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Adoption Factors Associated with Electronic Health Record among Long-Term Care Facilities – A Systematic Review

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ABSTRACT

Background: The Health Information Technology for Economic and Clinical Health (HITECH) Act created incentives for adopting electronic health records (EHRs) for some healthcare organizations, but long-term care (LTC) facilities are excluded from those incentives. There are realizable benefits of EHR adoption in LTC facilities; however, there is limited research about this topic.

Objectives: The purpose of this systematic literature review is to identify EHR adoption facilitators and barriers for LTC facilities, to add to the body of research on the topic.

Materials & Methods: We conducted systematic searches of Cumulative Index of Nursing and Allied Health Literature (CINAHL) Complete via Ebson B. Stephens Company (EBSCO Host), Google Scholar, and the PubMed to collect data about EHR adoption factors in LTC facilities. Search results were filtered by date range, English language, and academic journals (n = 22). Multiple members of the research team read each article to confirm applicability and study conclusions.

Results: Results identify 50 instances of 10 facilitators and 50 instances of 11 barriers associated with EHR adoption in LTC facilities. The facilitator error reduction was identified the most often (20%) by the most number of articles studied (45%). The barrier cost occurred the most often (20%) in the greatest number of barriers identified in the articles studied (45%).

Discussion & Conclusions: Common facilitators and barriers were consistent in the literature. These commonalities should help policy makers use the most effective levers in the LTC segment of healthcare, and they should enable leaders in LTC facilities to align strategic decisions with EHR adoption.

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STRENGTHS AND LIMITATIONS OF THIS STUDY

This systematic review has several strengths and limitations, as detailed below.

Strengths

- Adds to a body of knowledge of EHR adoption
- Contributes toward EHR adoption in LTC
- Provides a systematic review, in accordance with PRISMA
- Queries three well known research databases
- Queries use key terms registered with MeSH
- Multiple reviewers determined inclusion and exclusion criteria

Limitations

- Only five years were examined
- Selection bias will always exist in subjective decisions (inclusion criteria). Controls for selection bias were enacted: more than one author had to recommend that an article be included in the study. The identification of both enablers and barriers followed the same rule.

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INTRODUCTION, BACKGROUND & SIGNIFICANCE

Incentives

The Health Information Technology for Economic and Clinical Health (HITECH) Act of the American Recovery and Reinvestment Act (ARRA) of 2009 created reimbursement incentives for U.S. healthcare organizations that are using EHRs in meaningful ways.[1] Long-term care facilities (as defined by the ARRA) are facility types excluded from the incentives including: skilled nursing homes, assisted living facilities, LTC hospitals, rehabilitation hospitals, and psychiatric hospitals. Unfortunately, there has been no clear communication regarding reasons why "ineligible providers" have been excluded from the incentives under the ARRA. This is despite a relatively large body of evidence showing that there is value in the use of EHR in long-term care settings where it not only improves resident care, but also increases communications between providers, consultants, hospital, and nursing home staff.[2] There is documentation that exists which alludes to Congress wanting to understand the extent to which ineligible providers work in settings which might receive EHR incentives under the ARRA.[3] However, it should be noted that eligible providers (physicians for instance) were able to assign their incentive funding to a facility of their choice (whether or not that facility was an eligible provider), but no evidence exists to the extent of this assignment in the literature or to whom.[3] This represents not only a potentially large amount of untraceable incentive funds under the ARRA, but also a source of statistical interference when "meaningful use" is assessed.

While facilities eligible for these incentives demonstrate EHR adoption rates of about 12%, ineligible facilities have adoption rates of only 2-4%.[4] Incentives and grants from the HITECH Act are clearly a major motivating factor for EHR adoption;[5] however, LTC facilities must bear the adoption costs on their own, which represents a significant barrier.[5-15]

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Identification and definition of key terms

The American College of Hospital Executives (ACHE) defines long-term care as "a continuum of medical and social services designed to support the needs of people living with chronic health problems that affect their ability to perform everyday activities." Long-term care spans a continuum of "traditional medical services, social services, and housing." Services in long-term care have a significantly different aim than those in traditional, acute-care settings. While acute-care services aim to restore the patient to health, long-term care "aims to prevent deterioration and promote social adjustment to stages of decline" and it is delivered through a wide range of care givers and environments both in a healthcare facility and at home.[16] A large majority (92%) of long-term care facilities are privately owned and operated. The aging of the population creates an ever-increasing shortage of LTC beds per 1000 people 65 and over. Estimates show this trend will continue until the year 2030 with the percentage of persons 65 or over ballooning to 19% of the population.[17]

The broad definition of LTC from the ACHE could cast a wider net than necessary, or effective, for the purposes of this research. The research question we posited would only be appropriate for health care organizations that would have a use for the EHR. An assisted-living facility would have little use for an EHR that manages a patient's entire continuum of care, when the facility may only need to manage something as small as medication or diet. Those with the need for an EHR would be those that manage the chronic conditions like a nursing home, or Skilled Nursing Facility. The latter two entities are targeted, for the purposes of this study,

The taxonomy for the Electronic Health Record widely varies: digital medical record, computerized patient record, electronic medical record, digital medical record, etc. For the purposes of this study, the term EHR will be used exclusively to speak to the longitudinal and

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interoperable capabilities of an electronic medical record. This practice is supported by the World Health Organization (WHO).[18] The inherent advantages of the EHR can enable any certified, credentialed provider to access any patient record from any health care organization, but the provider will only have access to the information necessary for the immediate incident of care. The EHR enables providers to see past history, allergies, and treatment regimens with trend analysis.[19] Therefore, the key term of "electronic health record" is targeted for this study. However, because the term "electronic medical record" is often used synonymously, it will be included in the key search terms.

EHR adoption among facilities

In 2009, the US Government passed the American Recover and Reinvestment Act (ARRA), which included a significant section for healthcare intended to incentivize the adoption of the EHR. This section was called: Health Information Technology for Economic and Clinical Health (HITECH) Act.[1] The three phases of Meaningful Use consume IT strategies because of the HITECH Act's timeline for healthcare organizations to qualify for monetary incentives. Unfortunately, long-term care facilities were not included in these incentives.

Long-term care facilities that have adopted EHRs experience improvements in quality of care, documentation access, billing and reimbursement, and employee satisfaction and retention rates.[5-15,20] Interoperable EHRs may be especially useful to LTC facilities during periods of transitional care, when coordination and communication with other healthcare organizations is critical to achieving the best health outcomes.[21] Electronic health records are becoming more important for LTC facilities because increased demand for services from aging baby-boomers is inevitable.[22] While eligible organizations have the benefit of incentives to mitigate some costs in attaining these benefits, LTC facilities must bear the full cost. There is a dearth of research

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available to help decision-makers at LTC facilities make objective conclusions about adopting EHRs, which is why this review is critical to future research.

Objectives

It is important to identify the factors that influence EHR adoption in LTC facilities that are not dependent on HITECH incentive payments. This study's focus is to identify the EHR adoption facilitators well as discern the multitude of barriers LTC facilities face. While it is clear that implementing an EHR system could bring many benefits to organizations, realizing those benefits in the beginning stages might not be possible for every LTC facility.

The findings of this review will be useful to LTC facility administrators interested in adopting EHRs into their organization by helping them identify barriers to overcome and opportunities to lever. Policymakers may also find the identified factors useful when attempting to increase EHR adoption in the long-term care industry. Additionally, vendors can benefit from this article's information so they can focus the software-development process of EHRs on the more salient facilitators and barriers to adoption.

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METHODS

Data

Data for this review were gathered from three separate databases: Google Scholar, Cumulative Index of Nursing and Allied Health Literature (CINAHL) Complete via EBSCO Host, and PubMed (which queries MEDLINE). Search criteria focused on EHR adoption in long-term care. To avoid the bandwagon effect, the authors independently reviewed the articles identified during the search. Following independent reviews, authors compared and discussed the articles and reason for inclusion in or exclusion from the study. Articles were only included in the final study if selected by at least two reviewers. An affinity matrix was created to identify frequency of both facilitators and barriers in the literature.

Sample

Research databases were queried using key terms from the Medical Subject Headings (MeSH) at the National Center for Biotechnology Information (NCBI). The MeSH database revealed multiple terms for the EHR, as predicted. The two most prevalent search terms for LTC, appropriate for this study, were “nursing home” and “skilled nursing facility.” Several exclusion criteria were implemented through filters. Searches were limited to peer-reviewed journal articles in U.S., published in the English language from 2009-2014 (n = 22). This process is illustrated by Figure 1.

Figure 1. An illustration of the literature review process

Standard for review and summary measures

The 2009 version of the preferred reporting items for systematic reviews and meta-analyses (PRISMA) was used as the standard and template for the review process. The primary

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summary measures for this review are the discrete frequency and statistical average of identified operators (facilitators and barriers) over the total identified.

Bias

Screening large quantities of manuscripts can be exhausting, and numbness of senses could easily introduce bias into this evaluation. To help control the possibility bias, the authors agreed to set a slow, but methodical pace of reading. Additionally, at least two authors read each article and listed recommendation for inclusion or exclusion. These recommendations were then compared and discussed in a group setting. Only articles recommended by more than one author were included in the final study. The multiple-selection criterion was the authors' attempt to control selection bias.

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RESULTS

Table of findings

The findings were summarized and inserted into the facilitators and barriers table after the authors chose articles to create the literature review. All duplicate articles were accounted for and consolidated before the findings table was created. The authors then reanalyzed the articles and identified the individual factors affecting EHR adoption in LTC facilities after the articles reached information saturation. These factors were then compiled into a frequency table to aid in the analysis. Results are summarized in Table 1.

Table 1. Summarized facilitators and barriers identified in the literature

#	Authors	Facilitators	Barriers
4	Wolf L, et al. (2012).	• Emerging payment methods could encourage EHR adoption. • "Quality Improvement Organizations" may increase adoption because they provide technical support that many LTC facilities need.	• HITECH incentives only focus on acute care and primary physicians. • Expanding the incentives to LTC facilities may be too costly.
5	Wang T, et al. (2012).	• Anticipating state and federal requirements. • Good communication between vendors and LTC facilities. • Education and training programs.	• Lack of initial investment resources. • No technical infrastructure. • Not enough time to implement the EHR. • Lack of space for the new system.
6	Resnick H, et al. (2009).	• Error reduction. • Quality. • Efficiency. • Better health outcomes.	• Cost. • Complex systems (implementation). • No standards (external).
7	Davidson J. (2009).	• Comprehensive implementation planning. • Governmental initiatives. • Management and staff support. •	• Cost. • Privacy issues. • Incorrect vendor.
8	Hamid F, et al. (2013).	• EHR satisfaction increases when the users understand the benefits. • Supportive management. • Training programs.	• Cost. • Perceived lack of usefulness. • Time consuming.

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#	Authors	Facilitators	Barriers
9	Alexander G, et al. (2009).	• Improve clinical decision making. • Earlier intervention. • Time savings.	• IT sophistication negatively correlated with detection of detection of incontinence (implementation issue?)
10	Phillips K, et al. (2010).	• Government financial incentives. • Reduced errors and adverse drug events. • Including users in the design and implementation process.	• Adoption costs. • Efficiency outcomes were inconsistent. • Incongruent cost savings. • Lack of interoperability. • Fear of changing the facility culture.
11	Wilkins M. (2009).	• Training and learning the system increases adoption. • Understanding the usefulness of the EHR technology.	• Facility size. • Lack of change agents or leaders in the facility. • Lack of interoperability. • Cost. • Resistance to change.
12	Filipova AA. (2013).	• Federal and state government incentives or policy initiatives could offset financial barriers. • Aligning organizational strategic plans could also encourage adoption.	• Financial barriers like no capital to implement an EHR and the cost of hardware and infrastructure. • Organizational barriers. • Legal and regulatory barriers. • Technological barriers. • Network barriers.
13	Bezboruah KC, et al. (2014).	• Institutional pressure like anticipated regulations and competition pressures increase EHR adoption.	• Cost of the electronic system and projected upgrades. • Leaders perceiving staff's resistance to change. • Misunderstanding how EHRs could be useful or not having enough information to choose the right system.
14	Cherry B. (2011).	• Fast-growing elder populations mean quality of care in LTC facilities must be addressed with EHRs. • A strong implementation plan within	• Cost and a lack of capital resources. • Lack of industry standards. • Complicated

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#	Authors	Facilitators	Barriers
		the facility that aligns with strategic plans. • Initial and follow-up training programs. • A perception shift about the benefits of EHR adoption.	implementation processes. • Lack of technical support. • Not enough evidence to support EHR's proposed benefits.
15	Grabenbauer L, et al. (2011).	• Improved communication. • Patient data access and sharing.	• Cost. • Reduced time with patients. • Currently EHRs do not impact population health.
20	Cherry B, et al. (2011).	• Rapid patient record retrieval. • Better document consistency, quality, and accuracy. • Improvements in employee satisfaction and retention. • Better patient assessments, oversight, and order processing. • Better time management.	• Technology and maintenance problems like downtime or learning the new system. • Residents thought providers were more focused on the computers than on them.
23	Tabar P. (2013).	• Perceptions are changing in long-term care; EHRs are becoming a cost of doing business.	• Most EHRs were built for acute care and LTC facilities had trouble finding a system that met the organization's needs.
24	*Vendor Group.* (2013).	• Cost reductions. • Improve patient outcomes. • State programs could help fund a facility's EHR adoption.	
25	Yu P, et al. (2013).	• Continuous training. • Open dialogue with vendors. • Balancing EHR accuracy with patient care.	• Staff resisted the new system because personal perceptions about their age, lack of documentation skills, or other reasons created limitations. • Information management became too difficult and documents lacked consistency. • Providers complained about spending less time with residents.
26	Hamann DJ, et al. (2013).	• Nonprofit facilities were 40% more likely to adopt EHRs.	• For-profit facilities lagged behind in EHR adoption

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#	Authors	Facilitators	Barriers
		• Nonprofits have more regulations, so may need the benefits of EHRs.	rates. • Fewer regulations enable for-profit facilities to invest in cost-effective endeavors and avoid the expense of EHR implementation.
27	Vest JR, et al. (2013).	• More EHR vendors. • Trends show electronic record use is on the rise. • Meaningful use makes EHRs more prevalent.	• Lagging widespread EHR adoption. • Misaligned incentives.
28	Weaver. (2009).	• Error reduction (quality). • Improved efficiency. • Consumer (user) perceptions • Improved health outcomes	• Difficulties transitioning from paper to EHR. (Implementation .) • Training becomes paramount.
29	Gruber N, et al. (2010).	• Strong implementation team. • Communicate often and thoroughly. • Set goals, tasks, and schedules for the implementation. • Reduced errors. • Improved documentation.	• Minor increases in operating expenses. • Training.
30	Holup AA, et al. (2014).	• Rapidly aging populations stresses the need to create interoperable, coordinated EHRs for LTC facilities.	• Long-term care EHRs are not as comprehensive as acute care EHRs.
31	Holup AA, et al. (2013).	• Created better health outcomes. • Reduced extra costs. • Improved delivery and quality. • An increasing elder population makes implementing EHRs a necessity. • Nonprofits were more likely to utilize EHRs.	• High initial investment means slower adoption in facilities that cannot afford the EHR system, which slows the rate of becoming better integrated with acute care. • Facility characteristics determine EHR adoption.

An analysis of the articles in the systematic literature review revealed multiple facilitators and barriers to adopting an EHR in LTC. The facilitators to adoption included error reduction, clinical and administrative efficiency, cost savings, health outcomes, access ad transfer to information, project planning, user perceptions, security, facility characteristics, and time

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savings. The barriers to adoption included costs, users' negative perception, implementation issues, external factors, lack of proper training, incompatible facility characteristics, cultural change, ineffective project planning, security concerns, staff retention, and incompatible system issues.

