ASSESSING THE EFFECT OF ELECTRONIC MEDICAL RECORD (EMR) SYSTEMS ON PHYSICIAN PRODUCTIVITY IN OUT-PATIENT DEPARTMENTS: A SYSTEMATIC REVIEW

Dissertation Submitted to

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in

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by

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Under the Supervision and Guidance of

Dr. Seema Mehta

2025

MAX Healthcare

CERTIFICATE

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CERTIFICATE

This is to certify that dissertation titled "Assessing the effect of Electronic Medical Record (EMR) Systems on Physician productivity in Out-Patient Departments: A Systematic Review" is a record of the research work undertaken by NAJEEHA KHAN in partial fulfilment of the requirements for the award of the degree of MBA (Hospital and Health Management) from the IIHMR University, Jaipur under my guidance and supervision and her approach to the research study has been sincere, scientific, and analytical.

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IIHMR University, Jaipur

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School Dean

IIHMR University, Jaipur

Date 11 June 2025

DECLARATION BY STUDENT

I hereby declare that this dissertation titled "Assessing the effect of Electronic Medical Record (EMR) Systems on Physician productivity in Out-Patient Departments: A Systematic Review" is the bonafide record of my original research work. I declare that it has not been submitted to any other university or institution for the award of any degree or diploma. Information derived from the published or unpublished work of others has been duly acknowledged in the text.

Najeeha Khan 11/06/25

(Signature)

Name of Student NAJEEHA KHAN

Date 11 June 2025

DEDICATION

First and foremost, I dedicate this work to the Lord God Almighty. Your grace has sustained me, Your mercy has renewed me each day, and Your strength has carried me through every challenge.

To my beloved family-thank you for your unconditional love, constant prayers, and unwavering support. Your belief in me has been my greatest encouragement.

To my mentor-your guidance, wisdom, and patience have been invaluable throughout this journey. I am truly grateful for your support and inspiration.

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ABBREVIATIONS

Acronym	Full Form
EMR	Electronic Medical Record
OPD	Outpatient Department
EHR	Electronic Health Record
CDSS	Clinical Decision Support System
IT	Information Technology
HITECH	Health Information Technology for Economic and Clinical Health (Act)
NDHM	National Digital Health Mission
WHO	World Health Organization
AI	Artificial Intelligence
ML	Machine Learning

ABSTRACT

Title:

Assessing the effect of Electronic Medical Record (EMR) Systems on Physician Productivity in Out-Patient Departments: A Systematic Review

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Background:

The implementation of Electronic Medical Record (EMR) systems has revolutionized healthcare delivery, especially in outpatient departments (OPDs), through the digitization of patient information and the optimization of clinical workflows. While EMRs are designed to enhance efficiency, their actual impact on physician productivity remains debated, with evidence showing both positive and negative effects depending on system design, user training, and workflow integration.

Objective:

To systematically assess the effect of EMR systems on physician productivity in OPDs, focusing on workflow, time management, and identifying factors that facilitate or hinder efficiency.

Method:

A systematic review was conducted, synthesizing findings from studies published after the HITECH Act. Databases were searched for literature examining EMR implementation in OPDs, with inclusion criteria emphasizing studies that measured physician productivity through metrics such as patient encounters, documentation time, and workflow efficiency. Both qualitative and quantitative findings were analyzed to identify consistent patterns and contextual factors.

Result:

The review found that approximately 60% of studies reported positive effects of EMRs on physician productivity, including improved documentation accuracy, faster information retrieval, and enhanced workflow organization. Tailored EMR interfaces and robust IT support were key facilitators of productivity gains. However, 20% of studies noted negative outcomes, such as increased administrative burden, screen time,

and disruptions in physician-patient interaction, contributing to emotional fatigue and potential burnout. The remaining studies indicated neutral effects, highlighting the importance of system usability and organizational readiness in determining outcomes.

Conclusion:

EMR systems have the potential to enhance physician productivity in OPDs when effectively integrated into clinical workflows and supported by adequate training and technical resources. Nevertheless, these advantages can be cancelled out by systems that are not well designed and by a lack of sufficient support. The positive effect of EMRs on outpatient physician efficiency is maximized by ongoing customization, user engagement and leadership support.

Keywords:

Electronic Medical Records, EMR, Physician Productivity, Doctor performance, Doctor efficiency, Outpatient Department, OPD, Ambulatory care

CHAPTER 1

INTRODUCTION

Introduction

The implementation of Electronic Medical Records (EMRs) has improved how patient information is documented, accessed, and shared across clinical settings and has brought meaningful changes to healthcare delivery [1,2]. EMRs store wide range of patient health data, such as medical histories, diagnoses, prescribed treatments, immunization records, allergies, diagnostic images, laboratory findings and function as medical repositories [1]. EMRs allow clinicians to access patient information in real time and track it longitudinally which could be done easily in paper based medical records. This improved accessibility supports better coordination among healthcare teams and facilitates informed, evidence-based clinical decisions [2,3].

Evolution and Global Expansion of EMRs

The evolution of Electronic Medical Records (EMRs) reflects the journey of technological progress, regulatory milestones, and ongoing change within healthcare systems worldwide. EMRs have changed how patient information is gathered, accessed, and utilized in clinical practice. First time introduced in the 1960s, these systems have slowly developed into an integral part of digital healthcare infrastructure today.

1960s: Pioneering Efforts and Early Adoption

Since 1960s, some of the major academic health institutions in the U.S. began testing the electronic systems to manage the administrative and billing tasks [45]. They used to run on large mainframe computers, they were quite expensive and offered limited features. At that time, they were more experimental than practical clinical tools for hospital use [45,46]. Besides all the limitations, these trials showed that digitizing parts of healthcare information was achievable, which sets the stage for future developments in the healthcare.

A major change in that period came in 1968 when Dr. Lawrence Weed introduced the Problem-Oriented Medical Record (POMR). This has brought a structured, problem-focused method to clinical documentation, prioritizing the value of maintaining

standardized, long-term patient records [2]. The principles behind the POMR went on to strongly shape the design of future EMR systems.

1980s: Academic Leadership and Technical Progress

During the 1980s, academic medical centers started developing a more advanced electronic health record (EHR) systems. As microcomputers became more affordable and data storage improved, it became possible to do more than just administrative tasks and begin recording clinical information electronically [46]. These early systems made it possible to use EMR for wider clinical use, though challenges with interoperability and scalability persisted. High implementation costs and the absence of standardized data formats were the challenges, because of this for the most part, EMR systems remained sticked to individual institutions [8,46].

1990s: Commercialization and the Rise of the Internet

By the 1990s the evolution of EMR got a spark, as their commercialization began to pick up speed. New vendors started offering commercial EMR solutions and the rapid rise of the internet made the remote access and electronic data sharing affordable and possible [50]. The internet made it possible to flow the patient information between different health care settings by connecting EMRs across larger healthcare networks. Even so, widespread adoption faced significant hurdles high upfront costs, technical complexity, and resistance from clinicians who were accustomed to working with paper records [8,50]. In addition, the lack of interoperability between proprietary systems prevented EMRs from reaching their full potential.

