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An Evidence Based Tool For Safe Configuration Of Electronic Health Records: The Esafety Checklist.

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AN EVIDENCE BASED TOOL FOR SAFE CONFIGURATION OF ELECTRONIC HEALTH RECORDS: THE eSAFETY CHECKLIST.

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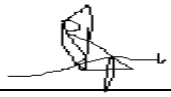

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Date here March 20, 2018

Abstract:

Background: Electronic health records (EHRs) are transforming the way healthcare is delivered. They are central to improving the quality of patient care and have been attributed to making healthcare more accessible, reliable and safe. However, in recent years, evidence suggests that specific features and functions of EHRs can introduce new, unanticipated patient safety concerns that can be mitigated by safe configuration practices. **Objective:** To develop an evidence-based checklist of safe configuration practices for use by clinical informatics professionals to safely configure hospital-based EHRs. **Methods:** A literature review was conducted to synthesize evidence on safe configuration practices; data were analyzed to elicit themes of common EHR system capabilities. Two rounds of iterative testing were completed with end users to inform checklist design and usability. This was followed by a four-member expert panel review, where each item was rated for clarity (clear, not clear), and importance (high, medium, low). **Results:** An expert panel consisting of three clinical informatics professionals and one health information technology expert reviewed the checklist for clarity and importance. Medium and high importance ratings were considered affirmative responses. Of the 870 items contained in the original checklist, 535 (61.4%) received 100% affirmative agreement among all four panelists. Clinical panelists had a higher affirmative agreement rate of 75.5% (656 items). Upon detailed analysis items with 100% clinician agreement were retained in the checklist with the exception of 47 items and the addition of 33 items, resulting in a total of 642 items in the final checklist. **Conclusions:** Safe implementation of EHRs requires consideration of both technical and socio-technical factors through close collaboration of health IT and clinical informatics professionals. The recommended practices described in this checklist provide

systems implementation guidance that should be considered when EHRs are being configured, implemented, audited, or updated, to improve system safety and usability.

Keywords: *Human-computer interaction, Interfaces and usability, Socio-technical aspects of information technology. MESH Headings: Electronic Health Records; Patient Safety; Medical Informatics; User-computer Interface.*

1. Background and Significance

Electronic health records (EHRs) have been hailed as transformative to healthcare because of their ability to greatly improve the quality, safety and efficiency of care delivery. The Institute of Medicine (IOM) states that, "more than any other health technology to date, computers and communication technologies will affect the lives of patients in the twenty-first century" [1]. EHRs, a type of health information technology (HIT), can reduce patient safety incidents, but can also cause technology-induced errors if configured and/or used in an unsafe manner [2]. Literature pertaining to EHR safety has matured over the last decade, but remains a relatively new area of safety science with limited evidence, standards and tools.

In 2012, the Office of the National Coordinator (ONC) for Health Information Technology commissioned the IOM to review the evidence on impact of HIT (including EHRs) on patient safety and recommend actions to be taken. In the report titled *Health IT and Patient Safety: Building Safer Systems for Better Care* [1], the IOM found that HIT can improve patient safety under the right conditions but those conditions cannot be replicated easily. The committee discovered that information needed for an objective analysis of the safety of HIT was not available [1]. Instead, they focused on ways to make information about the magnitude of harm discoverable. They offered a vision of how the discipline of safety science can be better integrated into a health IT enabled world, and provided specific recommendations to establish a

HIT safety management framework that included monitoring and evaluation of incidents at both organizational and national levels [1].

Canada responded to the IOM report by developing national standards titled *2013 eSafety Guidelines* that provide guidance for the inclusion of safety in the design, implementation and use of EHRs [3]. Published by Digital Health Canada (formerly known as COACH), the guidelines coined the term *eSafety* and defined it as the safety of HIT; the policies, processes and practices which serve to protect patients against harm resulting from the development, implementation and use of HIT solutions and software [3]. That same year the ONC also published the *Health Information Technology Patient Safety Action & Surveillance Plan* [4]. Both guidelines called for adoption of eSafety frameworks in public and private healthcare organizations and more stringent policies and programs to support the safe implementation, use and continuous improvement of EHRs [3, 4].

It is estimated that approximately one-third of patient safety incidents following an EHR implementation are caused by its design and use [5]. In an audit conducted by Magrabi and colleagues [6] of the US Food and Drug Administration database, forty-two reports of patient harm and four deaths in 436 critical incidents involving EHRs were reported over a thirty-month period ending July 2010. A more recent study analyzed EHR-related patient safety incidents across 23 fully digital hospitals in Finland over a two-year period, and showed the proportion of incidents to be markedly higher. The study found that human-computer interaction problems were the most frequently reported, and that technology-induced errors pose a significant safety risk in fully digital hospitals [7]. Since mandatory reporting of such events is not required, and patient safety events overall are grossly underreported [8], we can presume that actual rates of error are much higher.

To better understand errors and near misses associated with EHRs, Dr. Adelman, Chief Patient Safety Officer at Columbia University Medical Centre created the "wrong-patient retract-and-reorder measure" which became the first HIT safety measure to be endorsed by the National Quality Forum (NQF Measure #2723) [9]. The measure predicts un-reported near misses on how often providers placed an order on the wrong patient and retracted it within two minutes [9]. It was discovered that 6,885 wrong patient near miss errors occurred at Columbia University Medical Centre over a twelve-month period. Based on this, a daily wrong patient electronic order rate was estimated at fourteen incidents per day, which was significantly higher than their rate of reported incidents. Dr. Adelman concluded that proactive audits of EHRs reveal significantly higher error and near miss rates that can be reduced by safer design of EHRs [9].

