

# The Implementation of Standard Terminology in Electronic Health Record Systems and the Effect on Patient Outcomes: A Systematic Literature Review

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**Abstract:** *The implementation of uniform terminology and protocols to standardize healthcare procedures in healthcare organizations (HCOs) and data collection through electronic health records (EHRs) has rapidly increased in the United States since the implemented Health Information Technology for Economic and Clinical Health (HITECH) Act in 2009 (24). This standardization has shown to have significant impacts on healthcare (21), both reducing errors in healthcare delivery as well as creating new issues with interoperability (24). This study aimed to investigate whether the use of standard terminology compared to non-standard terminology improves clinical outcomes in HCOs that employ EHRs to manage patient health information (PHI). A search of MEDLINE and CINAHL Plus with Full Text was conducted. Four major themes emerged from analyzing 20 journal articles relevant to the research question. These include improving interdisciplinary communication, improving communication between providers and support staff, reducing patient injury, and standardized information dissemination. The results indicated that using standard terminology compared to non-standard terminology improves clinical outcomes in HCOs that employ EHRs to manage PHI. These results suggest that efforts to standardize terminology and processes within EHRs can ultimately continue to improve patient outcomes despite potential interoperability issues.*

**Keywords**—electronic health records, patient health information, standard terminology, health informatics

## 1. INTRODUCTION

The use of uniform language throughout the medical field is referred to as controlled or standard terminology [21]. Using standard or nonstandard terminology can significantly impact patient data interoperability [21]. Standard terminology refers to the same condition with the same phrases, using the same formatting to transmit similar types of health data or other related situations [21]. The implementation of the Health Information Technology for Economic and Clinical Health Act (HITECH) in 2009 led to rapid increases in HCOs adopting EHRs and it led to significant changes in patient care [24]. HITECH included meaningful use regulations that required healthcare providers to record certain patient care activities in specific ways [24]. Standardization of terminology regarding PHI and standardized medication prescribing technology have reduced adverse drug events from prescriptions from diabetes care facilities [24].

Established standards such as Health Level 7 Fast Healthcare Interoperability Resources (HL7 FHIR) and OpenEHR have encouraged the uniform expression of data; however, implementing these methods can create other interoperability issues at multiple levels [23]. Differences in EHR systems, versions, and standards can complicate interoperability [23]. Varying terminology to describe medical conditions overall can lead to similar miscommunications [22]. Neurological disorders, for example, may be referred to by several different phrases or descriptions [22]. This lack of standard language on a condition level can lead to similar problems with interoperability [22]. One study found that developing a new and more detailed database of test phrases to describe neurological conditions was more effective than using more general terminology databases [22].

Numerous studies have investigated the relationship between interoperability and implementation of different standard terminologies on broader analysis levels such as disease description and granular levels such as details in HL7 FHIR segments. These studies often explore the relationship between the functionality of EHRs with standard terminology and the extent of the effect on interoperability. This systematic literature review aimed to investigate whether using standard terminology compared to non-standard terminology improves clinical outcomes in HCOs that employ EHRs to manage PHI.

