Health information technology: a thorough examination of its positive impact on healthcare quality

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Abstract

The purpose of this research was to review all available literature on the topic of how HIS and HIT affect healthcare quality, with a special emphasis on how clinicians' adherence to evidence-based recommendations affects patient clinical outcomes.The review of health information systems and technologies included not just surgical and clinical medicine, but also allied health, preventive services, and the whole spectrum of medical specialties.Research that examined the impact of electronic health records (EHRs), computerized physician order entry (CPOE), or data systems (DS) and whose primary findings were on the extent to which clinicians adhered to policies based on evidence were eligible for inclusion in the review. The review focused on relevant measures, such as changes in clinical processes due to providers' behavioral shifts or particular patient outcomes showing the effectiveness of a provider-given treatment. Out of the twenty-three papers included in this meta-analysis, seventeen examined the effects of HIT/HIS on healthcare workers' efficiency and efficacy. They showed considerable progress in following evidence-based directions in 14 trials. Studies that looked at patient outcomes, however, failed to find any differences that were statistically or clinically significant. Consistent with similar previous assessments of this kind, the findings demonstrated that widespread use of HIT improves doctors' adherence to recommendations; however, the sample size was small.

Keywords (MeSH):

Evidence-Based Practice; Evidence-Based Health Care; Information Systems; Medical Informatics; Quality of Health Care; Review.

Introduction

The health care and medical systems in Australia and throughout the world are constantly evolving and facing several challenges. There has been a recent uptick in research into health information technology's (HIT) ability to reduce health care spending while simultaneously improving the efficacy, quality, and safety of medical treatment in response to rising community demand for and the associated costs of high-quality health care services.So, to assess the data on how HIT affects medical and health care quality, a literature study was performed systematically. In order to help stakeholders promote and maximize the adoption of HIT, this systematic review will attempt to contribute to a better understanding of the relationship between HIT and medical practices and other forms of health care.

Health information technology (HIT) refers to a wide range of tools used to save, retrieve, process, and disseminate patient data digitally as opposed to physically.

Among these IT advancements are health information systems (HIS) like EHRs, which aid in the administration of patients' medical records, and clinical decision support systems (CDSS) and computerized provider order entry (CPOE) systems, which facilitate the provision of medical and health care. Since both "health information technology" and "health information system" may mean the same thing when discussing electronic systems used for patient records, they will be used interchangeably throughout this analysis.

Methods

Research topic and background

The purpose of this research was to determine if and how health information technology may enhance the standard of medical

treatment.

To ensure maximum coverage, the study combed through articles on HIS implementations in a variety of healthcare settings, including hospitals, clinics, allied health centers, and preventative programs. Concerning the standard of medical treatment, we looked at how strictly doctors followed evidence-based protocols and how it affected the clinical results their patients experienced.

Search strategies

A three-step search strategy was utilised in each component of this review. An initial limited search for literature was performed on English language studies indexed in MEDLINE and CINAHL, followed by an analysis of the test words contained in the title or index terms used to describe the articles. This strategy was followed by a search for relevant studies using all identi- fied keywords and index terms in a number of electronic databases. For this purpose, a broad set of terms was used to maximise the search strat- egy's sensitivity. The following terms were used to find relevant studies for the current review:

The following terms are used interchangeably: computer, system, HIT, electronic, clinical, health, medical, physician, care, physician, decision, support, quality, evidence-based, adherence, EHR, EMR, EPR, computerized physician order entry, CPOE, and electronic health record.

Study inclusion criteria

Research Methodology

Studies that assessed the efficacy of HIT/HIS in enhancing a significant clinical practice were included, regardless of whether they were randomized controlled trials, controlled before and after (CBA) studies, or interrupted time series (ITS) studies. For the purpose of identifying the best evidence supporting the use of health information technology, the latter were also assessed for inclusion in a narrative summary.

User type for HIT/HIS

Clinical practitioners, including doctors, NPs, and allied health workers, who provide direct patient care were the focus of this evaluation of HIT/HIS.

Intervention kind

Research on the efficacy of the three most popular HITs/HISs—electronic health records (EHR), computerized provider order entry (CPOE), and decision support systems (DS), which include alerting and reminder systems—was included in the present study. Inclusion criteria for the studies included a comparison of the efficacy of one HIT/HIS to that of a manual system (like paper-based health records), another HIT/HIS with supplementary features (like an electronic health record system with a reminder), or two distinct HITs/HISs that performed the same clinical function. This research did not include any other information systems or technologies that are used for medical dose distribution, diagnostic imaging, or bar-coding for medication identification.