Sittig et. al. [10] published an organizational self-assessment strategy encompassing nine tools called 'SAFER Guides' to optimize eSafety. Similarly, Sengstack [11] published a 46-item design checklist for computerized provider order entry. Both utilized iterative methodologies and detailed literature reviews to develop their tools, which are excellent resources for organizations to inform eSafety policy and practice.

The National Center for Cognitive Informatics and Decision Making in Healthcare developed a set of ten 'Safety Enhanced Design Briefs' in 2013 [12]. They cover a variety of topics including effective table design, effective use of color, medication lists, and results management. The briefs are rich in tacit and practical knowledge to aid in reducing eSafety risks. Additional tools have emerged from organizations such as the Institute for Safe Medication Practices, Canada Health Infoway and the Agency for Healthcare Research and Quality, however, they each reference specific capabilities of EHRs and are scattered about the literature in formats that are sometimes difficult to find, consume, and translate into safe system design.

This paper describes the development of an eSafety Checklist to assist health and clinical informatics professionals to apply evidence based safety practices during configuration of EHRs. This is a new instrument; a detailed checklist of this kind has not otherwise been developed to help safely configure EHR software.

2. Objectives

The objective of the project was to consolidate evidence on safe configuration practices for hospital based EHRs into a user-friendly checklist for health and clinical informatics professionals. Project phases included: (1) synthesis of evidence on safe configuration practices, (2) organization of evidence into a checklist format familiar to informatics professionals, and (3) validation of checklist content by a panel of experts.

3. Methods

3.1 Setting

The eSafety Checklist was designed for use by Alberta Health Services during configuration of its new provincial clinical information system, ConnectCare. However, the checklist is system-agnostic and therefore, can be used to support configuration or optimization of any hospital based EHR.

Alberta Health Services (AHS) was founded in 2008 after merging nine former health regions and three agencies to create one provincial health service. It is Canada's first and largest province-wide, fully integrated health system responsible for delivering publicly funded health services to more than 4.2 million Albertans [13]. With approximately 109,000 employees and over 650 sites, AHS is the fifth largest employer in Canada [13]. Following the merger, AHS inherited approximately 1,300 legacy HIT systems, including four major hospital-based EHRs. The fragmentation of systems created inefficiencies in care and potential patient safety concerns,

therefore in 2016 AHS was granted $400 million in funding from the provincial government over four years to acquire and implement a new province-wide EHR. With safety being a core value at AHS, the adoption of the Canadian eSafety Guidelines, including policies, procedures and tools for the safe design and use of EHRs was identified as a priority. In the absence of a comprehensive listing of practical safety configuration requirements, the eSafety Checklist was developed to address this information gap at AHS.

3.2 Methods for Phase One

To synthesize evidence on safe configuration practices, our first project phase, a literature search was conducted in November 2015 using Ovid, PubMed, Scopus and Google Scholar with search terms listed in Table 1. The search was restricted to English language, peer-reviewed journal articles published since 2005. Searching was supplemented by scanning references from identified review articles pertaining to safe user interface design. The search returned 418 articles in total; upon initial screening of titles and abstracts, 67 articles were identified as duplicates, 211 articles were found to be irrelevant, and 140 articles were considered for full text review. Seven additional articles were identified by reviewing bibliographies, yielding a total of 147. Based on full text review, 107 articles were excluded because safe user interface design was not a main objective of the paper, leaving 40 articles for detailed analysis. A secondary literature scan was conducted using the same databases and search terms in August 2017, but limited to publication between 2015-17; from which one additional article was included for a total of 41 journal articles (Figure 1).

The same search terms (excluding publication year parameters) were used to conduct a web search in November 2015 and August 2017 for synthesis of relevant grey literature, standards, best practice guidelines and lessons learned from reputed international agencies and

organizations. The searches returned 103 unique articles that were reviewed for inclusion; of which 46 items were deemed relevant in 2015 with an additional ten items included in 2017.

In total, 41 peer-reviewed journal articles and 56 gray literature items were included (Figure 1). Each item was assessed for evidence level and quality by the project lead using the Johns Hopkins Nursing Evidence Based Practice Model [14]. Data were extracted in an evidence table that detailed article design, purpose, outcome, configuration recommendations and limitations.

Finally, practical configuration recommendations were organized according to a list of eight core EHR functionalities identified by the IOM Committee on Data Standards and Patient Safety [15]. Six of eight core functionalities (health information & data, clinical decision support, order management, result management, clinical communication and patient portal) aligned with recommended practices extracted from the literature review. Two functionalities (administrative processes, population health management) were excluded because they were outside the project scope. Five additional themes (functionalities) were identified from the data; a complete list of EHR functionalities considered and included in checklist is provided in Table 2.

3.3 Methods for Phase Two

The second phase of the project was to develop a checklist that was easy to navigate and use by its end users – health and clinical informatics professionals. Through a survey of end users conducted by the project lead, it was determined that Microsoft Excel was the software of choice for detailed checklists. An excel workbook template was designed for the eSafety Checklist, in collaboration with AHS human factors experts, using eleven EHR functions that emerged from phase one as separate tabs in the excel workbook. Standard formatting was used within each tab, which initially included columns for: item number, category, safety dimension,

recommended practice, compliance, comments and source. Additional administrative tabs were included in the spreadsheet titled: home, instructions and start, version control, and references. Each tab was populated with test content and/or items in preparation for initial proof of concept testing.

