited, requiring caution when applying the study's recommendations in future contexts.

3.10.4 Geographical Limitations

The study is geographically limited to private dental clinics in Zawia city, northwestern Libya. It does not extend to clinics in other cities, public hospitals, or governmental institutions. This focus allows for an in-depth understanding of the local context but limits the broader applicability of the findings, as administrative conditions and technological readiness may differ across regions with varying socioeconomic and technical environments.

3.11 Statistical Methods Used in Analyzing Primary Data

The following statistical techniques were applied:

- **Descriptive statistics** (frequencies, percentages, means, standard deviations)
- **Inferential statistics**:
  - One-sample t-test
  - Independent samples t-test
  - One-way ANOVA
  - Linear and multiple regression
  - Pearson correlation
  - Exploratory Factor Analysis (EFA) with Varimax rotation

3.12 Chapter Summary

This chapter outlined the methodological framework of the study, including the design, sampling, instrument development, validation, and analytical procedures. The use of a validated questionnaire and robust statistical methods ensures the reliability and validity of the findings, which are presented and interpreted in the subsequent chapter.

CHAPTER FOUR: DATA ANALYSIS AND FINDINGS

4.0 Introduction

This chapter presents the analysis of the data collected to examine the role of Health Information Systems (HIS) in improving administrative efficiency in dental clinics in Zawia City. It begins with a descriptive analysis of the sample characteristics and the study's key variables. Subsequently, it details the results of the statistical tests conducted to examine the research hypotheses. The findings are presented through descriptive statistics, tables, and inferential analyses, culminating in a chapter summary.

4.1 Descriptive Statistics

4.1.1 Sample Characteristics

The demographic and professional characteristics of the 95 participants are summarized below.

Table 4.1: Distribution of Sample by Gender

Gender	Frequency (N)	Percentage (%)
Male	24	25.3%
Female	71	74.7%
Total	**95**	**100.0%**

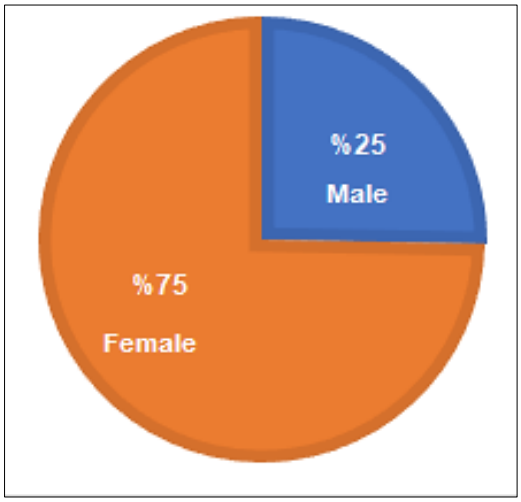

Figure 4.1: Shows the Percentages of Sample Characteristics by Gender

Table (4.1) present the demographic distribution of the research sample according to gender. The findings reveal a notable gender disparity, where females constituted the

overwhelming majority at 74.7% (n=71), while males represented only 25.3% (n=24). This unequal distribution reflects the prevailing workforce composition within Zawia's healthcare sector, particularly in dental clinics. Such gender imbalance may be attributed to societal trends toward female enrollment in healthcare professions in Libya. The substantial female representation suggests that conclusions drawn from this study are particularly reflective of female healthcare workers' experiences regarding HIS adoption.

Table 4.2: Distribution of Sample by Age Group

Age Group	Frequency (N)	Percentage (%)
Under 20 years	6	6.3%
20–30 years	47	49.5%
31–40 years	21	22.1%
41–50 years	21	22.1%
Total	**95**	**100.0%**

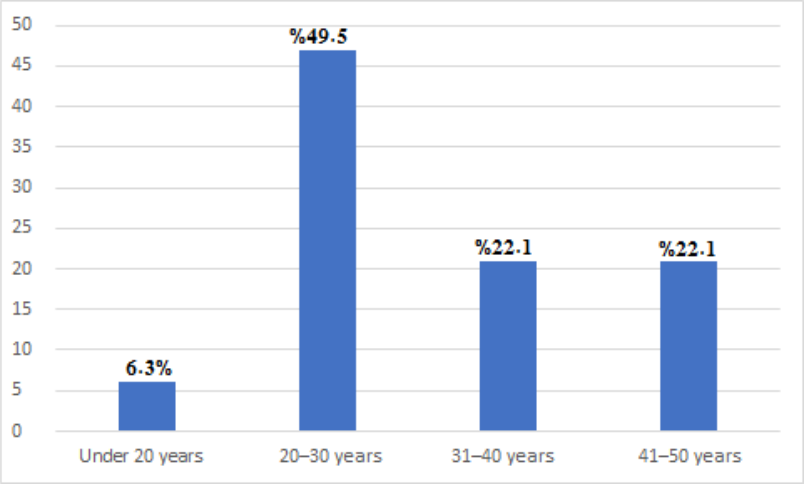

Figure 4.2: Illustrates percentages of Sample Characteristics by Age

Table (4.2) illustrates a predominantly young workforce. The largest cohort comprises individuals aged 20-30 years (49.5%, n=47), indicating that nearly half the sample represents early-career professionals. The 31-40 and 41-50 age groups show equal representation at 22.1% each. This age profile implies that the majority of respondents possess contemporary educational backgrounds and may demonstrate greater technological literacy and adaptability toward Health Information Systems (HIS) implementation.