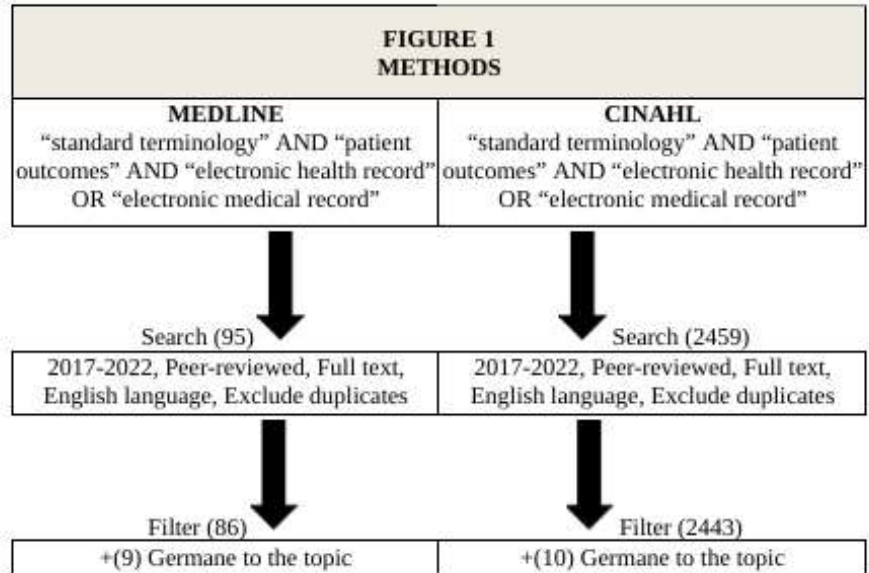
## 2. METHODS

A systematic literature review of standard terminology used in health informatics applications was conducted between May and August 2022. A search occurred using databases MEDLINE and Cumulative Index to Nursing and Allied Health Literature (CINAHL) Plus with Full Text. The following phrases and slight variations of the following were used to find initial potential

articles: "standard terminology" AND "electronic health record" OR "electronic medical record" AND "patient outcome." Non-peer-reviewed scientific articles were automatically excluded, as well as articles were written prior to 2017 (five years before the writing of this review). Additional factors that affected the determination of acceptability included full-text availability and overall relevance to the research question. Full-text article reviews were conducted before determining relevance. Search filtering and field-defining ultimately led to the final 20 relevant and eligible articles referenced to analyze the research question; does using standard terminology compared to non-standard terminology improve clinical outcomes in HCOs that employ EHRs to manage PHI? Information was gathered from the full text of these articles and incorporated into this review.

**3. RESULTS**

A systematic literature review was conducted to investigate whether using standard terminology compared to non-standard terminology improves clinical outcomes in HCOs that employ EHRs to manage PHI. MEDLINE and CINAHL Plus with Full-Text databases were utilized with selection and analysis methods established by Moher et al., 2009. From the search of these two databases, 20 articles were found to be relevant to the research question and analyzed (see below for summaries).



**TABLE 1  
SUMMARIZED FINDINGS OF THE LITERATURE**

TITLE	FINDINGS
Electronic Health Record Tool to Promote Team Communication and Early Patient Mobility in the Intensive Care Unit [1]	Standardization of terminology for mobility was implemented to help monitor patients using a scale of five distinct categories. The standardization of this language aimed to help alleviate poor communication between hospital staff members. Specifically, physician orders for patient movement were often miscommunication with supporting staff.
Twice-Weekly Structured Interdisciplinary Bedside Rounds and Falls among Older Adult Inpatients [2]	Patient fall data was recorded in a standardized manner using established templates attached to the patient's EHR to improve interdisciplinary communication within a healthcare team. Implementing this standard template for recording and evaluating twice weekly reduced patient falls.
Perspectives of healthcare practitioners: An exploration of interprofessional communication using electronic medical records [3]	Focus groups with healthcare professionals were conducted to assess the level of communication between departments after the implementation of EHR methods. Standardized methods were established for multiple processes to attempt to minimize errors. Results found that while communication increased overall, frustration with sign-in procedures and less face-to-face communication were reported.

