

Review Article

THE IMPACT OF ELECTRONIC MEDICAL RECORDS ON THE QUALITY OF CARE: A SCOPING REVIEW

Ariff Azfarahim **Ibrahim**¹, Na'eemah **Zaini**¹, Kavita **Jetly**^{1*}, Norayuni **Mohd Ismail**¹, Siti Rohani **Nurumal**¹, Aniza **Ismail**¹

¹ Department of Community Health, Universiti Kebangsaan Malaysia Medical Centre, Jalan Yaacob Latif, Bandar Tun Razak, 56000 Cheras, Kuala Lumpur, Malaysia

Submission Date:

11 February 2026

Acceptance Date:

13 September 2026

Publication Date:

30 October 2026

***Corresponding author:**

Kavita Jetly,
drkavitajetly@moh.gov.my
Tel: +603-33628321

DOI:

<http://doi.org/10.63719/imrj.2026.12.02.008>

IMRJ © 2026. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction, provided the original author and source are credited.

ABSTRACT

Electronic medical records (EMRs) have become an integral component of modern healthcare systems, with the potential to improve the quality, safety, and efficiency of healthcare delivery. This review aimed to evaluate the impact of EMR applications in healthcare systems based on the quality of care. A scoping review was conducted using three electronic databases (Web of Science, PubMed, and Scopus) from January 2015 to December 2019. The inclusion were open-access articles written in English, with quantitative and qualitative study designs. A total of 220 articles were retrieved from the literature search; 19 articles met the inclusion criteria and were eligible for the final analysis. The review identified five major quality-of-care domains, namely safe, effective, patient-centred, timely, and efficient. There were heterogeneous findings with some studies pointing toward positive, negative, or neutral consequences of EMR implementation in healthcare systems. This review suggests several vital future directions to further enhance the positive impacts of EMR in providing the best services to patients. Thus, recommendations focus on strengthening technical resources by addressing cost, ensuring the availability of appropriate software and support systems, and enhancing the comprehensiveness of user training.

KEYWORDS:

electronic medical records, electronic health records, healthcare quality, healthcare evaluation, quality of care

INTRODUCTION

In recent decades, electronic medical records (EMR) have been widely used in developed and developing countries. In 2009, the enactment of the Health Information Technology for Economic and Clinical Health (HITECH) Act in the United States of America (USA) was described as a milestone in health information technology, whereby incentive payments were provided to healthcare providers who adopted the technology (1). Since then, the number of EMR implementations has substantially increased, which is believed to be correlated with efficiency, cost-effectiveness, and increased provider satisfaction (2, 3).

With the help of technological advancements, EMR has become a promising solution that provides essential input in the healthcare industry to ensure the delivery of high-quality healthcare services and better patient outcomes compared to paper-based health records (4). According to the World Health Organisation (WHO), quality healthcare is described as the extent to which healthcare services provided to individuals and patient populations improve the desired health outcomes (5).

The quality of healthcare is a vital element in delivering services within the healthcare organisation. It was pioneered by a physician named Avedis Donabedian, who described a classic framework for the assessment of healthcare quality since 1966 (6). Donabedian's model focuses on the concepts of structure, process, and outcome to define the quality of care. On the other hand, the Institute of Medicine (IOM) has unpacked the concept further and suggested that quality should be focused around six domains, which are (1) safe, (2) effective, (3) timely, (4) patient-centred, (5) efficient and (6) equitable (7). The IOM has suggested that the wide-scale adoption of the EMR could be pivotal for improving healthcare quality. The Donabedian and IOM models overlap in many areas, but the latter includes additional concepts of cost and access in its domains of efficient and equitable care. The application of EMR has expanded substantially, although its impact across different domains of healthcare quality remains variable.

Despite the widespread use of EMR in different healthcare facilities for more than a decade, there are still unanswered questions regarding its significance for healthcare quality. Although EMR in healthcare services is more prominent than paper-based health records, the evidence regarding their impact on healthcare quality remains inconsistent. Previous studies have reported significant improvements in several healthcare quality outcomes following EMR implementation. The evidence established that proper implementation of EMR enhanced the quality of healthcare by increasing time efficiency, guideline adherence, lessening medication errors and adverse drug effects (8). However, another study conducted in different settings revealed that medical errors, missed diagnoses, and lack of adherence to guidelines increased significantly following the implementation of EMR (9). Therefore, it is pertinent to elucidate the benefits of EMR and the underlying challenges by providing adequate information after its implementation in healthcare systems.

The objective of this review was to evaluate the impact of EMR implementation in the healthcare system based on the quality of care. Therefore, this review was conducted to provide a rational basis to recommend the use of EMR in the holistic implementation of healthcare services.

MATERIALS AND METHODS

Search strategy

The electronic databases used for the literature search included Web of Science, PubMed, and Scopus, covering the international content of healthcare. The search strategy entailed combined terms using the Boolean operators 'AND' and 'OR', as follows:

“impacts” OR “outcomes”
AND
“Electronic medical records” OR “Electronic health records”

Study selection

Eligible studies were open-access articles published in English between January 2015 and December 2019 that used quantitative or qualitative study designs in the databases mentioned above. Database filters were applied to restrict the publication period to January 2015 through December 2019. The inclusion criteria were based on the patient/population, intervention, comparison, and outcomes (PICO) framework: a) Population: patients; b) Intervention: electronic medical records or electronic health records; c) Comparison: no electronic system used, such as paper-based health records; d) Outcomes: impacts or outcomes of EMR on the quality of care in any of the six domains described in IOM. Studies on enhanced tools of EMR, such as alert systems, reminders, electronic clinical decisions, and perceived quality, were excluded. In this review, the terms EMR and EHR were used interchangeably in line with the term used in the original article that presented the same category.