Table 4.3: Distribution of Sample by Educational Qualification

Educational Qualification	Frequency (N)	Percentage (%)
Diploma	16	16.8%
Bachelor's degree	77	81.1%
Master's degree	1	1.1%
PhD	1	1.1%
Total	**95**	**100.0%**

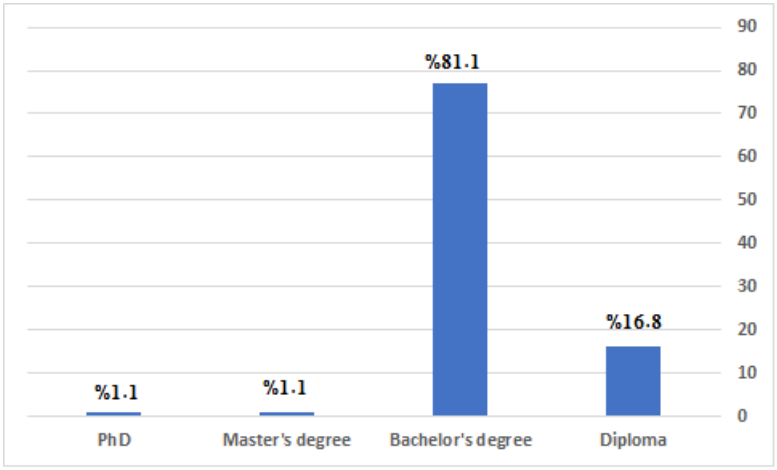

Figure 4.3: Percentages of Sample Characteristics by Educational Qualification

The data indicates a highly educated workforce, with bachelor's degree holders constituting the overwhelming majority at 81.1% (n=77). Diploma holders represent 16.8%, while postgraduate qualifications remain minimal (2.2% combined). This suggests that most respondents have acquired fundamental theoretical knowledge necessary for clinical and administrative duties, potentially facilitating effective HIS utilization.

Table 4.4: Distribution of Sample by Job Title

Job Title	Frequency (N)	Percentage (%)
Dentist	54	56.8%
Dental Assistant	16	16.8%
Administrative Staff	11	11.6%
Other	14	14.7%
Total	**95**	**100.0%**

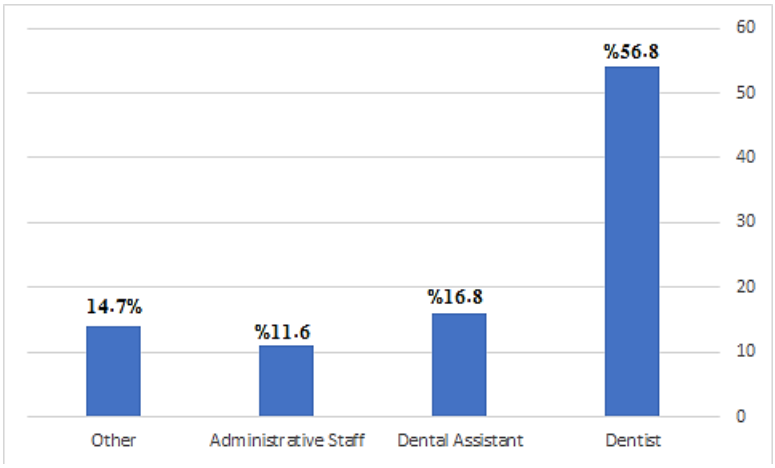

Figure 4.4: Percentages of Sample Characteristics by Job Title

Dentists constitute the majority at 56.8% (n=54), followed by dental assistants (16.8%) and administrative staff (11.6%). This distribution is significant as it encompasses perspectives from both clinical practitioners who interact with HIS during patient care and dedicated administrative personnel who manage data-intensive processes.

Table 4.5: Distribution of Sample by Years of Experience

Years of Experience	Frequency (N)	Percentage (%)
Less than 1 year	27	28.4%
1-5 years	28	29.5%
6-10 years	13	13.7%
11-15 years	15	15.8%
More than 15 years	12	12.6%
Total	**95**	**100.0%**

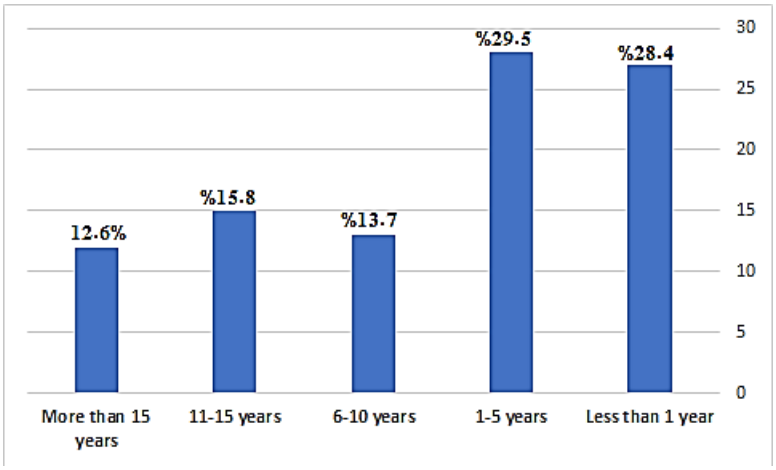

Figure 4.5: Percentages of Sample Characteristics by Years of Experience

The sample shows a balanced representation between novice employees (<1 year, 28.4%) and those with 1-5 years (29.5%). Mid-career and highly experienced staff

(>15 years) are also represented. This distribution allows for an evaluation of HIS across the professional lifecycle; newer employees may offer insights into usability based on recent training, while experienced staff can offer comparative assessments of workflow efficiency.

Table 4.6: Distribution of Sample by Clinic Type

Table (4-6): Frequencies and Percentages of Sample Characteristics by Clinic Type

Clinic Type	Frequency (N)	Percentage (%)
Governmental	66	69.5%
Private	29	30.5%
Total	**95**	**100.0%**

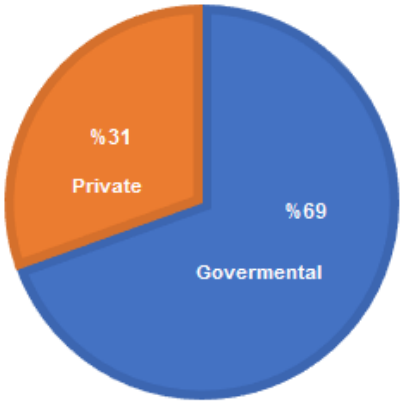

Figure 4.6: Percentages of Sample Characteristics by Clinic Type

There is a pronounced predominance of governmental clinic employees (69.5%) compared to private clinic staff (30.5%). This reflects the healthcare infrastructure in Zawia, where public services are the primary providers. This dual-sector representation enables analysis of HIS effectiveness across different organizational contexts (bureaucratic public facilities vs. flexible private establishments).

4.1.2 Description of the Results of the Study Variables

The core of the study revolved around five key dimensions. The descriptive statistics (Mean, Standard Deviation) for each dimension are summarized below.