Facilitators

The determined facilitators associated with EHR adoption were: access and transfer of information, long-run cost savings, error reduction, clinical and administrative efficiency, project planning, security, user perceptions, facility characteristics, health outcomes, time savings, and staff retention. The facilitators also have narrowed subsections throughout the articles. The benefits LTC facilities faced after adopting EHRs are connected to the facilitators. For example, facilities realized an ability to get to patient records quickly and easily, which is related to access and transfer of information.[7,8,15, 20] Cost savings looked at the long-run facility savings and how an EHR is an investment with benefits that take time to realize.[23,24] Error reduction was another benefit of using EHRs, expressed as fewer prescription errors, more patient medication and allergy alerts, and more overall health safeguards.[8,9,20] Efficiency enabled rapid information exchange through administrative channels, improved productivity and consistency, and better communication between clinical and administrative departments.[9-11,15,20]

Barriers

The barriers varied in topic specification. The broad categories determined from the literature review were: cost savings, user perception, implementation issues, external factors, training, facility characteristics, cultural change, project planning, security, staff retention, and

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system issues. Each broader category has sub-issues that LTC facilities face during EHR adoption.

Of the sub-issues, cost barriers were a consistent concern because adopting and implementing an EHR requires a substantial initial investment. Other cost concerns stem from the lack of funding for LTC facilities, future upgrades, and maintenance that will be necessary to successfully use the EHR.[8,13]

User perception barriers included issues with professional and public acceptance of the new system as well as functionality problems.[8-10] Implementation barriers were lack of complete understanding from the staff, too little training during and after implementation, and lack of time for implementation and understanding.[5,6,14,20] The external factors that present implementation problems were employee recruitment, lack of industry standards, facility location, and impact on the population.[5,14,15]

Table 2. Factors identified in the literature

Factors	Occurrences by Article Reference Number	Total Occurrences
Facilitators		
Error Reduction	6, 7, 8, 9, 10, 20, 28, 29	8
Clinical & Administrative Efficiency	6, 9, 10, 11, 15, 20, 28	7
Health Outcomes	6, 9, 10, 20, 24, 28, 31	7
Cost Savings	7, 10, 13, 23, 24, 26, 27	6
Access and Transfer to Information	7, 8, 10, 15, 20	5
Project Planning	4, 8, 14, 29	4
User Perceptions	8, 13, 14, 20	4
Security	10, 13, 26	3
Facility Characteristics	14, 30, 31	3
Time Saving	8, 9, 20	3
Barriers		

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Cost	5, 6, 7, 8, 10, 11, 12, 13, 14, 15	10
User Perceptions	5, 8, 10, 13, 14, 15, 20, 25	8
Implementation Issues	5, 6, 8, 9, 10, 14, 15, 25	8
External Factors	5, 6, 10, 11, 14, 15, 30	7
Training	14, 15, 20, 25, 28,29	6
Facility Characteristics	5, 14, 23, 31	4
Cultural Change	10, 25	2
Project Planning	10, 13	2
Security	8, 25	2
Staff Retention	14	1
System Issues	25	1

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DISCUSSION

Many factors are identified in association with adoption of EHR technology in LTC facilities. The review identified error reduction and clinical and administrative efficiency as the facilitators to EHR adoption in LTC, and cost as the barrier most often identified in the literature.

The literature suggests that quality measures would increase if EHRs were more prevalent in LTC facilities, but vendors' main focus is the acute care environment;[10,21] which make the current EHRs impractical for most LTC facilities.[10,11,23] The literature also suggests that the adoption rate could increase if there were standardization in the EHR market, which would make systems easier to use across diverse healthcare environments.[10]

Vendors would benefit from connecting with long-term care leaders to understand how EHRs fit long-term care strategic planning. A useful EHR helps LTC facilities improves quality, reduces errors, aids with billing and reimbursement, increases employee satisfaction, and may also increase employee retention.[6,8,13] Long-term care facilities need EHRs that are interoperable with other hospital systems so transfers and coordination of care become easier and have less errors. Vendors would benefit from understanding how LTC facilities use EHRs and how to make them more compatible for long-term care needs.

The cost of implementing the EHR was the most prevalent barrier. Many facilities may reject acquiring or installing an EHR because the initial cost is so high and maintaining and upgrading the EHR may also be too costly.[5-15,20] Lack of initial capital could inhibit the first step of considering adopting an EHR. There was a general theme that if LTC facilities had funding, they could become meaningful EHR users more quickly. While cost is a barrier, it is important to point out that many studies stressed the need for LTC facilities to be coordinated with acute care hospitals to run more efficiently and productively. Finding the money required to

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execute an EHR is critical to LTC facilities gaining the information it needs to make improved clinical decisions.

Cost was a running topic among many studies because the HITECH Act's meaningful use incentives do not include LTC facilities. Long-term care facilities lack the ability to participate the HITECH incentive program, yet there is a gap in research that explores different funding alternatives for long-term care.

The literature agrees on the significance that user perceptions plays on EHR adoption in LTC environments.[5,8,10,13-15,20,25] Perception can manifest as something that can hinder or help EHR adoption at LTC facilities. Rejecting an EHR may be due to a lack of understanding about the user benefits,[8] which might be connected to fear of change.[13] The perception that an EHR system will simply not be useful could also be a result of marketing shortfalls on the part of EHR vendors. Lack of usefulness may also result from not effectively implementing the system and failing to achieve expected benefits. However, concerns that the system will be difficult to use can be addressed by selecting a system with a focus on user interfaces. Furthermore, misunderstanding EHR benefits may lead to a perception that using this technology will reduce the amount of time physicians and nurses spend with residents.[15,20,25] logically, an emphasis on facilitators such as cost savings and security improvements should also help assuage negative perceptions. [26,27] A surprising finding was that the negative impact providers perceived was due to a lack of training.[6,14,15,28,29] Training should help people who lack general computer skills, documentation skills, and people who may find the systems difficult to navigate.[25]

Administrators' perceptions about the changing regulatory and competitive long-term care environment may present some EHR adoption opportunities. Reasons facilities chose to

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adopt an EHR include anticipation about increases in the regulatory environment and changes to reimbursement.[4,13,30] Some nursing home administrators feared increased regulations in the industry, and this prompted EHR adoption to prepare for a possible mandate.[13,31] Others chose to adopt EHRs due to emerging payment methods, such as bundled payments, which require better coordination of care with outside entities to receive higher reimbursements.[4] The competitive long-term care environment steered some organizations to adopt EHRs to emulate competitors' EHR success.[13] The competitive advantage of EHRs should be explained to decision-makers so they can confidently adopt the systems. Additionally, policymakers must offer incentives along with the increases in regulations and changes in reimbursement; unfunded mandates would degrade EHR perceptions in long-term care.

Adopting an EHR relies heavily on the execution of the implementation process. Many studies agreed on the need for a strategic plan that accounts for the size, governance, costs, facility needs, and regulatory requirements of the internal and external environments.[8,10,13,14]

Limitations

This review summarizes current and comprehensive data about EHR adoption facilitators and barriers for LTC facilities. The lack of evidence written about EHR adoption among LTC facilities and the search database limits led to the exhaustive nature of adoption factors of the study. This study limited only the range of time in the collection of data. A set of criteria of quality of each article was not developed or enforced because we used data from research and opinion. Combining these two types of manuscripts was necessary to collect a depth of qualitative information concerning a topic that is not broadly researched. The authors' intent was

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to create a comparison of LTC facilities for LTC facilities that want to implement an EHR in today's environment.

Conclusions

It is important to study factors affecting EHR adoption in LTC facilities because those facilities do not receive HITECH incentives. This study identified numerous facilitating factors and barriers through a systematic review of current articles in three scholarly databases. This information can be useful for decision-makers attempting successful EHR adoption in their LTC facility, policymakers trying to increase adoption rates without expanding incentives, and vendors who wish to create EHRs that coordinate with the needs of long-term care.

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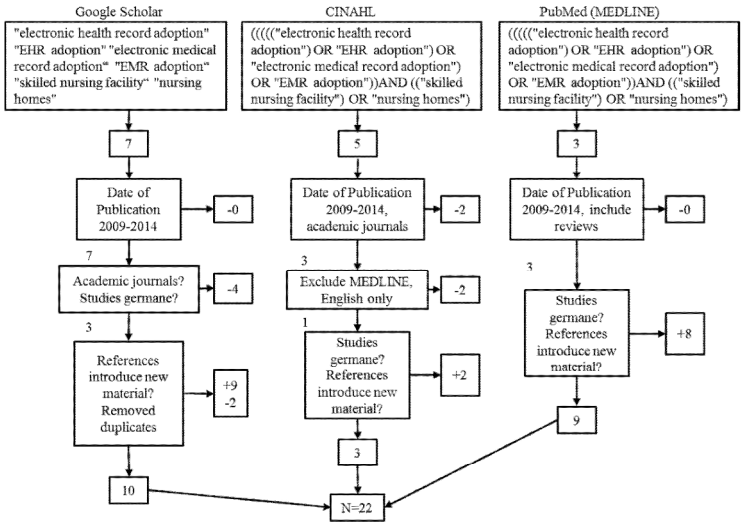

Literature review process from three research databases
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PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	4-7
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	7
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	NA
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	NA
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	8
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Figure 1
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	8
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	8
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	5
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	9
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	9
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	10

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PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	NA
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	NA
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	10
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	10-13
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	NA
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	Table 1
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	NA
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	NA
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	NA
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	17
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	3,19
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	20
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	21

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(6): e1000097. doi:10.1371/journal.pmed1000097

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Adoption Factors Associated with Electronic Health Record among Long-Term Care Facilities – A Systematic Review

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2716 words

Running page headline: Factors Associated w EHR Adoption in LTC

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ABSTRACT

Background: The Health Information Technology for Economic and Clinical Health (HITECH) Act created incentives for adopting electronic health records (EHRs) for some healthcare organizations, but long-term care (LTC) facilities are excluded from those incentives. There are realizable benefits of EHR adoption in LTC facilities; however, there is limited research about this topic.

Objectives: The purpose of this systematic literature review is to identify EHR adoption facilitators and barriers for LTC facilities, to add to the body of research on the topic.

Materials & Methods: We conducted systematic searches of Cumulative Index of Nursing and Allied Health Literature (CINAHL) Complete via Ebson B. Stephens Company (EBSCO Host), Google Scholar, and the PubMed to collect data about EHR adoption factors in LTC facilities. Search results were filtered by date range, English language, and academic journals (n = 22). Multiple members of the research team read each article to confirm applicability and study conclusions.

Results: Results identify 50 instances of 10 facilitators and 50 instances of 11 barriers associated with EHR adoption in LTC facilities. The facilitator error reduction was identified the most often (20%) by the most number of articles studied (45%). The barrier cost occurred the most often (20%) in the greatest number of barriers identified in the articles studied (45%).

Discussion & Conclusions: Common facilitators and barriers were consistent in the literature. These commonalities should help policy makers use the most effective levers in the LTC segment of healthcare, and they should enable leaders in LTC facilities to align strategic decisions with EHR adoption.

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STRENGTHS AND LIMITATIONS OF THIS STUDY

This systematic review has several strengths and limitations, as detailed below.

Strengths

- Adds to a body of knowledge of EHR adoption
- Contributes toward EHR adoption in LTC
- Provides a systematic review, in accordance with PRISMA
- Queries three well known research databases
- Queries use key terms registered with MeSH
- Multiple reviewers determined inclusion and exclusion criteria

Limitations

- Only five years were examined
- Selection bias will always exist in subjective decisions (inclusion criteria)

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INTRODUCTION, BACKGROUND & SIGNIFICANCE

Incentives

The Health Information Technology for Economic and Clinical Health (HITECH) Act of the American Recovery and Reinvestment Act (ARRA) of 2009 created reimbursement incentives for U.S. healthcare organizations that are using EHRs in meaningful ways.[1] Long-term care facilities (as defined by the ARRA) are facility types excluded from the incentives including: skilled nursing homes, assisted living facilities, LTC hospitals, rehabilitation hospitals, and psychiatric hospitals. Unfortunately, there has been no clear communication regarding reasons why "ineligible providers" have been excluded from the incentives under the ARRA. This is despite a relatively large body of evidence showing that there is value in the use of EHR in long-term care settings where it not only improves resident care, but also increases communications between providers, consultants, hospital, and nursing home staff.[2] There is documentation that exists which alludes to Congress wanting to understand the extent to which ineligible providers work in settings which might receive EHR incentives under the ARRA.[3] However, it should be noted that eligible providers (physicians for instance) were able to assign their incentive funding to a facility of their choice (whether or not that facility was an eligible provider), but no evidence exists to the extent of this assignment in the literature or to whom.[3] This represents not only a potentially large amount of untraceable incentive funds under the ARRA, but also a source of statistical interference when "meaningful use" is assessed.

While facilities eligible for these incentives demonstrate EHR adoption rates of about 12%, ineligible facilities have adoption rates of only 2-4%.[4] Incentives and grants from the HITECH Act are clearly a major motivating factor for EHR adoption;[5] however, LTC facilities must bear the adoption costs on their own, which represents a significant barrier.[5-15]

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Identification and definition of key terms

The American College of Hospital Executives (ACHE) defines long-term care as "a continuum of medical and social services designed to support the needs of people living with chronic health problems that affect their ability to perform everyday activities." Long-term care spans a continuum of "traditional medical services, social services, and housing." Services in long-term care have a significantly different aim than those in traditional, acute-care settings. While acute-care services aim to restore the patient to health, long-term care "aims to prevent deterioration and promote social adjustment to stages of decline" and it is delivered through a wide range of care givers and environments both in a healthcare facility and at home.[16] A large majority (92%) of long-term care facilities are privately owned and operated. The aging of the population creates an ever-increasing shortage of LTC beds per 1000 people 65 and over. Estimates show this trend will continue until the year 2030 with the percentage of persons 65 or over ballooning to 19% of the population.[17]

The broad definition of LTC from the ACHE could cast a wider net than necessary, or effective, for the purposes of this research. The research question we posited would only be appropriate for health care organizations that would have a use for the EHR. An assisted-living facility would have little use for an EHR that manages a patient's entire continuum of care, when the facility may only need to manage something as small as medication or diet. Those with the need for an EHR would be those that manage the chronic conditions like a nursing home, or Skilled Nursing Facility. The latter two entities are targeted, for the purposes of this study,

The taxonomy for the Electronic Health Record widely varies: digital medical record, computerized patient record, electronic medical record, digital medical record, etc. For the purposes of this study, the term EHR will be used exclusively to speak to the longitudinal and

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interoperable capabilities of an electronic medical record. This practice is supported by the World Health Organization (WHO).[18] The inherent advantages of the EHR can enable any certified, credentialed provider to access any patient record from any health care organization, but the provider will only have access to the information necessary for the immediate incident of care. The EHR enables providers to see past history, allergies, and treatment regimens with trend analysis.[19] Therefore, the key term of "electronic health record" is targeted for this study. However, because the term "electronic medical record" is often used synonymously, it will be included in the key search terms.

EHR adoption among facilities

In 2009, the US Government passed the American Recover and Reinvestment Act (ARRA), which included a significant section for healthcare intended to incentivize the adoption of the EHR. This section was called: Health Information Technology for Economic and Clinical Health (HITECH) Act.[1] The three phases of Meaningful Use consume IT strategies because of the HITECH Act's timeline for healthcare organizations to qualify for monetary incentives. Unfortunately, long-term care facilities were not included in these incentives.

Long-term care facilities that have adopted EHRs experience improvements in quality of care, documentation access, billing and reimbursement, and employee satisfaction and retention rates.[5-15,20] Interoperable EHRs may be especially useful to LTC facilities during periods of transitional care, when coordination and communication with other healthcare organizations is critical to achieving the best health outcomes.[21] Electronic health records are becoming more important for LTC facilities because increased demand for services from aging baby-boomers is inevitable.[22] While eligible organizations have the benefit of incentives to mitigate some costs in attaining these benefits, LTC facilities must bear the full cost. There is a dearth of research

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available to help decision-makers at LTC facilities make objective conclusions about adopting EHRs, which is why this review is critical to future research.

Objectives

It is important to identify the factors that influence EHR adoption in LTC facilities that are not dependent on HITECH incentive payments. This study's focus is to identify the EHR adoption facilitators well as discern the multitude of barriers LTC facilities face. While it is clear that implementing an EHR system could bring many benefits to organizations, realizing those benefits in the beginning stages might not be possible for every LTC facility.