Study screening and data extraction

The search results were imported into EndNote, and duplicates were removed. The data was then transferred into Microsoft Excel. Two reviewers independently screened the titles and abstracts against the eligibility criteria. Potentially eligible articles were subsequently retrieved and independently assessed in full text by the two reviewers. Disagreements at any stage were resolved through discussion and consensus. The classification of the studies was based on the year of publication, authors, study settings and locations, study designs, dependent variables or outcome measures, and the main findings.

Quality assessment tool

A critical appraisal of the articles for quality was conducted by two independent reviewers using the mixed-methods appraisal tool (MMAT version 2018). This tool can assess the quality of multiple study designs. A third reviewer was responsible for assessing any disagreement between the two independent reviewers regarding the quality of one or more articles.

RESULTS

Study selection

A total of 220 articles were retrieved from the primary literature search from three electronic databases. All the articles were subjected to further screening. Upon the removal of duplicates, 123 articles were selected, and their titles were screened. Subsequently, 44 articles were left from the initial database search. A total of 31 articles were available after the screening of abstracts, and all of

them were retrieved for a full-text review. Finally, 19 articles met the inclusion criteria for data extraction and synthesis. The selection process is illustrated in Figure 1.

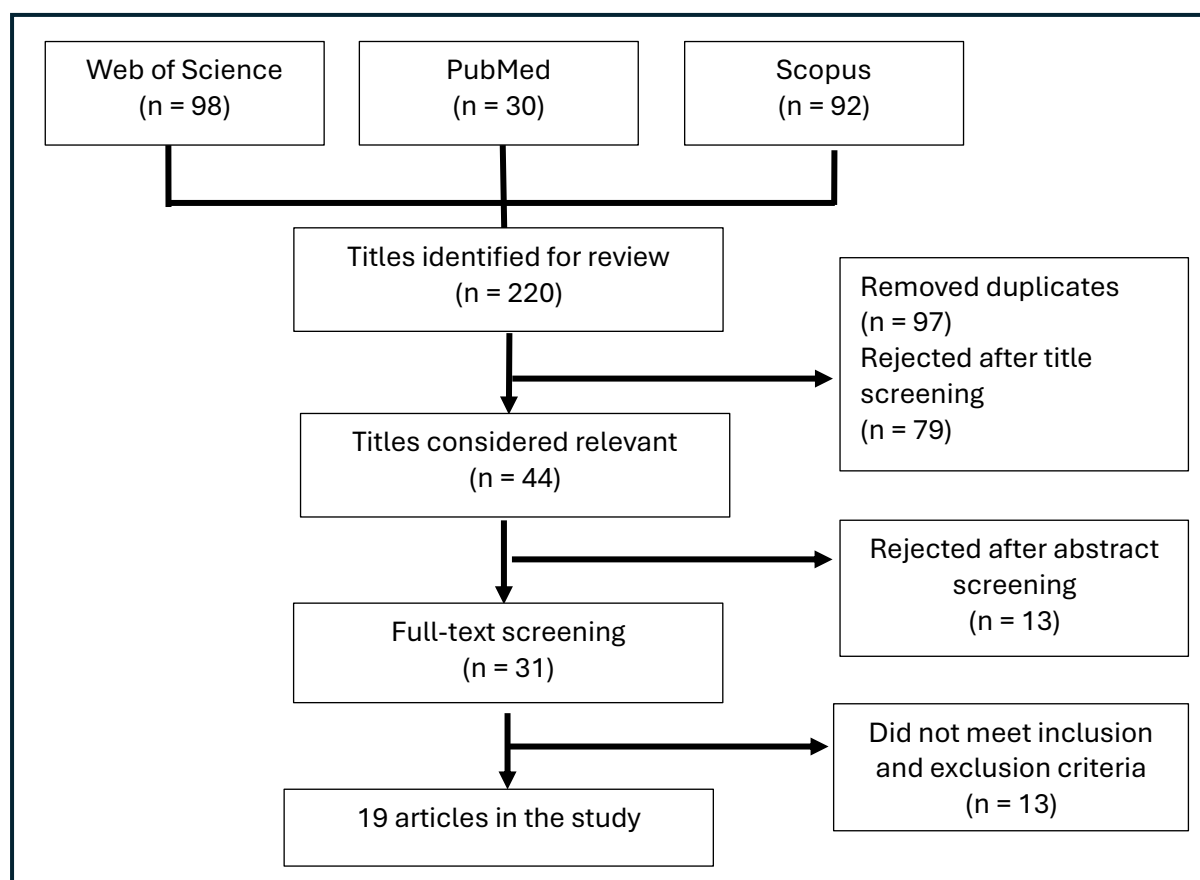


Figure 1. PRISMA flowchart

Study characteristics

As shown in Table 1, a total of 19 articles were included in this review. The studies were conducted in various countries with different study designs and outcome measures. Most of the studies were conducted in the USA ($n = 15$), while one study each was undertaken in Austria, Japan, Kenya, and Spain. Based on study designs, eight were cross-sectional studies, eight were non-randomised controlled trials, two were case-control studies, and one was a cohort study.

Most of the reviewed studies were conducted in hospital-based settings, including academic medical centres, while others involved primary care practices, specialised clinical settings, disease-based registries, or non-facility databases. The studies varied considerably in scale and setting, ranging from single healthcare facilities to multisite studies involving large numbers of hospitals and healthcare practices. Disease-based registries included those involving heart failure, acute myocardial infarction, and stroke. Overall, the included studies evaluated the impact of electronic medical records on healthcare quality across a diverse range of healthcare settings and data sources.