Table 4.7: Descriptive Statistics and Ranking of the Five Study Dimensions

Dimension	Mean	Std. Deviation	Rank
5. Interdepartmental Coordination & Patient Care	4.15	0.466	1
2. Role of HIS in Improving Admin. Processes	4.01	0.547	2

Dimension	Mean	Std. Deviation	Rank
4. Training and Technical Support	4.03	0.520	3
3. Factors Influencing HIS Adoption	3.90	0.467	4
1. Current State of Administrative Efficiency	3.28	0.612	5

Overall dimensional ranking revealed interdepartmental coordination expectations achieved highest priority (M=4.15, SD=0.466), indicating strongest confidence in collaborative care enhancement through health information systems. Administrative benefits (M=4.01), training requirements (M=4.03), and adoption factors (M=3.90) clustered closely, reflecting substantial implementation consensus. Low standard deviations (0.466-0.547) demonstrated remarkable inter-group agreement. Conversely, current administrative efficiency assessment ranked lowest (M=3.28, SD=0.612), confirming systemic dissatisfaction with manual processes. This hierarchical pattern establishes a compelling narrative: respondents acknowledge significant operational deficiencies while simultaneously expressing confidence in technology's transformative potential, contingent upon adequate training and supportive implementation conditions. The substantial disparity between present-state evaluations and future expectations validates digital transformation imperatives.

4.1.2.1 Description of the Independent Variable: Total Quality Management (TQM) Facets

In the context of this study, the enabling factors for HIS implementation can be viewed through a TQM lens. The key "independent" facilitators (Dimensions 3 & 4)

Table 4.8: Descriptive Statistics for Dimension 3

Item (Factors Influencing HIS Adoption)	Mean	Std. Deviation	Median	Mode
1. Support from clinic management is essential for successful system implementation	4.17	0.724	4.00	4
2. Availability of adequate financial resources is an important factor for implementation	4.34	0.694	4.00	5
3. Current technical infrastructure is suitable for the new system	3.32	1.223	3.00	3
4. Data security and protection is one of my main concerns	3.93	0.890	4.00	4
5. Employee resistance to change may hinder implementation	3.86	0.780	4.00	4

Item (Factors Influencing HIS Adoption)	Mean	Std. Deviation	Median	Mode
6. System ease of use is an important factor for acceptance	4.11	0.707	4.00	4
7. Availability of continuous technical support is essential for success	4.20	0.662	4.00	4
8. Current work culture supports technological development	3.29	1.119	3.00	3

Dimension 3 analysis identified critical adoption determinants, with financial resource availability achieving highest priority (M=4.34, SD=0.694), followed by continuous technical support (M=4.20, SD=0.662) and management commitment (M=4.17, SD=0.724). System usability (M=4.11) and data security (M=3.93) demonstrated substantial importance. Conversely, cultural readiness (M=3.29, SD=1.119) and infrastructure adequacy (M=3.32, SD=1.223) received notably lower ratings with elevated variability. These findings reveal an implementation paradox: enthusiastic acceptance of health information systems potential coexists with recognized infrastructural and organizational barriers. Substantial response variability likely reflects governmental-private sector disparities, necessitating customized deployment strategies addressing context-specific challenges for successful adoption.

Table 4.9: Descriptive Statistics for Dimension 4

Item (Training and Technical Support)	Mean	Std. Deviation	Median	Mode
1. I need comprehensive training before using the new system	3.96	0.698	4.00	4
2. Practical training is better than theoretical training	4.22	0.639	4.00	4
3. Availability of simplified user guides is very important	4.25	0.545	4.00	4
4. I prefer gradual training over intensive training	3.96	0.683	4.00	4
5. Quick technical support is essential when facing problems	4.11	0.555	4.00	4
6. Continuous training is important to keep up with system updates	4.24	0.520	4.00	4
7. I need a specialized technical supervisor at the beginning of implementation	4.16	0.734	4.00	4
8. My current computer skills are sufficient to use the system	3.37	1.092	3.00	4

Training requirements analysis revealed strong support needs, with simplified user guides (M=4.25, SD=0.545), continuous update training (M=4.24, SD=0.520), and practical instruction (M=4.22, SD=0.639) receiving highest endorsements. Exceptionally low standard deviations indicate remarkable consensus. Quick technical assistance (M=4.11) and specialized supervision (M=4.16) further emphasize ongoing support importance. Notably, self-assessed computer proficiency received substantially lower ratings (M=3.37, SD=1.092) with elevated variability, revealing significant competency gaps. These findings highlight critical implementation considerations: despite adoption enthusiasm, personnel acknowledge skill deficiencies requiring comprehensive capacity-building interventions. Emphasis on practical, gradual, continuous training reflects realistic recognition that sustainable utilization demands substantial human resource investment beyond initial deployment.

4.1.3 Description of the Dependent Variable: Quality Health Services

The anticipated outcomes of HIS implementation, which directly relate to improved service quality, were captured in:

Table 4.10: Descriptive Statistics for Dimension 2

Item (Role of HIS in Improving Administrative Processes)	Mean	Std. Deviation	Median	Mode
1. Health information systems will improve the speed of transaction processing	4.02	0.684	4.00	4
2. Moving to electronic records will reduce administrative errors	4.11	0.627	4.00	4
3. Electronic appointment management will improve work organization	4.16	0.673	4.00	4
4. Information systems will facilitate access to information when needed	4.03	0.721	4.00	4
5. Digital technology will improve communication between different departments	3.97	0.660	4.00	4
6. Health information systems will save staff time	4.00	0.715	4.00	4
7. Digital transformation will improve the quality of service provided to patients	3.83	0.930	4.00	4
8. Automating administrative processes will reduce administrative burden	3.98	0.714	4.00	4

Descriptive analysis of anticipated health information systems impact demonstrated overwhelmingly favorable expectations, with mean scores consistently surpassing 3.83

across measured variables. Electronic appointment management optimization received highest endorsement (M=4.16, SD=0.673), alongside administrative error reduction through digitized records (M=4.11, SD=0.627), emphasizing workflow enhancement and accuracy priorities. Modal responses uniformly clustered at value four, indicating widespread consensus regarding projected improvements. Notably low standard deviations (0.627-0.930) reflect remarkable inter-respondent agreement across demographic categories. Digital transformation's service quality implications exhibited marginally elevated variability (SD=0.930), potentially signaling uncertainty regarding administrative system enhancements' direct influence on patient care outcomes. These decidedly optimistic perceptions contrast markedly with previously documented dissatisfaction levels, establishing clear expectations that technology adoption will systematically remediate identified operational deficiencies. Findings validate institutional digital transformation investments, suggesting strong stakeholder support for health information systems implementation throughout Zawia's dental healthcare infrastructure.