Iterative testing was conducted on the initial template design by eight end users in April 2017. Potential checklist users were selected based on their role, expertise and professional background. Two users (one with clinical informatics expertise and one with information technology expertise) were selected from each of the four major EHR systems (Allscripts, Epic, Meditech, Metavision) in use at AHS. Participation in testing was entirely voluntary and confidential to the project committee. Trained human factors safety specialists conducted one-on-one standardized semi-structured interviews using an online meeting platform with screen sharing capabilities. De-identified data from testing were captured in a standardized spreadsheet and summarized by the human factors team into a power point summary presentation for the project committee.

A second round of usability testing was conducted in October 2017 once the checklist content was complete. Six end users representing three different EHR systems participated in the second round of testing. Testing was conducted online in one-to-one sessions with participants, but this time using two to three scenarios and standardized semi-structured interview questions. De-identified data were recorded and results were summarized into a power point for the project committee. Both rounds of testing greatly informed iterative design and usability of the eSafety Checklist.

3.4 Methods for Phase Three

The third and final phase of the project was to validate checklist content by a panel of

experts. Panel members were selected based on their professional expertise and experience in this subject area, local and national recognition, scholarship and responsiveness to requests for participation [16]. Specifically, the panel included expert representation from the following domains: nursing informatics, medical informatics, health information technology architecture, eSafety, and academia. Panel participation was voluntary, and upon acceptance of our request, each panelist was briefed on the project, the checklist, and the rating instructions during a one-on-one online meeting. Upon participation in the online briefing and receipt of written consent, panelists were sent a paper and electronic copy of instructions and the checklist.

Panelists were asked to rate each system capability, sub-category and item within the checklist for clarity (clear/not clear) and importance (high/medium/low); definitions of each rating were provided to panelists, and are listed in Table 3. Due to checklist length, panelists were given one month to independently evaluate between December 15, 2017 to January 14, 2018.

4. Results

4.1 Iterative Testing Results

The first round of testing gathered feedback on checklist utility, instruction clarity, and relevance of tab and column headings. Testers were asked to rate the overall value of the checklist to their work on a five-point likert scale with five being high value; the average rating was 4.1. Based on feedback, several changes were made to the instructions tab for improved clarity, particularly for when the checklist should be used, and that only relevant sections pertaining to a project at hand should be completed. Participants agreed that EHR functionality tabs were distinct, necessary, and without significant overlap. Specific feedback on changes to workbook tab labels included: (1) change ‘Home’ to ‘About’, (2) add a ‘Glossary’ tab, (3)

change ‘System Wide Settings’ to ‘Global Settings’, (4) change ‘Health Information & Data’ to ‘Clinical Documentation’, (5) change ‘Personal Health Management’ to ‘Patient Portal.’ Testers also reviewed standard column headers within the EHR capability tabs; there was strong consensus to remove the columns for ‘Category’ and ‘eSafety Dimension’ due to confusion and lack of understanding. It was also suggested to add a column for ‘Evidence Level and Quality’ for each recommended configuration item. Further general feedback included: use of consistent language, eliminate use of abbreviations, each item/line should only provide one recommendation (e.g. do not recommend a font type and size on one line, separate as two recommended configuration practices).

The second round of user testing required participants to use the checklist to improve safety of three different EHR screenshots. Based on this, participants were asked to rate the user friendliness of the checklist on a five-point likert scale with five representing high usability. Four participants rated the checklist as user friendly, while two rated it as difficult to use. IT participants rated the checklist lower than clinical informatics professionals. Specific feedback on changes to tab labels in the second round of testing included: (1) create a tab labeled ‘Instructions and Scoring’ and remove this content from the ‘About’ tab, and (2) remove the ‘Quality Assurance’ tab and instead add this as a subsection within each of the system capability tabs. Further general feedback included: provide greater clarity on how items are scored, provide ‘tips and tricks’ for excel navigation, improve clarity of subheadings in system capability tabs, reduce redundancy of items between medication management and order management tabs.

4.2 Expert Panel Results

Seven panelists were invited to review the checklist, of which six accepted the initial invite. Five went on to sign the consent and participate in online briefings, and four returned their

completed ratings. Two of the final panelists were nurses with eSafety expertise, one panelist was a clinical informatics physician, and one was a non-clinician with a computer science background and eSafety specialization. All four panelists lived and worked in North America, and all but one panelist had academic appointments.

Panel ratings for clarity (clear, not clear) and importance (high, medium, low) were summarized in a master excel file by the project lead. Items were considered for retention and inclusion in the eSafety Checklist if they achieved at least 78% affirmative responses for importance ('high' or 'medium' ratings); this ensured a level of agreement greater than chance [16]. To achieve this level of agreement in a four-member panel, 100% affirmative responses were required for an item to be considered for retention. Of 870 items reviewed by panelists, 100% affirmative agreement was achieved on 534 (61.4%) items. When non-clinical panelist ratings were removed, 100% affirmative agreement among clinical panelists was achieved on 656 (75.5%) items. Upon detailed review and discussion among the project team, the decision was made to retain items in the checklist with 100% clinical panelist agreement. Due to poor overall agreement on quality assurance (QA) items in each category (n=98), it was decided that further research and testing is required on these items for inclusion therefore, all QA items were excluded from the checklist, including those that achieved 100% clinical panelist agreement (n=47).