Table 1. Summary of study design and key findings of articles on impact of electronic medical records in healthcare quality

No.	Authors and year	Setting	Country	Study design	Outcome measures	Key findings
1	Bae et al. 2016 (10)	1470 primary care physicians, including general practitioners, family practitioners, and general internists.	USA	Cross-sectional analytic study	1. The duration of time, measured in minutes, of the face-to-face encounter between physicians and patients for direct patient care during the office visit. 2. The total number of patient office visits per physician per week.	1. Primary care physicians were associated with 1.5 extra hours spent on patient face time per week for each physician. 2. No change in the overall number of visits per week for primary care physicians to see additional patients.
2	Barnett et al. 2016 (11)	17 study hospitals and 399 control hospitals	USA	Case-control study	All-cause readmission within 30 days of discharge, all-cause mortality within 30 days of admission, and adverse safety events for selected indicators (1)-90 composite measured 90 days before and 90 days after implementation of the EHR compared with the control group.	There was no evidence of a significant or consistent negative association between EHR implementation and short-term mortality, readmissions, or adverse events.
3	Bernal et al. 2018 (12)	A tertiary university hospital	Spain	Non-randomised controlled trial	The quality, length and readability of the discharge summary (DS) and the number of diagnoses and procedure codes by raw and risk-adjusted data.	1. The DS had better quality, length and readability post-implementation of EHR. 2. The implementation of EHR in our hospital did not change the proportion of diagnoses and procedures coded in the DS. 3. The number of diagnoses and procedures coded per DS has significantly increased with

						EHR, using both raw and risk-adjusted data.
4	Carayon et al. 2015 (13)	Three intensive care units (ICUs) of a tertiary care medical centre for adult medical/ surgical, neonatal and paediatric	USA	Non-randomised controlled trial	Time spent by ICU residents and attending physicians on various tasks before and after EHR implementation	The use of EHR technology has a major impact on ICU physicians' work by increasing the time spent on clinical review and documentation.
5	Hernandez-Boussard et al. 2016 (14)	Academic medical centre	USA	Cross-sectional analytic study	Identification of urinary incontinence as a patient-centred outcome within the EHR.	EHR based identification of urinary incontinence had good precision and recall for urinary incontinence (positive predictive value: 0.73 and sensitivity: 0.84)
6	Ng-Mak et al. 2019 (15)	Inovalon MORE ² Registry, a multipayer medical and pharmacy claims database covering private and public-sector health plans	USA	Cross-sectional analytic study	1. Quality of mental health care was assessed using four Healthcare Effectiveness Data and Information Set indicators, which were diabetes screening, diabetes monitoring, cardiovascular monitoring, and assessment of antipsychotic medication adherence. 2. Patient outcomes included inpatient admissions and emergency department visits	EHR use was associated with improved rates of diabetes screening, diabetes monitoring and better antipsychotic adherence. EHR use was associated with fewer inpatient admissions and emergency department visits. These data suggest that EHR use may have a positive influence on the process and outcomes of psychiatric care when treating patients with schizophrenia.

7	Yanamadala et al. 2016 (16)	Surgical and medical patients from six large, diverse states	USA	Cross-sectional analytic study	Inpatient mortality, 30-day all-cause readmission rates, patient safety indicators (1), and length of stay	Patients receiving medical and surgical care at hospitals with no EHR system have similar outcomes compared to patients seeking care at hospitals with a full EHR system, after controlling for important confounders.
8	Lim et al. 2015 (17)	Eye Centre and its satellites at the University of California	USA	Non-randomised controlled trial	1. Clinical revenues collected per provider 2. Transcription costs	1. The difference in total inflation-adjusted clinical revenue collected per provider per year did not change significantly after EHR implementation. 2. Clinical revenue collected per visit per year did not change significantly after EHR implementation. 3. Transcription costs per year were significantly reduced after EHR implementation.
9	Liu et al. 2018 (18)	Hospital	USA	Non-randomised controlled trial	1. Accuracy and quality of physician documentation (via All Patient Refined Diagnosis-Related Group Scores) 2. Total time to complete clinical documentation 3. Average expected hospital payment	1. Significant improvement in All Patient Refined Diagnosis-Related Group Scores (severity of illness, risk of mortality, and case mix index) 2. Increased time to complete history and physical and progress notes (borderline significant) and significantly decreased time to complete discharge summary 3. Significantly increased

						hospital average expected payments.
10	Mitsch et al. 2015 (19)	Medical University	Austria	Non-randomised controlled trial	Completeness of information documented electronically	Clinical documentation (in all categories) was significantly more complete in the EHR group in comparison to paper-based records.
11	Enriquez et al. 2015 (20)	414 hospitals with and without EHRs based on ACTION Registry-GWTG and the American Hospital Association annual survey	USA	Cross-sectional analytic study	1. Primary: Baseline patient demographics, clinical characteristics, in-hospital treatments, processes of care, and outcomes were compared between patients according to hospital EHR status 2. Secondary: The change in defect-free score from 1 year before adoption to 1 year after adoption	1. a) EHR use was associated with less heparin overdosing and slightly greater adherence to acute myocardial infarction guideline-recommended therapies. b) In non-ST-elevation myocardial infarction, slightly lower risk of major bleeding and mortality in hospitals with full EHRs. ST-elevation myocardial infarction: there were no differences in outcomes. 2. EHR use was associated with a higher mean increase in defect-free care as compared to those who did not change EHR status
12	Flatow et al. 2015 (21)	Surgical intensive care unit (SICU) in a tertiary hospital	USA	Non-randomised controlled trial	Length of stay, mortality, central line-associated bloodstream infection (CLABSI) rates, Clostridium difficile (C. diff.) colitis	EHR implementation was statistically associated with reductions in CLABSI rates and SICU mortality.