Methods for evaluating results

The results of these research mostly concerned the extent to which doctors treated a certain population in accordance with established protocols. The frequency with which doctors followed and opted for a treatment option that belonged to a certain health care system's recommendations is called adherence to clinical guidelines (Bouaud et al. 2001). Thus, outcomes were either changes in clinical processes seen before and after an intervention as a consequence of a change in provider behavior in providing medical care, or particular outcomes for patients.

It dealt with the efficacy of a certain therapy as recommended by a specific HIT/HIS based on data. Here, we also included research that looked at how medication errors caused by HIT or a particular computerized healthcare system relate to patients' adherence to clinical recommendations.

Criteria for exclusion

Studies that did not adhere to the following criteria were not considered: those that were not written in English, those that were published before 1998, qualitative studies that relied on the first-hand accounts of clinicians using health information systems or technology to promote the adoption of evidence-based guidelines, and various other types of texts like opinion papers and commentaries.

Gathering and analyzing data

It was necessary to verify the study's relevancy by looking at its title once the search algorithms had found it. Databases, Google Scholar, and citation lists turned up 36 studies. Upon reviewing the titles, only 32 of the 36 papers were deemed relevant. We looked over the abstracts to see whether these papers answered our review questions.

A rating of "not relevant" or "potentially relevant" was assigned to each abstract after reading them. Studies were excluded from this procedure because they either did not address the study topics (n=2) or were published before 1998 (n=3). Only titles that were deemed "poten-tially relevant" had their full-text articles retrieved. Unfortunately, the researchers had to exclude two papers from the final evaluation since they were only accessible in abstract form. Two studies were removed from the study owing to data duplication after

full-text article reviews; a total of twenty-three research were ultimately considered for inclusion in the review. Eight randomized controlled trials, ten time series studies, four systematic reviews, and one experimental (case scenario) research make up these investigations. Tabulated in Table 1 are the following study-specific data points:
study specifics, research methodology, study design, HIT/HIS type and study goal, main outcome evaluated, and important result.

Review and summary of studies were done using both tabular and text formats. There was no meta-analysis done since the trials were different.

Evaluation of quality

Studies included in this review were evaluated using standardised critical appraisal instruments from the Joanna-Briggs Institute (JBI) System for the Unified Management, Assessment and Review of Information Package (SUMARI). For randomised-controlled trials, quality assess- ment was focused on the basis of randomisation and allocation concealment procedures used,
as these are the main sources of bias that have been empirically associated with overestima- tion of treatment effect (Schulz et al. 1995).
For this purpose, the JBI Critical Appraisal Checklist for Experimental Studies was used to determine whether the studies have reported sufficient details of randomisation and conceal- ment procedures, and satisfactory attempt to control selection bias has been made. Trials were further rated as: 'A' if allocation procedures and attempts to control selection bias were suffi- ciently reported; 'B' if studies did not report

how randomisation was performed and alloca- tion concealed, or reported in insufficient detail to determine whether a satisfactory attempt to control selection bias has been made; and 'C' if there was no information about avoidance or attempt to control selection bias.

In addition, JBI Critical Appraisal Checklist for Descriptive Case Series was used to assess the quality of other non-randomised studies included in the current review. For time-series studies, quality assessment was focused on whether or
not the study has met three (3) important criteria namely: a rationale for the number and spacing of data points was described or sample size calculation was performed; the primary outcome measure was assessed blindly or was measured objectively; and data was appropriately analysed using time series regression models. Therefore, studies that met all criteria stated above were rated as 'A'. For studies with insufficient detail to determine whether appropriate data collection procedures were used and analysed using time series regression models, or simply not reported, studies were rated as 'B' or 'C'.