The findings of this review will be useful to LTC facility administrators interested in adopting EHRs into their organization by helping them identify barriers to overcome and opportunities to lever. Policymakers may also find the identified factors useful when attempting to increase EHR adoption in the long-term care industry. Additionally, vendors can benefit from this article's information so they can focus the software-development process of EHRs on the more salient facilitators and barriers to adoption.

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METHODS

Data

Data for this review were gathered from three separate databases: Google Scholar, Cumulative Index of Nursing and Allied Health Literature (CINAHL) Complete via EBSCO Host, and PubMed (which queries MEDLINE). Search criteria focused on EHR adoption in long-term care. To avoid the bandwagon effect, the authors independently reviewed the articles identified during the search. Following independent reviews, authors compared and discussed the articles and reason for inclusion in or exclusion from the study. Articles were only included in the final study if selected by at least two reviewers. An affinity matrix was created to identify frequency of both facilitators and barriers in the literature.

Sample

Research databases were queried using key terms from the Medical Subject Headings (MeSH) at the National Center for Biotechnology Information (NCBI). The MeSH database revealed multiple terms for the EHR, as predicted. The two most prevalent search terms for LTC, appropriate for this study, were “nursing home” and “skilled nursing facility.” Several exclusion criteria were implemented through filters. Searches were limited to peer-reviewed journal articles in U.S., published in the English language from 2009-2014 (n = 22). This process is illustrated by Figure 1.

Figure 1. An illustration of the literature review process

Standard for review and summary measures

The 2009 version of the preferred reporting items for systematic reviews and meta-analyses (PRISMA) was used as the standard and template for the review process. The primary

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summary measures for this review are the discrete frequency and statistical average of identified operators (facilitators and barriers) over the total identified.

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RESULTS

Table of findings

The findings were summarized and inserted into the facilitators and barriers table after the authors chose articles to create the literature review. All duplicate articles were accounted for and consolidated before the findings table was created. The authors then reanalyzed the articles and identified the individual factors affecting EHR adoption in LTC facilities after the articles reached information saturation. These factors were then compiled into a frequency table to aid in the analysis. Results are summarized in Table 1.

Table 1. Summarized facilitators and barriers identified in the literature

#	Authors	Facilitators	Barriers
4	Wolf L, et al. (2012).	• Emerging payment methods could encourage EHR adoption. • "Quality Improvement Organizations" may increase adoption because they provide technical support that many LTC facilities need.	• HITECH incentives only focus on acute care and primary physicians. • Expanding the incentives to LTC facilities may be too costly.
5	Wang T, et al. (2012).	• Anticipating state and federal requirements. • Good communication between vendors and LTC facilities. • Education and training programs.	• Lack of initial investment resources. • No technical infrastructure. • Not enough time to implement the EHR. • Lack of space for the new system.
6	Resnick H, et al. (2009).	• Error reduction. • Quality. • Efficiency. • Better health outcomes.	• Cost. • Complex systems (implementation). • No standards (external).
7	Davidson J. (2009).	• Comprehensive implementation planning. • Governmental initiatives. • Management and staff support. •	• Cost. • Privacy issues. • Incorrect vendor.
8	Hamid F, et al. (2013).	• EHR satisfaction increases when the users understand the benefits. • Supportive management. • Training programs.	• Cost. • Perceived lack of usefulness. • Time consuming.

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#	Authors	Facilitators	Barriers
9	Alexander G, et al. (2009).	• Improve clinical decision making. • Earlier intervention. • Time savings.	• IT sophistication negatively correlated with detection of detection of incontinence (implementation issue?)
10	Phillips K, et al. (2010).	• Government financial incentives. • Reduced errors and adverse drug events. • Including users in the design and implementation process.	• Adoption costs. • Efficiency outcomes were inconsistent. • Incongruent cost savings. • Lack of interoperability. • Fear of changing the facility culture.
11	Wilkins M. (2009).	• Training and learning the system increases adoption. • Understanding the usefulness of the EHR technology.	• Facility size. • Lack of change agents or leaders in the facility. • Lack of interoperability. • Cost. • Resistance to change.
12	Filipova AA. (2013).	• Federal and state government incentives or policy initiatives could offset financial barriers. • Aligning organizational strategic plans could also encourage adoption.	• Financial barriers like no capital to implement an EHR and the cost of hardware and infrastructure. • Organizational barriers. • Legal and regulatory barriers. • Technological barriers. • Network barriers.
13	Bezboruah KC, et al. (2014).	• Institutional pressure like anticipated regulations and competition pressures increase EHR adoption.	• Cost of the electronic system and projected upgrades. • Leaders perceiving staff's resistance to change. • Misunderstanding how EHRs could be useful or not having enough information to choose the right system.
14	Cherry B. (2011).	• Fast-growing elder populations mean quality of care in LTC facilities must be addressed with EHRs. • A strong implementation plan within	• Cost and a lack of capital resources. • Lack of industry standards. • Complicated

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#	Authors	Facilitators	Barriers
		the facility that aligns with strategic plans. • Initial and follow-up training programs. • A perception shift about the benefits of EHR adoption.	implementation processes. • Lack of technical support. • Not enough evidence to support EHR's proposed benefits.
15	Grabenbauer L, et al. (2011).	• Improved communication. • Patient data access and sharing.	• Cost. • Reduced time with patients. • Currently EHRs do not impact population health.
20	Cherry B, et al. (2011).	• Rapid patient record retrieval. • Better document consistency, quality, and accuracy. • Improvements in employee satisfaction and retention. • Better patient assessments, oversight, and order processing. • Better time management.	• Technology and maintenance problems like downtime or learning the new system. • Residents thought providers were more focused on the computers than on them.
23	Tabar P. (2013).	• Perceptions are changing in long-term care; EHRs are becoming a cost of doing business.	• Most EHRs were built for acute care and LTC facilities had trouble finding a system that met the organization's needs.
24	*Vendor Group.* (2013).	• Cost reductions. • Improve patient outcomes. • State programs could help fund a facility's EHR adoption.	
25	Yu P, et al. (2013).	• Continuous training. • Open dialogue with vendors. • Balancing EHR accuracy with patient care.	• Staff resisted the new system because personal perceptions about their age, lack of documentation skills, or other reasons created limitations. • Information management became too difficult and documents lacked consistency. • Providers complained about spending less time with residents.
26	Hamann DJ, et al. (2013).	• Nonprofit facilities were 40% more likely to adopt EHRs.	• For-profit facilities lagged behind in EHR adoption

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#	Authors	Facilitators	Barriers
		• Nonprofits have more regulations, so may need the benefits of EHRs.	rates. • Fewer regulations enable for-profit facilities to invest in cost-effective endeavors and avoid the expense of EHR implementation.
27	Vest JR, et al. (2013).	• More EHR vendors. • Trends show electronic record use is on the rise. • Meaningful use makes EHRs more prevalent.	• Lagging widespread EHR adoption. • Misaligned incentives.
28	Weaver S. (2011).	• Error reduction (quality). • Improved efficiency. • Consumer (user) perceptions • Improved health outcomes	• Difficulties transitioning from paper to EHR. (Implementation .) • Training becomes paramount.
29	Gruber N, et al. (2010).	• Strong implementation team. • Communicate often and thoroughly. • Set goals, tasks, and schedules for the implementation. • Reduced errors. • Improved documentation.	• Minor increases in operating expenses. • Training.
30	Holup AA, et al. (2014).	• Rapidly aging populations stresses the need to create interoperable, coordinated EHRs for LTC facilities.	• Long-term care EHRs are not as comprehensive as acute care EHRs.
31	Holup AA, et al. (2013).	• Created better health outcomes. • Reduced extra costs. • Improved delivery and quality. • An increasing elder population makes implementing EHRs a necessity. • Nonprofits were more likely to utilize EHRs.	• High initial investment means slower adoption in facilities that cannot afford the EHR system, which slows the rate of becoming better integrated with acute care. • Facility characteristics determine EHR adoption.

An analysis of the articles in the systematic literature review revealed multiple facilitators and barriers to adopting an EHR in LTC. The facilitators to adoption included error reduction, clinical and administrative efficiency, cost savings, health outcomes, access ad transfer to information, project planning, user perceptions, security, facility characteristics, and time

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savings. The barriers to adoption included costs, users' negative perception, implementation issues, external factors, lack of proper training, incompatible facility characteristics, cultural change, ineffective project planning, security concerns, staff retention, and incompatible system issues.

Facilitators

The determined facilitators associated with EHR adoption were: access and transfer of information, long-run cost savings, error reduction, clinical and administrative efficiency, project planning, security, user perceptions, facility characteristics, health outcomes, time savings, and staff retention. The facilitators also have narrowed subsections throughout the articles. The benefits LTC facilities faced after adopting EHRs are connected to the facilitators. For example, facilities realized an ability to get to patient records quickly and easily, which is related to access and transfer of information.[7,8,15, 20] Cost savings looked at the long-run facility savings and how an EHR is an investment with benefits that take time to realize.[23,24] Error reduction was another benefit of using EHRs, expressed as fewer prescription errors, more patient medication and allergy alerts, and more overall health safeguards.[8,9,20] Efficiency enabled rapid information exchange through administrative channels, improved productivity and consistency, and better communication between clinical and administrative departments.[9-11,15,20]

Barriers

The barriers varied in topic specification. The broad categories determined from the literature review were: cost savings, user perception, implementation issues, external factors, training, facility characteristics, cultural change, project planning, security, staff retention, and

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system issues. Each broader category has sub-issues that LTC facilities face during EHR adoption.

Of the sub-issues, cost barriers were a consistent concern because adopting and implementing an EHR requires a substantial initial investment. Other cost concerns stem from the lack of funding for LTC facilities, future upgrades, and maintenance that will be necessary to successfully use the EHR.[8,13]

User perception barriers included issues with professional and public acceptance of the new system as well as functionality problems.[8-10] Implementation barriers were lack of complete understanding from the staff, too little training during and after implementation, and lack of time for implementation and understanding.[5,6,14,20] The external factors that present implementation problems were employee recruitment, lack of industry standards, facility location, and impact on the population.[5,14,15]

Table 2. Factors identified in the literature

Factors	Occurrences by Article Reference Number	Total Occurrences
Facilitators		
Error Reduction	6, 7, 8, 9, 10, 20, 28, 29	8
Clinical & Administrative Efficiency	6, 9, 10, 11, 15, 20, 28	7
Health Outcomes	6, 9, 10, 20, 24, 28, 31	7
Cost Savings	7, 10, 13, 23, 24, 26, 27	6
Access and Transfer to Information	7, 8, 10, 15, 20	5
Project Planning	4, 8, 14, 29	4
User Perceptions	8, 13, 14, 20	4
Security	10, 13, 26	3
Facility Characteristics	14, 30, 31	3
Time Saving	8, 9, 20	3
Barriers		

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Cost	5, 6, 7, 8, 10, 11, 12, 13, 14, 15	10
User Perceptions	5, 8, 10, 13, 14, 15, 20, 25	8
Implementation Issues	5, 6, 8, 9, 10, 14, 15, 25	8
External Factors	5, 6, 10, 11, 14, 15, 30	7
Training	14, 15, 20, 25, 28,29	6
Facility Characteristics	5, 14, 23, 31	4
Cultural Change	10, 25	2
Project Planning	10, 13	2
Security	8, 25	2
Staff Retention	14	1
System Issues	25	1

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DISCUSSION

Many factors are identified in association with adoption of EHR technology in LTC facilities. The review identified error reduction and clinical and administrative efficiency as the facilitators to EHR adoption in LTC, and cost as the barrier most often identified in the literature.

The literature suggests that quality measures would increase if EHRs were more prevalent in LTC facilities, but vendors' main focus is the acute care environment;[10,21] which make the current EHRs impractical for most LTC facilities.[10,11,23] The literature also suggests that the adoption rate could increase if there were standardization in the EHR market, which would make systems easier to use across diverse healthcare environments.[10]

Vendors would benefit from connecting with long-term care leaders to understand how EHRs fit long-term care strategic planning. A useful EHR helps LTC facilities improves quality, reduces errors, aids with billing and reimbursement, increases employee satisfaction, and may also increase employee retention.[6,8,13] Long-term care facilities need EHRs that are interoperable with other hospital systems so transfers and coordination of care become easier and have less errors. Vendors would benefit from understanding how LTC facilities use EHRs and how to make them more compatible for long-term care needs.

The cost of implementing the EHR was the most prevalent barrier. Many facilities may reject acquiring or installing an EHR because the initial cost is so high and maintaining and upgrading the EHR may also be too costly.[5-15,20] Lack of initial capital could inhibit the first step of considering adopting an EHR. There was a general theme that if LTC facilities had funding, they could become meaningful EHR users more quickly. While cost is a barrier, it is important to point out that many studies stressed the need for LTC facilities to be coordinated with acute care hospitals to run more efficiently and productively. Finding the money required to

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execute an EHR is critical to LTC facilities gaining the information it needs to make improved clinical decisions.

Cost was a running topic among many studies because the HITECH Act's meaningful use incentives do not include LTC facilities. Long-term care facilities lack the ability to participate the HITECH incentive program, yet there is a gap in research that explores different funding alternatives for long-term care.

The literature agrees on the significance that user perceptions plays on EHR adoption in LTC environments.[5,8,10,13-15,20,25] Perception can manifest as something that can hinder or help EHR adoption at LTC facilities. Rejecting an EHR may be due to a lack of understanding about the user benefits,[8] which might be connected to fear of change.[13] The perception that an EHR system will simply not be useful could also be a result of marketing shortfalls on the part of EHR vendors. Lack of usefulness may also result from not effectively implementing the system and failing to achieve expected benefits. However, concerns that the system will be difficult to use can be addressed by selecting a system with a focus on user interfaces. Furthermore, misunderstanding EHR benefits may lead to a perception that using this technology will reduce the amount of time physicians and nurses spend with residents.[15,20,25] logically, an emphasis on facilitators such as cost savings and security improvements should also help assuage negative perceptions. [26,27] A surprising finding was that the negative impact providers perceived was due to a lack of training.[6,14,15,28,29] Training should help people who lack general computer skills, documentation skills, and people who may find the systems difficult to navigate.[25]

Administrators' perceptions about the changing regulatory and competitive long-term care environment may present some EHR adoption opportunities. Reasons facilities chose to

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adopt an EHR include anticipation about increases in the regulatory environment and changes to reimbursement.[4,13,30] Some nursing home administrators feared increased regulations in the industry, and this prompted EHR adoption to prepare for a possible mandate.[13,31] Others chose to adopt EHRs due to emerging payment methods, such as bundled payments, which require better coordination of care with outside entities to receive higher reimbursements.[4] The competitive long-term care environment steered some organizations to adopt EHRs to emulate competitors' EHR success.[13] The competitive advantage of EHRs should be explained to decision-makers so they can confidently adopt the systems. Additionally, policymakers must offer incentives along with the increases in regulations and changes in reimbursement; unfunded mandates would degrade EHR perceptions in long-term care.

Adopting an EHR relies heavily on the execution of the implementation process. Many studies agreed on the need for a strategic plan that accounts for the size, governance, costs, facility needs, and regulatory requirements of the internal and external environments.[8,10,13,14]

Limitations

This review summarizes current and comprehensive data about EHR adoption facilitators and barriers for LTC facilities. The lack of evidence written about EHR adoption among LTC facilities and the search database limits led to the exhaustive nature of adoption factors of the study. This study was limited to only current research, which helped create a comparison for LTC facilities that want to implement an EHR in today's environment.

Conclusions

It is important to study factors affecting EHR adoption in LTC facilities because those facilities do not receive HITECH incentives. This study identified numerous facilitating factors

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and barriers through a systematic review of current articles in three scholarly databases. This information can be useful for decision-makers attempting successful EHR adoption in their LTC facility, policymakers trying to increase adoption rates without expanding incentives, and vendors who wish to create EHRs that coordinate with long-term care.