					rates, readmission rates, and number of coded diagnoses two years before compared to two years after EHR implementation.	
13	Howley et al. 2015 (22)	Six medical primary care practices, 12 medical specialty practices, five obstetrics and gynecology practices, six surgical practices, and a sleep centre within an academic medical centre	USA	Non-randomised controlled trial	Number of patients seen by each practice and the reimbursements received as a result of those visits for 2 years after EHR implementation, and comparison with a pre-implementation baseline.	Practice reimbursements increased after EHR implementation, but there was a long-term decrease in the number of patient visits.
14	Joynt et al. 2015 (23)	Hospitals with stroke care involved in the Get with the Guidelines-Stroke (GWTG-Stroke) and the American Hospital Association annual survey	USA	Cross-sectional analytic study	Comparing EHR versus non-EHR based hospitals, for stroke patients: A composite “all-or-none” quality performance measure, length of stay >4 days, discharge home, in-hospital mortality	EHRs were not associated with higher-quality care or better clinical outcomes for stroke care.
15	Kaneko et al. 2018 (24)	658 municipal public hospitals	Japan	Cross-sectional analytic study	Labour productivity and multifactor productivity (MFP) of the hospitals and their average rate of change during the study period.	Implementation of an EMR system had a significantly negative impact on MFP growth for the ‘late adopters’. No significant association was found between EMR

						implementation and labour productivity growth.
16	Selvaraj et al. 2018 (25)	Hospitals enrolled in Get with the Guideline: Heart Failure (GWTG-HF), a national registry of hospitalised patients with HF	USA	Cross-sectional analytic study	1. The individual quality metrics: hospital length of stay, discharge location (home versus other), in-hospital mortality and defect-free composite quality score. 2. The post-discharge outcomes and readmission.	There was no association between EHR status and patient-level quality metrics or in-hospital outcomes. No association between EHR status and 30-day event rates, including death, readmission, or a combined outcome.
17	Singh et al. 2015 (26)	Eye institute	USA	Case-control study	Net revenue, patient volume, revenue-to-volume ratio, diagnostic and procedure volume, capital and implementation costs, EHR incentive payments received, and coding volumes.	This study did not identify significant differences in revenue or productivity following EHR conversion in this clinical setting. The EHR incentive payments did not offset the costs of implementation.
18	Thirukumaran et al. 2015 (27)	Two tertiary care teaching hospitals	USA	Non-randomised controlled trial	Compliance with Surgical Care Improvement Project (SCIP); a measure that aims to increase adherence to processes that reduce postoperative complications.	Statistically significant short-term declines in scores were observed for the composite, postoperative removal of urinary catheter and post-cardiac surgery glucose control measures. A statistically insignificant improvement in scores for these measures was noted three months after EHR deployment. The transition to an EHR is associated with a short-term decline in quality.

19	Tierney et al. 2016 (28)	Three rural Kenyan health centres	Kenya	Cohort study	Patient flow and provider work assessed with time-motion studies before implementation and two years later	Patient waiting time was dramatically lengthened while the nurses’ and the clerks’ patient care time decreased.
----	-----------------------------	---	-------	--------------	---	--

Study findings

Contradictory findings were reported with regard to the quality of care, specifically in terms of effectiveness and safety domains of healthcare quality. Overall, several studies reported favourable outcomes. For instance, Ng-Mak et al. found that the use of EMR significantly delivered better quality patient care as measured by the Healthcare Effectiveness Data and Information Set (HEDIS) mental health quality measures (44.9%) compared to the non-EMR providers (29.4%; $P < 0.001$) (15). Another study that was based on a cardiovascular registry reported that EMR use was associated with less frequent heparin overdosing and greater adherence to acute myocardial infarction guideline-recommended therapies (20). Additionally, Flatow et al. showed that following EMR implementation, the surgical intensive care unit (ICU) reported significant reductions in the central line-associated bloodstream infection ($P < 0.005$) (21).

In contrast, some studies reported that EMR implementation led to either poor or no change in the quality of care. Based on the stroke registry, Joynt et al. concluded that there was no association between EMR and overall higher-quality care or better clinical outcomes (23). Thirukumaran et al. also conducted a Surgical Care Improvement Project (SCIP) with measures aimed at increasing adherence to processes that reduce postoperative complications, such as surgical site infections, urinary tract infections, cardiovascular events, and venous thromboembolism (27). The authors found that there was no significant improvement in the scores after three months of EMR use, thus concluding that the transition to EMR was associated with a short-term decline in quality.

Furthermore, four studies showed that EMR had no significant impact on the readmission and mortality rates. These findings were reported in the studies by Barnett et al. and Yanamadala et al. (11, 16) among patients receiving care either at hospitals with or without the EMR system. Likewise, another study conducted among heart failure patients across the USA demonstrated similar outcomes (25). Flatow et al. found that the reduction in surgical ICU mortality was associated with EMR implementation; however, the readmission rates were not significantly different before and after EMR implementation (21). Similarly, other safety outcomes such as morbidity complications (16, 20, 21) and adverse effects (11) also revealed no difference in facilities with or after EMR implementation.

The effect of EMR on timeliness was investigated in three studies. Two of the studies were conducted in primary care settings, one was hospital-based, and all of them compared patient-care time pre- and post-implementation of EMR. Bae et al. reported that the time spent by each physician on patients' face-to-face meetings per week increased by 1.5 extra hours. This finding was consistent with that of Carayon et al., who reported increased time spent on documentation and clinical review by ICU physicians after EHR implementation (13). Conversely, Tierney et al. reported a significant decrease in the time spent by nurses and clerks involved in patient care based on the facilities investigated (28). This study also showed that patient waiting time was substantially increased.

Furthermore, three studies evaluated the quality of documentation as an outcome. Favourable outcomes on data quality were reported in all these studies after EMR implementation. Bernal et al. analysed the quality, length, and readability of discharge summaries, as well as the number of diagnoses and procedures coded (12). The quality of the discharge summary based on formal requirements was significantly better after EMR implementation, despite being prolonged and difficult to read due to a significant increase in the average number of coded diagnoses and procedures. Meanwhile, Mitsch et al. concluded that the implementation of EMR in the Department of Ophthalmology and Optometrics showed a statistically significant positive impact on documentation completeness after assessing the facility during the management of diabetic retinopathy patients (19). Following the analysis of the documentation of postoperative urinary incontinence in patients diagnosed with localised prostate cancer and who underwent prostatectomy, Hernandez-Boussard et

al. also revealed that EMR is a good mechanism for reporting patient outcomes. Specifically, the EMR system recorded a positive predictive value of 0.73 and a sensitivity of 0.84, thus exhibiting a good precision in identifying urinary incontinence (14).