The 'Patient Portal' tab received 0% agreement among panelists because one panelist rated all items within this tab as 'low importance.' The project team discussed this tab at length and agreed it was important to retain in the checklist due to its high visibility among patients, and because many organizations lack experience pertaining to patient portal configuration. Therefore, the ratings of one panelist were excluded in this section. Of 70 items in the patient portal tab, 33

(47.1%) items received 100% affirmative agreement among the remaining three panelists. Therefore, these items were retained, bringing the final total of the checklist to 642 items across ten core EHR functionalities.

Finally, of the retained items, those rated ‘not clear’ were reviewed and edited for clarity based on panelist notes and feedback.

5. Discussion

97 articles pertaining to eSafety were analyzed (Table 4), which resulted in 870 unique configuration practice recommendations. Recommendations were organized by ten key EHR system capabilities, and input into their respective tabs within the eSafety Checklist (Table 5). Data in each tab were analyzed into natural themes and grouped into sub-categories that can be expanded and collapsed by the user, allowing for quick navigation (Figure 2).

During proof of concept testing, users commented on the value of the tool to ensure consistency of systems design (particularly when multiple EHRs are in use), and its value in providing justification for evidence-based design decisions. Testers further commented that comprehensive evidence on eSafety practices is difficult and time consuming to find, therefore the checklist addresses a significant information gap. Although reference documents such as ‘Style Guides’ exist for current EHRs in use, they are not focused on safety and are not detailed. Most testers appreciated and preferred the level of detail in the checklist, commenting it was necessary to configure, implement, and evaluate system safety. Despite its detail, users found the tool easy to navigate due to its user-friendly, intuitive design. One tester indicated the size of the checklist was overwhelming and questioned its practicality, however, configuration procedures used during implementation can be extensive. Among testers, clinical informatics users commented the checklist will greatly support system design and were excited to use it, whereas

information technology users were less enthusiastic and questioned its function. One user commented on the checklist's automatic scoring function "…[it is] nice to quantify the work that we do – we probably have looked at many of these elements over the years, its nice to finally have it in one place." Two users commented that although the full detailed checklist is necessary and includes many best practices they were not aware of, it would be nice to have an abbreviated version with just high priority items.

Expert panelists also commented that the checklist is very detailed, yet practical in comparison to other EHR safety tools that provide policy and project guidance. Panelists agreed that a high priority version of the checklist would be helpful, although it too may be lengthy due to the large volume of practices rated with high importance. Although panelists were asked to rate each tab heading, sub-category heading, and each item in the checklist for importance and clarity, most panelists only returned item-specific ratings, thus making it difficult to eliminate entire categories or sub-categories for a trimmed down version.

During end user and expert panel reviews, IT professionals tended to rate more items with low importance and/or relevance than clinical informatics professionals. Items that were rated unanimously low by IT participants were often rated unanimously high by clinical participants. This dichotomy in opinions on eSafety practices is concerning, and highlights the need for close collaboration among clinical and IT staff to ensure safe systems design.

A key strength of the project was the multiple usability review cycles conducted on the checklist by diverse end users who work with different EHR systems. This ensured the tool was user-friendly and generalizable to multiple EHR vendor solutions. Testers commented they had not come across a similar tool to ensure their configuration approach minimized unanticipated

harm. Another strength of the project was the inter-disciplinary expert panel review, which helped determine items that would be retained or excluded in the eSafety Checklist.

This project has several limitations. Detailed evidence review and data extraction, including evidence level and quality assessment, was conducted by one reviewer. All relevant configuration practices were included in the checklist irrespective of evidence level and quality. Evidence strength was only documented in the checklist for the purpose of offering end users additional information to inform their decision to implement a recommended practice. Finally, expert panelists did not take evidence strength into account during their review.

Although end users appreciated the length and detail of the checklist, it was a limitation to achieving a robust expert panel review. A larger panel would have been ideal, and one with an equal number of clinical informatics professionals and health information technology professionals. Further testing, including a pilot implementation, and additional expert review are required to determine the effectiveness and value of the checklist.

6. Conclusion

Although EHRs significantly improve patient safety, they also introduce unique and unintended consequences [10]. The results of this project underscore the importance of collaboration between clinical informatics and IT professionals to address socio-technical factors that impact use of EHRs and cause unanticipated patient harm. The eSafety Checklist is a resource for implementers' that compiles emerging evidence on eSafety best practices in a user-friendly format, allowing for effective translation to practice. Although the checklist was designed for use by AHS, it is system agnostic and therefore, generalizable for use with any hospital-based EHR. The best practices described in the checklist address a gap in current eSafety tools as it offers more practical and detailed guidance for front line informatics staff that

should be considered when EHRs are being implemented, audited or updated, to improve system safety and usability. The checklist is currently being implemented and evaluated at AHS, which will inform future iterations of the tool.

7. Clinical Relevance Statement

The eSafety Checklist aids to build organizational safety competence and fosters effective dialogue between IT teams and clinical informatics professionals to address the safety of EHRs collaboratively. The checklist compiles emerging eSafety evidence into a succinct and easy to navigate format for effective translation of knowledge to practice.

8. Conflict of Interest

The authors do not have a conflict of interest to declare with respect to the content of this manuscript.

9. Human Subjects Protections

This quality improvement project was performed in compliance with the Yale Human Research Protection Program, and Alberta Innovates: A Project Ethics Community Consensus Initiative (ARECCI). The project was granted operational approval by Alberta Health Services in accordance with applicable AHS quality improvement policies and procedures.