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#	Authors	Study Characteristics	Facilitators	Barriers
4	Wolf L, et al. (2012). Hospitals ineligible for federal meaningful use incentives have dismally low rates of adoption of EHR.	• Secondary data analysis, 2009 health IT supplement to the AHA survey. • Hospitals reported on 32 clinical functions of an EHR system and extent of implementation.	• Emerging payment methods could encourage EHR adoption. • "Quality Improvement Organizations" may increase adoption because they provide technical support that many LTC facilities need.	• HITECH incentives only focus on acute care and primary physicians. • Expanding the incentives to LTC facilities may be too costly.
5	Wang T, et al. (2012). Adoption and utilization of EHR systems by LTC in Texas.	• Survey instrument mailed to all Texas LTC facilities. • Data were self-reported rates of adoption.	• Anticipating state and federal requirements. • Good communication between vendors and LTC facilities. • Education and training programs.	• Lack of initial investment resources. • No technical infrastructure. • Not enough time to implement the EHR. • Lack of space for the new system.
6	Resnick H, et al. (2009). Use of Electronic Information Systems in Nursing Homes: United States.	• Secondary data analysis from the National Nursing Home Survey (NNHS). • The data reported a wide range in level of adoption.	• Error reduction. • Quality. • Efficiency. • Better health outcomes.	• Cost. • Complex systems (implementation). • No standards (external).
7	Davidson J. (2009). Electronic Medical Records: what they are and how they will revolutionize the delivery of care.	• Summary of articles (non-study) and concepts justifying the creation of the Canadian Health Infoway..	• Comprehensive implementation planning. • Governmental initiatives. • Management and staff support.	• Cost. • Privacy issues. • Incorrect vendor.
8	Hamid F, et al. (2013). Providers Acceptance Factors and	• Survey instrument given to physicians (n=24), nurse practitioners and PAs (n= 20) in acute-care settings.	• EHR satisfaction increases when the users understand the benefits. • Supportive	• Cost. • Perceived lack of usefulness. • Time consuming.

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#	Authors	Study Characteristics	Facilitators	Barriers
	their Perceived Barriers to Electronic Health Record EHR Adoption.		management. • Training programs.	
9	Alexander G, et al. (2009). IT Sophistication and Quality Measures in Nursing Homes.	• Survey instrument of 210 nursing homes in Missouri. • Two groups of measurements collected: level of IT sophistication and quality measures, as defined by the U.S. Center for Medicare and Medicaid Services.	• Improve clinical decision making. • Earlier intervention. • Time savings.	• IT sophistication negatively correlated with detection of incontinence (implementation issue?)
10	Phillips K, et al. (2010). Electronic medical records in long-term care.	• Systematic literature review.	• Government financial incentives. • Reduced errors and adverse drug events. • Including users in the design and implementation process.	• Adoption costs. • Efficiency outcomes were inconsistent. • Incongruent cost savings. • Lack of interoperability. • Fear of changing the facility culture.
11	Wilkins M. (2009). Factors influencing acceptance of electronic health records in hospitals.	• Survey instrument to members of the Arkansas Hospital Association. • LTC hospitals were cross-tabbed separately from other hospitals.	• Training and learning the system increases adoption. • Understanding the usefulness of the EHR technology.	• Facility size. • Lack of change agents or leaders in the facility. • Lack of interoperability. • Cost. • Resistance to change.
12	Filipova AA. (2013). Electronic Health Records Use and Barriers and Benefits to	• Cross-sectional design. • Mail and web survey instruments.	• Federal and state government incentives or policy initiatives could offset financial barriers. • Aligning organizational strategic plans could	• Financial barriers like no capital to implement an EHR and the cost of hardware and infrastructure. • Organizational

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#	Authors	Study Characteristics	Facilitators	Barriers
	Use in Skilled Nursing Facilities.		also encourage adoption.	barriers. • Legal and regulatory barriers. • Technological barriers. • Network barriers.
13	Bezboruah KC, et al. (2014). Management attitudes and technology adoption in long-term care facilities	• Exploratory, qualitative case study.	• Institutional pressure like anticipated regulations and competition pressures increase EHR adoption.	• Cost of the electronic system and projected upgrades. • Leaders perceiving staff's resistance to change. • Misunderstanding how EHRs could be useful or not having enough information to choose the right system.
14	Cherry B. (2011). Management attitudes and technology adoption in long-term care facilities.	• Survey instrument to LTC facilities in Texas.	• Fast-growing elder populations mean quality of care in LTC facilities must be addressed with EHRs. • A strong implementation plan within the facility that aligns with strategic plans. • Initial and follow-up training programs. • A perception shift about the benefits of EHR adoption.	• Cost and a lack of capital resources. • Lack of industry standards. • Complicated implementation processes. • Lack of technical support. • Not enough evidence to support EHR's proposed benefits.
15	Grabenbauer L, et al. (2011). Electronic Health Record Adoption - Maybe It's not about the Money: Physician	• Qualitative study conducted to compare two robust EHR solutions. • EHR- savvy users from multiple organizations interviewed through focus groups..	• Improved communication. • Patient data access and sharing.	• Cost. • Reduced time with patients. • Currently EHRs do not impact population health.

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#	Authors	Study Characteristics	Facilitators	Barriers
	Super-Users, Electronic Health Records and Patient Care			
20	Cherry B, et al. (2011). Experiences with electronic health records: Early adopters in long-term care facilities.	• Semi-structured interviews conducted at 10 LTC sites. • Interviewees consisted of administrators, nurse managers, nurses, certified nurse aides, and other system users.	• Rapid patient record retrieval. • Better document consistency, quality, and accuracy. • Improvements in employee satisfaction and retention. • Better patient assessments, oversight, and order processing. • Better time management.	• Technology and maintenance problems like downtime or learning the new system. • Residents thought providers were more focused on the computers than on them.
23	Tabar P. (2013). Why EHRs matter to LTC's future	• Editorial.	• Perceptions are changing in long-term care; EHRs are becoming a cost of doing business.	• Most EHRs were built for acute care and LTC facilities had trouble finding a system that met the organization's needs.
24	Vendor group develops EHR code of conduct. (2013).	• Journal bulletin board post.	• Cost reductions. • Improve patient outcomes. • State programs could help fund a facility's EHR adoption.	
25	Yu P, et al. (2013). Unintended adverse consequences of introducing electronic health records in residential aged care homes.	• Qualitative semi-structured interview study of 9 residential aged care homes. • User perceptions evaluated.	• Continuous training. • Open dialogue with vendors. • Balancing EHR accuracy with patient care.	• Staff resisted the new system because personal perceptions about their age, lack of documentation skills, or other reasons created limitations. • Information management became too difficult and documents lacked consistency.

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#	Authors	Study Characteristics	Facilitators	Barriers
				• Providers complained about spending less time with residents.
26	Hamann DJ, et al. (2013). Utilization of Technology by Long-Term Care Providers Comparisons Between For-Profit and Nonprofit Institutions.	• Secondary data analysis of multiple surveys conducted by the CDC. •	• Nonprofit facilities were 40% more likely to adopt EHRs. • Nonprofits have more regulations, so may need the benefits of EHRs.	• For-profit facilities lagged behind in EHR adoption rates. • Fewer regulations enable for-profit facilities to invest in cost-effective endeavors and avoid the expense of EHR implementation.
27	Vest JR, et al. (2013). Changes to the electronic health records market in light of health information technology certification and meaningful use.	• Secondary data analysis of HIMSS data. • Hospital referral regions were used to define local markets. • Analysis was changes over time.	• More EHR vendors. • Trends show electronic record use is on the rise. • Meaningful use makes EHRs more prevalent.	• Lagging widespread EHR adoption. • Misaligned incentives.
28	Weaver. (2005). EHR adoption in LTC and the HIM value.	• Practice brief (a regular section in the journal). • A publication of practice guidelines for managing health information.	• Error reduction (quality). • Improved efficiency. • Consumer (user) perceptions • Improved health outcomes	• Difficulties transitioning from paper to EHR. (Implementation .) • Training becomes paramount.
29	Gruber N, et al. (2010). Embracing change to improve performance: implementation of an	• Case study of an implementation of an EHR in a facility. • Includes cost, staffing, and experience over 2 years.	• Strong implementation team. • Communicate often and thoroughly. • Set goals, tasks, and schedules for the implementation. • Reduced errors.	• Minor increases in operating expenses. • Training.

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#	Authors	Study Characteristics	Facilitators	Barriers
	electronic health record system.		• Improved documentation.	
30	Holup AA, et al. (2014). Going Digital Adoption of Electronic Health Records in Assisted Living Facilities.	• Pilot study examining associations between structural characteristics and adoption and use of EHR as a process characteristic in assisted living.	• Rapidly aging populations stresses the need to create interoperable, coordinated EHRs for LTC facilities.	• Long-term care EHRs are not as comprehensive as acute care EHRs.
31	Holup AA, et al. (2013). Facility characteristics associated with the use of electronic health records in residential care facilities	• Secondary data analysis of annual survey instrument of the National Survey of Residential Care Facilities.	• Created better health outcomes. • Reduced extra costs. • Improved delivery and quality. • An increasing elder population makes implementing EHRs a necessity. • Nonprofits were more likely to utilize EHRs.	• High initial investment means slower adoption in facilities that cannot afford the EHR system, which slows the rate of becoming better integrated with acute care. • Facility characteristics determine EHR adoption.

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Adoption Factors Associated with Electronic Health Record among Long-Term Care Facilities – A Systematic Review

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ABSTRACT

Objectives: The Health Information Technology for Economic and Clinical Health (HITECH) Act created incentives for adopting electronic health records (EHRs) for some healthcare organizations, but long-term care (LTC) facilities are excluded from those incentives. There are realizable benefits of EHR adoption in LTC facilities; however, there is limited research about this topic. The purpose of this systematic literature review is to identify EHR adoption factors for LTC facilities that are ineligible for the HITECH Act incentives.

Setting: We conducted systematic searches of Cumulative Index of Nursing and Allied Health Literature (CINAHL) Complete via Ebson B. Stephens Company (EBSCO Host), Google Scholar, and the university library search engine to collect data about EHR adoption factors in LTC facilities since 2009.

Participants: Search results were filtered by date range, full text, English language, and academic journals (n = 22).

Interventions: Multiple members of the research team read each article to confirm applicability and study conclusions.

Primary and secondary outcome measures: Researchers identified common themes across the literature: specifically facilitators and barriers to adoption of the EHR in LTC.

Results: Results identify facilitators and barriers associated with EHR adoption in LTC facilities. The most common facilitators include access to information and error reduction. The most prevalent barriers include initial costs, user perceptions, and implementation problems.

Conclusions: Similarities span the system selection phases and implementation process; of those, cost was the most common mentioned. These commonalities should help leaders in LTC facilities align strategic decisions to EHR adoption. This review may be useful for decision-

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makers attempting successful EHR adoption, policymakers trying to increase adoption rates without expanding incentives, and vendors that produce EHRs.

STRENGTHS AND LIMITATIONS OF THIS STUDY

This systematic review has several strengths and limitations, as detailed below.

Strengths

- Adds to a body of knowledge of EHR adoption.
- Contributes toward EHR adoption in LTC.
- Provides a systematic review, in accordance with PRISMA.
- Queries three well known research databases.
- Queries use key terms registered with MeSH.
- Multiple reviewers determined inclusion and exclusion criteria.

Limitations

- Only five years were examined.
- An objective assessment of study bias was not conducted in this review.
- Selection bias will always exist in subjective decisions (inclusion criteria). Controls for selection bias were enacted: more than one author had to recommend that an article be included in the study. The identification of both enablers and barriers followed the same rule.

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INTRODUCTION, BACKGROUND & SIGNIFICANCE

Incentives

The Health Information Technology for Economic and Clinical Health (HITECH) Act of the American Recovery and Reinvestment Act (ARRA) of 2009 created reimbursement incentives for U.S. healthcare organizations that are using EHRs in meaningful ways.[1] Long-term care facilities (as defined by the ARRA) are facility types excluded from the incentives including: skilled nursing homes, assisted living facilities, LTC hospitals, rehabilitation hospitals, and psychiatric hospitals. Unfortunately, there has been no clear communication regarding reasons why "ineligible providers" have been excluded from the incentives under the ARRA. This is despite a relatively large body of evidence showing that there is value in the use of EHR in long-term care settings where it not only improves resident care, but also increases communications between providers, consultants, hospital, and nursing home staff.[2] There is documentation that exists which alludes to Congress wanting to understand the extent to which ineligible providers work in settings which might receive EHR incentives under the ARRA.[3] However, it should be noted that eligible providers (physicians for instance) were able to assign their incentive funding to a facility of their choice (whether or not that facility was an eligible provider), but no evidence exists to the extent of this assignment in the literature or to whom.[3] This represents not only a potentially large amount of untrackable incentive funds under the ARRA, but also a source of statistical interference when "meaningful use" is assessed.

While facilities eligible for these incentives demonstrate EHR adoption rates of about 12%, ineligible facilities have adoption rates of only 2-4%.[4] Incentives and grants from the HITECH Act are clearly a major motivating factor for EHR adoption;[5] however, LTC facilities must bear the adoption costs on their own, which represents a significant barrier.[5-15]

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Identification and definition of key terms

The American College of Hospital Executives (ACHE) defines long-term care as "a continuum of medical and social services designed to support the needs of people living with chronic health problems that affect their ability to perform everyday activities." Long-term care spans a continuum of "traditional medical services, social services, and housing". Services in long-term care have a significantly different aim than traditional acute care services. While acute-care services aim to restore the patient to health, long-term care "aims to prevent deterioration and promote social adjustment to stages of decline" and it is delivered through a wide range of care givers and environments both in a healthcare facility and at home.[16] A large majority (92%) of long-term care facilities are privately owned and operated. The aging of the population creates an ever-increasing shortage of LTC beds per 1000 people 65 and over. Estimates show this trend will continue until the year 2030 with the percentage of persons 65 or over ballooning to 19% of the population.[17] The broad definition from the ACHE could encompass a wider range than necessary for the purposes of this research. The research question we posited would only be appropriate for health care organizations that would have a use for the EHR. While we think that an EHR would be beneficial at all levels of care to compensate for the lack of a provider of continuity between levels of care, we also look pragmatically at the cost versus the benefit. Because funding for an EHR would come from each independent health care organization in the U.S., an assisted-living facility in the U.S. would not have a significant need for an EHR that manages a patient's entire continuum of care; the facility may only need to manage something as small as medication or diet, which would not justify the millions of dollars to implement an EHR solution. Those with the greatest need for an EHR would be those that manage the chronic conditions like a nursing home, or Skilled Nursing Facility.

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The taxonomy for the Electronic Health Record widely varies: digital medical record, computerized patient record, electronic medical record, digital medical record, etc. For the purposes of this study, the term EHR will be used exclusively to speak to the longitudinal and interoperable capabilities of an electronic medical record. This practice is supported by the World Health Organization (WHO).[18] The inherent advantages of the EHR are that it can enable any certified, credentialed provider to access any patient record from any health care organization, but the provider will only have access to the information necessary for the immediate incident of care. The EHR enables providers to see past history, allergies, and treatment regimens with trend analysis.[19]

In 2009, the US Government passed the American Recover and Reinvestment Act (ARRA), which included a significant section for healthcare intended to incentivize the adoption of the EHR. This section was called: Health Information Technology for Economic and Clinical Health (HITECH) Act.[1] The three phases of Meaningful Use consume IT strategies because of the HITECH Act's timeline for healthcare organizations to qualify for monetary incentives. Unfortunately, long-term care facilities were not included in these incentives.

EHR adoption among facilities

Long-term care facilities that have adopted EHRs experience improvements in quality of care, documentation access, billing and reimbursement, and employee satisfaction and retention rates.[5-15,20] Interoperable EHRs may be especially useful to LTC facilities during periods of transitional care, when coordination and communication with other healthcare organizations is critical to achieving the best health outcomes.[21] Electronic health records are becoming more important for LTC facilities because increased demand for services from aging baby-boomers is inevitable.[22] While eligible organizations have the benefit of incentives to mitigate some costs in

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attaining these benefits, LTC facilities must bear the full cost. There is a dearth of research available to help decision-makers at LTC facilities make objective conclusions about adopting EHRs, which is why this review is critical to future research.