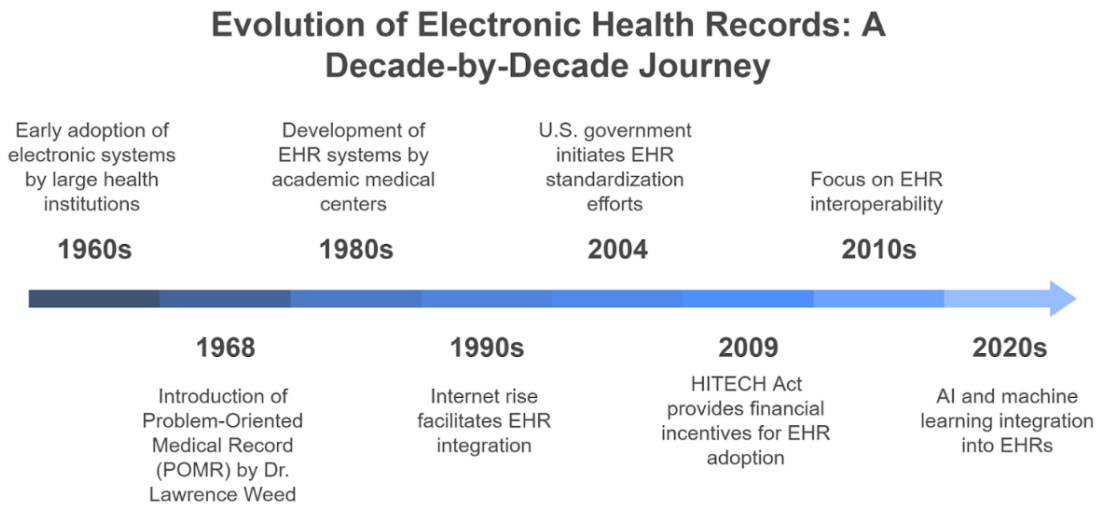

Figure 1.1: Evolution of EHR[52]

2000s: Policy Catalysts and Accelerated Adoption

In the early 2000s, a significant transformation occurred as governments worldwide recognized that EMRs could enhance the quality, safety, and efficiency of healthcare services. The introduction of the Health Information Technology for Economic and Clinical Health (HITECH) Act in 2009 marked a major milestone for the U.S. healthcare system [9]. The Act provided strong financial incentives for healthcare providers to adopt EMRs and show that they were using them in ways that improved care a concept known as “meaningful use.” These efforts had a significant effect on EMR adoption. In fact, the percentage of U.S. office-based physicians using EMRs rose from less than 20% in 2008 to over 85% by 2017.

2010s: Interoperability and International Expansion

The adoption of EMRs in the U.S. healthcare system was pushed largely due to the introduction of HITECH Act in 2009 [9]. The healthcare providers were encouraged not just to implement EMRs but to use them in ways that would improve patient care and for this they were offered generous financial incentives. The result was that more than 85% of office-based physicians were using EMRs by the year 2017 [10].

After this huge success in US other nations like the UK, Australia, Canada, and India also initatiated out their own digital health solutions to promote EMR use and improve the ability of systems to work together [11,48]. It was by the year 2010 that the global healthcare community began to see how important it was to have data that could move easily between different systems. Efforts were made to create common data standards, set up health information exchanges, and develop APIs that would allow for smoother sharing of patient information [8,17].

As EMRs spread beyond the U.S., they quickly became a key part of healthcare modernization around the world. In India, for example, the National Digital Health Mission (NDHM) set out to digitize health records for everyone, using cloud technology to get around infrastructure limitations [11]. Meanwhile, China and many Asia-Pacific countries adopted EMRs at a rapid pace, often skipping older technologies and moving straight to mobile and cloud-based solutions to serve their large, varied populations [48].

Taken together, these efforts show just how central EMRs have become in improving healthcare quality, making operations more efficient, and helping healthcare systems become more focused on patients around the world.

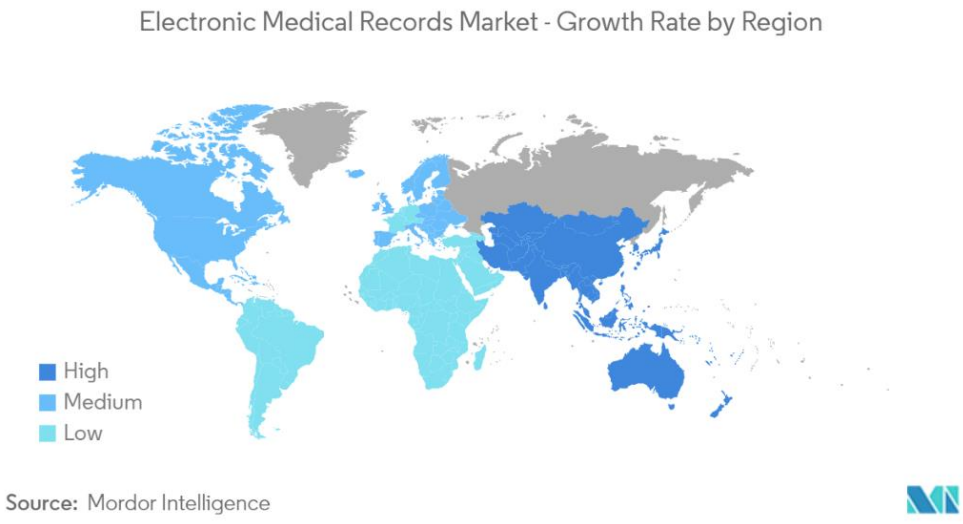

Figure 1.2: Electronic Medical Records Market- Growth Rate by Region[53]

2020s: Artificial Intelligence and the Future of EMRs

One of the biggest shifts in the 2020s has been the integration of artificial intelligence (AI) and machine learning (ML) into EMRs [44]. Today, clinicians are supported by AI-

powered tools that offer clinical decision support, predictive insights, and personalized care recommendations. This shift is transforming EMRs from simple data storage systems into active partners in delivering care. The Diagnostic accuracy, reduced burden of administrative tasks, and a more proactive, data-driven approach were some benefits that were received by the introduction of EMRs to healthcare.

By the same time digital health infrastructure was receiving investments, government was making policies and there was a growing need for interoperability which was making health data accessible. The telemedicine platforms, wearable medical devices and patient facing apps were also connected with the EMRs which created a more connected and patient centered model of care.

Significance of EMRs in Outpatient Settings

Outpatient departments (OPD) have a major role for EMRs as many patients come and doctors have to see them quickly. The EMRs help by making patient information easier to access and by speeding up clinical work of physician [3]. EMRs role is to provide accurate, complete, and in place health data, so doctors can give better and faster care [2]. EMRs help track patients over time, send reminders for check-ups, and monitor chronic illnesses, which all improve the patient care in the outpatient setting [1,4]. They also reduce repeated paper work and make it easier for healthcare teams to share information by automating notes and billing [5].

Number of patient visits, the time spent on clinical documentation, and efficiency in care tasks are some of the parameters by which physicians productivity is measured in Outpatient departments [6]. Some studies from the U.S. says that EMRs can enable documentation that is both more accurate and quicker compared to manual methods, which may increase clinical throughput [7]. However, the effect of EMRs on productivity is complex and affected by factors such as system design, user skill levels, and how well the EMR is integrated with the existing clinical workflows [8].

Several studies have acknowledged how EMRs affects outpatient workflows. Some studies says that EMRs help by organizing clinical notes better, improving access to data, and making it easier to manage clinical tasks, which can improve physician efficiency [12]. However, other reports show that EMRs can sometimes also increase the screen time and administrative work, which may reduce the physician’s productivity [13].

EMR Functionality and Physician Workflow

In OPDs, the availability of real-time information including prior diagnoses, medication histories, known allergies, and recent test results enables clinicians to make swift, informed decisions [14]. A cross-sectional study in a multi-specialty clinic noted that EMR usage was associated with reduced documentation time per patient, allowing for more consultations without compromising care quality [15]. Nonetheless, challenges such as system lag, complicated user interfaces, and inadequate customization for specialty-specific requirements continue to affect EMR usability in outpatient settings [16,17].