10. Acknowledgments

We acknowledge the Chief Information Office and Human Factors Department at Alberta Health Services for their collaboration on this work. We further acknowledge the significant time commitment of our four expert panelists in reviewing the checklist and providing their thoughtful and candid feedback.

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Tables and Figures

TABLE 1: Search Terms & Restrictions				
Concept 1	*AND*	*Concept 2*	*AND*	*Concept 3*
Electronic Health Record Health Information Technology eHealth Health Information System Hospital Information System Clinical Information System Medication Administration Record Computerized Provider Order Entry Clinical Decision Support System Patient Portal Clinical Communication Electronic Referral Result Management		Safety Electronic Safety Safety Management Patient Safety Incident Error		Configuration Design Usability User Interface User Interface Design User Centered Design
Restrictions: published since 2005; peer-reviewed journal; English language,				

TABLE 2: Core EHR Functionalities		
Identified by IOM, 2003 [15]	*Additional themes from literature review*	*Final functionalities included in Checklist*
Population Health Mgmt Administrative Processes Health Information & Data Order Management Decision Support Result Management Electronic Communication Patient Support	Quality Improvement System-Wide Settings Patient Identification Medication Management Referral Management	Global Settings Patient Identification Clinical Documentation Order Management Clinical Decision Support Medication Management Referral Management Result Management Clinical Communication Patient Portal

TABLE 3: Expert Panel Rating Definitions	
Clear	Recommendation is clear, direct and easily understood.
Not Clear	Recommendation lacks sufficient detail to be easily understood; there is a risk of misinterpretation.
High Importance	A critical requirement that if not applied, has a high likelihood to result in patient harm in the near future. System is not acceptable unless this requirement is satisfied.
Medium Importance	A major requirement that if not applied might result in patient harm in the near future. Would enhance safety, but the system is not unacceptable if absent.

Low Importance	A minor requirement that is unlikely to result in patient harm and would be nice to have if system and resources permit.

