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

Submitted by-
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INTRODUCTION

- **Electronic Medical Records (EMRs)** are defined as digital versions of an individual's health related data, which can be created, collected, managed, and accessed by authorized clinicians and personnel within a single healthcare organization.
- EMR adoption has grown rapidly, supported by national initiatives like the **HITECH Act** in the United States and the **National Digital Health Mission** in India. Both efforts aim to effect meaningful improvements in healthcare efficiency and quality through widespread EMR implementation.
- In outpatient departments (OPDs), where clinicians often manage heavy patient loads under tight time constraints, EMRs are expected to affect physician productivity by helping streamline workflows, improve documentation accuracy, and provide quick access to patient medical histories.

Evolution of Electronic Health Records: A Decade-by-Decade Journey

EMRs in Current Healthcare Practice

- Modern EMRs consolidate medical history, diagnostics, medications, and clinical notes in a digital platform.
- They enable real time access to patient information, improving clinical decision-making and care quality.
- In Outpatient Departments (OPDs), EMRs streamline patient encounters, documentation, and workflow efficiency.
- However, the impact on physician productivity varies based on system design, training, and workflow integration.
- EMRs hold the potential to enhance efficiency but can introduce challenges if not properly implemented.
- Continuous evaluation and optimization are key to realizing the full benefits of EMR systems.

Purpose of Research

- This study aims to gather and assess existing research to clarify whether EMR systems positively or negatively affect physician productivity in outpatient settings.
- As more healthcare institutions adopt EMRs, understanding their effect on clinical workflows, time management, and overall physician efficiency becomes essential.
- The findings can assist healthcare administrators, policymakers, and system designers in improving EMR implementation to better support clinical performance and patient care.

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:

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

METHODOLOGY

This study is a Systematic Review conducted according to **PRISMA 2020 (Preferred Reporting Items for Systematic Reviews and Meta-Analyses)** guidelines.

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.	-

Section and Topic	Item #	Checklist item	Location where item is reported
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Pg- 11-12
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	
Study characteristics	17	Cite each included study and present its characteristics.	Pg- 23-24
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	-
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Pg- 24-31
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Pg- 24-31
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	Pg- 24-31
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	-
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	-
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	-
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	-
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Pg- 31-33
	23b	Discuss any limitations of the evidence included in the review.	Pg- 33-34
	23c	Discuss any limitations of the review processes used.	Pg- 35-36
	23d	Discuss implications of the results for practice, policy, and future research.	Pg- 36-37
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	-
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	-
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	-
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	-
Competing interests	26	Declare any competing interests of review authors.	-
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	-

Eligibility Criteria

Inclusion criteria

Studies that meet the following criteria were included:

- Published between 2015 and 2025
- Were in English language
- 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