Lastly, the impact of EMR on efficiency was reported in four of the reviewed articles. Two ophthalmologic practice centre-based studies by Lim et al. and Singh et al. found no significant difference in clinical revenues and patient volume before and after EMR implementation (17, 26). A study by Liu et al. assessed the impact of EMR on productivity assessment, and no improvement in the overall documentation productivity was observed in the All-Patient Refined Diagnosis-Related Group. In contrast, a study conducted in Japan by Kaneko et al. reported that the 'late adopters' of the EMR system experienced a significant negative impact on their multifactor productivity growth. Furthermore, no significant relationship was found between labour productivity growth and EMR implementation. Thus, it can be summarised that the impact of EMR implementation varies in the provision of quality healthcare, pointing toward either positive or negative outcomes as mentioned in this review.

DISCUSSION

This scoping review of the existing academic literature regarding the impact of EMR implementation on healthcare quality has found mixed results of positive and negative outcomes. Nonetheless, the improvement in the positive outcomes could be observed compared to the earlier literature findings from the years 1995 to 2004 (29). The present review of published studies in the implementation of EMR over the past five years appeared to have similar mixed outcomes as those conducted almost a decade ago (3, 30). For instance, this scoping review revealed that several of the included studies demonstrated improved medical outcomes, although other studies demonstrated mixed findings across different measures of healthcare quality. These heterogeneous findings may contribute to uncertainty regarding the expected benefits of EMR implementation. This review provides a synthesis of evidence published between 2015 and 2019 on the impact of EMR implementation on healthcare quality and the heterogeneity of outcomes during this period.

Safety and effectiveness domains were the most assessed in the studies reviewed. This concurs with the fact that patient safety is crucial in reducing the risk of adverse effects in medical care (31). Both domains appeared to have mixed outcomes, as mentioned earlier. Nevertheless, the findings need to be interpreted with caution, as neutral and negative outcomes in healthcare quality are not generalisable to all healthcare providers due to the differences in study settings. For instance, certain studies were based on disease registries, which cannot be considered representative of all healthcare facilities (23, 25).

Among the reviewed studies, one reported a negative safety outcome; however, interpretation of this finding may be limited by differences in services, culture, and organisation between the comparison hospitals (27). Notably, it was observed that no study specifically evaluated the domain of equity; the absence of avoidable or remediable differences among groups of people in terms of social, economic, demographic, or geographical aspects (32). Although Kenya was the only developing country represented in this scoping review, the Kenyan study focused on patient flow and provider work patterns following EMR implementation and did not specifically evaluate equity-related outcomes (28). Most of the reviewed studies were conducted in developed countries due to earlier utilisation and advancement of information technology in healthcare. For example, in the USA, the hardware is more affordable, powerful, and compact, attributed to the use of personal computers, local area networks, fast internet, and easier access to medical information (33). Meanwhile, the quality assessment of EMR among developing countries is still limited due to the later adoption of EMR in the healthcare system.

Healthcare providers have also discovered that EMR is cost-effective and enhances medical practice management by increasing practice efficiencies. This would improve overall organisational efficiency and may be able to generate a positive return on investment and reduce errors (34). For instance, EMR assists in improved documentation and automated coding capabilities, reducing transcription costs, reducing billing and medical errors through better access to patient data, and alerts for error prevention. Other benefits also include fewer resources and less time required for manual charge entry, leading to more accurate billing and minimising lost charges. In this review, some studies showed positive efficiency outcomes after the implementation of EMR, such as increased productivity in documentation (18). However, several studies showed no clinical revenue improvement after the implementation of EMR (17, 26). In fact, a study reported a short-term negative effect on one of the important aspects of a productivity indicator after the implementation of EMR (24). Again, the domain of efficiency was found to have mixed results in the outcome.

Another important domain of healthcare quality that has been described in this review is patient-centred care. It is defined as providing care that is respectful of and responsive to the individual patient's preferences, needs, and values, thereby ensuring that patient values guide all clinical decisions (35). It has the potential to make care more tailored to patients' needs with multimorbidity, and this specific domain was documented in one of the reviewed studies (14). The clinicians were able to accurately and efficiently analyse the data in the EMR system to provide an evidence-based outcome for a certain treatment. Since patient involvement plays a vital part in quality improvement, the evidence from analysing EMR allows clinicians to give more precise information to the patients for them to make informed treatment decisions based on their values of various risks.

In this era of technology, improvement of timeliness is a quality of care that is highly expected from healthcare providers and patients after EMR implementation. It is pertinent for healthcare providers to reduce prolonged waiting times and delays in assessing patients' needs. Evidence suggests that EMR results in faster and easier access to patient records, which improves medication and procedure turnaround times (13, 36). On top of that, EMR can increase patient-facing time per week with each physician, hence providing more time for clinical review and documentation, which are vital to ensure the patients are treated thoroughly (10, 13, 28). Nevertheless, these positive findings are not consistent in all studies. This can be attributed to the difficult and detailed computer interfaces, as well as work disruption that causes slower processes after EMR implementation (36, 37). Furthermore, another possible contributing factor is the inability of health centres to modify their workflow to the new information system (28).

The positive impact of EMR on the quality of care is substantially important to improve population health. Otherwise, EMR would only be known as a very expensive version of paper-based records. The objective of universal health coverage, which has been promoted by the World Health Organisation (WHO) to provide a good healthcare system, might be jeopardised by any substandard care (38). As the world develops, there have been wide discussions on the aim of healthcare quality to improve service delivery to patients by enhancing all six domains of quality defined by IOM. The application of EMR could maximise its benefits to healthcare without correspondingly increasing its risks (39).