Table 1: Summary of previous research using HIT/HIS to improve quality of medical and health care

STUDY	STUDY DESIGN	PURPOSE (to determine the effect of)	PRIMARY OUTCOME MEASURED	KEY FINDING
Adams et al (2003)	ITS	EHR on the quality of paediatric primary care including preventive	*Provider outcome:* Number of routine healthcare maintenance topics addressed during hospital visits; clinician assessment of computer-based system	▪ Use of EHR was significantly more likely to address 22 over 30 routine health maintenance topics ▪ All users of the system reported that its use had improved the overall quality of care delivered, well accepted by families and improved guidance quality
Patkar et al (2006)	EXP	DSS with and without guidelines for assessment of breast cancer patients	*Provider outcome:* Clinician's compliance with evidence-based guidelines provided by DSS; Clinician's assessment of DSS	▪ Clinicians made significantly more deviations from guideline without DSS (60/120 errors without DSS and 16/120 with DSS, $p<0.001$) ▪ Opinions of clinicians towards DSS were positive $p<0.025$
Mullet et al (2001)	ITS	Anti-infective decision support system in paediatric intensive care units	*Provider outcome:* Antibiotic prescription outside the recommended dosing range; pharmacists intervention for incorrect dosing *Patient outcome*: Proportion of ICU patients receiving antibiotics	▪ 32% relative decrease (from 15.8 to 10.8) in the days that antibiotics were prescribed outside the recommended dosing range ▪ 59% relative decrease in a composite measure of need for pharmacist interventions for incorrect dosing ▪ 6.3 percentage point of absolute increase (from 60.2% to 66.5% in the proportion of ICU patients receiving antibiotics
Steele, Eisert, Witter et al (2005)	ITS	DSS for appropriate drugs ordering	*Provider outcome:* Rate of appropriate drug ordering for 18 high-volume and high risk medications	▪ The provider increased ordering the rule-associated lab test when alert displayed (39% at baseline *v.* 51% after intervention, $p>0.001$)
Evans et al (1998)	ITS	Computer alert for antibiotics and other anti-	*Patient outcome:* Antibiotic-associated adverse drug events (ADEs); number of	Compare with the 2-y pre-intervention period, reductions were seen on the following:

STUDY	STUDY DESIGN	PURPOSE (to determine the effect of)	PRIMARY OUTCOME MEASURED	KEY FINDING
Bouaud et al (2001)	ITS	Guideline-based DSS on infective agents ordering breast cancer management for drugs prescription	*Provider outcome:* Physician compliance days of excessive drug dosage	▪ 23.6 percentage point absolute increase in physician compliance after using the system (from 61.42% to 85.03%) ▪ Antibiotic-associated ADEs (28 *v.* 4) ▪ Mismatches of infection susceptibility and antibiotic (206 *v.* 12 eps) ▪ Ordered drugs for which a patient had an allergy (146 *v.* 35 eps) ▪ 66 percentage point absolute increase (from 15.6% to 81.3%, $p>0.001$) ▪ Days of excessive dosing (from 5.9 to 2.7 d)
Teich et al (2000)	ITS	CPOE on physician prescribing practices and CPOE with guideline and formulary decision support for patients with renal insufficiency	*Provider outcome:* Medication selection for H2-Blockers; consequent orders for Provider outcome: Prophylaxis; reduction of prescription by dose and frequency Dosing range *Patient outcome:* Length of stay	▪ 21 percentage point absolute increase (from 24% to 47%) in adherence for all Histamine-Blockers orders ▪ 21 percentage point absolute increase (from 24% to 47%) in appropriate use of subcutaneous heparin prophylaxis ▪ 4.5 percentage point absolute decrease (from 12% to 7.6%) in number of medication doses written that exceeded the recommended maximum
Chertow et al (2001)	ITS	CPOE with guideline and formulary decision support for patients with renal insufficiency	Provider outcome: Prophylaxis; reduction of drug prescribed outside recommended dosing range *Patient outcome:* Length of stay	▪ 4.5 percentage point absolute decrease (from 12% to 7.6%) in number of medication doses written that exceeded the recommended maximum

able 1: continued

Steele, Eisert, Davidson et al (2005)	ITS	DSS for latent tuberculosis screening	*Provider outcome:* Appropriate adherence to CDC LTBI screening guideline	▪ 16.9 percentage point absolute increase in physician adherence to guidelines for LTBI screening (from 8.9% to 25.2%, $p<0.001$)
Dexter et al (2004)	RCT	Inpatient computerised provider order-entry system *v.* computerised reminder for influenza and pneumococcal vaccination administration	*Patient outcome:* Vaccines administration	▪ Pts with standing orders received influenza vaccine *sig.* more often (42%) that pts with reminders (30%) ▪ Pts with standing order received a pneumococcal vaccine *sig.* more often (51%) than those with reminders (30%)
ITS	Electronic alerts to prevent venous thromboembolism among hospitalised patients			
RCT	DSS on compliance with mental health clinical practice guidelines			
RCT	DSS for major depression treatment			
ITS	DSS for prevention of venous thromboembolism			
RCT	Computerised reminder for appropriate ambulatory care			
RCT	DSS for diabetes mellitus treatment			