Figure 1: Literature Search

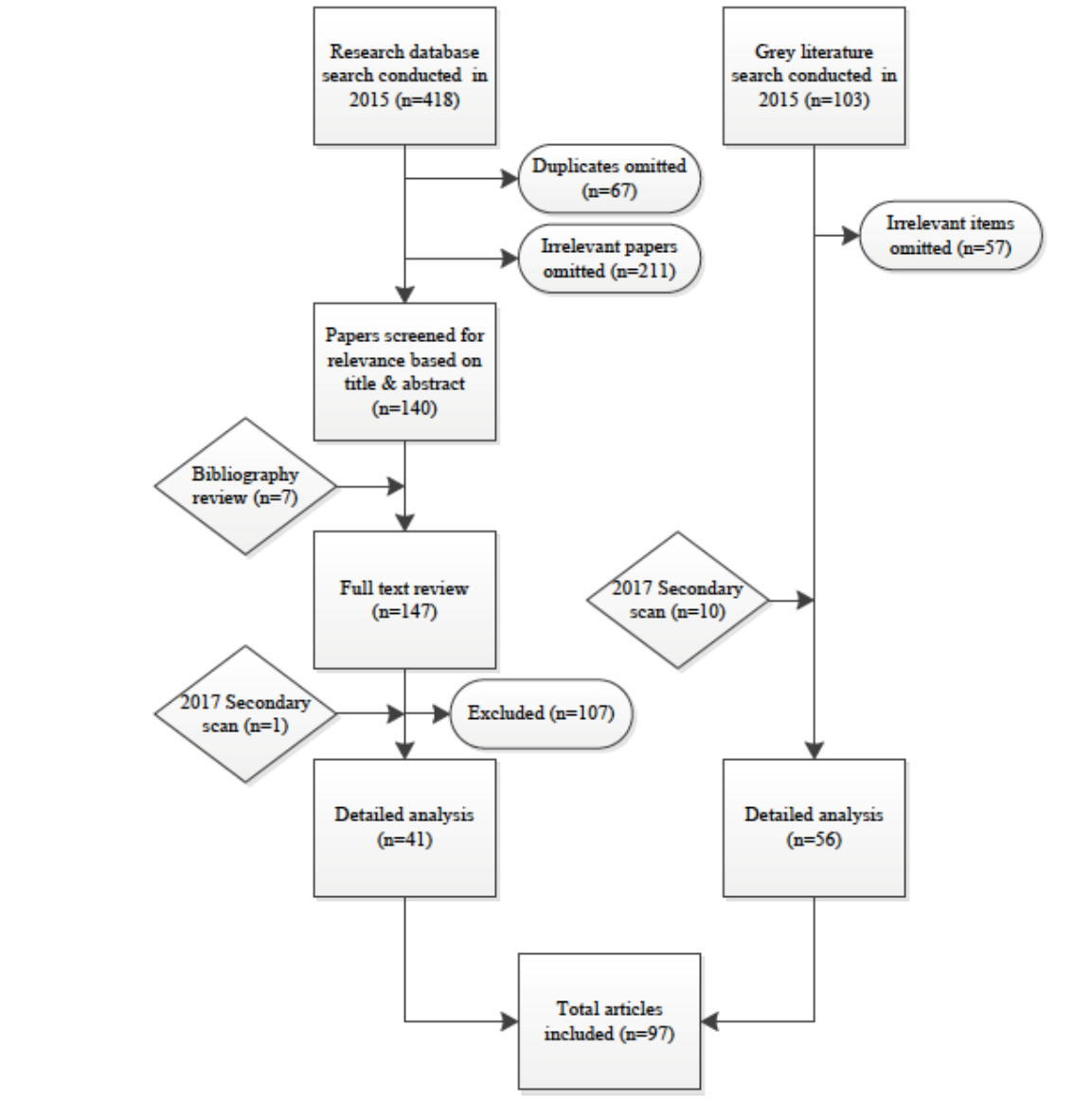

TABLE 4: Evidence Cited in eSafety Checklist * Recommended practice retained in final checklist. x Recommended practice excluded in final checklist. **Reference:**	Global Settings	Patient Identification	Clinical Documentation	Order Management	Clinical Decision Support	Medication Management	Referral Management	Result Management	Clinical Communication	Patient Portal	Other
1. Sengstack, 2010	*	*		*	*	*					
2. Sittig & Singh, 2011		*			*				*		
3. Meeks et. al. 2014											*
4. Sittig, Classen & Singh, 2014	x	x		x	x		x				
5. Sittig, Ash & Singh, 2014											*
6. McCoy et. al., 2013		*									
7. Singh, Classen, & Sittig, 2011											*
8. Sittig, Campbell, Guappone, Dykstra, & Ash, 2007	x		x	x	x						
9. Magrabi, Ong, Runciman, & Coiera, 2009											*
10. Magrabi, Ong, Runciman, & Coiera, 2012	*	*									
11. Magrabi et. al., 2013											*
12. Baker & Norton et. al., 2004											*
13. Digital Health Canada, eSafety Guidelines, 2013											*
14. ONC HIT, HIT Patient Safety Action Plan, 2013											*
15. Wallace, Zimmer, Possanza, Giannini, & Solomon, 2013		*									
16. Huckvale et. al., 2010											*
17. Joint Commission, Safely Implementing HIT, 2008					*						
18. Institute of Medicine, HIT and Patient Safety, 2012											*
19. ONC HIT, Progress on HIT Patient Safety Action Plan, 2014											*
20. Kushniruk, Bates, Bainbridge, Househ, & Borycki, 2013											*
21. ISMP, Safe eCommunication & Drug Nomenclature, 2015	*		*		*	*					
22. ISMP, Guidelines for Standard Order Sets, 2010	*			*		*					

23. ISMP, Tallman Lettering, 2015						*					
24. ISMP, FDA Look-Alike Drugs, 2016						*					
25. ISMP, Human Over-Reliance on Technology, 2016	x										
26. McCoy et. al., 2012					x						
27. IOM, Key Capabilities of EHRs, 2003											*
28. Westbrook et. al., 2012						*					
29. Menon, Singh, Meyer, Belmont & Sittig, 2014	x		x								
30. Alberta Health Services, 2009	x		x	x	x	x		x	x		
31. Partnership for HIT Patient Safety, Copy & Paste Toolkit, 2016			x								
32. Cusack & Poon, 2007	x		x	x	x	x					
33. Classen & Adelman, 2016	*			x							
34. Roper Anderson, Marsh & Flemming, 2013	x										
35. Horsky, Kuperman, & Patel, 2005					x	*		*			
36. National Quality Forum, HIT Patient Safety Measures, 2015	x		x	x	x	x		x		x	
37. Osheroff et. al., 2013					*						
38. Centers for Medicare and Medicaid Services, CDS, 2014					*						*
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64. Phansalkar et. al., 2010	*				*						
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89. NCCD, Preventing Medication Order Errors, 2013						*					
90. NCCD, Medication Reconciliation, 2013						*					
91. NCCD, Problem List, 2013			*								
92. NCCD, Table Design, 2013	*	*									
93. NCCD, Timely Result Management, 2013								*			
94. NCCD, Effective User of Color, 2013	*										
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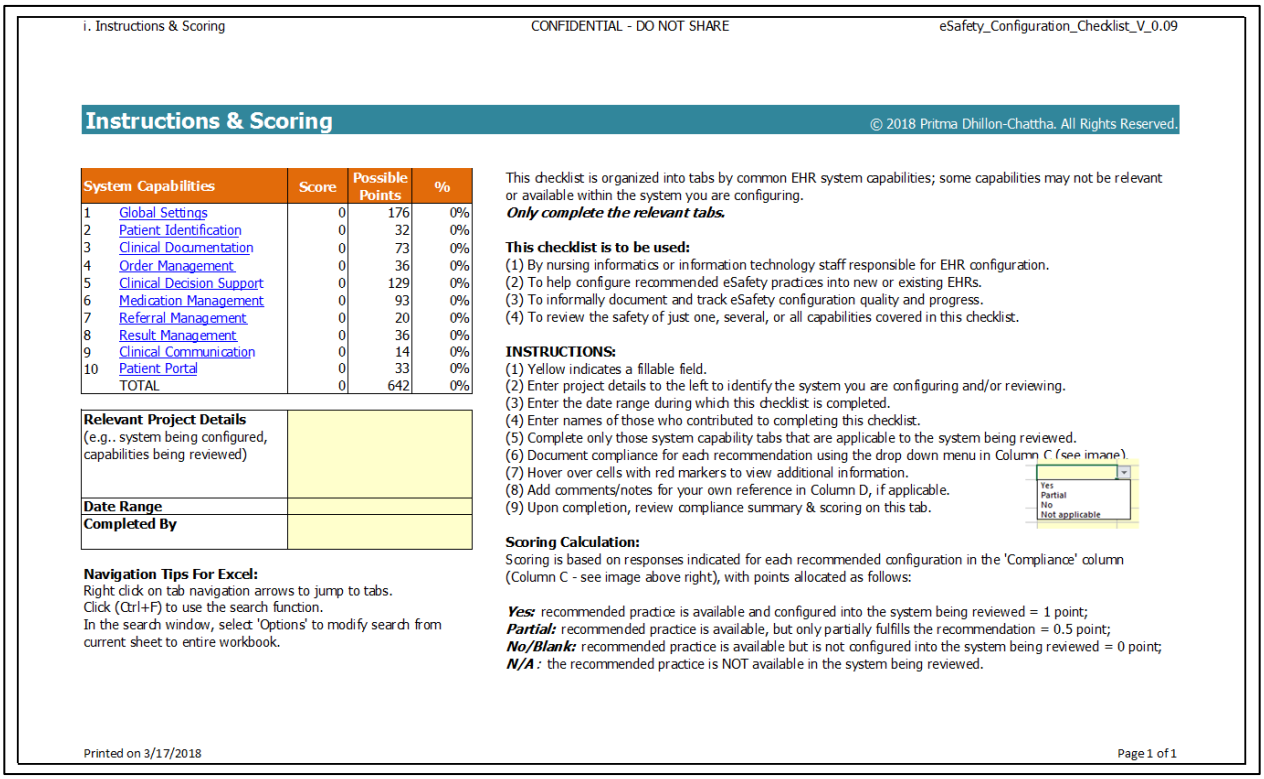
TABLE 5: Complete List of Checklist Tabs and Expandable Sub-Sections
About
i. Instructions & Scoring
ii. Glossary
1. Global Settings • Consistency and standards in design. • Clear navigation. • Match between system and world. • Minimalist design. • Designed to prevent errors from use. • Minimize human memory load. • Informative feedback. • Enable user flexibility and efficiency. • Useful error messages. • Clear closure to tasks. • Reversible actions. • Clear and concise use of users' language. • Users control system actions. • Help and documentation.
2. Patient Identification • Patient name & birthdate formatting. • Patient demographics and identifiers. • Patient banner. • Patient information display. • Patient record creation & merge. • User notifications.
3. Clinical Documentation • Allergies. • Problem list. • Patient status and consent. • Structured charting templates & notes. • Age and unit measures. • Pediatric specific documentation. • Clinical reference material.
4. Order Management • Computerized provider order entry design principles. • Order sets. • Order forms. • Order entry. • Order verification • Order communication.
5. Clinical Decision Support (CDS) • CDS design policies and principles. • CDS alert display.