The failure of EMR implementation to achieve the intended improvements in healthcare quality may also reflect technical and non-technical implementation challenges (40). For the EMR to operate at an optimised level, the healthcare provider should ensure adequate infrastructure to prevent slow uptake of EMR among users. This also includes a good network connection, which is vital for EMR use since network disruption can slow operations and indirectly affect the quality of care provided to patients. Another reason for unsuccessful EMR implementation is that various vendors develop the software. Moreover, most studies in this review did not thoroughly describe their EMR system, and presently,

there is no standardised EMR software or set of basic features used across the world. Some EMR software adopted by healthcare providers may have weaknesses in its suitability, efficiency, and data quality. Any EMR software that is not user-friendly and has poor support from vendors will detract from achieving a high quality of care (41). A vendor should be responsive to fix the technical problems encountered by the users consistently and promptly to resume its optimal function. For example, practitioners in a children's hospital stated that the software of EMR for adult patients may not be suitable for paediatric patients, as they require the inclusion of certain features (42, 43). Thus, the EMR would have a better outcome if the system provider gained input from the practitioner in the early process.

In addition, an analysis of EMR in a Malaysian healthcare system reported several weaknesses that should be tackled at the implementation phase. The system requires comprehensive personnel training, and the transition to its application reduced up to 20% of physicians' productivity for months or more (44). Engagement with key personnel is important by providing user training to assist them in utilising the EMR system. Unfortunately, such training is often inadequate, and its significance is underestimated as it requires additional resources, such as costs and time. These technical issues should be effectively addressed before assessing the impact of EMR because they can be mitigated and even avoided if tackled during the implementation process (45). Hence, this shows that a very well-planned system is imperative for the successful implementation of information facilities in the healthcare system (46).

The limitations of this scoping review are well acknowledged. Firstly, although systematic literature research was performed, not all the reviewed studies may represent the six domains of healthcare quality as defined by IOM. Secondly, the definition and description of EMR were often very limited, making it difficult to assess whether some system capabilities were either truly absent or unreported by the researchers. Thirdly, as this scoping review was restricted to the definition of healthcare quality by IOM, any study related to the perception of EMR implementation, either by healthcare providers or patients, was unable to be reported. The perception may not reflect the actual quality, but it is an important driver and key attribute of quality. Finally, this review included studies published between 2015 and 2019 and therefore reflects the evidence available during that period. Given the continuing evolution of EMR systems, healthcare digitalisation and clinical workflows, the findings should not be interpreted as representing the full contemporary evidence base. More recent developments may have introduced additional benefits and implementation challenges that were not captured within the scope of this review.

CONCLUSION

Overall, this study revealed that safety and effectiveness domains were the most assessed in the reviewed articles, and the domains appeared to have mixed outcomes. Several important future directions in health information technology were suggested in this review that would positively impact the quality of care. EMR has the potential to improve healthcare quality, and the current impact of EMR implementation in this review could inform stakeholders to provide further positive impact and better healthcare services. However, the negative impacts and challenges need to be addressed before EMR is fully implemented in the healthcare system. To fully maximise their potential, it is vital to resolve potential technical issues before performing an appropriate impact assessment on EMR implementation. This includes issues with available resources, such as cost, appropriate software, support systems, and comprehensive training among users. These issues need to be effectively addressed in future studies to provide better information to stakeholders and to realise the benefits of its use. As EMR systems and healthcare delivery continue to evolve, future reviews incorporating

more recent evidence are warranted to determine whether the heterogeneous findings identified in this review persist and to examine emerging workforce-related outcomes.

Author Contributions: A.A.I (Conceptualisation and study design, Development of review protocol, Systematic literature search, Study selection and screening, Data extraction, Quality appraisal/risk of bias assessment, Manuscript drafting), A.I (Conceptualisation and study design, Development of review protocol, Critical revision of the manuscript, Supervision and final approval of manuscript), N.Z (Systematic literature search, Study selection and screening, Data extraction, Manuscript drafting, Critical revision of the manuscript), K.J (Systematic literature search, Study selection and screening, Data extraction, Quality appraisal/risk of bias assessment, Critical revision of the manuscript), N.M.I (Data extraction), S.R.N (Manuscript drafting, Critical revision of the manuscript). All authors discussed and approved the final version.

Funding: This study did not receive any funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable. This scoping review involved the synthesis of data from previously published literature and did not involve human participants or the collection of primary data.

Data Availability: Not applicable.

Acknowledgements: The authors would like to thank the Director General of Malaysia for permission to publish this work.

Conflicts of Interest: The authors have no conflicts of interest to declare.

CITATION

Ibrahim, A. A., Zaini, N., Jetly, K., Mohd Ismail, N., Nurumal, S. R., & Ismail, A. (2026). The impact of electronic medical records on the quality of care: a scoping review. *International Medical Research Journal*, 12(2), 77–95. <https://doi.org/10.63719/imrj.2026.12.02.008>

REFERENCES

1. Petrides AK, Bixho I, Goonan EM, Bates DW, Shaykevich S, Lipsitz SR, et al. The benefits and challenges of an interfaced electronic health record and laboratory information system: effects on laboratory processes. *Arch Pathol Lab Med*. 2017;141(3):410-7. doi:10.5858/arpa.2016-0146-OA.
2. Abdulla AE, Ahmed SY, Alnoaimi MA, Ali H. Users' satisfaction with the electronic health record (EHR) in the Kingdom of Bahrain. *Int J E-Health Med Commun*. 2016;7(3):29-51. doi:10.4018/IJEHMC.2016070103.
3. Buntin MB, Burke MF, Hoaglin MC, Blumenthal D. The benefits of health information technology: a review of the recent literature shows predominantly positive results. *Health Aff (Millwood)*. 2011;30(3):464-71. doi:10.1377/hlthaff.2011.0178.
4. Ayaad O, Alloubani A, Alhajaa EA, Farhan M, Abuseif S, Al Hroub A, et al. The role of electronic medical records in improving the quality of health care services: comparative study. *Int J Med Inform*. 2019;127:63-7. doi:10.1016/j.ijmedinf.2019.04.014.
5. World Health Organization, Organisation for Economic Co-operation and Development, World Bank. *Delivering quality health services: a global imperative for universal health coverage*. Geneva: World Health Organization; 2018.