EHR impact

It is important to identify the factors that influence EHR adoption in LTC facilities that are not dependent on HITECH incentive payments. This study's focus is to identify what those adoption factors are, as well as discern the multitude of barriers those facilities face. While it is clear that implementing an EHR system could bring many benefits to organizations, realizing those benefits in the beginning stages might not be possible for every LTC facility.

Objectives

The findings of this review will be useful to LTC facility administrators interested in adopting EHRs into their organization by helping them identify barriers to overcome and opportunities to lever. Policymakers may also find the identified factors useful when attempting to increase EHR adoption in the long-term care industry. Additionally, vendors can benefit from this article's information to design EHRs that are more useful for LTC facilities.

METHODS

Data

Data for this review were gathered using three separate databases: Google Scholar, Cumulative Index of Nursing and Allied Health Literature (CINAHL) Complete via EBSCO Host, and PubMed (which queries MEDLINE). Search criteria focused on EHR adoption in long-term care. The authors independently reviewed the articles identified during the search and independently summarized findings germane to this review . Following independent reviews, authors compared and discussed the articles and reason for inclusion in the study. Articles were

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only included if selected by at least two reviewers. The comparable search criteria demonstrated the authors had a similar understanding of the research problem.

Sample

Research databases were queried using terms from the Medical Subject Headings (MeSH) at the National Center for Biotechnology Information (NCBI). Although multiple terms appeared for the EHR, the only heading listed in MeSH for LTC was "long-term care." Several exclusion criteria were also specified: The authors began with broad database searches then narrowed the criteria to identify the most commonly mentioned factors listed in the articles. This method avoids excluding relevant data by too narrowly defining initial search criteria. Searches were limited to peer-reviewed journal articles in U.S.-based English language from 2009-2014 (n = 16). This process is illustrated by Figure 1.

Figure 1. An illustration of the literature review process

Searches continued until the results reached saturation by repeating information about costs, perceptions, and implementation.

RESULTS

Table of findings

The findings were summarized and inserted into the facilitators and barriers table after the authors chose articles to create the literature review. All duplicate articles were accounted for and consolidated before the findings table was created. The authors then reanalyzed the articles and identified the individual factors affecting EHR adoption in LTC facilities after the articles reached information saturation. These factors were then compiled into a frequency table to aid in the analysis. An objective assessment of study bias was not conducted in this review. Results are

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summarized in Table 1. An expanded version of this table is provided as a supplementary file. It augments the information below with the title of each study, and study characteristics such as the study design, and data sources.

Table 1. Summarized facilitators and barriers identified in the literature

An analysis of the articles in the systematic literature review revealed multiple facilitators and barriers to adopting an EHR. The review's focus was on LTC facility facilitators and barriers. The facilitators to adoption included ease of access to information, error reduction, long-run cost savings, efficiency, and information security. The barriers to adaptation included increasing costs, users' negative perception, cultural changes, lack of proper training, and lack of implementation proper planning.

Facilitators

The determined facilitators associated with EHR adoption were: access and transfer of information, long-run cost savings, error reduction, clinical and administrative efficiency, project planning, security, user perceptions, facility characteristics, health outcomes, time savings, and staff retention. The facilitators also have narrowed subsections throughout the articles. The benefits LTC facilities faced after adopting EHRs are connected to the facilitators. For example, facilities realized an ability to get to patient records quickly and easily, which is related to access and transfer of information.[7,8,15] Cost savings looked at the long-run facility savings and how an EHR is an investment with benefits that take time to realize.[23,24] Error reduction was another benefit of using EHRs, expressed as fewer prescription errors, more patient medication and allergy alerts, and more overall health safeguards.[8,9,20] Efficiency enabled rapid information

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exchange through administrative channels, improved productivity and consistency, and better communication between clinical and administrative departments.[9-11,15,20]

Barriers

The barriers varied in topic specification. The broad categories determined from the literature review were: cost savings, user perception, implementation issues, external factors, training, facility characteristics, cultural change, project planning, security, staff retention, and system issues. Each broader category has sub-issues that LTC facilities face during EHR adoption.

Of the sub-issues, cost barriers were a consistent concern because adopting and implementing an EHR requires a substantial initial investment. Other cost concerns stem from the lack of funding for LTC facilities, future upgrades, and maintenance that will be necessary to successfully use the EHR.[8,13]

User perception barriers included issues with professional and public acceptance of the new system as well as functionality problems.[8-10] Implementation barriers were lack of complete understanding from the staff, too little training during and after implementation, and lack of time for implementation and understanding.[5,6,14,20] The external factors that present implementation problems were employee recruitment, lack of industry standards, facility location, and impact on the population.[5,14,15]These facilitators and barriers are summarized in Table 2.

Table 2. Factors identified in the literature

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DISCUSSION

Many factors determine the adoption of EHR technology in LTC facilities. The authors found the cost, perceptions, and implementation process as the most significant factors that affect EHR adoption by LTC facilities. By considering these factors and the degree to which a facility can manipulate them, it may be possible to increase EHR use among LTC facilities to create better outcomes, reduce costs, and increase coordination of care.

Population

The rapid increase in long-term care residency exemplifies the need for facilities to be efficient, coordinated, and have good patient outcomes. Quality measures would increase if EHRs were more prevalent in LTC facilities, but vendors' main focus is creating acute care EHRs;[10,21] which make current EHRs impractical for most LTC facilities.[10,11,23] The adoption rate could increase if there were standardization in the EHR market,[10] which would make systems easier to use across different facilities.

Vendors would benefit from connecting with long-term care leaders to understand how EHRs fit long-term care strategic planning. A useful EHR helps LTC facilities improve quality, reduce errors, aids with billing and reimbursement, increases employee satisfaction, and may also increase employee retention.[6,8,13] Long-term care facilities need EHRs that are interoperable with other hospital systems so transfers and coordination of care become easier and have less errors. Vendors would benefit from understanding how LTC facilities use EHRs and how to make them more compatible for long-term care needs.

Cost

The cost of implementing the EHR was the most prevalent barrier. Many facilities may reject acquiring or installing an EHR because the initial cost is so high[5-15] and maintaining and

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upgrading the EHR may also be too costly.[10,13,20] Lack of initial capital could inhibit the first step of considering adopting an EHR. There was a general theme that if LTC facilities had funding, they could become meaningful EHR users more quickly. While cost is a barrier, it is important to point out that many studies stressed the need for LTC facilities to be coordinated with acute care hospitals to run more efficiently and productively. Finding the money required to execute an EHR is critical to LTC facilities gaining the information it needs to make improved clinical decisions.

Cost was a running topic among many studies because the HITECH Act's meaningful use incentives do not include LTC facilities. Long-term care facilities lack the ability to participate the HITECH incentive program, yet there is a gap in research that explores different funding alternatives for long-term care.

Perceptions

Another major factor that determines if an EHR will be adopted by a LTC facility is the administrative and clinical user perceptions.[5,8,10,13-15,20,25] Perception can manifest as something that can hinder or help EHR adoption at LTC facilities. Rejecting an EHR may be due to a lack of understanding about the user benefits,[8] which might be connected to fear of change.[13] The perception that an EHR system will simply not be useful could also be a result of marketing shortfalls on the part of EHR vendors. Lack of usefulness may also result from not effectively implementing the system and failing to achieve expected benefits. However, concerns that the system will be difficult to use can be addressed by selecting a system with a focus on user interfaces. Furthermore, misunderstanding EHR benefits may lead to a perception that using this technology will reduce the amount of time physicians and nurses spend with residents.[15,20,25] A

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surprising finding was that the negative impact providers perceived was due to a lack of training.[6,14,15]

Training helps change negative perceptions and increases the likelihood of adopting an EHR; a theme among some articles was that initial, follow-up, and ongoing training is the best method to ensure broad EHR acceptance.[8,14,15] Training could also help people who lack general computer skills, documentation skills, and people who may find the systems difficult to navigate.[25] Having the funds to conduct proper training will determine whether users can learn to accept the new system, which further stresses the need for funding.

Administrators' perceptions about the changing regulatory and competitive long-term care environment may present some EHR adoption opportunities. Reasons facilities chose to adopt an EHR include anticipation about increases in the regulatory environment and changes to reimbursement.[4,13] Some nursing home administrators feared increased regulations in the industry, and this prompted EHR adoption to prepare for a possible mandate.[13] Others chose to adopt EHRs due to emerging payment methods, such as bundled payments, which require better coordination of care with outside entities to receive higher reimbursements.[4] The competitive long-term care environment steered some organizations to adopt EHRs to emulate competitors' EHR success.[13] The competitive advantage of EHRs should be explained to decision-makers so they can confidently adopt the systems. Additionally, policymakers must offer incentives along with the increases in regulations and changes in reimbursement; unfunded mandates would degrade EHR perceptions in long-term care.

Implementation

Adopting an EHR relies heavily on the execution of the implementation process. Many studies pointed to having a strategic plan that accounts for the size, governance, costs, facility

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needs, and regulatory requirements of the internal and external environments.[8,10,13,14] Also significant is having the right people to implement the system; this should include a committee, strong leadership, trainers, and the right vendor. Creating a successful implementation plan could make or break the EHR project. Some facilities found not having long-term care industry standards was a barrier to adoption because they did not have a benchmark to use for an implementation plan.[6,14] This finding's implication is a need to involve interest groups to create industry standards to help LTC facilities adopt EHRs in the future.

Facilitators

Long-term care facilities may begin to realize the on-going benefits of EHR adoption after an organization weighs the EHR adoption barriers, determines whether it aligns with the strategic plan, and decides to make the steps to implementation. The facilitator's overarching theme was an ultimate increase in efficiency for the entire organization. This finding is interesting because the path to implementing an EHR can disrupt business in the beginning stages by taking time to train employees, integrate information, as well as cost the facility ample money. If decision-makers prioritize EHR adoption with an implementation plan, then the organization is more likely to realize facilitators like cost savings, better transfer of information, and error reduction.

Decision-makers should recognize the EHR facilitators, find ways to overcome the initial costs, and rely on research that indicates recognizable savings of successful system implementation. As with all decisions, there are costs and benefits to LTC facilities widely adopting EHRs, but the research suggests EHRs may soon be heavily utilized, and adopting one now could help prepare staff and residents for this inevitable change.

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Limitations

This paper provides a review of current and comprehensive data about EHR adoption factors for LTC facilities, and will help those facilities understand the costs and benefits of adopting an EHR system.

This study generalized all LTC facilities together, which bolsters the study's external validity because many of the articles also conducted research this way. Long-term care facilities can be lumped together because they all lack HITECH incentives. The differences between the facilities are size, location, and reimbursement structure. The authors found different facilities adopted EHRs at various rates, but the difference was not relevant to this study's results because all LTC facilities have similar obstacles to adoption.

The lack of evidence written about EHR adoption among LTC facilities and the search database limits led to the exhaustive nature of adoption factors of the study. This study was limited to only current research, which helped create a comparison for LTC facilities that want to implement an EHR in today's environment.

Conclusions

It is important to examine factors affecting EHR adoption in LTC facilities because those facilities do not receive HITECH incentives. This study identified numerous facilitating factors and barriers through a systematic review of current articles in three scholarly databases. This information can be useful for decision-makers attempting successful EHR adoption in their LTC facility, policymakers trying to increase adoption rates without expanding incentives, and vendors who wish to create EHRs that coordinate with long-term care.

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Authors provided equal contribution to the final product. The topic originated as directed research for a class for a Masters in Health Administration. The research was intended as both instructional on the topic and on writing for journals for publication. Dr.s Kruse and Mileski provided guidance, advice, and independent analysis to validate that of the graduate students.

COMPETING INTERESTS

Conflicts of interest: None declared

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MISCELENEOUS DECLARATION

There were neither humans nor animals used as subjects of this research. In accordance with 45CFR46, this research qualifies as IRB Exempt.

DATA SHARING STATEMENT

There was no sharing of data. All research used was original. This research was originally submitted to the U.S. Journal of American Medical Informatics Association, but it was rejected. The review was rewritten based on input from reviewers from JAMIA. No portion of this research is currently with another publisher, nor has any of the research been published.

FIGURE LEGEND

Figure 1: Illustration of the manuscript-selection process for the review

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Table 1: Results from the review of the literature.

Authors	Facilitators	Barriers
Wolf L, Harvell J, Jha AK. (2012).[4]	• Emerging payment methods could encourage EHR adoption. • "Quality Improvement Organizations" may increase adoption because they provide technical support that many LTC facilities need.	• HITECH incentives only focus on acute care and primary physicians. • Expanding the incentives to LTC facilities may be too costly.
Wang T, Biedermann S. (2012).[5]	• Anticipating state and federal requirements. • Good communication between vendors and LTC facilities. • Education and training programs.	• Lack of initial investment resources. • No technical infrastructure. • Not enough time to implement the EHR. • Lack of space for the new system.
Resnick H, et al. (2009).[6]	• Error reduction. • Quality. • Efficiency. • Better health outcomes.	• Cost. • Complex systems (implementation). • No standards (external).
Davidson J. (2009).[7]	• Comprehensive implementation planning. • Governmental initiatives. • Management and staff support. •	• Cost. • Privacy issues. • Incorrect vendor.
Hamid F, Cline TW. (2013).[8]	• EHR satisfaction increases when the users understand the benefits. • Supportive management. • Training programs.	• Cost. • Perceived lack of usefulness. • Time consuming.
Alexander G, Madsen R. (2009).[9]	• Improve clinical decision making. • Earlier intervention. • Time savings.	• IT sophistication negatively correlated with detection of detection of incontinence (implementation issue?)
Phillips K, Wheeler C, Campbell J, et al. (2010).[10]	• Government financial incentives. • Reduced errors and adverse drug events. • Including users in the design and implementation process.	• Adoption costs. • Efficiency outcomes were inconsistent. • Incongruent cost savings. • Lack of interoperability. • Fear of changing the facility culture.
Wilkins M. (2009).[11]	• Training and learning the system increases adoption. • Understanding the usefulness of the EHR technology.	• Facility size. • Lack of change agents or leaders in the facility. • Lack of interoperability. • Cost. • Resistance to change.
Filipova AA.	• Federal and state government	• Financial barriers like no

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Authors	Facilitators	Barriers
(2013).[12]	incentives or policy initiatives could offset financial barriers. • Aligning organizational strategic plans could also encourage adoption.	capital to implement an EHR and the cost of hardware and infrastructure. • Organizational barriers. • Legal and regulatory barriers. • Technological barriers. • Network barriers.
Bezboruah KC, Hamann, DJ, Smith JD. (2014).[13]	• Institutional pressure like anticipated regulations and competition pressures increase EHR adoption.	• Cost of the electronic system and projected upgrades. • Leaders perceiving staff's resistance to change. • Misunderstanding how EHRs could be useful or not having enough information to chose the right system.
Cherry B. (2011).[14]	• Fast-growing elder populations mean quality of care in LTC facilities must be addressed with EHRs. • A strong implementation plan within the facility that aligns with strategic plans. • Initial and follow-up training programs. • A perception shift about the benefits of EHR adoption.	• Cost and a lack of capital resources. • Lack of industry standards. • Complicated implementation processes. • Lack of technical support. • Not enough evidence to support EHR's proposed benefits.
Grabenbauer L, Skinner A, Windle J. (2011).[15]	• Improved communication. • Patient data access and sharing.	• Cost. • Reduced time with patients. • Currently EHRs do not impact population health.
Cherry B, Ford E, Peterson L. (2011).[20]	• Rapid patient record retrieval. • Better document consistency, quality, and accuracy. • Improvements in employee satisfaction and retention. • Better patient assessments, oversight, and order processing. • Better time management.	• Technology and maintenance problems like downtime or learning the new system. • Residents thought providers were more focused on the computers than on them.
Tabar P. (2013).[23]	• Perceptions are changing in long-term care; EHRs are becoming a cost of doing business.	• Most EHRs were built for acute care and LTC facilities had trouble finding a system that met the organization's needs.
Vendor Group Develops EHR	• Cost reductions. • Improve patient outcomes.	