• CDS alert components & language. • Recommended high-severity, clinically significant drug-drug interaction pair alerts. • Drug-drug interaction decision support. • Drug-allergy interaction decision support. • Drug-laboratory interaction decision support. • Drug-condition/age interaction decision support. • Duplicate order decision support. • Formulary decision support. • Drug dosing decision support. • Point of care alerts and reminders. • Order facilitators. • Relevant information display. • Expert systems. • Workflow support.
6. Medication Management • Medication display settings. • Dose expression. • Medication name. • Medication ordering. • Medication reconciliation.
7. Referral Management • Referral request. • Referral tracking. • Referral communication and notifications.
8. Result Management • Structured data. • Result tracking. • Result notification & delivery. • Pending results. • Results display. • Results follow-up.
9. Clinical Communication • Secure messaging. • Message delivery, notification & tracking. • Clinician communication management workflow. • Communication records.
10. Patient Portal • Patient portal access for adults. • Patient portal access for minors. • Patient portal content availability. • Patient data entry.
iii. Version Control
iv. References

Figure 2: eSafety Checklist Screenshots



i. Instructions & Scoring | CONFIDENTIAL - DO NOT SHARE | eSafety_Configuration_Checklist_V_0.09

Instructions & Scoring

	System Capabilities	Score	Possible Points	%
1	Global Settings	0	176	0%
2	Patient Identification	0	32	0%
3	Clinical Documentation	0	73	0%
4	Order Management	0	36	0%
5	Clinical Decision Support	0	129	0%
6	Medication Management	0	93	0%
7	Referral Management	0	20	0%
8	Result Management	0	36	0%
9	Clinical Communication	0	14	0%
10	Patient Portal	0	33	0%
	TOTAL	0	642	0%

Relevant Project Details (e.g.. system being configured, capabilities being reviewed)	
Date Range	
Completed By	

Navigation Tips For Excel:
Right click on tab navigation arrows to jump to tabs.
Click (Ctrl+F) to use the search function.
In the search window, select 'Options' to modify search from current sheet to entire workbook.

This checklist is organized into tabs by common EHR system capabilities; some capabilities may not be relevant or available within the system you are configuring.
Only complete the relevant tabs.

This checklist is to be used:
(1) By nursing informatics or information technology staff responsible for EHR configuration.
(2) To help configure recommended eSafety practices into new or existing EHRs.
(3) To informally document and track eSafety configuration quality and progress.
(4) To review the safety of just one, several, or all capabilities covered in this checklist.

INSTRUCTIONS:
(1) Yellow indicates a fillable field.
(2) Enter project details to the left to identify the system you are configuring and/or reviewing.
(3) Enter the date range during which this checklist is completed.
(4) Enter names of those who contributed to completing this checklist.
(5) Complete only those system capability tabs that are applicable to the system being reviewed.
(6) Document compliance for each recommendation using the drop down menu in Column C (see image).
(7) Hover over cells with red markers to view additional information.
(8) Add comments/notes for your own reference in Column D, if applicable.
(9) Upon completion, review compliance summary & scoring on this tab.