6. Donabedian A. Evaluating the quality of medical care. *Milbank Mem Fund Q.* 1966;44(3):166-206.
7. Wolfe A. Institute of Medicine report: crossing the quality chasm: a new health care system for the 21st century. *Policy Polit Nurs Pract.* 2001;2(3):233-5. doi:10.1177/152715440100200312.
8. Campanella P, Lovato E, Marone C, Fallacara L, Mancuso A, Ricciardi W, et al. The impact of electronic health records on healthcare quality: a systematic review and meta-analysis. *Eur J Public Health.* 2016;26(1):60-4. doi:10.1093/eurpub/ckv122.
9. Temple MW, Sisk B, Krams LA, Schneider JH, Kirkendall ES, Lehmann CU. Trends in use of electronic health records in pediatric office settings. *J Pediatr.* 2019;206:164-71.e2. doi:10.1016/j.jpeds.2018.10.039.
10. Bae J, Encinosa WE. National estimates of the impact of electronic health records on the workload of primary care physicians. *BMC Health Serv Res.* 2016;16:172. doi:10.1186/s12913-016-1422-6.
11. Barnett ML, Mehrotra A, Jena AB. Adverse inpatient outcomes during the transition to a new electronic health record system: observational study. *BMJ.* 2016;354:i3835. doi:10.1136/bmj.i3835.
12. Bernal JL, DelBusto S, García-Mañoso MI, de Castro Monteiro E, Moreno Á, Varela-Rodríguez C, et al. Impact of the implementation of electronic health records on the quality of discharge summaries and on the coding of hospitalization episodes. *Int J Qual Health Care.* 2018;30(8):630-6. doi:10.1093/intqhc/mzy075.
13. Carayon P, Wetterneck TB, Alyousef B, Brown RL, Cartmill RS, McGuire K, et al. Impact of electronic health record technology on the work and workflow of physicians in the intensive care unit. *Int J Med Inform.* 2015;84(8):578-94. doi:10.1016/j.ijmedinf.2015.04.002.
14. Hernandez-Boussard T, Tamang S, Blayney D, Brooks J, Shah N. New paradigms for patient-centered outcomes research in electronic medical records: an example of detecting urinary incontinence following prostatectomy. *EGEMS (Wash DC).* 2016;4(3):1231. doi:10.13063/2327-9214.1231.
15. Ng-Mak D, Ruetsch C. Association between meaningful use of electronic health records and patient health outcomes in schizophrenia: a retrospective database analysis. *Am J Manag Care.* 2019;25(9 Suppl):S159-65.
16. Yanamadala S, Morrison D, Curtin C, McDonald K, Hernandez-Boussard T. Electronic health records and quality of care: an observational study modeling impact on mortality, readmissions, and complications. *Medicine (Baltimore).* 2016;95(19):e3332. doi:10.1097/MD.0000000000003332.
17. Lim MC, Patel RP, Lee VS, Weeks PD, Barber MK, Watnik MR. The long-term financial and clinical impact of an electronic health record on an academic ophthalmology practice. *J Ophthalmol.* 2015;2015:329819. doi:10.1155/2015/329819.
18. Liu W, Walsh T. The impact of implementation of a clinically integrated problem-based neonatal electronic health record on documentation metrics, provider satisfaction, and hospital reimbursement: a quality improvement project. *JMIR Med Inform.* 2018;6(2):e40. doi:10.2196/medinform.9776.
19. Mitsch C, Huber P, Kriechbaum K, Scholda C, Duftschmid G, Wrba T, et al. eHealth 2015 special issue: impact of electronic health records on the completeness of clinical documentation generated during diabetic retinopathy consultations. *Appl Clin Inform.* 2015;6(3):478-87. doi:10.4338/ACI-2015-03-RA-0028.
20. Enriquez JR, de Lemos JA, Parikh SV, Simon DN, Thomas LE, Wang TY, et al. Modest associations between electronic health record use and acute myocardial infarction quality of care and outcomes: results from the National Cardiovascular Data Registry. *Circ Cardiovasc Qual Outcomes.* 2015;8(6):576-85. doi:10.1161/CIRCOUTCOMES.115.001837.