Data Sources and Search Strategy

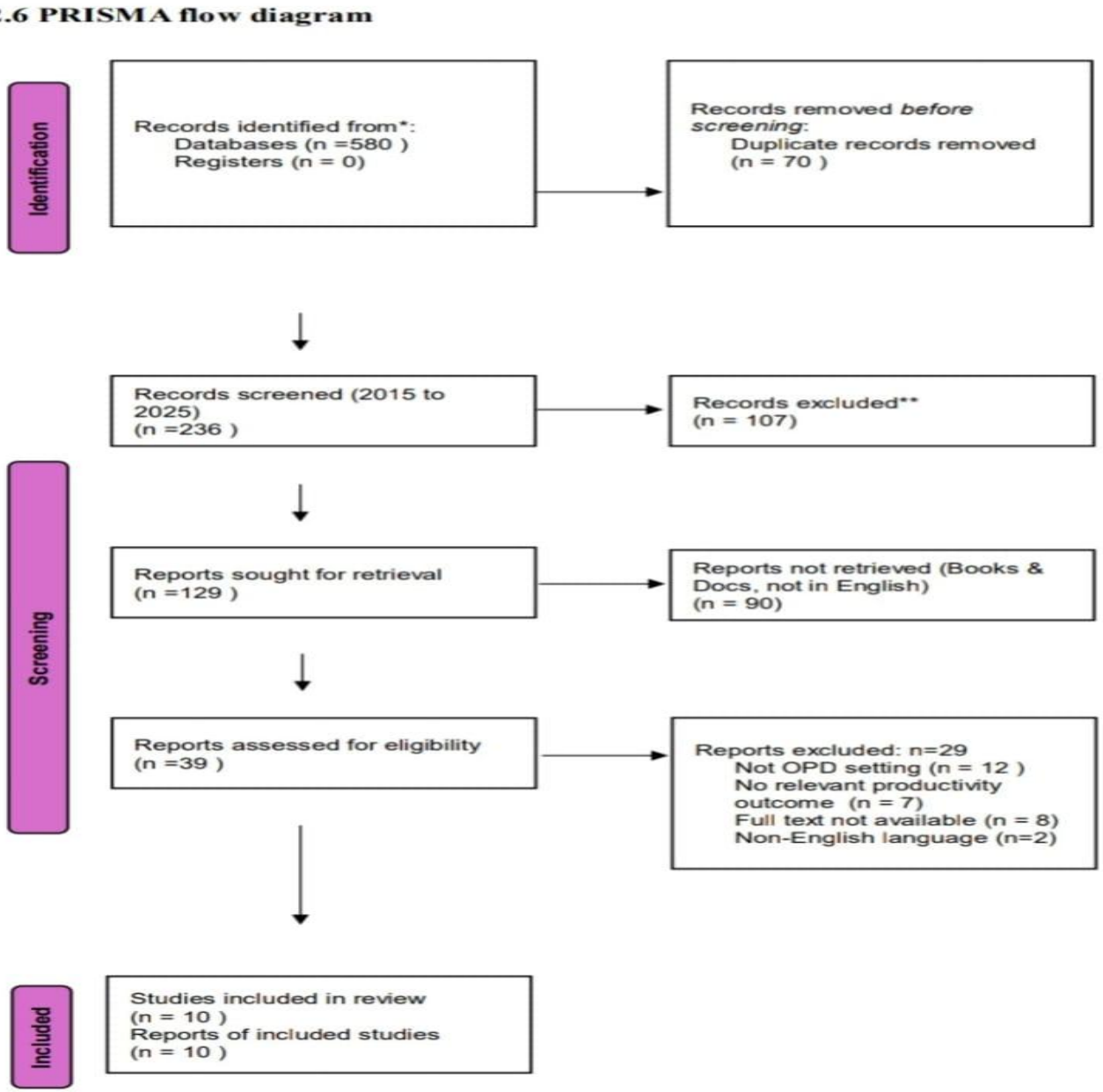
The following electronic databases and Search engine were used to conduct an exhaustive literature search:

- PubMed Central
- ProQuest
- Google Scholar

Keywords and Boolean operators- *("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.

Study Selection Process



RESULTS
Review of Studies

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 Care Physicians' Work in the Electronic Health Record Era	Measure how primary care physicians allocate time during outpatient visits, EHR vs face-to-face care	Cross-sectional observational time-motion study	Family medicine clinics, 10 residency programs, Texas, USA; May–June 2015 (4 weeks)	- Physicians spent more time on EHR work (18.5 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.