Yes
Partial
No
Not applicable

Scoring Calculation:
Scoring is based on responses indicated for each recommended configuration in the 'Compliance' column (Column C - see image above right), with points allocated as follows:

Yes: recommended practice is available and configured into the system being reviewed = 1 point;
Partial: recommended practice is available, but only partially fulfills the recommendation = 0.5 point;
No/Blank: recommended practice is available but is not configured into the system being reviewed = 0 point;
N/A: the recommended practice is NOT available in the system being reviewed.

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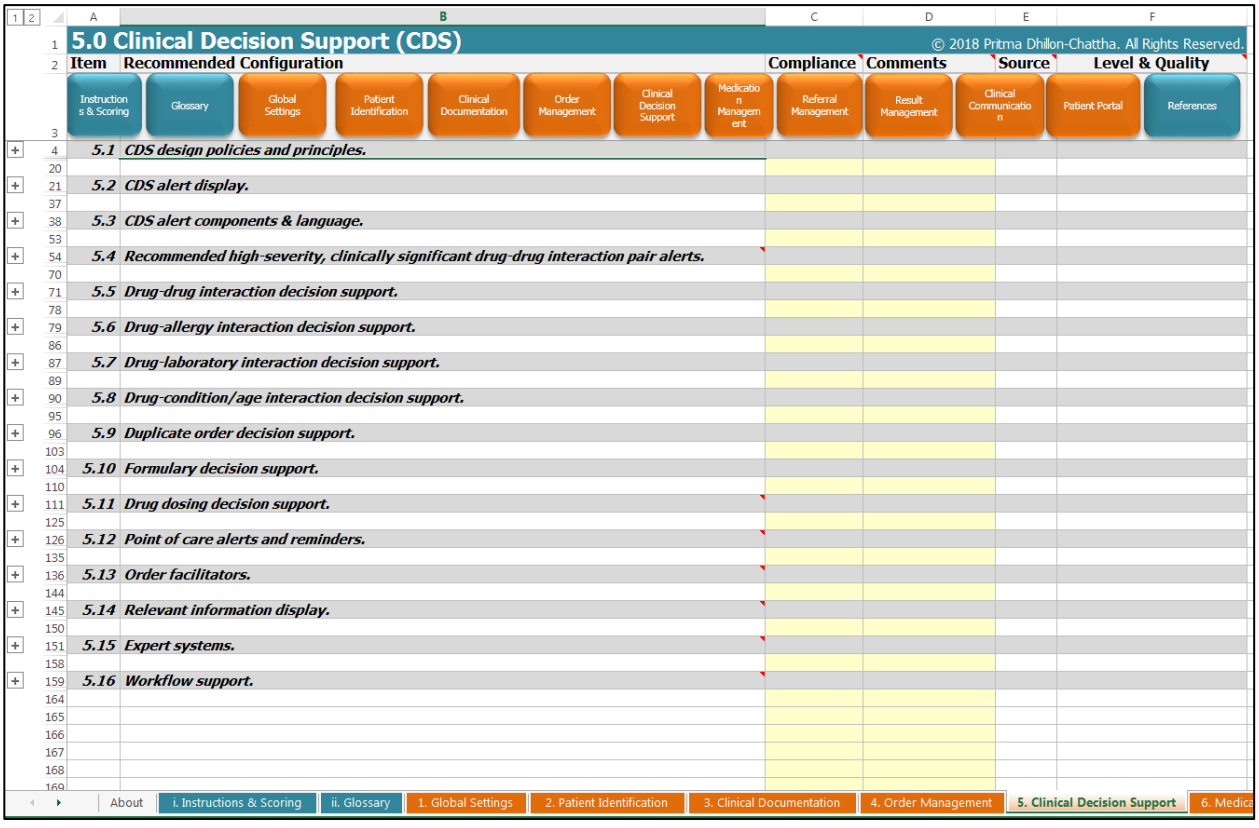

5.0 Clinical Decision Support (CDS)

Item	Recommended Configuration	Compliance	Comments	Source	Level & Quality
5.1	*CDS design policies and principles.*				
5.2	*CDS alert display.*				
5.3	*CDS alert components & language.*				
5.4	*Recommended high-severity, clinically significant drug-drug interaction pair alerts.*				
5.5	*Drug-drug interaction decision support.*				
5.6	*Drug-allergy interaction decision support.*				
5.7	*Drug-laboratory interaction decision support.*				
5.8	*Drug-condition/age interaction decision support.*				
5.9	*Duplicate order decision support.*				
5.10	*Formulary decision support.*				
5.11	*Drug dosing decision support.*				
5.12	*Point of care alerts and reminders.*				
5.13	*Order facilitators.*				
5.14	*Relevant information display.*				
5.15	*Expert systems.*				
5.16	*Workflow support.*				

Instructions & Scoring | Glossary | Global Settings | Patient Identification | Clinical Documentation | Order Management | Clinical Decision Support | Medication Management | Referral Management | Result Management | Clinical Communication | Patient Portal | References

About | i. Instructions & Scoring | ii. Glossary | 1. Global Settings | 2. Patient Identification | 3. Clinical Documentation | 4. Order Management | 5. Clinical Decision Support | 6. Medica