Table 1: continued

STUDY	STUDY DESIGN	PURPOSE (to determine the effect of)	PRIMARY OUTCOME MEASURED	KEY FINDING
Delipierre et al (2004)	SR	EHR system on the process of clinical care	Process of care: Length of the consultation hour and content of consultation	▪ 26 articles were selected. Use of an EHR was perceived favourably by GPs, with studies of satisfaction being mainly positive. ▪ 12 studies evaluating the impact on medical practice and guidelines compliance showed that positive experiences were as frequent as experiences showing no benefit. ▪ None of the six studies analysing the impact of CBPRS on pts' outcomes reported any benefit
Hunt et al (1998)	SR	DSS on physician performance and patient outcomes	Drug dosing; diagnosis; prevention and other medical care	▪ Effects on physician performance were assessed in 65 studies and 43 found a benefit (66%) ▪ 6 of 14 studies assessing patient outcomes found a benefit. Of the remaining 8 studies, only 3 had a power of greater than 80% to detect a clinically important effect

LIST OF ABBREVIATIONS:

1 RCT: Randomised Controlled Trial
2 ITS: Interrupted Time Series study
3 SR: Systematic review
4 DSS: Decision Support System
5 EHR: Electronic Health Record
6 CPOE: Computerised Provider Order-Entry
7 pts: Patients
8 eps: Care episodes
9 EXP: Experimental study

Results

Summary of research

Eight randomized controlled trials, ten time series studies, four systematic reviews, and one balanced block design experimental research make up the 23 papers included in this review.

Fourteen studies were carried out in the US, three in the UK, three in France, one in Norway, one in the Netherlands, and one in Canada.

Type and functions of HIT/HIS

Clinical decision support for providers, electronic health records, and computerized provider order input were the main system types covered in the included research.

Electronic health record systems or computerized provider order-entry systems often housed the clinical decision support systems. According to Chertow et al. (2001), Evans et al. (1998), and Steele, Eisert, Witter et al. (2005), an advanced clinical decision support system can integrate with electronic health records and computerized provider order input. Two studies looked at the effects of standalone decision support systems that didn't share data well, meaning doctors had to manually enter new information into their EHRs (Cannon & Allen, 2000; Bouaud et al., 2001). In two investigations, the examined systems were not well explained, and the researchers failed to mention how the clinicians interacted with the systems (Steele, Eisert, Davidson et al., 2005; Patkar et al. 2006).

Certow et al. (2001), Teich et al. (2000), and Dexter et al. (2004) evaluated the efficacy of electronic provider order input systems. To provide services like medication administration recommendations based on evidence, as well as follow-up treatment reminders and preventative care, these order-entry systems were automatically connected to patients' health records or clinical decision support systems.

In most circumstances, a patient's record may be automatically updated, and electronic health records systems are often connected with administrative and clinical systems. Out of all the studies that compared paper records to electronic ones, only one (Adams et al., 2003) looked at the former's efficacy. Medical professionals made heavy use of reminders in electronic health records to assess patients' risk of diabetes mellitus, deep vein thrombosis, latent tuberculosis infections, adverse drug reactions, and other health complications (Hetlevik et al., 2000; Kucher et al., 2005; Durieux et al., 2000; Steele, Eisert, Davidson et al., 2005; Teich et al., 2000; Steele, Eisert, Witter et al., 2005; Mullet et al., 2001; Chertow et al., 2001). Also, according to Mullette et al. (2001), clinical personnel may be guided in providing medical treatment by electronic health record systems' capacity to create a particular report or health summary.Intervention kind

Increased adherence to care based on guidelines or protocols was the primary impact of HIS/HIT on care quality. The impact of electronic health record systems on medication prescriptions was the subject of five research.