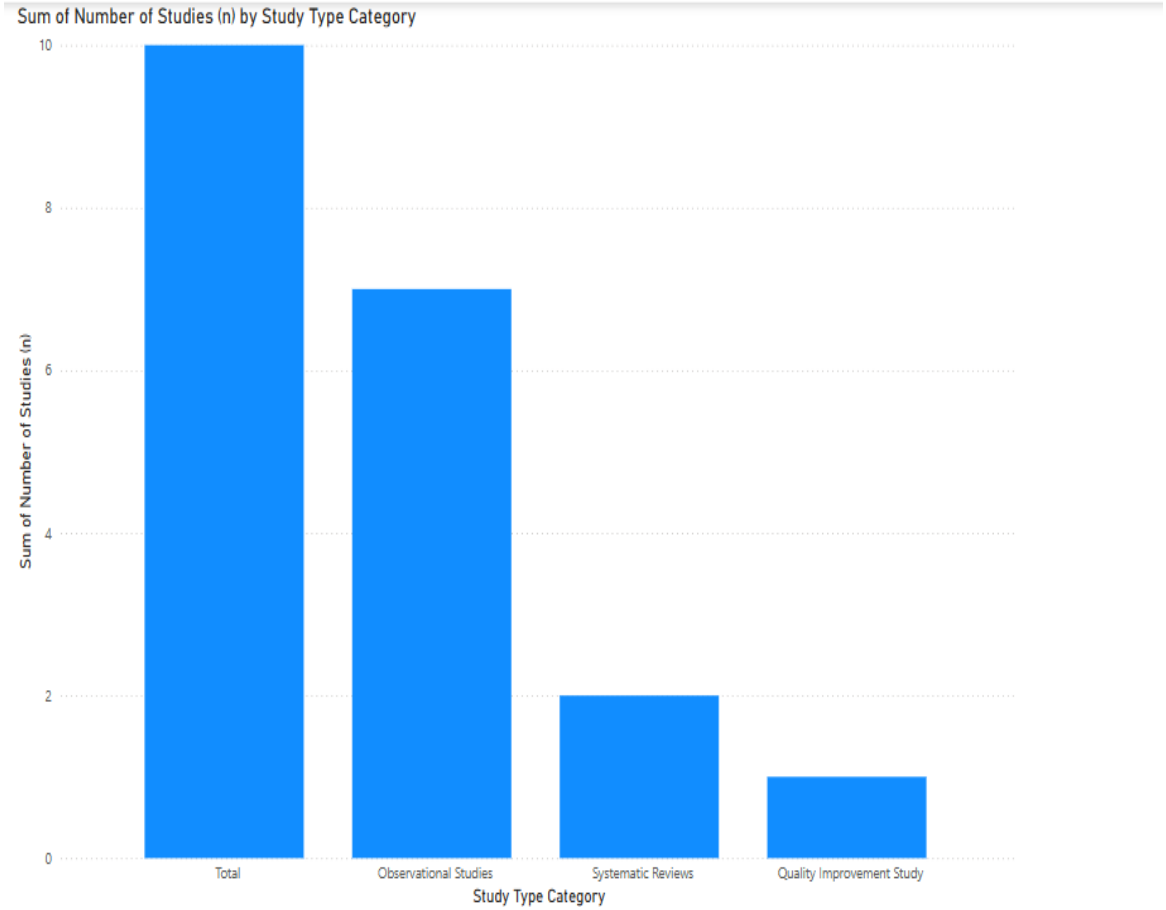
Garry Janchenko, Robert Morris University (2020) [38]	**The impact of electronic health record systems on physician productivity**	**Evaluate EHR impact on physician productivity and relative value unit intensity**	**Retrospective before-and-after observational study**	**Pediatrics healthcare practice, Southwestern Pennsylvania; 2007–2018**	**- EHR implementation may initially reduce productivity due to learning curve. - Productivity stabilizes or improves with training and customization. - Success depends on organizational 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/negative 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.

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)