Verifying the Effectiveness of Educational Communication Across Multi-Site Ambulatory Care Clinics [4]	Tools were implemented to standardize terminology and communication methods used for unit updates between nurses and other internal messaging. Nurses were shown to perform better on education-based polling following the implementation.
A Daily Operational Huddle and a Real-Time Communication Application Improve Efficiency of Laboratory Processes [5]	Electronic quality-based tools were developed to minimize variation in processes within a hospital laboratory and a virtual daily huddle. This huddle minimized variation between turn-around times for processing laboratory specimens but did not significantly shorten them.
Effective virtual patient simulators for medical communication training: A systematic review [6]	Standard terminology was employed in virtual patients and virtual communication training for medical students. Significant improvements were found in the study group versus the control group regarding communicating PHI.
Communication in Pediatric Critical Care Units: A Review of the Literature [7]	Standard communication tools implemented in pediatric critical care facilities improved communication between providers and reduced patient costs. Oversaturation of information for healthcare providers can be a concern but can be alleviated by adjusting EHRs.
Getting work done: a grounded theory study of resident physician value of nursing communication [8]	Nursing work environments were evaluated through the lens of Getting Work Done, a work theory that combines defining the team, assessing and adjusting communication, and maximizing staff knowledge bases. These were carried out by developing and implementing standardized terminology within issued protocols to minimize human error and create structure.
Interprofessional Huddle: One Children's Hospital's Approach to Improving Patient Flow [9]	A pediatric emergency department combined analysis of standard milestones for patient success with in-person daily huddles to help improve department within departments and across departments. Data collection and analysis to determine if these new meetings improved patient outcomes found that patient flow and communication improved with scheduled communication.
Increased physician and physical therapist communication is associated with earlier mobility and decreased length of stay in the cerebrovascular and trauma neuroscience population [10]	Short, frequent mobilizations for brain injury patients have been shown to improve patient outcomes. Communicating these sessions between neurologists and physical therapists was challenging for some healthcare teams. Facilitating standardized and consistent methods of scheduling and evaluating these sessions in long-term care was shown to improve patient outcomes.
Early Warning Score Communication Bundle: A Pilot Study [11]	A standard communication bundle of interventions for detecting and treating early deterioration of long-term intensive care unit patients was implemented to improve patient outcomes. Standard alerts through EHRs and other communication methods, standardized templates, and protocols for treatment for various signs and symptoms were included. The use of these standard prompts increased early interventions for these patients.
An exploration of nurse-physician perceptions of collaborative behaviour [12]	Communication difficulties between nursing teams and physicians can be problematic in healthcare scenarios. The use of integrated EHRs can be used to improve the frequency and clarity of these communications. Improving communication in a standardized electronic way can help prevent rushed conversations or miscommunications.
Improving Detection of Early Chronic Obstructive Pulmonary Disease [13]	The standardization of EHR monitoring and hospital protocols was found to have improved the detection of early-onset Chronic Obstructive Pulmonary Disease (COPD). Standard definitions of early COPD and common risk factors helped identify individuals at risk for declining respiratory health.

Haiti's National HIV Quality Management Program and the Implementation of an Electronic Medical Record to Drive Improvement in Patient Care [14]	An EHR, iSanté, was incorporated into the Haiti hospital system to collect and analyze HIV patient care and treatment data. This EHR established standard terminology and protocols for the care of these patients and attempted to reduce variation in the treatment of affected patients. Standardized collection and data aggregation has made structural review easier for healthcare administrators, allowing for improvement.
Providing Inclusive Care for Transgender Patients: Capturing Sex and Gender in the Electronic Medical Record [15]	EHRs and laboratory information systems (LIS) were evaluated for the capability to better record data on patient sexual orientation and gender identity (SOGI), which has been historically inconsistent. This study found that although many current systems can consistently record this information, there is room to improve standard terminology and implementation across systems.
Predicting Patient Deterioration: A Review of Tools in the Digital Hospital Setting [16]	Standardized automated prediction systems for deterioration risk inpatients were not found to decrease risk significantly. This study finds that improvement is needed in standard algorithm implementation to improve patient outcomes successfully.
The Role of Electronic Medical Records in Reducing Unwarranted Clinical Variation in Acute Health Care: Systematic Review [17]	Standardizing subcomponents of the care process and EHRs reduces patient costs and improves patient outcomes. Reducing variation in clinical treatments can improve patient outcomes, but it is difficult to measure due to variables in the treatment process and the loss of data between healthcare teams.
Impact of an Advance Care Planning Video Intervention on Care of Short-Stay Nursing Home Patients [18]	A clinical trial was conducted to test the effectiveness of a standardized training tool online called the Pragmatic Trial of Video Education in Nursing Homes (PROVEN). The tool did not significantly affect several patient health indicators versus the control group; however, the tool was not used consistently.
Artificial Intelligence in Acute Kidney Injury: From Static to Dynamic Models [19]	Standard definitions of Acute Kidney Disease (AKI) were implemented into predictive models within an EHR. These were built into risk scoring systems and flag triggers in various systems. Overall, patient outcomes were increased by employing standard terminology definitions within existing risk assessment systems.
Economic evaluation and analyses of hospital-based electronic medical records (EMRs): a scoping review of international literature [20]	Electronic medical record implementation was analyzed over a variety of different healthcare facilities. This study found a lack of standard framework in terms of EMR implementation that does not capture data in a way that can lead to healthcare system improvements. Standardized collection of data on healthcare workforce sustainability may improve future implementations.