The features embedded within EMR systems significantly influence their impact on clinical efficiency. Tools like voice-to-text transcription, embedded clinical decision support, and structured documentation templates can help alleviate the cognitive and administrative burden on clinicians [18]. Conversely, poorly designed systems with limited compatibility or non-intuitive navigation may disrupt workflows and reduce productivity [19].

Though EMRs enhance documentation legibility and structure, excessive alerts and an overwhelming amount of on screen information can contribute to cognitive fatigue among providers, especially in high-paced OPD environments [20]. According to Howley and colleagues, EMR driven productivity improvements are more likely when accompanied by optimized workflows and robust technical support systems [21]. A broader meta-analysis supports this view, emphasizing that training quality and system adaptability are critical to realizing the full productivity benefits of EMRs [22].

EMR effectiveness also varies across medical disciplines. For example, primary care providers benefit from EMRs through decision support tools and continuity of care features. In contrast, specialists often encounter barriers due to the general nature of EMRs that may not align with their diagnostic or procedural requirements [23,24]. Time-motion studies reflect this duality, while some clinics report reduced charting time and improved physician–patient interaction, others note increased after hours documentation burdens [25]. Sinsky et al. found that physicians often spent nearly double the time on EMR tasks compared to direct patient interaction during outpatient shifts [26].

Another key consideration is how EMRs affect communication dynamics in clinical encounters. While comprehensive health data access enhances diagnostic precision, the

physical presence of screens can sometimes interfere with visual engagement and rapport building between physician and patient [27]. Studies have shown that EMRs are most beneficial when integrated into collaborative consultation styles rather than acting as physical or cognitive barriers [28].

Despite a growing body of literature on EMR utilization, comprehensive evidence specifically examining its impact on physician productivity within outpatient care remains limited [29]. There are many findings from inpatient and outpatient settings on EMRs which makes it tough to carry out a systematic review which gathers existing evidence, highlights the common trends in the healthcare, identifies the gaps in the research and which finds out the factors affect physician productivity when using EMRs in the OPDs. [31].

Challenges faced in EMR implementation

Instead of various advantages of Electronic medical records (EMRs), there are various challenges too which affects the effective implementation and its sustained use in the outpatient settings. The EMR adoption is shaped by several technical, financial, and human factors. Many challenges like the financial ones, including high upfront costs, ongoing maintenance expenses, and the need to build supporting infrastructure are faced in the outpatient facilities. Along with this, healthcare providers are usually hesitant to shift from paper-based records or older systems to Electronic ones. This reluctance usually comes from concerns about increased administrative work, possible disruptions to clinical workflows, and the fear of losing professional control.

These challenges are further worsened if there arises technical issues such as poor interoperability with existing health information systems with limited options for customizing EMRs to fit specialty practices, and user interfaces that are tough to use. Workflow inefficiencies, delays in documentation, and user dissatisfaction are the result of these challenges. Doctors have also reported feeling mentally exhausted due to long hours spent on screens, frequent alerts, and strict documentation requirements all of which leads to lower job satisfaction and higher burnout levels [16,17,43]. Lack of ongoing support, Poor training programs and the absence of solutions tailored to specific clinical needs further add to these difficulties.

There were several challenges found by Olayiwola et al. (2016) in Electronic medical Records (EMRs), when tried to integrate behavioral health with primary care. The disruptions to workflow, usability issues, and the need for manual workarounds due to

system limitations were some [43]. The study tells about the importance of regularly evaluating and adapting EMR systems to meet the needs of different outpatient settings in a better way.

Data privacy is also a major concern in outpatient settings, beacuse maintaining patient trust and following regulations is tough. EMR systems are vulnerable to data breaches and misuse without strong cybersecurity measures. Similarly, an inconsistent IT support and shortage of skilled technical staff can cause delays in fixing issues and improving the system, which further reduces the physician productivity.

Addressing these complex challenges through careful planning, involvement of key stakeholders, customized training, and continuous system evaluation can help in the successful adoption of EMRs. User-friendly design, scalable infrastructure, and flexible workflows should be taken care of in future to ensure that EMRs help improve productivity of physician and enhance patient care across different outpatient settings.

Figure 1.3: Common challenges in EHR Implementation [54]

This systematic review is carried out to gather the existing evidence on the effect of EMR systems on physician productivity in outpatient settings. It examines how EMR use affects clinical workflows, documentation processes, and time management, based on studies from various healthcare settings. It also helps in knowing the effect on physician productivity in ambulatory care and also to identify patterns in the literature that show how EMR systems either support or negatively.

1.1 Purpose of Research

The objective of this study is to systematically find how Electronic Medical Record (EMR) systems affect physician productivity in Out-Patient Department (OPD) settings. Understanding the effect of EMRs on clinical workflows, time management, and overall physician efficiency becomes essential as its being used on a large scale in ambulatory care and has an important role to play in its efficiency. This study is being done to gather and assess the existing research done on EMRs use in OPDs to clarify whether these systems affect physician productivity positively or negatively in the outpatient settings. The findings from this study can further help the healthcare administrators, policymakers, and system designers to improve EMR implementation to better support clinical performance and patient care.

1.2 Aims and Objectives

Aim:

To assess the effect of Electronic Medical Record (EMR) systems on Physician productivity in Outpatient Departments.

Research Question:

What is the effect of Electronic Medical Record (EMR) systems on Physician productivity in the Outpatient departments?

Objectives:

1. To explore the effect of EMR systems on the workflow of physicians in outpatient care.
2. To examine the relationship between EMR usage and time management during outpatient consultations.
3. To identify factors that may affect physician productivity in an EMR-enabled outpatient settings.

CHAPTER 2: METHOD

2.1 Eligibility Criteria

2.1.1 Inclusion and Exclusion Criteria

Inclusion criteria

Studies that meet the following criteria were included:

- Published between 2015 and 2025
- Were in English
- Focused on EMR/EHR use in outpatient settings
- Reported outcomes related to physician productivity or workflow
- Provided full-text access

Exclusion Criteria

Studies that did not meet the following criteria were excluded:

- Focused exclusively on Inpatient or Emergency department settings
- Lacked outcome measures related to Physician productivity
- Were technical or architectural studies without user or workflow outcomes
- Were conference abstracts, editorials, commentaries, or opinion pieces
- Were not available in full text

2.2 Study Design

This study is a systematic review conducted according to PRISMA 2020 (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. It gathers evidence from published studies to evaluate the effect of Electronic Medical Record (EMR) systems on physician productivity in outpatient departments (OPDs).

2.3 Data Sources and Search Strategy

The following electronic databases were used to conduct an exhaustive literature search:

- PubMed Central
- ProQuest
- Google Scholar

The search was limited to studies published from 2015 to 2025. Relevant articles were found by using specific keywords combined with Boolean operators, with the search terms adjusted to suit each database.

("electronic medical record" OR "EMR") AND ("outpatient department" OR "OPD" OR "ambulatory care") AND ("physician productivity" OR "doctor performance" OR "doctor efficiency")

- Filters were applied to select articles in English, between year 2015 to 2025.
- The searches were conducted in April–May 2025.

2.4 Keywords

- Electronic medical record
- EMR
- Outpatient department
- OPD
- Ambulatory care
- Physician productivity
- Doctor performance
- Doctor efficiency

2.5 Study Selection Process

A thorough literature search was carried out on PubMed Central, ProQuest, and Google Scholar to find studies published between 2015 and 2025 which focuses on how Electronic Medical Record (EMR) systems affect physician productivity in outpatient departments (OPDs). The search strategy involved combining keywords related to EMRs, outpatient care, and physician productivity, along with the filters to select only full-text articles available in English language.