Study type Distribution



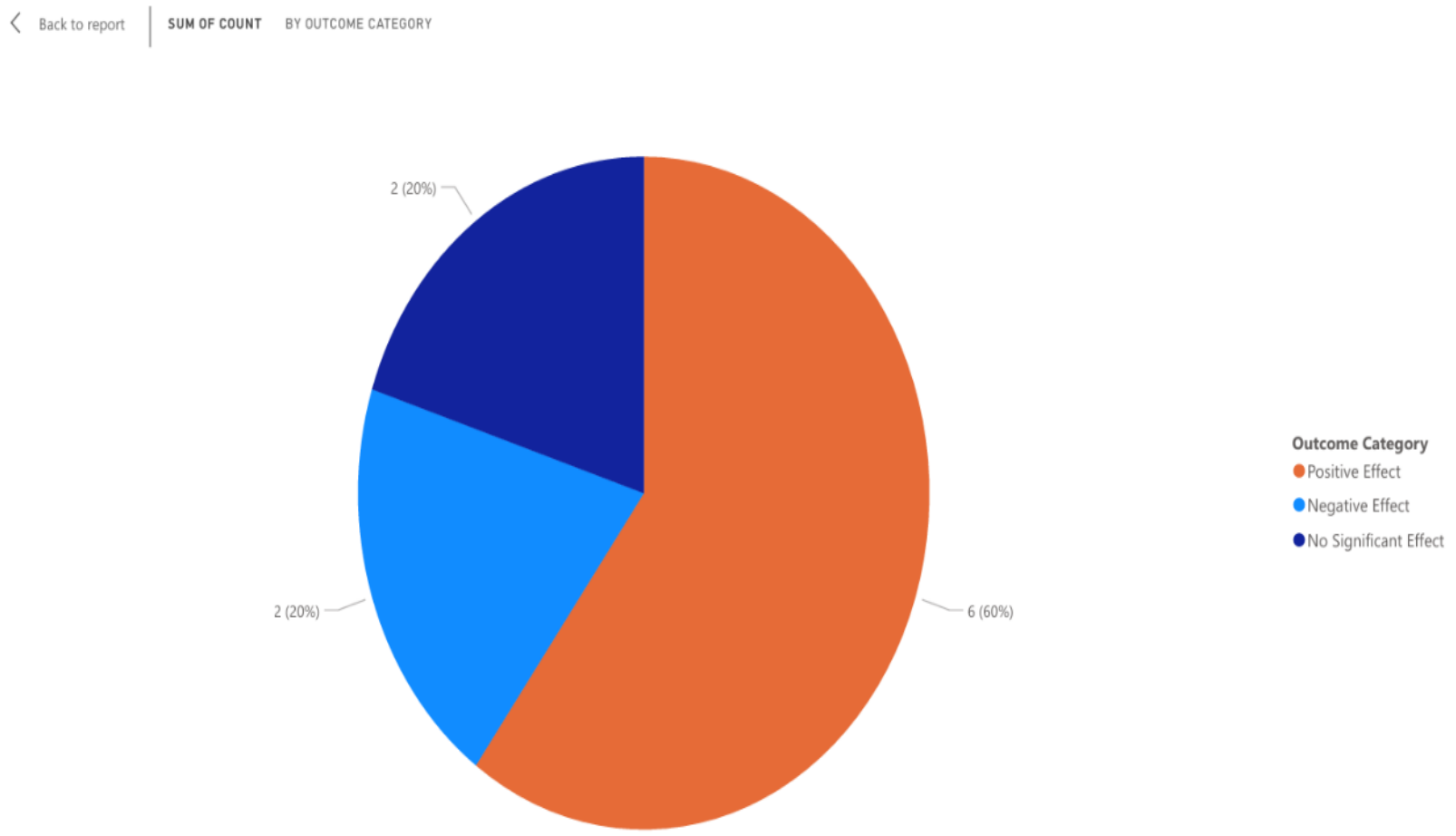
Study Type Category	Number of Studies (n)	Percentage (%)
Observational Studies	7	70%
Systematic Reviews	2	20%
Quality Improvement Study	1	10%
Total	10	100%

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.

Study Outcomes Summary

Outcome Category	Count
Negative Effect	2
No Significant Effect	2
Positive Effect	6



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.