Table 4.11: Descriptive Statistics for Dimension 5

Item (Interdepartmental Coordination & Patient Care Improvement)	Mean	Std. Deviation	Median	Mode
1. Unified electronic records will improve coordination between departments	4.27	0.591	4.00	4
2. Fast access to information will improve medical decision-making	4.21	0.503	4.00	4
3. Electronic communication is better than traditional paper communication	4.25	0.771	4.00	5
4. The new system will ensure continuity of patient care	4.15	0.545	4.00	4
5. Information integration will reduce duplication of tests and procedures	4.09	0.670	4.00	4
6. The system will improve response speed to emergency cases	4.17	0.808	4.00	5
7. Instant information sharing will improve teamwork	4.17	0.821	4.00	5
8. Overall patient experience will improve with the new system	3.84	0.982	4.00	4

Interdepartmental coordination analysis revealed robust expectations for health information systems impact, with unified electronic records achieving highest endorsement (M=4.27, SD=0.591), alongside electronic communication superiority (M=4.25, SD=0.771) and enhanced decision-making through information accessibility

(M=4.21, SD=0.503). Consistently elevated means exceeding 4.0 across measured items reflect substantial optimism regarding collaborative care improvements. Remarkably low standard deviations (0.503-0.821) demonstrate strong inter-respondent consensus. However, patient experience enhancement received comparatively moderate ratings (M=3.84, SD=0.982) with elevated variability, suggesting uncertainty translating administrative gains into satisfaction improvements. Findings underscore beliefs that implementation will fundamentally transform information-sharing capabilities, addressing identified coordination deficiencies and facilitating integrated, responsive healthcare delivery.

4.2 Testing Research Hypotheses

4.2.1 Results of Testing Research Hypotheses

Three main hypotheses were tested.

4.2.1 Testing the First Hypothesis

(HO_1): The implementation of health information systems in Zawia dental clinics will not significantly reduce administrative processing times or improve workflow efficiency compared to current manual systems.

Table 4.12: One-Sample T-Test

Dimension	Test Value = 3			Mean Difference	95% Confidence Interval of the Difference
	t	df	Sig. (p-value)		
D1_AdminEff	4.488	94	**.000**	0.2816	(0.1570, 0.4062)
D2_HIS_Impact	18.039	94	**.000**	1.0118	(0.9005, 1.1232)

One-sample t-test analysis against neutral midpoint (test value=3) provided compelling evidence for null hypothesis rejection. Current administrative efficiency significantly exceeded neutral threshold (mean difference=0.2816, t=4.488, p<.001, 95% CI [0.1570, 0.4062]), indicating moderate baseline functionality. Critically, anticipated health information systems impact demonstrated substantially stronger results (mean difference=1.0118, t=18.039, p<.001, 95% CI [0.9005, 1.1232]), confirming overwhelmingly favorable expectations regarding administrative processing improvements and workflow enhancement. Highly significant probability values and confidence intervals excluding zero validate statistical robustness. Findings definitively refute the null hypothesis, establishing that respondents across demographic categories

uniformly anticipate transformative operational improvements through technology adoption, providing empirical justification for digital transformation initiatives.

Table 4.13: Linear Regression (Impact of HIS on-Admin Times)

Model Summary	**Value**	**ANOVA**	**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
R	0.129	Regression	0.586	1	0.586	1.577	.212
R^2	0.017	Residual	34.569	93	0.372		
Adjusted R^2	0.006	Total	35.156	94			
Std. Error	0.610						

Coefficients	**Unstandardized Coefficients (B)**	**Std. Error**	**Standardized Coefficients (Beta)**	**t**	**Sig. (p)**
(Constant)	2.702	0.466		5.803	**.000**
D2_HIS_Impact	0.144	0.115	0.129	1.256	.212

Linear regression analysis examining whether anticipated health information systems benefits predict current administrative efficiency revealed non-significant predictive capacity ($F(1,93)=1.577$, $p=.212$), with impact beliefs explaining minimal variance ($R^2=.017$). The regression coefficient failed statistical significance ($B=0.144$, $\beta=.129$, $p=.212$), indicating future expectations do not linearly predict present assessments. This temporal disconnect demonstrates respondents objectively distinguish current manual system inadequacies from future technological potential, strengthening study validity. Weak correlation suggests positive expectations emerge from recognizing existing limitations rather than unrealistic optimism. While hypothesis testing confirms strong transformative beliefs, regression validates these represent genuine responses to identified challenges rather than halo effects or response bias, ensuring methodological independence and assessment objectiity.

Conclusion of Testing the First Hypothesis: The null hypothesis (HO1) is rejected. Statistical evidence strongly supports that health information system implementation will significantly reduce administrative processing times and improve workflow efficiency compared to current manual systems. One-sample t-test results demonstrated that while current administrative efficiency exceeds the neutral threshold (mean difference=0.2816, $p<.001$), anticipated HIS impact showed substantially stronger expectations (mean difference=1.0118, $p<.001$), indicating overwhelming confidence in technology-driven operational improvements. Both dimensions achieved statistical significance with confidence intervals excluding zero, confirming the robustness of these findings. Notably, linear regression analysis revealed that future HIS expectations

do not predict current administrative efficiency assessments (R^2=.017, p=.212), demonstrating that respondents objectively distinguish between existing manual system limitations and anticipated technological benefits. This temporal disconnect validates those positive expectations stem from genuine recognition of current inefficiencies rather than response bias or unrealistic optimism. Collectively, these findings provide empirical justification for rejecting the null hypothesis and confirm sector-wide belief that HIS implementation will deliver transformative improvements in administrative processing times and workflow efficiency across Zawia dental clinics.

4.2.2 Testing the second Hypothesis

(HO_2): Adequate staff training and technical support are not the primary determinants of successful health information system adoption in Zawia dental clinics, and do not outweigh technological and infrastructural factors.