The 20 final articles were categorized into four main themes/topics of relevance to the research question and improving overall patient outcomes: improving interdisciplinary communication, improving communication between providers and support staff, reducing patient injury, and standardized information dissemination. Each category describes a method of standardization to improve patient outcomes. The frequency of these themes and topics is seen in Table 2.

Benefits	Occurrences	Instances of Attributes (n)	Percentage (%)
Improving interdisciplinary communication	2-4, 6, 9, 10, 11, 15	8	40%
Improving communication between providers and support staff	1-3, 7, 8, 12, 15, 17	8	40%
Reducing patient injury	1, 2, 7-9, 11, 13, 15-17, 19-20	12	60%
Standardized information dissemination	4-6, 8, 9, 12-14, 18	9	45%

Results of the study found that 40% of the final 20 articles included a discussion of improving interdisciplinary communication. This was found in articles 2-4, 6, 9, 10, 11, and 15. Improving communication between providers and support staff was found in articles 1-3, 7, 8, 12, 15, and 17, also 40% of the total articles. Articles 1, 2, 7-9, 11, 13, 15-17, 19, and 20 discussed reducing patient injury, which was the most often-discussed theme at 60% of total articles. Standardized information dissemination was discussed in 45% of articles, including 4-6, 8, 9, 12-14, and 18.

#### 4. DISCUSSION

This systematic literature review aimed to determine whether using standard terminology compared to non-standard terminology improves clinical outcomes in HCOs that employ EHRs to manage PHI. An analysis of twenty peer-reviewed English-language articles published between 2017 and 2022 occurred for this study. This review allowed for a current analysis of standard terminology as it applies to EHRs and patient outcomes. Analysis revealed four main themes among these articles: improving interdisciplinary communication [2-4, 6, 9, 10, 11, and 15], improving communication between providers and support staff [1-3, 7, 8, 12, 15, and 17], reducing patient injury [1, 2, 7-9, 11, 13, 15-17, 19, and 20], and the dissemination of standard information [4-6, 8, 9, 12-14, and 18]. Table 2 displays these four major themes and the frequency with which they appear within the literature.

The first central theme analyzed was improving interdisciplinary communication, which improves various functions of a hospital system. Improving interdisciplinary communication was a theme presented in 40% of the articles analyzed [2-4, 6, 9, 10, 11, and 15]. Standardized terminology in healthcare facilities and its implementation was found to improve interdisciplinary communication and reduce patient falls [2], minimize errors and improve the clarity of communication [3], and reduce lost information between units [4]. Other communication improvements between departments have been shown to reduce the length of patient hospital stays [10] or improve early identification of health deterioration by concatenating PHI [11]. Although these outcomes manifest in diverse ways, the overall results of the article analysis show that implementing standard terminology in EHRs improves patient outcomes by improving interdisciplinary communication. That is closely related to the second significant theme, improving communication between providers and staff. Although healthcare providers and their support staff often work closely and are not in different departments within the healthcare system, there are many opportunities for improving communication. Improving communication between providers and support staff was also discussed in 40% of the articles analyzed [1-3, 7, 8, 12, 15, and 17].