An initial search across the databases and search engine gave 580 records. Once duplicates were removed, 236 unique records were left for further screening. The titles and abstracts of these records were carefully reviewed, and studies that didn’t meet the inclusion criteria were excluded. The remaining articles then underwent a full-text review based on the predefined inclusion and exclusion criteria.

As a result of this procedure, the final systematic review encompassed 10 studies. During the full-text review, the primary grounds for exclusion included: concentration on inpatient or emergency contexts, absence of pertinent outcome measures, emphasis on technical/architectural aspects without workflow outcomes, and publication as conference abstracts, editorials, or opinion pieces.

Figure 2.1 (PRISMA Flow Diagram) below illustrates the study selection process, detailing the number of records identified, screened, excluded, and included at each stage.

2.6 PRISMA flow diagram

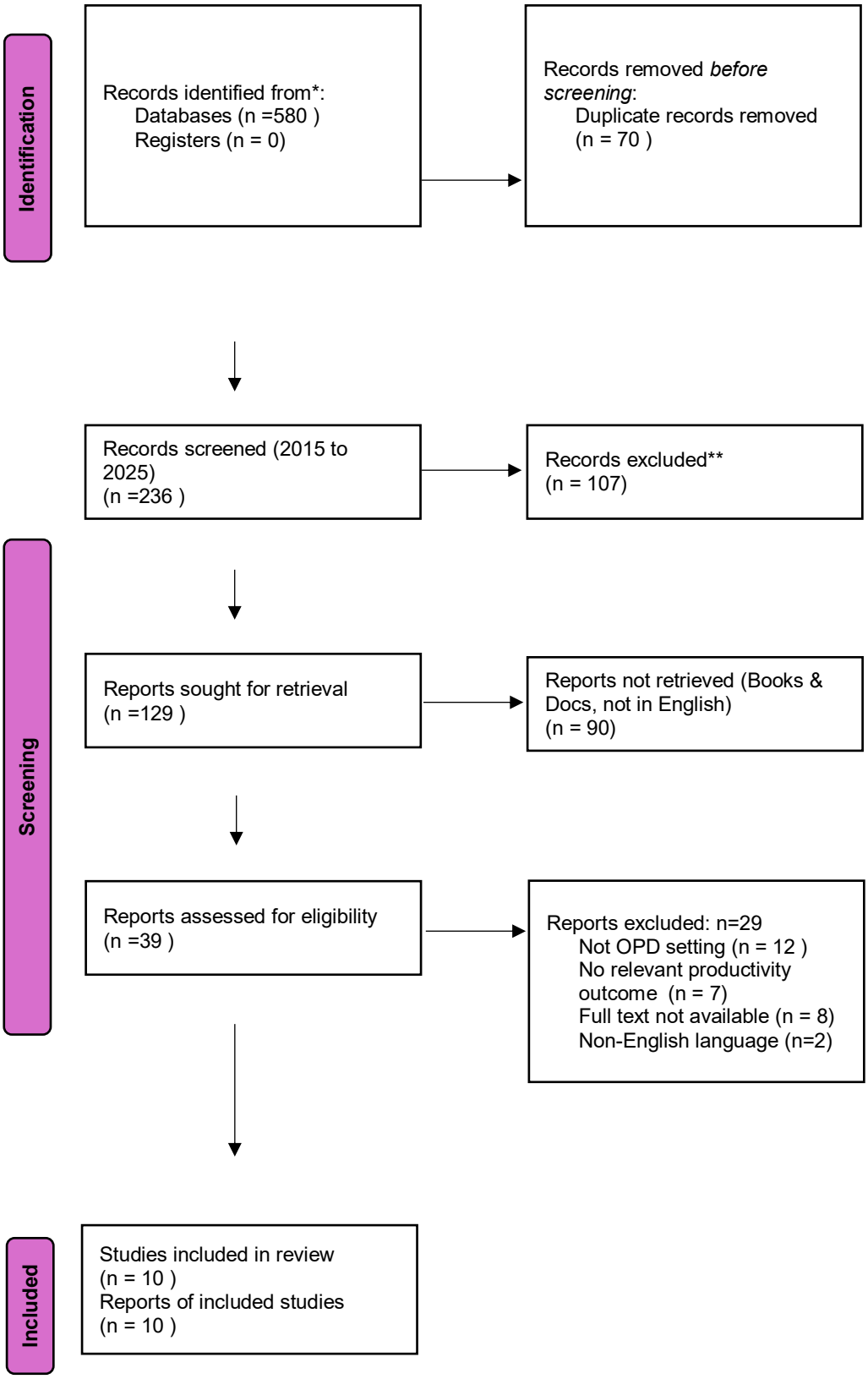

Figure 2.1: PRISMA Flow diagram[55]

2.7 Data Extraction and Synthesis

Data were extracted using a standardized form capturing:

- Author(s) and year
- Study title and objectives
- Study design and Setting
- Study Duration
- Key findings on EMR effect on physician productivity

A narrative synthesis was conducted, grouping findings into themes such as:

- Documentation time and burden
- Patient consultation time
- Direct vs. indirect patient care time
- Workflow changes and efficiency
- Physician satisfaction and perceived productivity

CHAPTER 3: RESULTS

3.1 Review of Studies

Table 3.1 below presents a summarized overview of the selected studies involved in this systematic review. It emphasizes the study Author and Year, Article title, Study Purpose, Study Design, Study Setting and Study period, along with Key findings about the effect of EMR systems on physician productivity in outpatient care.

Author, Year	Article Title	Purpose of the Study	Study Design	Setting & Period	Key Findings
Young, R. A., et al. (2018) [32]	**A Time-Motion Study of Primary**	**Measure how primary care**	**Cross-sectional observational time-**	**Family medicine clinics, 10 residency**	**- Physicians spent more time on EHR work (18.5**

	Care Physicians' Work in the Electronic Health Record Era	**physicians allocate time during outpatient visits, EHR vs face-to-face care**	**motion study**	**programs, Texas, USA; May–June 2015 (4 weeks)**	**min) than face-to-face care. - EHR work extended beyond clinic hours in 64.6% visits. - Longer EHR time linked to new patients, number of issues, physician experience. - High EHR workload linked to stress and reduced job satisfaction.**
Melnick, E. R., et al. (2021) [33]	**Analysis of Electronic Health Record Use and Clinical Productivity and Their Association With Physician Turnover**	**Evaluate association of physician productivity, EHR use patterns with physician turnover**	**Retrospective cohort study**	**Large ambulatory care network, New England, USA; Mar 2018 – Feb 2020**	**- 5.1% annual turnover among 314 physicians. - Avg 2.6 appointments /hr, 5.5 hrs EHR per 8 hrs scheduled. - Less EHR inbox time**

					associated with higher turnover odds. **- High teamwork and patient demand protective against turnover.** **- EHR audit data can identify high-risk physicians for targeted interventions.**
Tabche et al. (2023) [34]	**Effect of electronic health records on doctor-patient relationship in Arabian gulf countries: a systematic review**	**Evaluate EHR impact on doctor-patient relationships in Gulf countries**	**Systematic review**	**Studies in six Arabian Gulf countries (GCC); 1992–2023**	**- EHR improved physician productivity and record accuracy.** **- Patients reported reduced doctor attention due to screen focus.** **- Negative effects: loss of eye contact,**