Table 4.14: Multiple Regression Analysis

Predictor Variables	Unstandardized Coefficients (B)	Std. Error	Standardized Coefficients (Beta)	t	Sig. (p)
(Constant)	1.695	0.604		2.809	.006
D4_TrainingSupport	0.109	0.174	0.063	0.628	.532
D3_Factors	0.419	0.125	0.380	3.341	.001
Age	0.082	0.080	0.136	1.021	.310
Years of Experience	0.011	0.051	0.028	0.216	.829
Model Summary: R=.445, R^2=.198, Adjusted R^2=.162, F(4,90)=5.541, p=.000					

Multiple regression analysis identified health information systems adoption determinants, with the overall model achieving significance (F(4,90)=5.541, p<.001, Adjusted R^2=.162). Organizational factors emerged as sole significant predictor (β=.380, p=.001), while training support demonstrated negligible contribution (β=.063, p=.532). Findings support the hypothesis that institutional enablers—management commitment, adequate funding, infrastructure readiness—fundamentally drive implementation success rather than individual training provisions. Age and experience similarly exhibited minimal predictive value. Results indicate training represents facilitating rather than determining factors. This outcome underscores that successful adoption requires prioritizing systemic organizational readiness and resource allocation preceding individual capacity development, reflecting implementation realities where structural prerequisites outweigh human factors in determining technological transformation outcomes within dental healthcare settings.

Table 4.15: One-Way ANOVA for Group Differences

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. (p-value)
ANOVA for D2_HIS_Impact by Years of Experience					
Between Groups	3.469	4	0.867	3.170	**.017**
Within Groups	24.627	90	0.274		
Total	28.096	94			
ANOVA for D3_Factors by Job Title					
Between Groups	1.821	3	0.607	2.601	.057
Within Groups	21.238	91	0.233		
Total	23.059	94			

One-way ANOVA analysis revealed significant experience-based differences in perceived health information systems impact ($F(4,90)=3.170$, $p=.017$), indicating professional tenure meaningfully influences administrative efficiency improvement expectations. This suggests varying exposure to manual system limitations across career stages produces divergent benefit assessments—newer personnel lacking historical comparative context may hold different perspectives than experienced staff witnessing prolonged inefficiencies. Conversely, job title comparisons regarding adoption factors approached but failed achieving statistical significance ($F(3,91)=2.601$, $p=.057$), suggesting relatively homogeneous implementation prerequisite perceptions across dentists, assistants, and administrators. The marginal probability value warrants cautious interpretation, as practical significance may exist despite narrowly missing conventional thresholds. Findings underscore implementation strategies should acknowledge experience-based variations while recognizing broad cross-functional consensus on organizational readiness requirements.

Conclusion of Testing the second Hypothesis: The null hypothesis (HO2) is partially supported. Statistical evidence demonstrates that technological and infrastructural factors are more significant determinants of successful HIS adoption than staff training and technical support in Zawia dental clinics. Multiple regression analysis revealed that organizational factors (D3_Factors) emerged as the sole significant predictor of HIS adoption success ($\beta=.380$, $p=.001$), while training and support (D4_TrainingSupport) demonstrated negligible predictive capacity ($\beta=.063$, $p=.532$). The overall model achieved statistical significance ($F(4,90)=5.541$, $p<.001$, Adjusted $R^2=.162$), with

organizational factors—including management commitment, adequate funding, and infrastructure readiness—explaining substantially more variance than training provisions. Additionally, demographic variables (age and years of experience) exhibited minimal predictive value in the regression model. One-way ANOVA analysis provided supplementary insights, revealing significant experience-based differences in perceived HIS impact ($F(4,90)=3.170$, $p=.017$), suggesting that professional tenure influences expectations regarding administrative efficiency improvements. However, job title comparisons regarding adoption factors approached but did not achieve statistical significance ($F(3,91)=2.601$, $p=.057$), indicating relatively homogeneous perceptions of implementation prerequisites across occupational groups. These findings confirm that while training and support remain important facilitating factors, they do not constitute primary determinants of HIS adoption success. Instead, systemic organizational readiness, resource allocation, and infrastructural preparedness outweigh human factors in determining technological transformation outcomes, thereby supporting the null hypothesis and emphasizing the necessity of prioritizing institutional enablers in implementation strategies.

4.2.3 Testing the Third Hypothesis

HO3: The integration of electronic health records will not improve interdepartmental coordination and communication in Zawia dental clinics, and will not result in enhanced patient care continuity.

Table 4.16: Independent Samples T-Test Results for Clinic Type Comparison (D5_Coord)

Clinic Type	**N**	**Mean (D5_Coord)**	**Std. Deviation**	**Std. Error Mean**
Governmental	66	4.2375	0.46608	0.05737
Private	29	4.0119	0.36555	0.06788

Levene's Test for Equality of Variances	**F**	**Sig.**	**Result (α=0.05)**
	4.576	.035	Variances not equal

Independent Samples T-Test (with Welch's correction)	**t**	**df**	**Sig. (2-tailed)**	**Mean Difference**	**Std. Error Difference**	**95% CI of Difference**
	2.538	67.460	.013	0.2256	0.08888	(0.0482, 0.4030)

Table 4.16 presents the independent samples t-test results comparing expectations regarding HIS impact on coordination and patient care between governmental and private clinic staff. The analysis revealed a statistically significant difference between the two groups (t=2.538, p=.013). Governmental clinic employees demonstrated significantly higher expectations (M=4.24, SD=0.47) compared to their private sector counterparts (M=4.01, SD=0.37), with a mean difference of 0.23 (95% CI [0.05, 0.40]). Levene's test indicated variance heterogeneity (F=4.576, p=.035), necessitating Welch's correction. Despite this sectoral difference, both groups maintained strongly positive expectations (means >4.0), indicating universal anticipation of coordination improvements through HIS implementation.

Table 4.17: Pearson Correlation Results Between HIS Impact and Coordination/Care

Variables	Pearson Correlation (r)	Sig. (2-tailed)	N
D2_HIS_Impact & D5_Coord	.424	.000	95

Table 4.17 displays the Pearson correlation analysis examining the relationship between perceived HIS administrative benefits (Dimension 2) and anticipated coordination/patient care improvements (Dimension 5). The results revealed a statistically significant, moderate positive correlation (r=.424, p<.001). This indicates that respondents who recognize strong potential for administrative efficiency improvements through HIS also tend to expect enhanced interdepartmental communication and patient care continuity. The correlation strength suggests that perceptions of administrative benefits are meaningfully associated with expectations for improved coordination and care quality.