Risk of bias in included studies

Two studies did not provide enough information on their allocation processes to be evaluated as 'A' out of eight randomized controlled trials that were included in this review. In other words, they looked for ways to prevent selection bias, such as making participants' treatment assignments a mystery until they were recruited and assigned to a study condition (van Wijk et al., 2001; Rollman et al., 2002). Dexter et al. (2004), Eccles et al. (2002), and Demakis et al. (2000) all received a grade of 'B' because they failed to disclose the methods used for randomization and allocation concealment or provided inadequate information to assess the extent to which they attempted to control selection bias. Hetlevik et al. (2000) and Sequist et al. (2005) found that participants were randomly assigned to treatment based on the healthcare center. Cannon and Allen (2000) found that participants who were newly referred to the study were not randomly assigned to either the control or intervention groups. Consequently, these investigations were given a grade of 'C' because of the possible bias that makes one question the outcome.According to the quality assessment of these time-series studies, most of them failed to completely exclude the possibility that another event may have happened simultaneously with the intervention. It was common practice in many research to include details on data collecting, main result, and data completeness. The amount of data points employed and the nature of the intervention effect were both justified by just one research (Steele, Eisert, Witter et al. 2005). Evans et al. (1998), Durieux et al. (2000), Mullet et al. (2001), Chertow et al. (2001), Adams et al. (2003), and Patkar et al. (2006) were among six interrupted time-series studies that were improperly analyzed using statistical approaches based on the ordinary least squares test. As an example, a regression model and basic square-tests were used to analyze extended time-series investigations (Evans et al. 1998; Durieux et al. 2000). Part of the reason why these tests don't work for interrupted time-series designs is that they assume error independence, which isn't always the case. For example, when events or behaviors are measured over time, they often correlate, which leads to biased parameter estimates due to correlation (Ramsay et al. 2004).

One way to mitigate this risk to internal validity is to use a time-series regression model that is specifically built to produce unbiased estimates of series errors, such the autoregressive integrated moving average (ARIMA) model.

the intervention resulted in an increase in proper prescription of 12.1% (from 82.8% to 94.9%; p<0.000). The combined primary end point of deep vein thrombosis and pulmonary embolism in high-risk hospitalized patients decreased by 3.3 percentage points (from 8.2% to 4.9%) in another study that used computerized surveillance and identification of high-risk patients plus alerts to physicians (Kucher et al. 2005).

Two studies comparing computer and manual reminder methods for mental health clinical practice implementation were also included in the study. According to Cannon and Allen (2000), there was a significant increase in the screening rate for mood disorders (86.5% vs. 61%; p=0.008) and the rate of full recording from clinical guidelines criteria (100% vs. 5.6%; p<0.0001) when computerized reminders were used instead of the manual reminder method. However, according to another research (Rollmen et al., 2002), there was little to no difference in the influence on the clinical or procedural results for patients.

During the study phase, clinicians' adherence to the LTBI guidelines increased significantly by 16.3 percentage points (from 8.8% to 25.2%; 183% increase, p<0.0001), according to one study that evaluated the effectiveness of a computerized clinical decision support system for latent tuberculosis infection (LTBI) screening (Steele, Eisert, Davidson et al. 2005).

Various health services

The majority of research demonstrating the positive effects of health information systems on patient outcomes has been on preventative care, however other studies have examined a wide variety of treatment modalities. Some of the systems that were tested were disease specific, specifically targeting diabetes, coronary artery diseases, asthma, angina, or breast cancer in women. Other systems focused on care processes, such as ambulatory care services, blood test ordering, or computerized health record management. Computerized systems have been shown to improve practitioner performance in five separate trials (Sequist et al., 2005; Patkar et al., 2006; Demakis as al., 1998; van Wijk et al., 2001; Adams, et al., 2003). Two randomized trials that looked at the effectiveness of computerized reminders for diabetes, coronary artery disease, asthma, and angina (Hetlevik et al. 2000; Sequist et al. 2005; Eccles et al. 2002) found no statistically significant change in practitioner behavior or patient outcomes.

Discussion

The research on health IT has so far shown that computerized health information systems have numerous significant positive effects on quality. It is clear that a well-designed information system can become a powerful tool for preventing medical errors by ensuring that clinicians adhere to evidence-based clinical guidelines (Bates et al., 1998), in addition to the obvious administrative benefits of HIT/HIS, such as reducing paperwork and the workload of health professionals (Schoen et al., 2006; Hillestad et al., 2005). Fourteen of the seventeen studies included in this meta-analysis found that health care providers' performance improved when it came to following evidence-based recommendations after using HIT/HIS.