Communication standardization in an EHR was found to reduce patient costs; however, oversaturation of information for healthcare providers is a potential concern if EHRs are not appropriately configured [7]. Standardizing processes for recording and discussing patient sexual orientation and gender identity found that implementation reduced information loss between healthcare providers and their teams and led to more consistent care for these patients [15]. Although many EHRs have the capability to record and disseminate this type of PHI, there is room for improvement in consistent implementation [15].

The third central theme of the articles analyzed was reducing patient injury [1, 2, 7-9, 11, 13, 15-17, 19, and 20] and was present in 60% of articles. Reducing patient injury can be partially intertwined with other major themes of this analysis (particularly involving communication). Defining standard terminology for patient flow in a pediatric hospital resulted in improved communication and reduced patient injury due to extended wait times and poor patient flow [9]. Similarly, standardized alerts through an EHR in a long-term intensive care unit (ICU) allowed healthcare providers to employ early interventions for at-risk patients that would not have been implemented before these changes, thus avoiding potential patient injury [11]. The results from theme three coordinate well with the fourth central theme of the articles analyzed: dissemination of standard information by use of standardization [4-6, 8, 9, 12-14, and 18], which was present in 45% of articles. The standard dissemination of information helps ensure that healthcare providers have the proper tools to provide the best possible care, ultimately improving patient outcomes. Implementing standard terminology and communication methods for nursing staff in a multi-site ambulatory care clinic resulted in increased performance in an education-based poll [4]. Likewise, a communication application used to standardize laboratory processes in tandem with a daily virtual huddle minimized variation in the performance of procedures and lowered turn-around time for medical laboratory technologists [5]. Increasing efficiency and reducing variation allows for greater efficiency and improves patient outcomes.

The limitations of this systematic literature review include the subjectivity of the authors when selecting search terms and reviewing articles, language limitations (only English language articles were reviewed), potential exclusion of relevant articles due to search term mismatches, and the potential exclusion of relevant articles due to over-filtering results. This study occurred over twelve weeks in 2022. A preliminary search identified articles via Google Scholar, and after initial identification, MEDLINE and CINAHL Plus with Full-Text databases were used to identify relevant articles. Only peer-reviewed, English-language articles were included in the analysis. Articles were selected and analyzed using methods established by Moher et al., 2009 to minimize subjectivity. Research began with MEDLINE searches that yielded 95 articles; selective filtering reduced the result to nine relevant and appropriate articles. CINAHL searches produced 2459 articles; applying identical filters resulted in 12 relevant and proper articles, providing a total of 21 articles, one of which was excluded as the study was still in progress. A thorough review of each article to determine relevance to the research question minimized limitations. Although this study has these limitations, the application of stringent qualifications for inclusion helped minimize them. The study shows that implementing standard versus nonstandard terminology in an EHR improves patient clinical outcomes.

Future researchers can use the results of this study to develop more specific analyses into various methods of employing standard terminology in healthcare systems that use EHRs. These studies can be designed to collect quantitative data to objectively determine the value of implementing various tools to standardize terminology in a healthcare setting. Further, healthcare administrators can employ this study to help guide decision-making processes on changes made to their current practices or EHR configurations.

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## 6. CONCLUSION

The rapid expansion of the use of EHRs to manage PHI has created many opportunities for improving the quality of patient care but also has weaknesses and vulnerabilities. This study aimed to investigate whether the use of standard terminology compared to non-standard terminology improves clinical outcomes in HCOs that employ EHRs to manage PHI. Further research can include a more granular analysis of different methodologies for standardization and their relationship with patient outcomes. The implications of the results of this study provide healthcare administrators an opportunity to improve workflows and patient outcomes by standardizing terminologies and procedures.

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