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Authors	Facilitators	Barriers
Code of Conduct. (2013).[24]	• State programs could help fund a facility's EHR adoption.	
Yu P, Zhang Y, Gong Y, et al. (2013).[25]	• Continuous training. • Open dialogue with vendors. • Balancing EHR accuracy with patient care. • Facilities should have all paper or all electronic systems.	• Staff resisted the new system because personal perceptions about their age, lack of documentation skills, or other reasons created limitations. • Information management became too difficult and documents lacked consistency. • Providers complained about spending less time with residents.
Hamann DJ, Bezboruah KC. (2013).[26]	• Nonprofit facilities were 40% more likely to adopt EHRs. • Nonprofits have more regulations, so may need the benefits of EHRs.	• For-profit facilities lagged behind in EHR adoption rates. • Fewer regulations enable for-profit facilities to invest in cost-effective endeavors and avoid the expense of EHR implementation.
Vest JR, Yoon J, Bossak BH. (2013).[27]	• More EHR vendors. • Trends show electronic record use is on the rise. • Meaningful use makes EHRs more prevalent.	• Lagging widespread EHR adoption. • Misaligned incentives.
Weaver S. (2011).[28]	• Error reduction (quality). • Improved efficiency. • Consumer (user) perceptions • Improved health outcomes	• Difficulties transitioning from paper to EHR. (Implementation .) • Training becomes paramount.
Gruber N, Darragh J, Puccia P, et al. (2010).[29]	• Strong implementation team. • Train and prepare all users. • Have ample space for training. • Communicate often and thoroughly. • Set goals, tasks, and schedules for the implementation. • Reduced errors. • Improved documentation.	• Minor increases in operating expenses.
Holup AA, Dobbs D, Temple A, et al. (2014).[30]	• Rapidly aging populations stresses the need to create interoperable, coordinated EHRs for LTC facilities.	• Long-term care EHRs are not as comprehensive as acute care EHRs.
Holup AA, Dobbs D, Meng H, et al. (2013).[31]	• Created better health outcomes. • Reduced extra costs. • Improved delivery and quality.	• High initial investment means slower adoption in facilities that cannot afford

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Authors	Facilitators	Barriers
	• An increasing elder population makes implementing EHRs a necessity. • Nonprofits were more likely to utilize EHRs.	the EHR system, which slows the rate of becoming better integrated with acute care. • Facility characteristics determine EHR adoption.

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Table 2: Affinity matrix identifying frequency of factors listed in the literature

Factors	Total Occurrences
Facilitators	
Error Reduction	7
Clinical & Administrative Efficiency	7
Cost Savings	6
Health Outcomes	6
Access and Transfer to Information	5
Project Planning	4
User Perceptions	4
Security	3
Facility Characteristics	3
Time Saving	3
Barriers	
Cost	10
User Perceptions	8
Implementation Issues	8
External Factors	6
Training	5
Facility Characteristics	4
Cultural Change	2
Project Planning	2
Security	2
Staff Retention	1
System Issues	1

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Adoption Factors Associated with Electronic Health Record among Long-Term Care Facilities – A Systematic Review

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ABSTRACT

Objectives: The Health Information Technology for Economic and Clinical Health (HITECH) Act created incentives for adopting electronic health records (EHRs) for some healthcare organizations, but long-term care (LTC) facilities are excluded from those incentives. There are realizable benefits of EHR adoption in LTC facilities; however, there is limited research about this topic. The purpose of this systematic literature review is to identify EHR adoption factors for LTC facilities that are ineligible for the HITECH Act incentives.

Setting: We conducted systematic searches of Cumulative Index of Nursing and Allied Health Literature (CINAHL) Complete via Ebson B. Stephens Company (EBSCO Host), Google Scholar, and the university library search engine to collect data about EHR adoption factors in LTC facilities since 2009.

Participants: Search results were filtered by date range, full text, English language, and academic journals (n = 22).

Interventions: Multiple members of the research team read each article to confirm applicability and study conclusions.

Primary and secondary outcome measures: Researchers identified common themes across the literature: specifically facilitators and barriers to adoption of the EHR in LTC.

Results: Results identify facilitators and barriers associated with EHR adoption in LTC facilities. The most common facilitators include access to information and error reduction. The most prevalent barriers include initial costs, user perceptions, and implementation problems.

Conclusions: Similarities span the system selection phases and implementation process; of those, cost was the most common mentioned. These commonalities should help leaders in LTC facilities align strategic decisions to EHR adoption. This review may be useful for decision-

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makers attempting successful EHR adoption, policymakers trying to increase adoption rates without expanding incentives, and vendors that produce EHRs. **Background:** The Health Information Technology for Economic and Clinical Health (HITECH) Act created incentives for adopting electronic health records (EHRs) for some healthcare organizations, but long-term care (LTC) facilities are excluded from those incentives. There are realizable benefits of EHR adoption in LTC facilities; however, there is limited research about this topic.

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STRENGTHS AND LIMITATIONS OF THIS STUDY

This systematic review has several strengths and limitations, as detailed below.

Strengths

- Adds to a body of knowledge of EHR adoption.
- Contributes toward EHR adoption in LTC.
- Provides a systematic review, in accordance with PRISMA.
- Queries three well known research databases.
- Queries use key terms registered with MeSH.
- Multiple reviewers determined inclusion and exclusion criteria.

Limitations

- Only five years were examined.
- An objective assessment of study bias was not conducted in this review.
- Selection bias will always exist in subjective decisions (inclusion criteria). Controls for selection bias were enacted: more than one author had to recommend that an article be included in the study. The identification of both enablers and barriers followed the same rule.

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INTRODUCTION, BACKGROUND & SIGNIFICANCE

Incentives

The Health Information Technology for Economic and Clinical Health (HITECH) Act of the American Recovery and Reinvestment Act (ARRA) of 2009 created reimbursement incentives for U.S. healthcare organizations that are using EHRs in meaningful ways.[1] Long-term care facilities (as defined by the ARRA) are facility types excluded from the incentives including: skilled nursing homes, assisted living facilities, LTC hospitals, rehabilitation hospitals, and psychiatric hospitals. Unfortunately, there has been no clear communication regarding reasons why "ineligible providers" have been excluded from the incentives under the ARRA. This is despite a relatively large body of evidence showing that there is value in the use of EHR in long-term care settings where it not only improves resident care, but also increases communications between providers, consultants, hospital, and nursing home staff.[2] There is documentation that exists which alludes to Congress wanting to understand the extent to which ineligible providers work in settings which might receive EHR incentives under the ARRA.[3] However, it should be noted that eligible providers (physicians for instance) were able to assign their incentive funding to a facility of their choice (whether or not that facility was an eligible provider), but no evidence exists to the extent of this assignment in the literature or to whom.[3] This represents not only a potentially large amount of untrackable incentive funds under the ARRA, but also a source of statistical interference when "meaningful use" is assessed.

While facilities eligible for these incentives demonstrate EHR adoption rates of about 12%, ineligible facilities have adoption rates of only 2-4%.[4] Incentives and grants from the HITECH Act are clearly a major motivating factor for EHR adoption;[5] however, LTC facilities must bear the adoption costs on their own, which represents a significant barrier.[5-15]

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Identification and definition of key terms

The American College of Hospital Executives (ACHE) defines long-term care as "a continuum of medical and social services designed to support the needs of people living with chronic health problems that affect their ability to perform everyday activities." Long-term care spans a continuum of "traditional medical services, social services, and housing". Services in long-term care have a significantly different aim than traditional acute care services. While acute-care services aim to restore the patient to health, long-term care "aims to prevent deterioration and promote social adjustment to stages of decline" and it is delivered through a wide range of care givers and environments both in a healthcare facility and at home.[16] A large majority (92%) of long-term care facilities are privately owned and operated. The aging of the population creates an ever-increasing shortage of LTC beds per 1000 people 65 and over. Estimates show this trend will continue until the year 2030 with the percentage of persons 65 or over ballooning to 19% of the population.[17] The broad definition from the ACHE could encompass a wider range than necessary for the purposes of this research. The research question we posited would only be appropriate for health care organizations that would have a use for the EHR. While we think that an EHR would be beneficial at all levels of care to compensate for the lack of a provider of continuity between levels of care, we also look pragmatically at the cost versus the benefit. Because funding for an EHR would come from each independent health care organization in the U.S., ~~An~~ an assisted-living facility in the U.S. would ~~have little use~~not have a significant need for an EHR that manages a patient's entire continuum of care; ~~, when~~ the facility may only need to manage something as small as medication or diet, which would not justify the millions of dollars to implement an EHR solution. Those with the greatest need for an EHR

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would be those that manage the chronic conditions like a nursing home, or Skilled Nursing Facility. ~~For the purposes of this study~~

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The taxonomy for the Electronic Health Record widely varies: digital medical record, computerized patient record, electronic medical record, digital medical record, etc. For the purposes of this study, the term EHR will be used exclusively to speak to the longitudinal and interoperable capabilities of an electronic medical record. This practice is supported by the World Health Organization (WHO).[18] The inherent advantages of the EHR are that it can enable any certified, credentialed provider to access any patient record from any health care organization, but the provider will only have access to the information necessary for the immediate incident of care. The EHR enables providers to see past history, allergies, and treatment regimens with trend analysis.[19]

In 2009, the US Government passed the American Recover and Reinvestment Act (ARRA), which included a significant section for healthcare intended to incentivize the adoption of the EHR. This section was called: Health Information Technology for Economic and Clinical Health (HITECH) Act.[1] The three phases of Meaningful Use consume IT strategies because of the HITECH Act's timeline for healthcare organizations to qualify for monetary incentives. Unfortunately, long-term care facilities were not included in these incentives.

EHR adoption among facilities

Long-term care facilities that have adopted EHRs experience improvements in quality of care, documentation access, billing and reimbursement, and employee satisfaction and retention rates.[5-15,20] Interoperable EHRs may be especially useful to LTC facilities during periods of transitional care, when coordination and communication with other healthcare organizations is critical to achieving the best health outcomes.[21] Electronic health records are becoming more

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important for LTC facilities because increased demand for services from aging baby-boomers is inevitable.[22] While eligible organizations have the benefit of incentives to mitigate some costs in attaining these benefits, LTC facilities must bear the full cost. There is a dearth of research available to help decision-makers at LTC facilities make objective conclusions about adopting EHRs, which is why this review is critical to future research.

EHR impact

It is important to identify the factors that influence EHR adoption in LTC facilities that are not dependent on HITECH incentive payments. This study's focus is to identify what those adoption factors are, as well as discern the multitude of barriers those facilities face. While it is clear that implementing an EHR system could bring many benefits to organizations, realizing those benefits in the beginning stages might not be possible for every LTC facility.

Objectives

The findings of this review will be useful to LTC facility administrators interested in adopting EHRs into their organization by helping them identify barriers to overcome and opportunities to lever. Policymakers may also find the identified factors useful when attempting to increase EHR adoption in the long-term care industry. Additionally, vendors can benefit from this article's information ~~so they can create~~to design EHRs that are more useful for LTC facilities.

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METHODS

Data

Data for this review were gathered using three separate databases: Google Scholar, Cumulative Index of Nursing and Allied Health Literature (CINAHL) Complete via EBSCO Host, and PubMed (which queries MEDLINE). Search criteria focused on EHR adoption in

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long-term care. ~~To avoid the bandwagon effect, t~~The authors independently reviewed the articles identified during the search and independently summarized findings germane to this review. Following independent reviews, authors compared and discussed the articles and reason for inclusion in the study. Articles were only included if selected by at least two reviewers. The comparable search criteria demonstrated the authors had a similar understanding of the research problem.

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Sample

Research databases were queried using terms from the Medical Subject Headings (MeSH) at the National Center for Biotechnology Information (NCBI). Although multiple terms appeared for the EHR, the only heading listed in MeSH for LTC was "long-term care." Several exclusion criteria were also specified: The authors began with broad database searches then narrowed the criteria to identify the most commonly mentioned factors listed in the articles. This method avoids excluding relevant data by too narrowly defining initial search criteria. Searches were limited to peer-reviewed journal articles in U.S.-based English language from 2009-2014 (n = 16). This process is illustrated by Figure 1.

Figure 1. An illustration of the literature review process

Searches continued until the results reached saturation by repeating information about costs, perceptions, and implementation.

RESULTS

Table of findings

The findings were summarized and inserted into the facilitators and barriers table after the authors chose articles to create the literature review. All duplicate articles were accounted for

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and consolidated before the findings table was created. The authors then reanalyzed the articles and identified the individual factors affecting EHR adoption in LTC facilities after the articles reached information saturation. These factors were then compiled into a frequency table to aid in the analysis. An objective assessment of study bias was not conducted in this review. Results are summarized in Table 1. An expanded version of this table is provided as a supplementary file. It augments the information below with the title of each study, and study characteristics such as the study design, and data sources.

Table 1. Summarized facilitators and barriers identified in the literature

Authors	Facilitators	Barriers
Wolf L, Harvell J, Jha AK. (2012).	• Emerging payment methods could encourage EHR adoption. • "Quality Improvement Organizations" may increase adoption because they provide technical support that many LTC facilities need.	• HITECH incentives only focus on acute care and primary physicians. • Expanding the incentives to LTC facilities may be too costly.
Wang T, Biedermann S. (2012).	• Anticipating state and federal requirements. • Good communication between vendors and LTC facilities. • Education and training programs.	• Lack of initial investment resources. • No technical infrastructure. • Not enough time to implement the EHR. • Lack of space for the new system.
Resnick H, et al. (2009).	• Error reduction. • Quality. • Efficiency. • Better health outcomes.	• Cost. • Complex systems (implementation). • No standards (external).
Davidson J. (2009).	• Comprehensive implementation planning. • Governmental initiatives. • Management and staff support. •	• Cost. • Privacy issues. • Incorrect vendor.
Hamid F, Cline TW. (2013).	• EHR satisfaction increases when the users understand the benefits. • Supportive management. • Training programs.	• Cost. • Perceived lack of usefulness. • Time consuming.
Alexander G, Madsen R. (2009).	• Improve clinical decision making. • Earlier intervention. • Time savings.	• IT sophistication negatively correlated with detection of detection of incontinence (implementation issue?)