DISCUSSION
Overview of Main Findings

1. Positive Effects of EMRs on Physician Productivity

- **Improved Workflow & Efficiency:** User-friendly interfaces, strong support, and optimized templates boost productivity (Crouch, 2024; Alissa et al., 2022).
- **More Time for Patient Care:** EMRs reduce administrative tasks, allowing greater focus on patient care (Takura & Itoh, 2019).
- **Long-Term Gains:** Continuous training and support lead to sustained productivity improvements (Janchenko, 2020).
- **Policy & Scale Benefits:** Supportive policies and larger practices enhance EMR impact (Balgrosky, 2015).
- **Meta-Analysis Findings:** 80% of studies report positive outcomes when EMRs align with clinical needs and institutional support (Modi & Feldman, 2022)

2. Negative Effects of EMRs on Physician Productivity

- **Increased Screen Time & Administrative Burden:** Physicians spent more time on EMRs than with patients, leading to longer work hours, stress, and lower job satisfaction (Young et al., 2018; Tai-Seale et al., 2017).
- **Reduced Face-to-Face Care:** "Desktop medicine" consumed ~50% of physician time, diminishing direct patient interaction (Tai-Seale et al., 2017).
- **Risk of Burnout:** Poorly designed or poorly integrated EMRs contribute to physician burnout and workflow disruption.

3. Mixed/Neutral Effects:

- **Melnick et al. (2021):** High EMR use but no clear impact on productivity.
- **Tabche et al. (2023):** Productivity improved, but patient communication and attention decreased, resulting in mixed outcomes.

EMRs & Physician Productivity
1. Effect on Physician Workflow

- Improves access to patient information and reduces documentation errors.
- Enables real-time clinical decision-making through instant access to patient history, labs, and imaging.
- Enhances workflow efficiency with integrated order entry, clinical decision support, and automated reminders.
- Increases administrative workload, with more time spent on documentation and non-clinical digital tasks, contributing to burnout.
- Usability issues and poorly integrated workflows can disrupt clinical tasks; continuous system optimization and clinician involvement are essential

2. Relationship Between EMR Usage and Physician's Time Allocation

- **Shift in Time Allocation:** EMRs increase time spent on digital tasks (documentation, order entry), sometimes reducing face-to-face patient interaction.
- **Administrative Burden:** Managing inboxes, patient messages, prescriptions, and orders often extends work beyond clinic hours, contributing to burnout.
- **Efficiency Gains (When Optimized):** Custom templates, voice recognition, and intelligent order sets can streamline documentation and free time for patient care.
- **Influencing Factors:** Impact varies by specialty, case complexity, system usability, and institutional support.
- **Importance of Customization:** Involving physicians in EMR design and ongoing system optimization improves alignment with clinical workflows and boosts productivity.

3. Factors Affecting Physician Productivity in EMR-Enabled OPD

- **System Usability:** Intuitive, customizable EMRs reduce cognitive load and save time.
- **Training & Support:** Continuous training and strong IT support boost efficiency.
- **Workflow Integration:** Seamless integration with clinical workflows enhances productivity.
- **Administrative Burden:** Excessive digital tasks can reduce patient care time and increase burnout.
- **Organizational Culture:** Leadership support and clinician involvement improve EMR adoption.
- **Specialty Needs:** Productivity impact varies by specialty and case complexity.
- **Continuous Optimization:** Regular updates and clinician feedback ensure ongoing improvements

Implications for Practice, Policy, and Future Research

- **Practice:** Design user-friendly EMRs integrated with clinical workflows; provide ongoing training and technical support.
- **Policy:** Promote EMR customization, interoperability, and adaptability, especially in resource-limited settings.
- **Engagement:** Involve physicians throughout the EMR lifecycle to ensure usability and minimize workflow disruptions.
- **Future Research:** Conduct long-term, multicenter studies on EMR impact; explore system usability, clinician workload, and decision support tools to guide future improvements.

Conclusion

- This review demonstrates that EMR systems can enhance physician productivity in outpatient settings when effectively integrated into clinical workflows, with 60% of studies reporting positive outcomes.
- However, 20% highlighted negative effects linked to poor system design and inadequate support.
- Neutral findings further underscore the critical role of usability and organizational readiness.
- Overall, the study emphasizes that achieving optimal EMR benefits requires thoughtful customization, comprehensive training, and sustained leadership engagement.

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Thank You!