However, as only a minority of trials demonstrated advantages, the effect of HIS/HIT on patient outcomes is uneven. In particular, out of a total of seven trials, three found an improvement and two found no change or even negative results. Research evaluating the effect of HIS/HIT on patient outcomes showed a great deal of variation in the statistical tools and methods utilized. Statistical significance was determined for included studies that measured duration of stay, percentage of intensive care unit patients given antibiotics, rate of adverse medication events, rate of immunization, and patients' reported health condition as measured by a questionnaire. However, only clinical significance (i.e., the efficacy of individual therapies) was considered in research that mainly examined the corresponding influence on patient outcomes after standard medical treatments or psychological evaluations. Researchers approached each research that looked at patient outcomes with care since, as the authors themselves admit, clinical significance and statistical significance are two distinct ways to analyze outcomes.

When looking at the efficacy of HIT/HIS as a whole, the sample size was too small to draw any firm conclusions.

Despite this, the results showed that HIT/HIS had the same effect on clinical practices as in previous evaluations (Hunt et al. 1998; Delipierre et al. 2004; Kawamoto et al. 2005; Chaudhry et al. 2006). The results of this research demonstrate that clinicians' compliance with clinical recommendations may be improved with the widespread use of HIT/HIS, particularly alerting and decision support systems. Health information technology and health systems (HIT/HIS) provide stakeholders, policymakers, and health care organizations continuous chances to maximize the application of research findings.

Benefits and drawbacks of the present analysis

Several significant strengths characterize this investigation. The first step was to do a thorough literature search. On the other hand, only 36 new research were discovered. All sorts of health services and medical treatments were covered by the included research. That is why it is possible to evaluate HIT/HIS's effect on healthcare from several angles. Secondly, many research designs were covered by the selected papers. While it is true that randomized controlled trials are the gold standard for proving an intervention's efficacy, other well-designed studies, like experimental and interrupted time series studies, can yield valid results in situations where randomization isn't an option. We proceeded with care when evaluating the studies' methodological quality because of the inherent bias in their designs. This was achieved by making use of a Joanna-Briggs Institute-provided standardized quality evaluation checklist for non-randomized trials. This led to a strict vetting process that ultimately included only those research that fulfilled the quality evaluation checklist's minimal requirements.
A significant drawback of this research is that it is limited in breadth and amount of literature. Regardless of Despite doing a thorough literature search, just a handful of studies were found.
It is possible that further relevant research with substantial results may go unnoticed if the inclusion criteria restrict the studies to journal papers published in English. Although further measures were made to collect unpublished papers, they were only partially successful. As a result, it is probable that a small number of unpublished publications were overlooked, leading to publication bias.
There is also the problem of reporting variability. It was impossible to determine whether certain system or technology capabilities were missing or just not disclosed due to the lack of thoroughness in the descriptions of HIT/HIS.

Conclusion and recommendations A deeper knowledge of the link between the usage of HIT/HIS and medical and health practices has been contributed by this systematic review, which is based on 23 studies published between 1998 and 2008. In recent decades, there has been an increase in the amount of research looking at how HIT/HIS affects clinical practice. But there haven't been many studies that look at how it affects patient outcomes. As an example, patient outcomes were the major metric in only eight research included in this evaluation, and the findings were mixed. One may make the case that this was mostly due to variations in the intervention's impact due to variances in the assessed variables.

For example, some research found a favorable correlation between patient satisfaction and a certain hospital care method, whereas other studies found no correlation between patient satisfaction and medical results (such as recovery rate). As a result, we need further research to draw firmer conclusions.

Also, this analysis points to a number of promising avenues for further research in this area. Further research integrating HIT/HIS with business processes like workflow redesign, organizational change, and project management, as well as with economic evaluation, is required, and more funding for this type of work may be required, given the growing importance of quality assurance and quality

management in the healthcare system. In addition, to raise the bar for health care decision-making research, standardized reporting of studies including HIT/HIS deployment should be instituted, following the model of currently utilized for reporting trials and meta-analyses. Finally, stakeholders interested in promoting or contemplating the implementation of HIT/HIS may find the conclusions of this research valuable. Additionally, stakeholders may learn from the papers analyzed here how to guide policies that use HIT/HIS to increase the adoption of evidence-based practice or how to

effectively deploy systems that maximize investment value.

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