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# A SYSTEMATIC LITERATURE REVIEW ON SAFE HEALTH INFORMATION TECHNOLOGY USE BEHAVIOUR

Lizawati Salahuddin[a,b,*], Zuraini Ismail[a], Wardah Zainal Abidin[a]

[a]Advanced Informatics School (AIS), Universiti Teknologi Malaysia (UTM), Kuala Lumpur, Malaysia
[b]Faculty of Information and Communication Technology, Universiti Teknikal Malaysia Melaka (UTeM), Melaka, Malaysia

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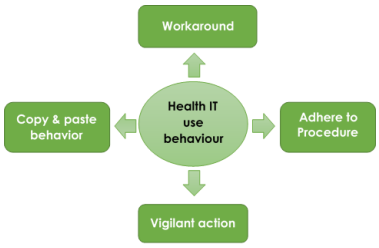
*Corresponding author
lizawati22@live.utm.my

## Graphical abstract




## Abstract

The implementation of health information technology (IT) is one of the strategy to improve patient safety due to medical errors. Nevertheless, inappropriate use of health IT may have serious consequences to the quality of care and patient safety. Most of the previous studies have been focused on the sociotechnical factors contributed to health IT related errors. Little focus has been given on the use behavior that influence the safety of health IT adoption. In order to address this gap, this study investigates the use behavior that influence the safety of health IT adoption. Systematic literature review was conducted to identify articles pertinent to safety of health IT. Science Direct, Medline, EMBASE, and CINAHL database were searched for reviews relevance articles. A total of 23 full articles were reviewed to extract use behavior that influence the safety of health IT adoption. Workarounds, adhere to procedure, vigilant action, and copy and paste behavior were discerned as the significance use behavior that influence health IT safety adoption. This study may be of significance in providing useful information on how to safely practice health IT adoption.

*Keywords*: Health information technology, behavior, patient safety, error, adoption



## 1.0 INTRODUCTION

Patient safety is the primary concern in healthcare delivery. Accordingly, health information technology (IT) has been introduced to improve the quality of care and patient safety [1]. As a result, many healthcare organizations in both public and private sectors has made considerable investments in health IT. Health IT is applied to numerous information and communication technologies used to collect, transmit, display, or store patient data [2]. Although health IT has been considered as the promising tools to improve the quality and safety, inappropriate use of health IT increased the possibility of adverse events [3]. Health IT safety concern not only involve unsafe technological features but also health IT user behavior [4]. Incorrectly handwritten onto an health IT test order print-out rather than using health IT to issue a revised order is an example of improper use of health IT that can effect patient safety [5]. 100 unique and closed investigations between August 2009 and May 2013 from 344 reported safety incidents over1700 sites of care in USA were analyzed [4]. The analysis showed nearly one quarter of the safety incidents involved unsafe use of technology. New types of errors emerged from the inappropriate use of health IT called health IT related errors [2]. These errors significantly increase the risk of adverse events and patient harm [2].

Most of the previous studies have been focused on sociotechnical factors influencing the occurrence of

health IT related errors [6,7,8,9,10]. For instance, interviews with 34 medical practices across three primary care in England identified seven categories that causes of prescribing errors [6]. The categories include the prescriber, the patient, the team, the work environment, the task, the computer system, and the primary–secondary care interface. In the same year, an analysis of 456 safety incidents were reported from April 2007 and October 2011 in a tertiary care clinic at the University Hospital in Basel reported human errors, communication problems, documentation and transmission errors, stress, multitasking, machine and/or computer problems, staff shortage, and tiredness were the reasons for critical incident. Moreover, literature review of publications between 2000 and 2009 was conducted to learn the safety of health IT systems [8]. The review grouped the safety issues according to process, people, technology, organization, and environment. In general, the previous studies demonstrated broad range of sociotechnical factors contributed to health IT-related errors. However, studies concern on safe health IT use behavior are scare. Therefore, the aim of this study is to identify the key health IT use behavior that influences on the safe health IT adoption. Systematic literature review was conducted to achieve the study aims.