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Authors	Facilitators	Barriers
Phillips K, Wheeler C, Campbell J, et al. (2010).	• Government financial incentives. • Reduced errors and adverse drug events. • Including users in the design and implementation process.	• Adoption costs. • Efficiency outcomes were inconsistent. • Incongruent cost savings. • Lack of interoperability. • Fear of changing the facility culture.
Wilkins M. (2009).	• Training and learning the system increases adoption. • Understanding the usefulness of the EHR technology.	• Facility size. • Lack of change agents or leaders in the facility. • Lack of interoperability. • Cost. • Resistance to change.
Filipova AA. (2013).	• Federal and state government incentives or policy initiatives could offset financial barriers. • Aligning organizational strategic plans could also encourage adoption.	• Financial barriers like no capital to implement an EHR and the cost of hardware and infrastructure. • Organizational barriers. • Legal and regulatory barriers. • Technological barriers. • Network barriers.
Bezboruah KC, Hamann, DJ, Smith JD. (2014).	• Institutional pressure like anticipated regulations and competition pressures increase EHR adoption.	• Cost of the electronic system and projected upgrades. • Leaders perceiving staff's resistance to change. • Misunderstanding how EHRs could be useful or not having enough information to chose the right system.
Cherry B. (2011).	• Fast-growing elder populations mean quality of care in LTC facilities must be addressed with EHRs. • A strong implementation plan within the facility that aligns with strategic plans. • Initial and follow-up training programs. • A perception shift about the benefits of EHR adoption.	• Cost and a lack of capital resources. • Lack of industry standards. • Complicated implementation processes. • Lack of technical support. • Not enough evidence to support EHR's proposed benefits.
Grabenbauer L, Skinner A, Windle J. (2011).	• Improved communication. • Patient data access and sharing.	• Cost. • Reduced time with patients. • Currently EHRs do not impact population health.
Cherry B, Ford E,	• Rapid patient record retrieval.	• Technology and

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Authors	Facilitators	Barriers
Peterson L. (2011).	• Better document consistency, quality, and accuracy. • Improvements in employee satisfaction and retention. • Better patient assessments, oversight, and order processing. • Better time management.	maintenance problems like downtime or learning the new system. • Residents thought providers were more focused on the computers than on them.
Tabar P. (2013).	• Perceptions are changing in long-term care; EHRs are becoming a cost of doing business.	• Most EHRs were built for acute care and LTC facilities had trouble finding a system that met the organization's needs.
Vendor Group Develops EHR Code of Conduct. (2013).	• Cost reductions. • Improve patient outcomes. • State programs could help fund a facility's EHR adoption.	
Yu P, Zhang Y, Gong Y, et al. (2013).	• Continuous training. • Open dialogue with vendors. • Balancing EHR accuracy with patient care. • Facilities should have all paper or all electronic systems.	• Staff resisted the new system because personal perceptions about their age, lack of documentation skills, or other reasons created limitations. • Information management became too difficult and documents lacked consistency. • Providers complained about spending less time with residents.
Hamann DJ, Bezboruah KC. (2013).	• Nonprofit facilities were 40% more likely to adopt EHRs. • Nonprofits have more regulations, so may need the benefits of EHRs.	• For-profit facilities lagged behind in EHR adoption rates. • Fewer regulations enable for-profit facilities to invest in cost-effective endeavors and avoid the expense of EHR implementation.
Vest JR, Yoon J, Bossak BH. (2013).	• More EHR vendors. • Trends show electronic record use is on the rise. • Meaningful use makes EHRs more prevalent.	• Lagging widespread EHR adoption. • Misaligned incentives.
Weaver S. (2011).	• Error reduction (quality). • Improved efficiency. • Consumer (user) perceptions • Improved health outcomes	• Difficulties transitioning from paper to EHR. (Implementation .) • Training becomes paramount.
Gruber N, Darragh	• Strong implementation team.	• Minor increases in

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Authors	Facilitators	Barriers
J, Puccia P, et al. (2010).	• Train and prepare all users. • Have ample space for training. • Communicate often and thoroughly. • Set goals, tasks, and schedules for the implementation. • Reduced errors. • Improved documentation.	operating expenses.
Holup AA, Dobbs D, Temple A, et al. (2014).	• Rapidly aging populations stresses the need to create interoperable, coordinated EHRs for LTC facilities.	• Long-term care EHRs are not as comprehensive as acute care EHRs.
Holup AA, Dobbs D, Meng H, et al. (2013).	• Created better health outcomes. • Reduced extra costs. • Improved delivery and quality. • An increasing elder population makes implementing EHRs a necessity. • Nonprofits were more likely to utilize EHRs.	• High initial investment means slower adoption in facilities that cannot afford the EHR system, which slows the rate of becoming better integrated with acute care. • Facility characteristics determine EHR adoption.

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An analysis of the articles in the systematic literature review revealed multiple facilitators and barriers to adopting an EHR. The review's focus was on LTC facility facilitators and barriers. The facilitators to adoption included ease of access to information, error reduction, long-run cost savings, efficiency, and information security. The barriers to adaptation included increasing costs, users' negative perception, cultural changes, lack of proper training, and lack of implementation proper planning.

Facilitators

The determined facilitators associated with EHR adoption were: access and transfer of information, long-run cost savings, error reduction, clinical and administrative efficiency, project planning, security, user perceptions, facility characteristics, health outcomes, time savings, and staff retention. The facilitators also have narrowed subsections throughout the articles. The benefits LTC facilities faced after adopting EHRs are connected to the facilitators. For example,

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facilities realized an ability to get to patient records quickly and easily, which is related to access and transfer of information.[7,8,15] Cost savings looked at the long-run facility savings and how an EHR is an investment with benefits that take time to realize.[23,24] Error reduction was another benefit of using EHRs, expressed as fewer prescription errors, more patient medication and allergy alerts, and more overall health safeguards.[8,9,20] Efficiency enabled rapid information exchange through administrative channels, improved productivity and consistency, and better communication between clinical and administrative departments.[9-11,15,20]

Barriers

The barriers varied in topic specification. The broad categories determined from the literature review were: cost savings, user perception, implementation issues, external factors, training, facility characteristics, cultural change, project planning, security, staff retention, and system issues. Each broader category has sub-issues that LTC facilities face during EHR adoption.

Of the sub-issues, cost barriers were a consistent concern because adopting and implementing an EHR requires a substantial initial investment. Other cost concerns stem from the lack of funding for LTC facilities, future upgrades, and maintenance that will be necessary to successfully use the EHR.[8,13]

User perception barriers included issues with professional and public acceptance of the new system as well as functionality problems.[8-10] Implementation barriers were lack of complete understanding from the staff, too little training during and after implementation, and lack of time for implementation and understanding.[5,6,14,20] The external factors that present implementation

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problems were employee recruitment, lack of industry standards, facility location, and impact on the population.[5,14,15] These facilitators and barriers are summarized in Table 2.

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Table 2. Factors identified in the literature

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Factors	Total Occurrences
Facilitators	
Error Reduction	7
Clinical & Administrative Efficiency	7
Cost Savings	6
Health Outcomes	6
Access and Transfer to Information	5
Project Planning	4
User Perceptions	4
Security	3
Facility Characteristics	3
Time Saving	3
Barriers	
Cost	10
User Perceptions	8
Implementation Issues	8
External Factors	6
Training	5
Facility Characteristics	4
Cultural Change	2
Project Planning	2
Security	2
Staff Retention	1
System Issues	1

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DISCUSSION

Many factors determine the adoption of EHR technology in LTC facilities. The authors found the cost, perceptions, and implementation process as the most significant factors that affect EHR adoption by LTC facilities. By considering these factors and the degree to which a facility can manipulate them, it may be possible to increase EHR use among LTC facilities to create better outcomes, reduce costs, and increase coordination of care.

Population

The rapid increase in long-term care residency exemplifies the need for facilities to be efficient, coordinated, and have good patient outcomes. Quality measures would increase if EHRs were more prevalent in LTC facilities, but vendors' main focus is creating acute care EHRs;[10,21] which make current EHRs impractical for most LTC facilities.[10,11,23] The adoption rate could increase if there were standardization in the EHR market,[10] which would make systems easier to use across different facilities.

Vendors would benefit from connecting with long-term care leaders to understand how EHRs fit long-term care strategic planning. A useful EHR helps LTC facilities improve quality, reduce errors, aids with billing and reimbursement, increases employee satisfaction, and may also increase employee retention.[6,8,13] Long-term care facilities need EHRs that are interoperable with other hospital systems so transfers and coordination of care become easier and have less errors. Vendors would benefit from understanding how LTC facilities use EHRs and how to make them more compatible for long-term care needs.

Cost

The cost of implementing the EHR was the most prevalent barrier. Many facilities may reject acquiring or installing an EHR because the initial cost is so high[5-15] and maintaining and

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upgrading the EHR may also be too costly.[10,13,20] Lack of initial capital could inhibit the first step of considering adopting an EHR. There was a general theme that if LTC facilities had funding, they could become meaningful EHR users more quickly. While cost is a barrier, it is important to point out that many studies stressed the need for LTC facilities to be coordinated with acute care hospitals to run more efficiently and productively. Finding the money required to execute an EHR is critical to LTC facilities gaining the information it needs to make improved clinical decisions.

Cost was a running topic among many studies because the HITECH Act's meaningful use incentives do not include LTC facilities. Long-term care facilities lack the ability to participate the HITECH incentive program, yet there is a gap in research that explores different funding alternatives for long-term care.

Perceptions

Another major factor that determines if an EHR will be adopted by a LTC facility is the administrative and clinical user perceptions.[5,8,10,13-15,20,25] Perception can manifest as something that can hinder or help EHR adoption at LTC facilities. Rejecting an EHR may be due to a lack of understanding about the user benefits,[8] which might be connected to fear of change.[13] The perception that an EHR system will simply not be useful could also be a result of marketing shortfalls on the part of EHR vendors. Lack of usefulness may also result from not effectively implementing the system and failing to achieve expected benefits. However, concerns that the system will be difficult to use can be addressed by selecting a system with a focus on user interfaces. Furthermore, misunderstanding EHR benefits may lead to a perception that using this technology will reduce the amount of time physicians and nurses spend with residents.[15,20,25] A

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surprising finding was that the negative impact providers perceived was due to a lack of training.[6,14,15]

Training helps change negative perceptions and increases the likelihood of adopting an EHR; a theme among some articles was that initial, follow-up, and ongoing training is the best method to ensure broad EHR acceptance.[8,14,15] Training could also help people who lack general computer skills, documentation skills, and people who may find the systems difficult to navigate.[25] Having the funds to conduct proper training will determine whether users can learn to accept the new system, which further stresses the need for funding.

Administrators' perceptions about the changing regulatory and competitive long-term care environment may present some EHR adoption opportunities. Reasons facilities chose to adopt an EHR include anticipation about increases in the regulatory environment and changes to reimbursement.[4,13] Some nursing home administrators feared increased regulations in the industry, and this prompted EHR adoption to prepare for a possible mandate.[13] Others chose to adopt EHRs due to emerging payment methods, such as bundled payments, which require better coordination of care with outside entities to receive higher reimbursements.[4] The competitive long-term care environment steered some organizations to adopt EHRs to emulate competitors' EHR success.[13] The competitive advantage of EHRs should be explained to decision-makers so they can confidently adopt the systems. Additionally, policymakers must offer incentives along with the increases in regulations and changes in reimbursement; unfunded mandates would degrade EHR perceptions in long-term care.

Implementation

Adopting an EHR relies heavily on the execution of the implementation process. Many studies pointed to having a strategic plan that accounts for the size, governance, costs, facility

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needs, and regulatory requirements of the internal and external environments.[8,10,13,14] Also significant is having the right people to implement the system; this should include a committee, strong leadership, trainers, and the right vendor. Creating a successful implementation plan could make or break the EHR project. Some facilities found not having long-term care industry standards was a barrier to adoption because they did not have a benchmark to use for an implementation plan.[6,14] This finding's implication is a need to involve interest groups to create industry standards to help LTC facilities adopt EHRs in the future.

Facilitators

Long-term care facilities may begin to realize the on-going benefits of EHR adoption after an organization weighs the EHR adoption barriers, determines whether it aligns with the strategic plan, and decides to make the steps to implementation. The facilitator's overarching theme was an ultimate increase in efficiency for the entire organization. This finding is interesting because the path to implementing an EHR can disrupt business in the beginning stages by taking time to train employees, integrate information, as well as cost the facility ample money. If decision-makers prioritize EHR adoption with an implementation plan, then the organization is more likely to realize facilitators like cost savings, better transfer of information, and error reduction.

Decision-makers should recognize the EHR facilitators, find ways to overcome the initial costs, and rely on research that indicates recognizable savings of successful system implementation. As with all decisions, there are costs and benefits to LTC facilities widely adopting EHRs, but the research suggests EHRs may soon be heavily utilized, and adopting one now could help prepare staff and residents for this inevitable change.

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Limitations

This paper provides a review of current and comprehensive data about EHR adoption factors for LTC facilities, and will help those facilities understand the costs and benefits of adopting an EHR system.

This study generalized all LTC facilities together, which bolsters the study's external validity because many of the articles also conducted research this way. Long-term care facilities can be lumped together because they all lack HITECH incentives. The differences between the facilities are size, location, and reimbursement structure. The authors found different facilities adopted EHRs at various rates, but the difference was not relevant to this study's results because all LTC facilities have similar obstacles to adoption.

The lack of evidence written about EHR adoption among LTC facilities and the search database limits led to the exhaustive nature of adoption factors of the study. This study was limited to only current research, which helped create a comparison for LTC facilities that want to implement an EHR in today's environment.

Conclusions

It is important to examine factors affecting EHR adoption in LTC facilities because those facilities do not receive HITECH incentives. This study identified numerous facilitating factors and barriers through a systematic review of current articles in three scholarly databases. This information can be useful for decision-makers attempting successful EHR adoption in their LTC facility, policymakers trying to increase adoption rates without expanding incentives, and vendors who wish to create EHRs that coordinate with long-term care.

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~~There are no conflicts of interest identified between the authors, results, or publication.~~

~~There were neither humans nor animals used as subjects of this research. In accordance with 45CFR46, this research qualifies as IRB Exempt.~~

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ACKNOWLEDGEMENTS & STATEMENT OF CONTRIBUTION

Authors provided equal contribution to the final product. The topic originated as directed research for a class for a Masters in Health Administration. The research was intended as both instructional on the topic and on writing for journals for publication. Dr.s Kruse and Mileski provided guidance, advice, and independent analysis to validate that of the graduate students.

COMPETING INTERESTS

Conflicts of interest: None declared

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FIGURE LEGEND

Figure 1: Illustration of the manuscript-selection process for the review

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Table 1: Results from the review of the literature.

Authors	Facilitators	Barriers
Wolf L, Harvell J, Jha AK. (2012).[4]	• Emerging payment methods could encourage EHR adoption. • "Quality Improvement Organizations" may increase adoption because they provide technical support that many LTC facilities need.	• HITECH incentives only focus on acute care and primary physicians. • Expanding the incentives to LTC facilities may be too costly.
Wang T, Biedermann S. (2012).[5]	• Anticipating state and federal requirements. • Good communication between vendors and LTC facilities. • Education and training programs.	• Lack of initial investment resources. • No technical infrastructure. • Not enough time to implement the EHR. • Lack of space for the new system.
Resnick H, et al. (2009).[6]	• Error reduction. • Quality. • Efficiency. • Better health outcomes.	• Cost. • Complex systems (implementation). • No standards (external).
Davidson J. (2009).[7]	• Comprehensive implementation planning. • Governmental initiatives. • Management and staff support. •	• Cost. • Privacy issues. • Incorrect vendor.
Hamid F, Cline TW. (2013).[8]	• EHR satisfaction increases when the users understand the benefits. • Supportive management. • Training programs.	• Cost. • Perceived lack of usefulness. • Time consuming.
Alexander G, Madsen R. (2009).[9]	• Improve clinical decision making. • Earlier intervention. • Time savings.	• IT sophistication negatively correlated with detection of detection of incontinence (implementation issue?)
Phillips K, Wheeler C, Campbell J, et al. (2010).[10]	• Government financial incentives. • Reduced errors and adverse drug events. • Including users in the design and implementation process.	• Adoption costs. • Efficiency outcomes were inconsistent. • Incongruent cost savings. • Lack of interoperability. • Fear of changing the facility culture.

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Authors	Facilitators	Barriers
Wilkins M. (2009).[11]	• Training and learning the system increases adoption. • Understanding the usefulness of the EHR technology.	• Facility size. • Lack of change agents or leaders in the facility. • Lack of interoperability. • Cost. • Resistance to change.
Filipova AA. (2013).[12]	• Federal and state government incentives or policy initiatives could offset financial barriers. • Aligning organizational strategic plans could also encourage adoption.	• Financial barriers like no capital to implement an EHR and the cost of hardware and infrastructure. • Organizational barriers. • Legal and regulatory barriers. • Technological barriers. • Network barriers.
Bezboruah KC, Hamann, DJ, Smith JD. (2014).[13]	• Institutional pressure like anticipated regulations and competition pressures increase EHR adoption.	• Cost of the electronic system and projected upgrades. • Leaders perceiving staff's resistance to change. • Misunderstanding how EHRs could be useful or not having enough information to chose the right system.
Cherry B. (2011).[14]	• Fast-growing elder populations mean quality of care in LTC facilities must be addressed with EHRs. • A strong implementation plan within the facility that aligns with strategic plans. • Initial and follow-up training programs. • A perception shift about the benefits of EHR adoption.	• Cost and a lack of capital resources. • Lack of industry standards. • Complicated implementation processes. • Lack of technical support. • Not enough evidence to support EHR's proposed benefits.
Grabenbauer L, Skinner A, Windle J. (2011).[15]	• Improved communication. • Patient data access and sharing.	• Cost. • Reduced time with patients. • Currently EHRs do not impact population health.
Cherry B, Ford E.	• Rapid patient record retrieval.	• Technology and

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Authors	Facilitators	Barriers
Peterson L. (2011).[20]	• Better document consistency, quality, and accuracy. • Improvements in employee satisfaction and retention. • Better patient assessments, oversight, and order processing. • Better time management.	maintenance problems like downtime or learning the new system. • Residents thought providers were more focused on the computers than on them.
Tabar P. (2013).[23]	• Perceptions are changing in long-term care; EHRs are becoming a cost of doing business.	• Most EHRs were built for acute care and LTC facilities had trouble finding a system that met the organization's needs.
Vendor Group Develops EHR Code of Conduct. (2013).[24]	• Cost reductions. • Improve patient outcomes. • State programs could help fund a facility's EHR adoption.	
Yu P, Zhang Y, Gong Y, et al. (2013).[25]	• Continuous training. • Open dialogue with vendors. • Balancing EHR accuracy with patient care. • Facilities should have all paper or all electronic systems.	• Staff resisted the new system because personal perceptions about their age, lack of documentation skills, or other reasons created limitations. • Information management became too difficult and documents lacked consistency. • Providers complained about spending less time with residents.
Hamann DJ, Bezboruah KC. (2013).[26]	• Nonprofit facilities were 40% more likely to adopt EHRs. • Nonprofits have more regulations, so may need the benefits of EHRs.	• For-profit facilities lagged behind in EHR adoption rates. • Fewer regulations enable for-profit facilities to invest in cost-effective endeavors and avoid the expense of EHR implementation.
Vest JR, Yoon J, Bossak BH. (2013).[27]	• More EHR vendors. • Trends show electronic record use is on the rise. • Meaningful use makes EHRs more prevalent.	• Lagging widespread EHR adoption. • Misaligned incentives.