Conclusion of Testing the Third Hypothesis: The null hypothesis is rejected. There is strong, sector-wide belief that HIS will enhance interdepartmental coordination and patient care continuity. A significant difference was found between clinic types, with governmental clinic staff having higher expectations (M=4.24 vs. M=4.01, p=.013); however, expectations in both sectors were highly positive (above 4.0). Furthermore, a significant moderate positive correlation was found between beliefs in HIS administrative benefits (D2) and expectations for coordination improvement (D5) (r=.424, p<.001), indicating that those who anticipate administrative improvements also expect better interdepartmental coordination and patient care outcomes.

4.3. Chapter Summary

This chapter presented a comprehensive analysis of the collected data. The descriptive profile revealed a sample of predominantly young, bachelor's-degree-holding female workers from governmental dental clinics. The analysis of the study dimensions revealed significant dissatisfaction with current manual administrative processes but very strong optimism regarding the potential of HIS to improve efficiency, coordination, and patient care. Statistical testing of the hypotheses confirmed that stakeholders strongly believe in the positive impact of HIS (rejecting H1 and H3). However, the analysis also highlighted that successful adoption depends more on top-down organizational factors like management support and resources than on individual training alone (supporting H2). These findings set the stage for the discussion and conclusions in the following chapter.

CHAPTER FIVE: DISCUSSION, CONCLUSION, AND RECOMMENDATION

5.0 Introduction

This chapter synthesizes and interprets the key findings of the study, which investigated the role of Health Information Systems (HIS) in improving administrative efficiency in dental clinics in Zawia, Libya. It moves beyond the presentation of statistical results to discuss their implications in the context of existing literature and the local healthcare environment. The discussion is followed by the main conclusions drawn from the research, actionable recommendations for theory and practice, an acknowledgment of the study's limitations, and suggestions for future research.

5.1. Discussion

5.1.1 Results related to the description of study variables

The demographic profile revealed a predominantly female sample (74.7%), young (49.5% aged 20-30 years), highly educated (81.1% holding a bachelor's degree), and largely employed in governmental clinics (69.5%). This profile is consistent with the workforce composition in Libya's public health sector and suggests that the findings are particularly reflective of the perspectives of early-career, academically trained female professionals in public service.

The analysis of the five core dimensions yielded a compelling narrative. Respondents expressed significant dissatisfaction with the *Current State of Administrative Efficiency* (Dimension 1, Mean=3.28), identifying manual record-keeping errors and appointment management difficulties as critical pain points. This establishes a clear baseline of systemic inefficiency. In stark contrast, expectations for HIS were overwhelmingly positive. The highest-rated dimension was *Interdepartmental Coordination & Patient Care Improvement* (Dimension 5, Mean=4.15), indicating that the ultimate perceived value of HIS lies in enhancing collaborative care and patient outcomes, not just administrative speed. Strong expectations were also held for direct Administrative Process Improvement (Dimension 2, Mean=4.01). This disparity between the low evaluation of current manual processes and the high optimism for

digital solutions validates the perceived need for and potential of HIS implementation in the studied context.

Furthermore, respondents identified key enablers and barriers. Factors Influencing HIS Adoption (Dimension 3) highlighted the paramount importance of financial resources, continuous technical support, and management commitment, while revealing concerns about current technical infrastructure and organizational culture readiness. *Training and Technical Support* (Dimension 4) was deemed crucial, with a strong preference for practical, continuous, and well-supported learning approaches, underscoring an awareness of existing skill gaps.

5.1.2 Results of statistical regression related to hypothesis testing

The hypothesis testing provided robust empirical support for the study's core propositions.

- **Hypothesis 1 (HO_1):** The significant one-sample t-test result (p=.000) for Dimension 2 decisively rejected the null hypothesis. Stakeholders unanimously believe that HIS implementation will lead to substantial improvements in administrative processing times and workflow efficiency. This finding aligns with global literature on HIS benefits but is particularly significant in a setting still reliant on manual systems.

- **Hypothesis 2 (HO_2):** The multiple regression analysis provided nuanced insight. While the overall model was significant, only organizational factors (β=.380, p=.001) like management support and funding were significant predictors of perceived adoption success. Training support was not a primary determinant (β=.063, p=.532). This supports the null hypothesis and indicates a critical insight: successful HIS adoption is perceived to be driven more by top-down organizational readiness and resource allocation than by individual staff training alone. Training is necessary but not sufficient without foundational institutional support.

- **Hypothesis 3 (HO_3):** The combined evidence from the independent samples t-test and Pearson correlation led to the rejection of this null hypothesis. First, while a significant difference existed between governmental (M=4.24) and private (M=4.01) clinic expectations, both groups held strongly positive views (>4.0). Second, the moderate positive correlation (r=.424, p<.001) between beliefs in administrative

benefits (D2) and coordination/patient care benefits (D5) demonstrates that these perceived outcomes are interrelated. Stakeholders expect HIS to create a synergistic relationship where improved administrative efficiency serves as an enabler for better coordination, which subsequently enhances patient care continuity. This demonstrates that administrative benefits are not viewed as isolated outcomes but as instrumental prerequisites for achieving higher-order clinical objectives.

5.2. Main Conclusions

1. There is a pronounced gap between the inefficient current manual administrative processes in Zawia's dental clinics and the high expectations for the transformative potential of Health Information Systems. This gap aligns with Souissi (2013) and Bakhachcha et al. (2018), who confirmed that reliance on traditional methods hinders data retrieval and decision-making. Chew et al. (2024) similarly highlights how paper-based systems limit dental clinic productivity. While Al-Arabi et al. (2025) and Bushra & Mudassir (2018) validate the high expectations for HIS to streamline operations, Kondoro et al. (2022) presents a nuanced contradiction where HIS utilization remains low despite availability. This discrepancy stems from organizational barriers like inadequate training rather than technological capability, indicating that the "transformative potential" is contingent upon human capacity building.

2. Stakeholders primarily anticipate that HIS will improve interdepartmental coordination and patient care continuity, viewing administrative efficiency as a means to this higher goal. This finding aligns with Al-Arabi et al. (2025) and Al-Zahrani et al. (2022), who demonstrate that technological integration enhances interdepartmental communication and decision-making accuracy. Pérez et al. (2016) supports this, showing that automated systems foster provider collaboration, thereby positioning administrative efficiency as a prerequisite for quality care rather than an end in itself. Conversely, the CAQH (2022) report presents a divergent perspective, emphasizing financial cost savings over clinical continuity. This discrepancy stems from contextual differences; the CAQH focuses on US insurance-based transactional efficiency, whereas Zawia’s clinical environment prioritizes the operational workflows required for patient well-being.