## 2.0 SYSTEMATIC REVIEW METHODOLOGY

Systematic review was conducted and reports based on the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) statement. PRISMA statement is a guideline for reporting of systematic reviews and meta-analyses particularly in the field of healthcare [11,12]. The search strategy comprises of four phases, namely, identification, screening, eligibility and included. In the identification phase, related articles were identified by searching the articles published in Medline, EMBASE, and CINAHL. The databases were chosen due to its relevancy and pertinence for journals in the field of Medical and Health Informatics. Besides, the articles in the database are available as full text articles, subscribed by two Malaysia's notable public university namely the Universiti Teknologi Malaysia, and Universiti Malaya. Search keywords used in this study encompassed the Boolean combination of electronic medical record 'OR' health information system 'OR' health information technology 'AND' medical error 'AND' safety. Next in the screening phase, duplicate articles were removed from further review. Potential article record titles and abstracts were then screened and retained for further review if they met three inclusion criteria which are (i) written in English articles, (ii) full-text articles and (iii) comprise of safety issues on the health IT. Subsequently in the eligibility phase, the remaining full-text articles were then reviewed for eligibility in order to extract the health IT use behavior. Only articles from empirical research that reported findings on the health IT use behavior are included for further analysis and synthesis in the inclusion phase. Articles without health IT focus and use behavior were excluded in this study. Besides this, hand searched is also frequently adopted as an additional step in executing SLR. Typically, for additional studies hand searched was performed on the reference lists of the included articles. Finally, we extracted the use behaviour based on the findings described in the articles included for this study.

## 3.0 RESULTS

In identification phase, the search keywords returned 2828 unique peer-reviewed journal articles available until the year of 2014. Out of those, 399 articles were screened based on abstracts in the screening phase, yielding a total of 148 full-text articles eligible for further assessment. Consequently, a total of 13 full-text articles were retrained for analysis in the inclusion phase. Additionally, articles listed in the references of the 13 full-text articles were hand searched for additional articles, yielding 10 more articles to be included. Finally, a total of 23 articles were reviewed to extract the health IT use behaviour. Figure 1 shows the flow of information through different phases of the SLR.

Of the 23 reviews, nearly two third (65%) of the selected studies originated from the USA. Studies conducted in Europe (22%) were the second highest and followed by Australia (9%). However, only one paper was from study conducted in Israel. These articles were published between 2003 and 2014. Over two third (70%) of the studies were conducted in hospital. The others were conducted in ambulatory care clinic and primary care clinic, both accounted for 9% each. This is followed by nursing home and commercial pharmacy, both recorded 4% each. Generally, paramount health IT safety researches were conducted in developed countries in which hospitals were the most concerned healthcare settings.

More than three quarter of the studies (87%) used qualitative methods for data collection. Specifically, slightly half of the qualitative studies (55%) employed single qualitative methods called document analysis (30%), interview (20%), and observation (5%). Combination of observation and interview (40%) were the most frequent applied in terms of multiple qualitative methods. However, very few studies (13%) employed dual combination of qualitative with quantitative methods. Hence, qualitative methods were the most preferred data collection methods in the health IT safety studies to explore and gain in depth understanding of the phenomenon.

Table 1 summarizes the previous work done in investigating the health IT use behaviour.

Workarounds, adhere to procedure, vigilant action, and copy and paste behaviour emerged as use behaviour that influence the safety of health IT adoption. Workarounds and adhere to procedure were the most frequent health IT use behaviour reported in the studies.