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Authors	Facilitators	Barriers
Weaver S. (2011).[28]	• Error reduction (quality). • Improved efficiency. • Consumer (user) perceptions • Improved health outcomes	• Difficulties transitioning from paper to EHR. (Implementation .) • Training becomes paramount.
Gruber N, Darragh J, Puccia P, et al. (2010).[29]	• Strong implementation team. • Train and prepare all users. • Have ample space for training. • Communicate often and thoroughly. • Set goals, tasks, and schedules for the implementation. • Reduced errors. • Improved documentation.	• Minor increases in operating expenses.
Holup AA, Dobbs D, Temple A, et al. (2014).[30]	• Rapidly aging populations stresses the need to create interoperable, coordinated EHRs for LTC facilities.	• Long-term care EHRs are not as comprehensive as acute care EHRs.
Holup AA, Dobbs D, Meng H, et al. (2013).[31]	• Created better health outcomes. • Reduced extra costs. • Improved delivery and quality. • An increasing elder population makes implementing EHRs a necessity. • Nonprofits were more likely to utilize EHRs.	• High initial investment means slower adoption in facilities that cannot afford the EHR system, which slows the rate of becoming better integrated with acute care. • Facility characteristics determine EHR adoption.

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Table 2: Affinity matrix identifying frequency of factors listed in the literature

Factors	Total Occurrences
Facilitators	
Error Reduction	7
Clinical & Administrative Efficiency	7
Cost Savings	6
Health Outcomes	6
Access and Transfer to Information	5
Project Planning	4
User Perceptions	4
Security	3
Facility Characteristics	3
Time Saving	3
Barriers	
Cost	10
User Perceptions	8
Implementation Issues	8
External Factors	6
Training	5
Facility Characteristics	4
Cultural Change	2
Project Planning	2
Security	2
Staff Retention	1
System Issues	1

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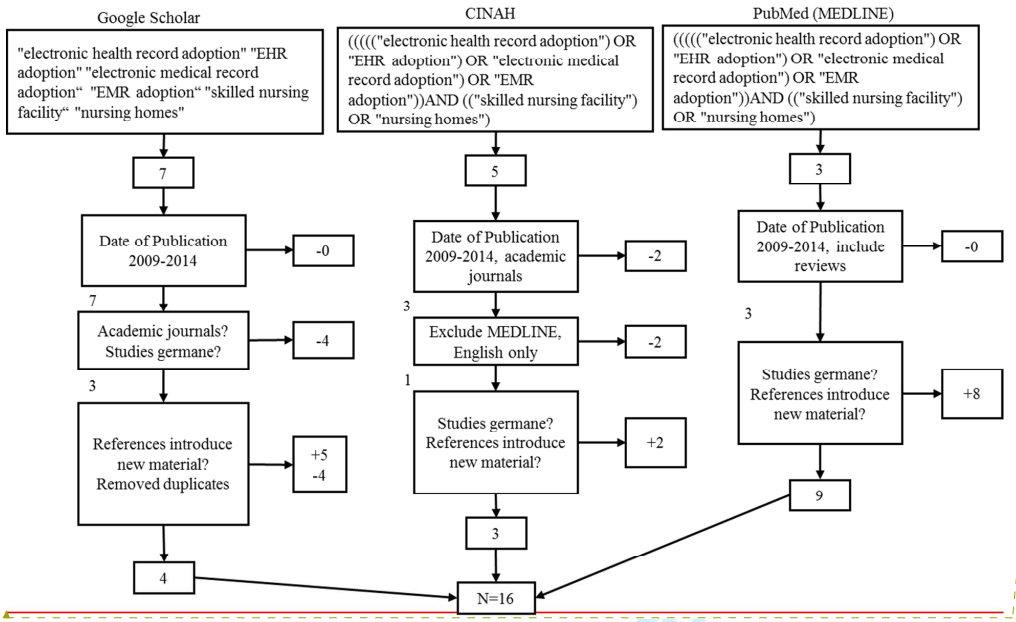
~~Figure 1~~



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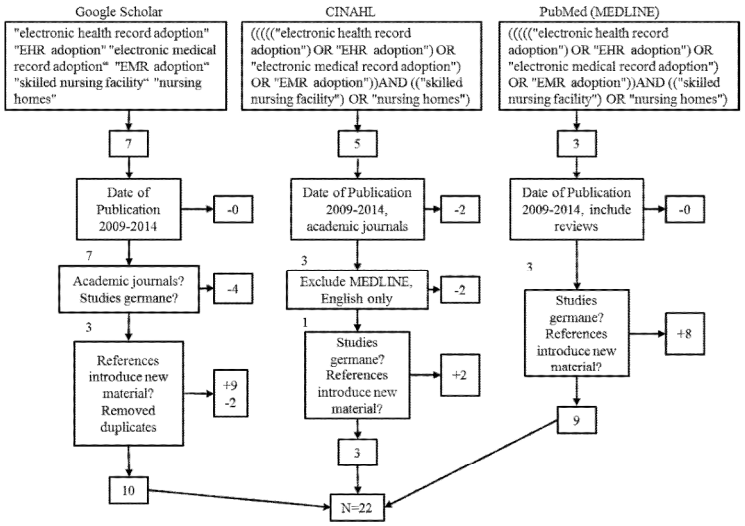

An illustration of the manuscript-selection process for the systematic review
279x215mm (300 x 300 DPI)

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Supplementary File

Authors	Study Characteristics	Facilitators	Barriers
Wolf L, et al. (2012). Hospitals ineligible for federal meaningful use incentives have dismally low rates of adoption of EHR.[4]	• Secondary data analysis, 2009 health IT supplement to the AHA survey. • Hospitals reported on 32 clinical functions of an EHR system and extent of implementation.	• Emerging payment methods could encourage EHR adoption. • "Quality Improvement Organizations" may increase adoption because they provide technical support that many LTC facilities need.	• HITECH incentives only focus on acute care and primary physicians. • Expanding the incentives to LTC facilities may be too costly.
Wang T, et al. (2012). Adoption and utilization of EHR systems by LTC in Texas.[5]	• Survey instrument mailed to all Texas LTC facilities. • Data were self-reported rates of adoption.	• Anticipating state and federal requirements. • Good communication between vendors and LTC facilities. • Education and training programs.	• Lack of initial investment resources. • No technical infrastructure. • Not enough time to implement the EHR. • Lack of space for the new system.
Resnick H, et al. (2009). Use of Electronic Information Systems in Nursing Homes: United States.[6]	• Secondary data analysis from the National Nursing Home Survey (NNHS). • The data reported a wide range in level of adoption.	• Error reduction. • Quality. • Efficiency. • Better health outcomes.	• Cost. • Complex systems (implementation). • No standards (external).
Davidson J. (2009). Electronic Medical Records: what they are and how they will revolutionize the delivery of care.[7]	• Summary of articles (non-study) and concepts justifying the creation of the Canadian Health Infoway..	• Comprehensive implementation planning. • Governmental initiatives. • Management and staff support.	• Cost. • Privacy issues. • Incorrect vendor.
Hamid F, et al. (2013). Providers Acceptance Factors and	• Survey instrument given to physicians (n=24), nurse practitioners and PAs (n= 20) in acute-care settings.	• EHR satisfaction increases when the users understand the benefits. • Supportive	• Cost. • Perceived lack of usefulness. • Time consuming.

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their Perceived Barriers to Electronic Health Record EHR Adoption.[8]		management. • Training programs.	
Alexander G, et al. (2009). IT Sophistication and Quality Measures in Nursing Homes.[9]	• Survey instrument of 210 nursing homes in Missouri. • Two groups of measurements collected: level of IT sophistication and quality measures, as defined by the U.S. Center for Medicare and Medicaid Services.	• Improve clinical decision making. • Earlier intervention. • Time savings.	• IT sophistication negatively correlated with detection of incontinence (implementation issue?)
Phillips K, et al. (2010). Electronic medical records in long-term care.[10]	• Systematic literature review.	• Government financial incentives. • Reduced errors and adverse drug events. • Including users in the design and implementation process.	• Adoption costs. • Efficiency outcomes were inconsistent. • Incongruent cost savings. • Lack of interoperability. • Fear of changing the facility culture.
Wilkins M. (2009). Factors influencing acceptance of electronic health records in hospitals.[11]	• Survey instrument to members of the Arkansas Hospital Association. • LTC hospitals were cross-tabbed separately from other hospitals.	• Training and learning the system increases adoption. • Understanding the usefulness of the EHR technology.	• Facility size. • Lack of change agents or leaders in the facility. • Lack of interoperability. • Cost. • Resistance to change.
Filipova AA. (2013). Electronic Health Records Use and Barriers and Benefits to Use in Skilled Nursing	• Cross-sectional design. • Mail and web survey instruments.	• Federal and state government incentives or policy initiatives could offset financial barriers. • Aligning organizational strategic plans could also encourage adoption.	• Financial barriers like no capital to implement an EHR and the cost of hardware and infrastructure. • Organizational barriers. • Legal and regulatory

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Facilities.[12]			barriers. • Technological barriers. • Network barriers.
Bezboruah KC, et al. (2014). Management attitudes and technology adoption in long-term care facilities.[13]	• Exploratory, qualitative case study.	• Institutional pressure like anticipated regulations and competition pressures increase EHR adoption.	• Cost of the electronic system and projected upgrades. • Leaders perceiving staff's resistance to change. • Misunderstanding how EHRs could be useful or not having enough information to choose the right system.
Cherry B. (2011). Management attitudes and technology adoption in long-term care facilities.[14]	• Survey instrument to LTC facilities in Texas.	• Fast-growing elder populations mean quality of care in LTC facilities must be addressed with EHRs. • A strong implementation plan within the facility that aligns with strategic plans. • Initial and follow-up training programs. • A perception shift about the benefits of EHR adoption.	• Cost and a lack of capital resources. • Lack of industry standards. • Complicated implementation processes. • Lack of technical support. • Not enough evidence to support EHR's proposed benefits.
Grabenbauer L, et al. (2011). Electronic Health Record Adoption - Maybe It's not about the Money: Physician Super-Users, Electronic Health	• Qualitative study conducted to compare two robust EHR solutions. • EHR- savvy users from multiple organizations interviewed through focus groups..	• Improved communication. • Patient data access and sharing.	• Cost. • Reduced time with patients. • Currently EHRs do not impact population health.

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Records and Patient Care.[15]			
Cherry B, et al. (2011). Experiences with electronic health records: Early adopters in long-term care facilities.[20]	• Semi-structured interviews conducted at 10 LTC sites. • Interviewees consisted of administrators, nurse managers, nurses, certified nurse aides, and other system users.	• Rapid patient record retrieval. • Better document consistency, quality, and accuracy. • Improvements in employee satisfaction and retention. • Better patient assessments, oversight, and order processing. • Better time management.	• Technology and maintenance problems like downtime or learning the new system. • Residents thought providers were more focused on the computers than on them.
Tabar P. (2013). Why EHRs matter to LTC's future.[23]	• Editorial.	• Perceptions are changing in long-term care; EHRs are becoming a cost of doing business.	• Most EHRs were built for acute care and LTC facilities had trouble finding a system that met the organization's needs.
Vendor group develops EHR code of conduct. (2013).[24]	• Journal bulletin board post.	• Cost reductions. • Improve patient outcomes. • State programs could help fund a facility's EHR adoption.	
Yu P, et al. (2013). Unintended adverse consequences of introducing electronic health records in residential aged care homes.[25]	• Qualitative semi-structured interview study of 9 residential aged care homes. • User perceptions evaluated.	• Continuous training. • Open dialogue with vendors. • Balancing EHR accuracy with patient care.	• Staff resisted the new system because personal perceptions about their age, lack of documentation skills, or other reasons created limitations. • Information management became too difficult and documents lacked consistency. • Providers complained about spending less time with residents.

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Hamann DJ, et al. (2013). Utilization of Technology by Long-Term Care Providers Comparisons Between For-Profit and Nonprofit Institutions.[26]	• Secondary data analysis of multiple surveys conducted by the CDC. •	• Nonprofit facilities were 40% more likely to adopt EHRs. • Nonprofits have more regulations, so may need the benefits of EHRs.	• For-profit facilities lagged behind in EHR adoption rates. • Fewer regulations enable for-profit facilities to invest in cost-effective endeavors and avoid the expense of EHR implementation.
Vest JR, et al. (2013). Changes to the electronic health records market in light of health information technology certification and meaningful use.[27]	• Secondary data analysis of HIMSS data. • Hospital referral regions were used to define local markets. • Analysis was changes over time.	• More EHR vendors. • Trends show electronic record use is on the rise. • Meaningful use makes EHRs more prevalent.	• Lagging widespread EHR adoption. • Misaligned incentives.
Weaver. (2005). EHR adoption in LTC and the HIM value. [28]	• Practice brief (a regular section in the journal). • A publication of practice guidelines for managing health information.	• Error reduction (quality). • Improved efficiency. • Consumer (user) perceptions • Improved health outcomes	• Difficulties transitioning from paper to EHR. (Implementation .) • Training becomes paramount.
Gruber N, et al. (2010). Embracing change to improve performance: implementation of an electronic health record system.[29]	• Case study of an implementation of an EHR in a facility. • Includes cost, staffing, and experience over 2 years.	• Strong implementation team. • Communicate often and thoroughly. • Set goals, tasks, and schedules for the implementation. • Reduced errors. • Improved documentation.	• Minor increases in operating expenses. • Training.
Holup AA, et al. (2014).	• Pilot study examining	• Rapidly aging populations stresses the	• Long-term care EHRs are not as

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Going Digital Adoption of Electronic Health Records in Assisted Living Facilities.[30]	associations between structural characteristics and adoption and use of EHR as a process characteristic in assisted living.	need to create interoperable, coordinated EHRs for LTC facilities.	comprehensive as acute care EHRs.
Holup AA, et al. (2013). Facility characteristics associated with the use of electronic health records in residential care facilities.[31]	• Secondary data analysis of annual survey instrument of the National Survey of Residential Care Facilities.	• Created better health outcomes. • Reduced extra costs. • Improved delivery and quality. • An increasing elder population makes implementing EHRs a necessity. • Nonprofits were more likely to utilize EHRs.	• High initial investment means slower adoption in facilities that cannot afford the EHR system, which slows the rate of becoming better integrated with acute care. • Facility characteristics determine EHR adoption.

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PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	4-7
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	7
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	NA
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	NA
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	8
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Figure 1
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	8
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	8
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	5
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	9
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	9
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	10

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PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	NA
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	NA
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	10
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	10-13
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	NA
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	Table 1
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	NA
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	NA
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	NA
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	17
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	3,19
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	20
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	21

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