					delayed communication, longer waits. **- Challenges: computer skill gaps, poor usability.** **- Recommends training and trust-building strategies.**
Crouch, T. (2024) [35]	**Relationship Between Healthcare Information Systems and Physician Productivity**	**Examine relationship between perceived EHR quality, system support, and physician productivity in OPD**	**Quantitative correlational study**	**Secondary data from KLAS Arch Collaborative (973 physicians, 7 US states)**	**- Perceived EHR quality and support predicted productivity (R^2 = .56).** **- Quality had greater impact (β = .61) than support (β = .26).** **- Poor usability and documentation burden reduce productivity, increase**

					burnout. **- Recommends proactive EHR design and tailored support to improve productivity and care.**
Takura & Itoh (2019) [36]	**Effect of Electronic Medical Record Systems on Cardiovascular Disease Outpatient Consultation Time**	**Evaluate how EMR, paper, and hybrid systems affect consultation time and productivity in cardiovascular care**	**Observational comparative study**	**Sakakibara Heart Institute Clinic, Tokyo, Japan; Oct 2006 (1 week)**	**- No significant difference in total consultation time between EMR and paper.** **- EMR group had highest direct patient time (10.9 min) and lowest work-up time (1.7 min).** **- EMR showed lower fee claims per practice time (67.5 vs 108.8 points/min).** **- EMR allows more patient**

					engagement and higher productivity.
Alissa, R., Hipp, J.A., Webb, K. (2022) [37]	**Saving Time for Patient Care by Optimizing Physician Note Templates: A Pilot Study**	**Assess if optimizing EMR note templates saves time and improves provider satisfaction**	**Quality improvement pilot study**	**Mother-Baby Unit, University of Florida, Jacksonville, USA; Jan 2016 – Sep 2019**	**- Optimized templates saved 23 min per infant, ~2.6 hrs/day saved for unit.** **- 69 fewer actions per note required.** **- Provider satisfaction improved.** **- Standardization and automation reduced documentation burden and improved workflow efficiency.**
Garry Janchenko, Robert Morris University (2020)	**The impact of electronic health record systems on physician productivity**	**Evaluate EHR impact on physician productivity and relative**	**Retrospective before-and-after observational study**	**Pediatrics healthcare practice, Southwestern Pennsylvania; 2007–**	**- EHR implementation may initially reduce productivity due to**

[38]		**value unit intensity**		**2018**	**learning curve.** **- Productivity stabilizes or improves with training and customizatio n.** **- Success depends on organizationa l support, user engagement, and usability.**
Modi, S., Feldman , S.S. (2022) [41]	**The Value of Electronic Health Records Since the HITECH Act: A Systematic Review**	**Systematic review of EHR value post-HITECH focusing on financial and clinical outcomes**	**Systematic literature review (PRISMA)**	**Various US healthcare settings; 2009–2019**	**- Mixed positive/negat ive impacts on financial and clinical outcomes.** **- 80% of studies showed positive associations between financial and clinical outcomes.** **- EHR improves workflow**

					efficiency, reduces errors, enhances patient satisfaction. **- Financial benefits vary; value is multifaceted involving tangible and intangible benefits.**
Tai-Seale, M., et al. (2017) [39]	**Electronic Health Record Logs Indicate That Physicians Split Time Evenly Between Seeing Patients And Desktop Medicine**	**Use EHR logs to measure time allocation between patient visits and desktop medicine activities**	**Retrospective observational study**	**471 primary care physicians, large CA health system; 2011–2014**	**- Physicians spent ~3.08 hrs/day face-to-face and 3.17 hrs/day on desktop medicine.** **- Desktop medicine includes messaging, orders, test reviews.** **- Time on face-to-face visits declined over time; desktop medicine increased.**

					- Highlights substantial work outside direct patient care not captured in productivity metrics.
Balgrosky, J.A. (2015) [40]	**Adoption of Electronic Health Records by Physicians for Use in Their Practices**	**Analyze patterns, determinants, and trends in EHR adoption among office-based physicians**	**Quantitative analysis of national survey data**	**Observational study**	**- EHR adoption increased overall but slower in small practices, widening adoption gap. - Some de-adoption of functionalities occurred but overall use increased. - Lower adoption linked to female, non-white, older physicians, and small practices. - Policy interventions helped but**

					disparities exist.

3.2 Study Characteristics

This section outlines the main features of the ten empirical studies included in this systematic review, following PRISMA 2020 guidelines. These traits offer vital background for understanding the results related to the effect of Electronic Medical Record (EMR) systems on physician productivity in outpatient departments (OPDs).

Table 3.2: Study Type Classification of Included Studies

Author, Year	Study Type Category
Young, R. A., et al. (2018)	Observational (Cross-sectional)
Melnick, E. R., et al. (2021)	Observational (Cohort)
Tabche et al. (2023)	Systematic Review
Crouch, T. (2024)	Observational (Correlational)
Takura & Itoh (2019)	Observational (Comparative)
Alissa, R., Hipp, J.A., Webb, K. (2022)	Quality Improvement Study
Garry Janchenko (2020)	Observational (Before-and-after)
Modi, S., Feldman, S.S. (2022)	Systematic Review
Tai-Seale, M., et al. (2017)	Observational (Retrospective)
Balgrosky, J.A. (2015)	Observational (Descriptive/Survey)

Table 3.3: Study type Distribution

Study Type Category	Number of Studies (n)	Percentage (%)
Observational Studies	**7**	**70%**
Systematic Reviews	**2**	**20%**
Quality Improvement Study	**1**	**10%**
Total	**10**	**100%**