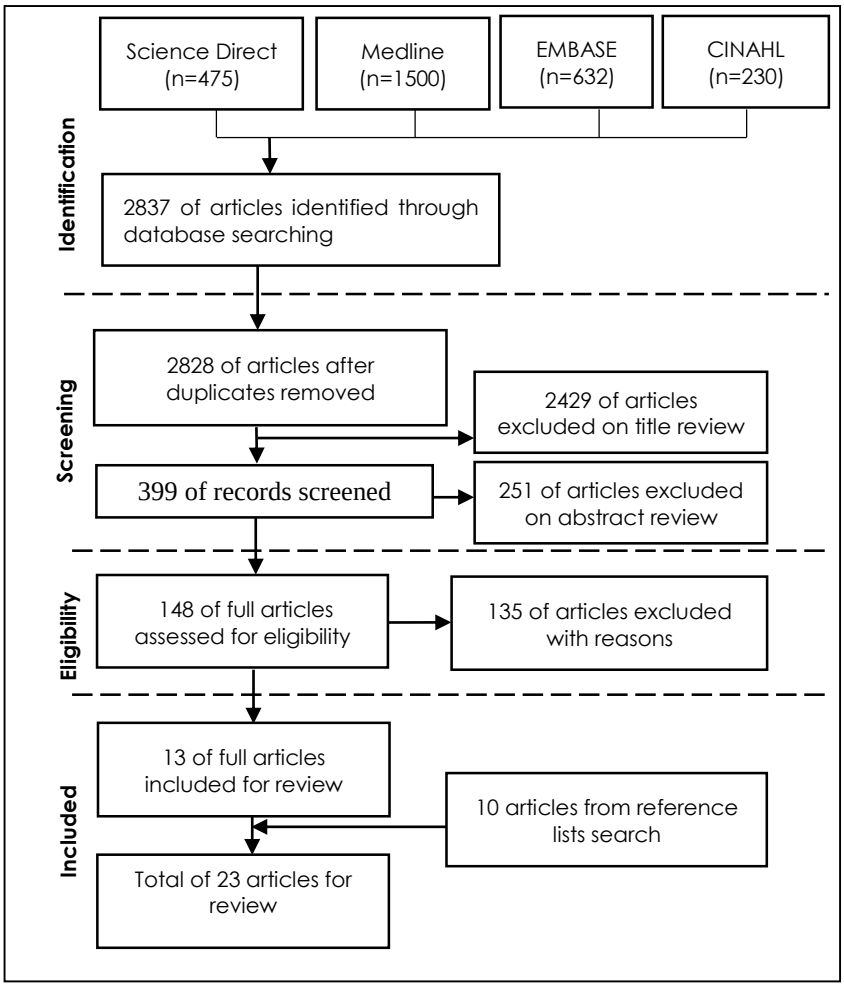



**Figure 1** SLR information flow diagram

### 3.1 Workarounds

Workarounds is alternative strategies that bypass formal procedural codes in an effort to improve efficiency and productivity [13]. Workarounds include omission of steps, out of sequence steps, and unauthorized steps. Workarounds were devised in various ways such as making phone calls, taking multiple paper notes, issuing paper-based and verbal orders, and changing and making notes on the printed orders [14]. There are various reasons for workarounds. Workarounds happened because it offers efficiency, benefits over electronic workflows such as ease of use and save time [30]. Workarounds were also due drawback of health IT such as the design inadequately support to the healthcare practitioners' work practice, and limited functionality due to poor integration between social and technical aspects [30]. For example healthcare practitioners made new order by making a call to the pharmacy instead of depending on fax printed orders due to either limited fax capabilities or due to low speed of the wireless connectivity. Likewise, workarounds were the most common strategies to deal with technical problems which prevented access to patients' and clinical information [27]. Nonetheless, healthcare practitioners developed unnecessary workarounds by using additional manual steps that might potentially be automated because they were not aware of the particular functionalities existed in the health IT or unable to use them due to lack of knowledge or skills [28].

Despite the advantages of workarounds, workarounds caused the health IT being used in a way that it was not intended for, and potentially resulted to errors as well adverse events [13]. For instance, sending same order using difference methods such as email, fax and telephone to assist delivery may cause

duplicate information led to duplication and unsafe condition [33]. Several examples of workaround as well as paper persistence were identified through observation and interviews with 16 healthcare practitioners [30]. In the case of bypassing the standard procedure such as not to use health IT due to the time constrain to complete inputting information into the system. In addition handwritten notes to be included for certain test results given on the printed outputs from the health IT were the

**Table 1** Summary of related works on health IT use behavior

| Article \ Use behavior | Workarounds | Adhere to procedure | Vigilant action | Copy and paste behavior |
|---|---|---|---|---|
| [15] | ✓ | ✓ | | |
| [16] | | | | ✓ |
| [17] | | | ✓ | |
| [18] | | ✓ | | |
| [19] | ✓ | ✓ | | ✓ |
| [20] | | ✓ | | |
| [21] | | | ✓ | |
| [22] | ✓ | ✓ | | |
| [13] | ✓ | ✓ | | |
| [23] | | ✓ | | |
| [24] | ✓ | | | |
| [25] | | ✓ | | |
| [26] | | | | ✓ |
| [27] | ✓ | | | |
| [28] | ✓ | | | ✓ |
| [14] | ✓ | | | |
| [29] | | | | ✓ |
| [30] | ✓ | | | ✓ |
| [31] | | ✓ | | |
| [32] | | ✓ | | |
| [33] | ✓ | | | |
| [34] | | | ✓ | |
| [35] | ✓ | | ✓ | |

examples of workaround. This may propagate medical errors. Further, it was found that specialists tend to write their reviews or orders on the paper containing information printed from the health IT rather than typing the related information into the health IT. These type of workarounds produced gaps in electronic documentation.