21. Flatow VH, Ibragimova N, Divino CM, Eshak DSA, Twohig BC, Bassily-Marcus AM, et al. Quality outcomes in the surgical intensive care unit after electronic health record implementation. *Appl Clin Inform.* 2015;6(4):611-8. doi:10.4338/ACI-2015-04-RA-0044.
22. Howley MJ, Chou EY, Hansen N, Dalrymple PW. The long-term financial impact of electronic health record implementation. *J Am Med Inform Assoc.* 2015;22(2):443-52. doi:10.1136/amiajnl-2014-002686.
23. Joynt KE, Bhatt DL, Schwamm LH, Xian Y, Heidenreich PA, Fonarow GC, et al. Lack of impact of electronic health records on quality of care and outcomes for ischemic stroke. *J Am Coll Cardiol.* 2015;65(18):1964-72. doi:10.1016/j.jacc.2015.02.059.
24. Kaneko K, Onozuka D, Shibuta H, Hagihara A. Impact of electronic medical records (EMRs) on hospital productivity in Japan. *Int J Med Inform.* 2018;118:36-43. doi:10.1016/j.ijmedinf.2018.07.008.
25. Selvaraj S, Fonarow GC, Sheng S, Matsouaka RA, DeVore AD, Heidenreich PA, et al. Association of electronic health record use with quality of care and outcomes in heart failure: an analysis of Get With The Guidelines-Heart Failure. *J Am Heart Assoc.* 2018;7(7):e008158. doi:10.1161/JAHA.117.008158.
26. Singh RP, Bedi R, Li A, Kulkarni S, Rodstrom T, Altus G, et al. The practice impact of electronic health record system implementation within a large multispecialty ophthalmic practice. *JAMA Ophthalmol.* 2015;133(6):668-74. doi:10.1001/jamaophthalmol.2015.0457.
27. Thirukumaran CP, Dolan JG, Webster PR, Panzer RJ, Friedman B. The impact of electronic health record implementation and use on performance of the Surgical Care Improvement Project measures. *Health Serv Res.* 2015;50(1):273-89. doi:10.1111/1475-6773.12191.
28. Tierney WM, Sidle JE, Diero LO, Sudoi A, Kiplagat J, Macharia S, et al. Assessing the impact of a primary care electronic medical record system in three Kenyan rural health centers. *J Am Med Inform Assoc.* 2016;23(3):544-52. doi:10.1093/jamia/ocv074.
29. Chaudhry B, Wang J, Wu S, Maglione M, Mojica W, Roth E, et al. Systematic review: impact of health information technology on quality, efficiency, and costs of medical care. *Ann Intern Med.* 2006;144(10):742-52. doi:10.7326/0003-4819-144-10-200605160-00125.
30. Holroyd-Leduc JM, Lorenzetti D, Straus SE, Sykes L, Quan H. The impact of the electronic medical record on structure, process, and outcomes within primary care: a systematic review of the evidence. *J Am Med Inform Assoc.* 2011;18(6):732-7. doi:10.1136/amiajnl-2010-000019.
31. Mitchell PH. Defining patient safety and quality care. In: Hughes RG, editor. *Patient safety and quality: an evidence-based handbook for nurses*. Rockville (MD): Agency for Healthcare Research and Quality (US); 2008. Chapter 1.
32. Ndumbe-Eyoh S, Moffatt H. Intersectoral action for health equity: a rapid systematic review. *BMC Public Health.* 2013;13:1056. doi:10.1186/1471-2458-13-105.
33. Evans RS. Electronic health records: then, now, and in the future. *Yearb Med Inform.* 2016;Suppl 1:S48-61. doi:10.15265/IYS-2016-s006.
34. Wang SJ, Middleton B, Prosser LA, Bardon CG, Spurr CD, Carchidi PJ, et al. A cost-benefit analysis of electronic medical records in primary care. *Am J Med.* 2003;114(5):397-403. doi:10.1016/S0002-9343(03)00057-3.
35. Kuipers SJ, Cramm JM, Nieboer AP. The importance of patient-centered care and co-creation of care for satisfaction with care and physical and social well-being of patients with multi-morbidity in the primary care setting. *BMC Health Serv Res.* 2019;19:13. doi:10.1186/s12913-018-3818-y.
36. Harle CA, Menachemi N. Will electronic health records improve healthcare quality? Challenges and future prospects. *Expert Rev Pharmacoecon Outcomes Res.* 2012;12(4):387-90. doi:10.1586/erp.12.43.

37. Carlson KL, McFadden SE, Barkin S. Improving documentation timeliness: a “brighter future” for the electronic medical record in resident clinics. *Acad Med*. 2015;90(12):1641-5. doi:10.1097/ACM.0000000000000792.
38. Hanefeld J, Powell-Jackson T, Balabanova D. Understanding and measuring quality of care: dealing with complexity. *Bull World Health Organ*. 2017;95(5):368-74. doi:10.2471/BLT.16.179309.
39. Gupta KS, Rokade V. Importance of quality in health care sector: a review. *J Health Manag*. 2016;18(1):84-94. doi:10.1177/0972063415625527.
40. Jawhari B, Keenan L, Zakus D, Ludwick D, Isaac A, Saleh A, et al. Barriers and facilitators to electronic medical record (EMR) use in an urban slum. *Int J Med Inform*. 2016;94:246-54. doi:10.1016/j.ijmedinf.2016.07.015.
41. Ismail A, Jamil AT, Rahman AFA, Abu Bakar JM, Mohd Saad N, Saadi H. The implementation of Hospital Information System (HIS) in tertiary hospitals in Malaysia: a qualitative study. *Malays J Public Health Med*. 2010;10(2):16-24.
42. Nakamura MM, Harper MB, Castro AV, Yu FB Jr, Jha AK. Impact of the meaningful use incentive program on electronic health record adoption by US children's hospitals. *J Am Med Inform Assoc*. 2015;22(2):390-8. doi:10.1093/jamia/ocu045.
43. Gildon BL, Condren M, Hughes CC. Impact of electronic health record systems on prescribing errors in pediatric clinics. *Healthcare (Basel)*. 2019;7(2):57. doi:10.3390/healthcare7020057.
44. Noraziani K, Nurul'Ain A, Azhim MZ, Eslami SR, Drak B, Sharifa Ezat WP, et al. An overview of electronic medical record implementation in healthcare system: lesson to learn. *World Appl Sci J*. 2013;25(2):323-32. doi:10.5829/idosi.wasj.2013.25.02.2537.
45. Yi M. Major issues in adoption of electronic health records. *J Digit Inf Manag*. 2018;16(4):180-91. doi:10.6025/jdim/2018/16/4/180-191.
46. Frame J, Watson J, Thomson K. Deploying a culture change programme management approach in support of information and communication technology developments in Greater Glasgow NHS Board. *Health Informatics J*. 2008;14(2):125-39. doi:10.1177/1081180X08089320.