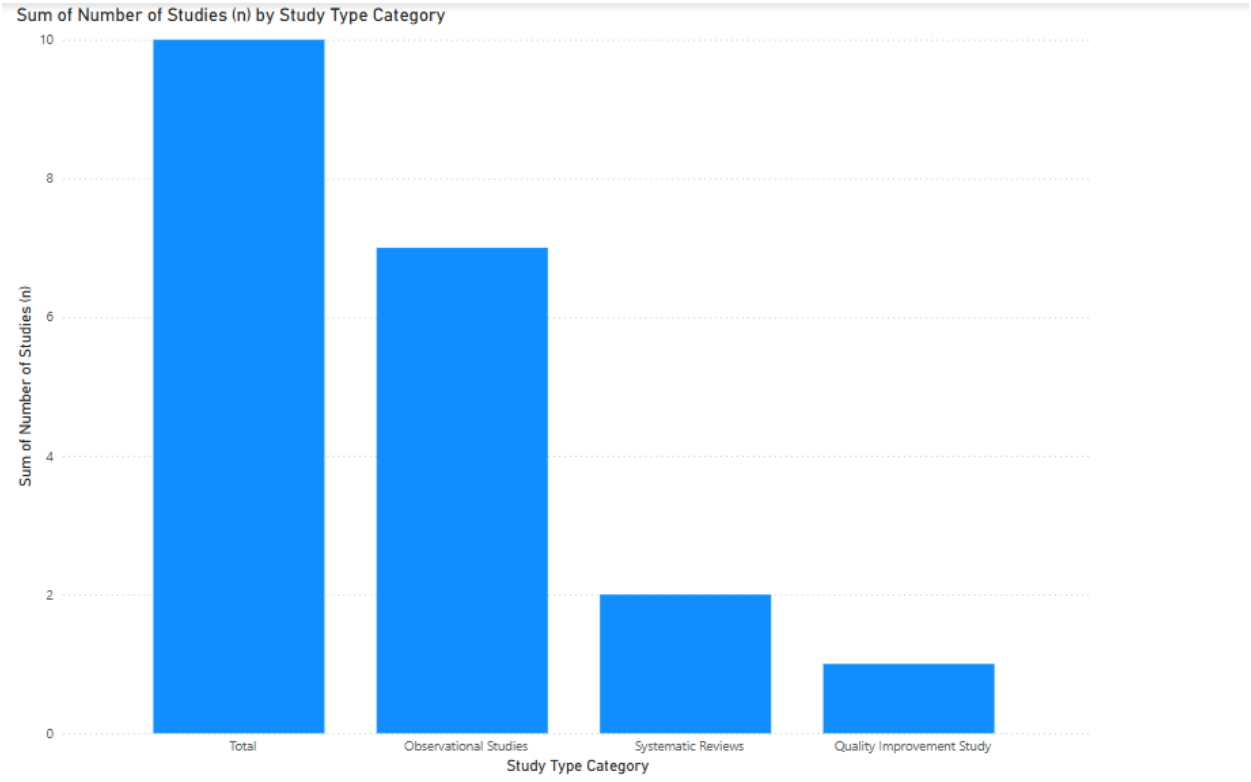

Figure 3.2 : Bar Chart – Distribution of Study Types

3.3 Study Types and Evidence Strength

This review encompassed a variety of study designs, including seven observational studies (such as cross-sectional, cohort, correlational, comparative, before-and-after,

retrospective, and descriptive/survey types), two systematic reviews, and one quality improvement study. The dominance of observational studies (70%) highlights the challenges of studying EMR implementation in real-world settings, though it also means there is some variability in the rigor and consistency of outcome measurements. Systematic reviews help by bringing together evidence from various studies, while the quality improvement study provides practical guidance on how to improve EMR workflows in clinical settings.

3.3.1 Effect of EMR Systems on Physician Workflow

The introduction of Electronic Medical Record (EMR) systems has brought significant changes to the way outpatient physicians manage their workflow. One of the key benefits is that EMRs allows clinicians to retrieve information more quickly and accurately by organizing and easy access of medical records [12,15,32]. Digital are easier to read because they are structured and they also help in reducing mistakes that can happen with handwritten notes, leading to safer and more effective patient care [12,32]. Additionally, EMRs gives instant access to comprehensive patient histories, lab results, and imaging reports, which support in real-time clinical decision making and assist doctors in making informed diagnoses and treatment plans [15,32].

The efficiency of clinical workflows is thus improved by features like integrated order entry, clinical decision support tools, and automated reminders. These tools assist physicians by managing follow-up care making it easier to place orders and follow evidence-based protocols[18,34]. The EMRs are designed as per the unique needs of various specialties or departments considering the existing workflows there[18,34].

Despite these benefits, there are several challenges which have emerged with the adoption of Electronic medical records. It is suggested in many studies that physicians often experience an increased administrative workload, spends more time on digital documentation, takes more time to navigate complex system interfaces, and respons to frequent alerts or messages [13,16,35]. The term “desktop medicine” has gained traction to describe the growing amount of time doctors spend on non-clinical digital tasks, such as managing inboxes and reviewing records, outside of direct patient care leading to time pressures and professional burnout [36].

Usability issues continue to pose challenges, with some physicians encountering system delays, confusing navigation, or poorly designed templates. These problems disrupt the flow of clinical work and contribute to frustration [33,34]. Such barriers highlight the ongoing need to optimize EMR systems through regular updates, customization to fit clinical workflows, and involving end users in the design and improvement process [33,34].

Overall, while EMR systems have the potential to improve physician workflow by making information more accessible and supporting clinical decisions, their true effectiveness depends on factors like usability, how well they fit into existing workflows, and their ability to lessen administrative tasks. Continuous feedback and ongoing improvements in the implementation is necessary to support the physician productivity and in providing quality patient care [33,34].

3.3.2 Relationship Between EMR Usage and Physician's Time Allocation

How physicians allocate their time during patient visits has been significantly changed by the integration of electronic medical records (EMRs) in outpatient settings. Some studies such as time-motion analysis and systematic reviews have discovered that EMR use often increases the amount of time doctors spend on documentation and digital tasks. This overlaps with the time spent on direct patient care [15,25,35].

Young et al. (2018) in his study showed that physicians in outpatient departments spend almost half of their time on EMR related activities like data entry, order management, and reviewing digital records. This reduces the time available for face-to-face patient interactions [35]. This finding is supported by several other studies highlighting that digital documentation and administrative duties may unintentionally shorten both the duration and quality of direct patient contact.

EMRs have added extra administrative tasks for physicians beyond documentation . This include managing electronic inboxes, responding to patient messages, handling prescription renewals, and entering clinical orders [26,36]. These tasks aim to improve care coordination, patient safety and often require physicians to work outside of their regular clinic hours. But it has caused higher risks of burnout, emotional fatigue, and lower job satisfaction, especially in hectic outpatient environments.

However, the effect of EMRs on physician productivity is not always detrimental. When these systems are carefully designed and customized to meet clinical needs, they

positively affect workflows and also increase the patient throughput without compromising with the quality of care [34]. EMR features such as customizable templates, voice recognition technology, and optimized workflows have reduced the time required for documentation. Physicians can now complete notes and orders more efficiently using tools like voice-to-text dictation and intelligent order sets, which helps free up time for patient care and decreases mental fatigue.

Productivity and time management is affected by EMR systems. These include the physician's area of expertise, the complexity of cases handled, the EMR system's ease of use and flexibility, and the level of institutional support provided. The departments for example internal medicine and pediatrics which require detailed documentation, often face a greater administrative burden compared to other procedural fields. A positive effect on physician efficiency and job satisfaction in observed by healthcare organizations that invest in comprehensive training, strong IT support, and ongoing user feedback systems.

Significant effect of continuous EMR customization and active user engagement in system design is seen in recent researches. Involving physicians in the development and enhancement of EMR interfaces leads to systems that are more compatible with clinical workflows, thereby boosting productivity and minimizing frustration is what several studies talks about. Physicians can make faster, evidence-based decisions, thereby improving the overall impact of EMR systems on outpatient care by the incorporation of clinical decision support and real-time analytics.

Physicians time management and workload in outpatient departments has been greatly influenced by the introduction of EMRs. The balance between digital efficiency and administrative demands are influenced by the factors like system design, integration of EMRs with workflows, clinical specialty, and the availability of support resources., EMRs have the potential to enhance documentation practices and contribute to the provision of effective, high-caliber outpatient services through continual refinement and prioritization of user requirements.

3.3.3 Factors effecting Physician Productivity in EMR-Enabled OPD

The physician's productivity in outpatient departments utilizing Electronic Medical Records (EMRs) is influenced by a complex interplay of technical, organizational, and human factors. It is essential to comprehend these elements in order to get benefit from

the full advantages of EMRs and to guarantee that digital transformation benefits clinical efficiency [17].