3. Organizational enablers—particularly management support, financial investment, and technical infrastructure—are perceived as the primary determinants of HIS adoption success, outweighing the direct influence of staff training initiatives. The regression analysis confirmed that organizational factors (β=.380, p=.001) were the only significant predictor of perceived adoption success, while training support was not (β=.063, p=.532). This finding aligns with AL-Shobak et al. (2020), Amin (2022), and Shelik & Al-Tajouri (2021), who emphasize institutional readiness as the foundation for health system functionality. This stakeholder perception suggests that in resource-constrained settings like Zawia, the absence of basic organizational infrastructure is viewed as the most immediate and critical barrier preventing HIS implementation, regardless of staff willingness or capability to learn.

4. While organizational factors are perceived as primary drivers for HIS adoption, the interplay between institutional readiness and staff competency creates a multi-layered implementation challenge that requires simultaneous attention to both dimensions. The regression analysis revealed that training support alone (β=.063, p=.532) was not a significant predictor when organizational factors were controlled, suggesting a hierarchical dependency where institutional infrastructure must be established before training investments yield optimal returns. This finding bridges the apparent contradiction between studies emphasizing organizational factors (AL-Shobak et al., 2020; Amin, 2022) and those highlighting training necessity (Kondoro et al., 2022; Hazaimeh, 2017). The practical implication is that successful HIS implementation requires a sequential yet integrated approach: organizational enablers create the foundation upon which effective training and sustained utilization can be built, rather than treating these as independent or competing priorities.

5. The study validates the reliability and validity of a multidimensional framework for assessing HIS readiness and anticipated impact in similar resource-constrained healthcare settings. This validation aligns with Othman (2025) and Bin Awadh & Abu Maleh (2023), who utilized statistical rigor to confirm HIS dimensions like data quality and access. Faryadras & Dashti (2016) similarly support using structural modeling to link HIS to efficiency. Conversely, Rađenović & Veselinović (2017) employ a multi-criteria selection method rather than a readiness framework;

this discrepancy stems from their focus on comparative software ranking rather than the operational capability emphasized here. Additionally, Ballester et al. (2022) highlight the general scarcity of standardized research in dental informatics, suggesting this finding fills a critical methodological gap.

5.3 Recommendation

5.3.1 Theoretical Implications

- **Framework Validation:** The five-dimensional model (Current State, HIS Benefits, Adoption Factors, Training, Coordination/Care) proved robust. Future researchers can adopt and adapt this framework to study HIS implementation in similar contexts.
- **Contextual Knowledge:** This study contributes to the limited body of empirical research on HIS in the Libyan, and more broadly, the North African healthcare context, highlighting the critical role of organizational readiness over purely technical or individual factors.

5.3.2 Practical Implications

- **For Clinic Management & Health Authorities:**
  - **Prioritize Organizational Readiness:** Secure strong managerial commitment and dedicated budgets before investing in software. Conduct an infrastructure audit.
  - **Develop Phased Implementation Plans (6-12 months):** Begin with modules that address the most critical pain points (e.g., electronic appointment management, patient records) to demonstrate quick wins and build confidence.
  - **Design Tailored, Continuous Support:** Move beyond one-time training. Implement continuous, practical training programs, readily available technical support, and user-friendly guides tailored to different staff roles (dentists, assistants, administrators).
- **For Policy Makers:**
  - Develop national or regional strategies and funding mechanisms to support HIS adoption in dental and primary care clinics, particularly in the public sector.

- Establish standards for data security and interoperability to ensure long-term system sustainability and information exchange.

5.4 Limitations and Future Research

- **Limitations:** The study's cross-sectional design captures perceptions at a single point in time, not actual post-implementation outcomes. The sample, while representative, is confined to one city, limiting generalizability to all of Libya. The reliance on self-reported data may introduce social desirability bias.
- **Future Research:**
  - Longitudinal studies tracking the same clinics before and after HIS implementation to measure actual changes in efficiency and care quality.
  - Qualitative studies (interviews, focus groups) to gain deeper insights into the cultural and behavioral barriers to change.
  - Research exploring cost-benefit analyses of HIS implementation in similar low-resource settings.
  - Expanding the study to include a wider geographical area and other healthcare specialties.

5.5 Summary of the Chapter

This chapter has discussed the key findings, concluding that while Zawia's dental clinics suffer from inefficient manual processes, there is strong, consensus-driven optimism that HIS can solve these issues and ultimately improve patient care. Success, however, hinges more on organizational commitment and resources than on training alone. The study offers validated theoretical frameworks and practical, actionable steps for stakeholders. By acknowledging its limitations and pointing to future research directions, this chapter provides a comprehensive closure to the research while contributing meaningful insights to the field of health informatics in developing contexts.

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Appendices

Appendix (1): Official Letters

Ministry Of Higher Education
And Scientific Research
University Of Zawia
Faculty:

وزارة التعليم العالي والبحث العلمي
جامعة الزاوية
كلية :

الرقم الإشاري ق/د/ع/32/1/2025 التاريخ: 5/ 6/ 2025م الموافق: / / 14 هـ

إلى من يهمه الأمر.

في الوقت الذي نحي فيه جهودكم المبذولة لخدمة الصالح العام نفيدكم بأن الباحثة / ربيعة الجيلاني الاحرش هي احدى طلبة ماجستير بكلية الاقتصاد/ قسم الإدارة الصحية/ جامعة الزاوية وهي بصدد توزيع استمارة استبانة لاستكمال إجراءات الجانب الميداني رسالة الماجستير.