- **System Usability and Customization:** Physician productivity is strongly impacted by use of EMR systems. Documentation time can be diminished and clinical workflows simplified through user-friendly interfaces, intuitive navigation, and templates tailored to specific specialties. Features, such as personalized order sets, adjustable note templates, and tailored dashboards, can be customized which enables clinicians to work more efficiently by reducing repetitive or unnecessary tasks. Conversely, poorly designed or inflexible systems increase cognitive load and documentation time, which negatively affects user satisfaction [33,34].
- **Training and Support**: The successful adoption of EMR relies significantly on thorough and continuous training, along with responsive IT support. Physicians and clinical staff require not only initial orientation but also continuous, role-specific training to stay current with system updates and workflow changes. Organizations that prioritize regular training sessions and provide accessible technical support report higher physician satisfaction and sustained productivity. In contrast, inadequate training contributes to underutilization of EMR features, workflow inefficiencies, and increased errors [17,33].
- **Workflow Integration:** The extent to which EMRs are integrated into existing clinical workflows significantly impacts productivity. Systems designed to align with the natural flow of patient care rather than imposing rigid, one-size-fits-all processes tend to improve efficiency. Integration with ancillary services such as laboratory, pharmacy, and radiology, along with automated reminders and real-time clinical decision support, further streamlines operations and reduces administrative burden. EMRs that disrupt established routines or require excessive manual data entry can impede clinical throughput and reduce user satisfaction [21,22].
- **Administrative Burden:** Although EMRs aim to simplify administrative tasks, they can sometimes increase workload. Managing electronic inboxes, responding to alerts, processing prescription renewals, and extensive documentation consume significant portions of physician's workdays. Excessive administrative demands reduce time for direct patient care and are linked to

emotional fatigue and burnout, especially in high-volume outpatient settings [36,47].

- **Organizational Readiness and Culture:** The broader organizational environment is critical for EMR success. Institutions that invest in robust IT infrastructure, foster a culture of continuous improvement, and involve clinicians in system design and implementation tend to achieve better productivity outcomes. Leadership engagement, clear communication of goals, and mechanisms for ongoing feedback and iterative system refinement are essential for clinician buy in and maximizing EMR benefits. Organizations neglecting these factors often face resistance, suboptimal use, and unrealized gains [32,33].
- **Clinical Context and Specialty Needs:** Physician productivity with EMRs also depends on the clinical context and specialty-specific needs. Specialties such as internal medicine and pediatrics, which involve detailed documentation, often experience a heavier administrative burden compared to procedural fields. The effect of EMRs on daily workflows is further influenced by factors like the complexity of patient cases, patient volume, and the demands of care coordination [33].
- **Continuous Optimization and User Engagement:** Optimizing EMRs is an ongoing process. To sustain and enhance physician productivity, it's important to continuously gather user feedback, make regular improvements to the system, and adopt new technologies such as voice recognition, mobile access, and AI-powered decision support. Involving clinicians in system refinements ensures that EMRs stay aligned with evolving clinical practices and user needs [34].

To fully harness the positive effect of EMRs on physician productivity in outpatient departments, it is essential to customize EMR systems to fit clinical workflows, offer sufficient training and support, and promote a culture of ongoing improvement.

Table 3.4: Study Outcomes

S.No.	Author(s) & Year	Outcome Category	Summary

1	Young et al. (2018)	□ Negative Effect	More time spent on EHR than patients; extended hours; stress and reduced job satisfaction.
2	Melnick et al. (2021)	□ No Significant Effect	Mixed findings; EHR time was high but not clearly linked to productivity decline or improvement.
3	Tabche et al. (2023)	□ No Significant Effect	Improved productivity but reduced patient attention and communication-overall mixed outcome.
4	Crouch (2024)	□ Positive Effect	EHR quality and support significantly predicted productivity; strong statistical correlation.
5	Takura & Itoh (2019)	□ Positive Effect	EMR allowed more direct patient time and lower work-up time.
6	Alissa et al. (2022)	□ Positive Effect	Optimized templates saved time and improved satisfaction and workflow efficiency.
7	Janchenko (2020)	□ Positive Effect	Long-term improvement in productivity with training and support.
8	Modi & Feldman (2022)	□ Positive Effect	80% of studies showed positive impact on productivity and efficiency.
9	Tai-Seale et al. (2017)	□ Negative Effect	Half of the time spent on "desktop medicine"; reduced face-to-face care over time.
10	Balgrosky (2015)	□ Positive Effect	EHR adoption linked to improved productivity with supportive policy, especially in larger practices.

Table 3.5: Study Outcomes Summary

Outcome Category	Count

□ Negative Effect	**2**
□ No Significant Effect	**2**
□ Positive Effect	**6**

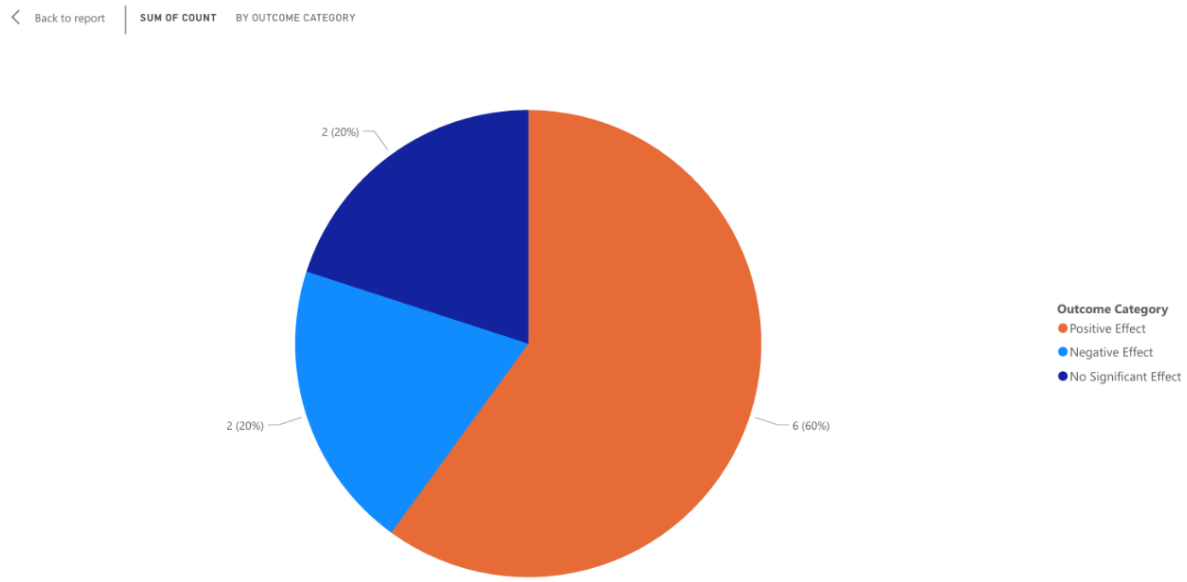

Fig 3.3 : Pie Chart- Proportion of outcome categories

3.4 Summary of Study Findings

- **Positive Effects (6 studies):** These studies report that following EMR implementation, workflow efficiency improved, documentation time decreased, patient throughput increased, and physician satisfaction rose.
- **Negative Effects (2 studies):** The studies showed an increased administrative burden, more time spent on documentation, reduced patient interaction, and a higher risk of physician burnout.
- **No Significant Effect (2 studies):** The findings from these studies were inconclusive or showed no clear link between EMR use and physician productivity.

CHAPTER 4: DISCUSSION

4.1 Overview of Main Findings

This systematic review compiled recent studies to evaluate the effect of Electronic Medical Record (EMR) systems on physician productivity in outpatient departments (OPDs). The findings suggest that while EMRs offer significant potential to improve workflow efficiency, their effect on physician productivity is complex and varies widely depending on the context. The review identified key factors that help or hinder effective EMR use, highlighting the crucial role of system design, implementation strategies, and organizational support in shaping the results.

Among the ten studies reviewed, six (60%) reported a positive effect of EMRs on physician productivity, two (20%) reported a negative effect, and two (20%) found no significant effect. This distribution indicates that although most evidence points to the potential of EMRs to improve productivity, there are still notable exceptions and mixed outcomes.

1.Positive effects: Six studies reporting positive outcomes (Crouch, 2024; Takura & Itoh, 2019; Alissa et al., 2022; Janchenko, 2020; Modi & Feldman, 2022; Balgrosky, 2015) consistently emphasized several key enabling factors.

- **Improved Workflow and Efficiency:** EMR systems with user-friendly interfaces, strong technical support, and well- designed templates were linked to noticeable improvements in physician productivity. For instance, Crouch (2024) identified a strong statistical relationship between EMR quality and productivity, while Alissa et al. (2022) found that optimized templates not only saved time but also increased user satisfaction.
- **More Direct Patient Care:** Takura and Itoh (2019) found that EMR adoption allowed physicians to spend more time on patient care and less on administrative duties, supporting the idea that well-implemented EMRs can enhance clinical workflows.
- **Long-Term Benefits:** Janchenko (2020) demonstrated that with ongoing training and support, long-term improvements in productivity are achievable.
- **Policy and Scale Effects:** Balgrosky (2015) noted that supportive policies and larger practice environments amplified the positive impact of EMRs.

Modi & Feldman (2022) provided a meta-perspective, reporting that 80% of studies in their synthesis showed positive effects, especially when EMRs were tailored to clinical needs and supported by institutional infrastructure.

2.Negative effects: Two studies (Young et al., 2018; Tai-Seale et al., 2017) reported negative effects.

- **Increased Screen Time and Administrative Burden:** Both studies found that physicians spent more time spent on the EMR than with patients, resulting in longer work hours, increased stress, and reduced job satisfaction. Tai-Seale et al. (2017) described "desktop medicine," where half of a physician's time was consumed by digital tasks, reducing the quality of face-to-face care.
- **Potential for Burnout:** These findings echo broader concerns in the literature about EMR-related burnout, particularly when systems are poorly designed or not well integrated into clinical workflows.

3.Mixed or Neutral effects: Two studies (Melnick et al., 2021; Tabche et al., 2023) found no significant effect.

- Melnick et al. (2021) observed high EMR usage but no clear link to productivity changes.
- Tabche et al. (2023) reported improved productivity but noted a reduction in patient communication and attention, leading to an overall mixed assessment.

4.2 General Interpretation of Results in the Context of Other Evidence

The results of this review are consistent with those published in previous studies and reviews. Research in countries like the United States and Japan has also shown that EMRs can improve physician productivity when the system is easy to use, supported by training, and well-integrated into daily workflows. However, just like in the review, many other studies have highlighted challenges such as increased documentation time, screen fatigue, and reduced patient interaction. These results show that while EMRs have the potential to improve efficiency, the outcome depends on how the system is designed, how well staff are trained, and the level of support provided by the hospital or clinic. This pattern is also observed in earlier reviews by authors such as Sinsky et al. (2016) who noted both benefits and challenges in EMR usage.

4.3 Limitations of the Evidence Included in the Review

Although this systematic review gives useful information about how EMR systems effect physician productivity in outpatient departments, there are some important limitations in the studies that were included.

1. Mostly Based on Observational Studies

Most of the studies (7 out of 10) were observational in nature, such as cross-sectional or before-and-after studies. These types of studies are good for understanding real-life situations but cannot prove cause-and-effect relationships. Only a few studies used stronger methods like systematic reviews or quality improvement designs.

2. Different Ways of Measuring Productivity

Each study used different ways to define and measure physician productivity. Some looked at time spent on documentation or patient consultations, while others focused on satisfaction or efficiency. This lack of standard measurement made it difficult to compare results or combine data across studies.

3. Limited Studies from Developing Countries

The majority of the studies included were conducted in high-income countries such as Japan and US. There were very few studies from low-resource settings such as rural areas in India or other developing countries. Because of this, the results may not apply to all healthcare environments.

4. Missing Details About EMR Systems

Some studies did not give enough information about the type of EMR system used, how much it was customized, or what kind of training and support was provided. These details are important because they can affect how the system impacts physician productivity.

5. Short-Term Focus Only

Many studies focused only on the short-term effects of EMR systems. They did not investigate how productivity evolves over time as users gain familiarity with the system. Long-term results are important to understand the complete impact.

6. Language and Selection Bias

This review included only studies published in English between 2015 and 2025.

Because of this, some useful research written in other languages or found in unpublished reports or local case studies might have been missed. This could cause selection bias.

7. No Separation by Medical Specialty

Although the focus was on outpatient settings, many studies did not separate results by medical specialty. Since EMR impact may be different for primary care doctors and specialists, this reduces the ability to make specific recommendations for different departments.

4.4 Limitations of the Review Process

While every effort was made to follow a structured and systematic approach, this review process had a few limitations that should be acknowledged:

1.Limited Database Coverage

The literature review utilized only three databases: PubMed Central, ProQuest, and Google Scholar. While these databases encompass a broad spectrum of health-related research, there exists the possibility that pertinent studies indexed in other significant databases like Scopus, Web of Science, or ScienceDirect may have been overlooked.

2. Restriction of Language

The review included only articles that were published in English. This exclusion of potentially relevant studies published in other languages may have introduced language bias and limited the diversity of global perspectives on EMR use.

3. Timeframe Limitation

The review included studies published between 2015 and 2025. This was done to focus on the most recent and relevant literature, especially after key policy changes like the HITECH Act. However, excluding studies published before 2015 might have led to the omission of valuable early evidence on EMR implementation.

4. Exclusion of Gray Literature

Gray literature, including conference abstracts, government reports, and unpublished dissertations, was not taken into account. This may have limited the inclusion of practical insights or data from real-world EMR implementations, particularly from hospitals or healthcare systems.

5. Manual Screening and Selection

The studies were selected manually by screening titles, abstracts, and full-text articles. Even after careful application of inclusion and exclusion criteria, there remains a chance of human error or selection bias during this process.

6. No Quality Appraisal of Included Studies

In this review a formal quality appraisal or risk of bias assessment of the selected studies was not included. It is difficult to measure the reliability and robustness of the evidence shown in various studies without evaluating methodological quality.

4.5 Implications for Practice, Policy, and Future Research

The results of this systematic review hold significant relevance for clinical practice, healthcare policy, and for future research. Physician's productivity can be boosted by healthcare organizations with EMR systems by creating intuitive EMRs that fit seamlessly into current clinical workflows. Also important is the provision of ongoing training and support for clinicians, along with dependable technical assistance, to promote the effective and lasting use of EMRs in outpatient environments.

At the policy level, thinking about offering incentives that encourage EMR customization and more thorough integration into clinical workflows, particularly in resource-limited settings where adoption challenges are more pronounced is advisable for decision-makers. Policies that promote system interoperability, flexibility, and adaptation to local needs can help in broadening the beneficial impacts of EMR implementation.

Involving physicians and other frontlin users throughout all stages of the EMR lifecycle from selection and design to ongoing evaluation is crucial. Their active engagement helps ensure that EMR systems are practical, support daily clinical tasks, and reduce workflow disruptions.

Future research should focus on long-term, multicenter studies to better understand how EMRs affect productivity across various outpatient care settings. Further exploration of system usability, clinician workload, and the impact of clinical decision support tools could provide valuable insights to guide future enhancements in EMR performance and physician satisfaction.

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ANNEXURE 1

PRISMA 2020 CHECKLIST

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	Pg- i
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Pg xii- xiii
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Pg- 1-9
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Pg- 10
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Pg- 10
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Pg- 10-11
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Pg- 10-11
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Pg- 11-12
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Pg- 14
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	14
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	14
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	-
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	-
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	Pg- 25
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Pg- 25
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Pg- 26
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	-
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	-
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	-
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	-
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	-

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