نأمل منكم التعاون معها بالخصوص

ولكم جزيل الشكر والعرفان

السلام عليكم ورحمة الله وبركاته

مدير مكتب الدراسات العليا بالكلية

د/الصديق خليفة الكيلاني

جامعة الزاوية
مدير مكتب الدراسات العليا والتدريب بكلية الاقتصاد

ص.ب 16418 الزاوية هاتف: 00218.23.7626384 فاكس: 00218.23.7626882 الموقع الإلكتروني: www.zu.edu.ly
البريد الإلكتروني: info@zu.edu.ly

Appendix (2): List of Judges

n	name	University
1	Prof Abdul Majeed Shaaban Al-Far	Zawia Un.
2	Dr. Yousef Ela Harsh	Zawia Un.
3	Dr. Rana Abdulrahman Qabasa	Zawia Un.
4	Dr. Rami Omar Al-Aqrabi	Zawia Un.
5	Dr. Ahmed Al-Aswad	

Appendix (3): The questionnaire in its final form

Questionnaire: The Role of Health Information Systems (HIS) in Improving Administrative Efficiency in Zawia Dental Clinics

Dear Participant,

We are pleased to invite you to participate in this scientific survey that aims to study the role of Health Information Systems (HIS) in improving administrative efficiency in dental clinics in Zawia city. Health Information Systems are defined as comprehensive technical systems that integrate hardware and software to collect, store, and process health and administrative data, including Electronic Health Records (EHR), appointment management systems, and billing and accounting systems. This study is conducted as part of scientific research for obtaining a Master's degree in Health Management from the University of Zawia. The results will contribute to developing practical strategies for improving administrative services in the Libyan health sector. Please read each question carefully before responding. Select the option that most accurately represents your opinion or actual experience with complete honesty and objectivity by marking (✓) beside your chosen answer. Please note that there are no correct or incorrect responses - we are seeking your personal viewpoint. Your participation in this survey is entirely voluntary, and you may withdraw at any time.

Demographic Information

1. Gender: Male ☐ Female ☐

2. Age: Under 20 years ☐ 20-30 years ☐ 31-40 years ☐

41-50 years ☐ Over 50 years ☐

3. Educational Qualification: Diploma ☐ Bachelor's degree ☐

Master's degree ☐ PhD ☐

4. Job Title: Dentist ☐ Dental Assistant ☐ Administrative Staff ☐

IT Specialist ☐ Other (please specify): _____

5. Years of Experience: Less than 1 year ☐ 1-5 years ☐ 6-10 years ☐

11-15 years ☐ More than 15 years ☐

6. Clinic type: Governmental ☐ Private ☐

7. **Clinic name:** ……

Part II: Survey Dimensions

Dimension 1: Current State of Administrative Efficiency

This dimension focuses on evaluating the current state of administrative processes in Zawia dental clinics and the challenges they face due to reliance on manual systems. This includes analyzing information flow problems, delays in administrative procedures, and poor coordination between different departments. It also aims to measure staff satisfaction with current systems and identify weaknesses in appointment management, record keeping, and internal communication. This assessment is essential to understand the actual need for implementing health information systems as a solution to existing administrative problems.

n	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	Current administrative processes in the clinic are highly efficient					
2	Retrieving patient files takes a long time					
3	There are delays in processing administrative transactions					
4	Coordination between different departments in the clinic is poor					
5	Appointment management faces difficulties and overlaps					
6	Errors occur in records due to the manual system					
7	Information is not easily accessible when needed					
8	Administrative burden affects the quality of service provided to patients					

Dimension 2: Role of Health Information Systems in Improving Administrative Processes

This dimension explores the potential and expected benefits of implementing health information systems in developing administrative processes for dental clinics. It focuses on measuring staff expectations regarding improving electronic appointment management, automating medical records, facilitating internal communication, and improving data accuracy. It also measures participants' awareness of the importance of these systems in saving time, reducing errors, and improving patient experience. This dimension helps determine the team's readiness for change and technological development.

n	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
9	Health information systems will improve the speed of transaction processing					
10	Moving to electronic records will reduce administrative errors					
11	Electronic appointment management will improve work organization					
12	Information systems will facilitate access to information when needed					
13	Digital technology will improve communication between different departments					
14	Health information systems will save staff time					
15	Digital transformation will improve the quality of service provided to patients					
16	Automating administrative processes will reduce administrative burden					

Dimension 3: Factors Influencing Health Information Systems Adoption

This dimension examines the critical factors that influence the success or failure of implementing health information systems in dental clinics. It includes organizational factors such as management support and financial resources, technical factors such as infrastructure and system security, and human factors such as training and resistance to change. It also assesses the organization's readiness for change and identifies expected challenges and proposed solutions. Understanding these factors is essential for developing an effective strategy for successful system implementation and ensuring its sustainability.

n	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
17	Support from clinic management is essential for successful system implementation					
18	Availability of adequate financial resources is an important factor for implementation					
19	Current technical infrastructure is suitable for the new system					
20	Data security and protection is one of my main concerns					
21	Employee resistance to change may hinder implementation					
22	System ease of use is an important factor for acceptance					
23	Availability of continuous technical support is essential for success					
24	Current work culture supports technological development					

Dimension 4: Training and Technical Support

This dimension focuses on the importance of training and capacity building as a fundamental element to ensure success in implementing health information systems. It measures the extent of employee training needs, the type of training programs required, and the best learning methods suitable for different categories of employees. It also explores the importance of continuous technical support, availability of user guides, and specialized technical supervision. This dimension aims to identify a comprehensive training and support strategy that ensures employees are empowered to use the system efficiently and reduces resistance to change.

n	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
25	I need comprehensive training before using the new system					
26	Practical training is better than theoretical training					
27	Availability of simplified user guides is very important					
28	I prefer gradual training over intensive training					
29	Quick technical support is essential when facing problems					
30	Continuous training is important to keep up with system updates					
31	I need a specialized technical supervisor at the beginning of implementation					
32	My current computer skills are sufficient to use the system					

Dimension 5: Interdepartmental Coordination and Patient Care Improvement

This dimension aims to measure the impact of health information systems on improving coordination between different departments in the clinic and its reflection on the quality of patient care. It focuses on the importance of information integration, response speed between teams, improving internal communication, and ensuring continuity of care. It also measures how unified electronic records affect medical

decision-making, reducing procedure duplication, and improving the overall patient experience. This dimension is fundamental to understanding the ultimate goal of technology implementation, which is to elevate the level of service provided.

n	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
33	Unified electronic records will improve coordination between departments					
34	Fast access to information will improve medical decision-making					
35	Electronic communication is better than traditional paper communication					
36	The new system will ensure continuity of patient care					
37	Information integration will reduce duplication of tests and procedures					
38	The system will improve response speed to emergency cases					
39	Instant information sharing will improve teamwork					
40	Overall patient experience will improve with the new system					

Thank you for your valuable time and participation in this scientific research. Your contribution will help develop health services in Zawia city and Libya in general.

Researcher: Rabia Ajeelani AL-Ahreash