A study on evaluation of the impact of a computerized physician order entry (CPOE) on communication between nurses and doctors was conducted using mix methods [24]. The study highlighted doctors and nurses devised workarounds to compensate with communication problems, which often represented risks for medication errors. For instance, nurses amended drug administration by simply cancelling with a cross mark over the medication timing on prescription labels when the medication administration plans did not fit in with their ward routine or with the patients' conditions. By doing so, they rarely informed the changes made to the doctors. Thus, the modification was not registered in the systems. Consequently, the information was not updated to the doctors. In a study [14] to evaluate medication process in the context of CPOE showed multiple notes taken during ward rounds as CPOE system was not accessible near patients' beds. This is another example of workaround. Doctors may write a brief note on papers, or rely on their memories before entering the orders into health IT system. Nevertheless, this may cause problems when there are many patients, and dealing with various changes made. The doctors may enter orders differently from what have been decided earlier.

Besides, a pharmacist contacted a doctor to request for amendment on a prescription error may led to prescription error when the doctor did not make changes in the health IT [35]. Instead, the doctor used the old prescription with errors to generate new electronic prescriptions (e-prescriptions) [35]. Likewise, computerized order entry preceded by verbal instruction caused error when doctors changed or forgot the details of their verbal orders when they input order into health IT [19,24]. Verbal communications concerning orders were informal, and therefore more likely to induce errors [15].

### 3.2 Adhere to Procedure

Failure to follow procedures or protocol played a significant role contributing to errors and potentially adverse events [13,23]. For an example, a healthcare practitioner opens a patient chart by typing the patient's name rather than using his unique identification number. This increased the possibility to

inadvertently select a wrong patient [25]. Failure to adhere to the procedures and protocols may indicate that the procedures to perform tasks using health IT such as processing medication orders were insufficient, impractical, inaccessible, or poorly understood due to inadequate training and education[23].

Features such as alerts and logon procedure that are primarily designed for safety may contribute to workflow disruptions when they are poorly incorporated into workflow [31]. Ignoring alert leading to failure to act to a truly important warning that may cause danger to patient safety. Alerts attributed to major workflow process issue [19]. Alerts forced healthcare practitioners to carefully consider whether a process could be hazardous. However, practitioners distracted by too much irrelevance alerts circumventing the safety features by overriding the alerts. This may sometimes cause an important alert being missed and potentially lead to adverse events [22,31]. Besides, case study comprised of observations and interviews of 19 healthcare practitioners were performed from January through November 2009 [32]. In spite of the much more powerful electronic health record (EHR) system with clinical decision support systems (CDSS) capabilities, the system was not perceived as improving patient safety.

Doctors and nurses were given individual password and different user rights in the system. Accordingly, only doctors have the authority to order and alter medications. Nurses are allowed to register changes in medication but requires electronic approval from doctors. In order to cope with this limitation, some doctors allowed nurses to perform the medication process under doctors' users right [20]. As it is time consuming to login while attending to the urgency in providing medical care, many healthcare practitioners just used other healthcare practitioner's that are already logged in sessions instead of using their own account [15,31]. In doing so, healthcare practitioners can cause either unintended patients receiving medication or patients not receiving the intended medication [18].

### 3.3 Vigilant Action

Vigilant refers to the careful action or attention to avoid potential error or risks. Using ethnographic research over a seven month period and interview data were collected at four clinics in USA in describing the kinds of unintended consequences related to the implementation of CPOE [21]. Interview involved 25 personals included administrators, IT related staff, and clinical staff. The observations demonstrated that healthcare practitioners did not perform conformation, and consequently made errors due to performing tasks urgently to meet the organizational demand as well due pressured for time. Errors were related to unintentionally selecting items close proximity on computer screen, and misspelling when performing data entry.

Healthcare practitioners who hurriedly prescribed an order were prone to make mistake when using drop-down menu [17]. A study in exploring consequences and contributing factors of electronic prescribing (e-prescribing) errors at five pharmacys in USA discovered unintentionally selecting wrong quantity were the most frequent errors[35]. The error may cause patients receiving wrong therapy, and thus could worsened the patient's condition. The finding is supported by an audit of 629 inpatient admissions at two hospitals in Sydney, Australia [34]. Selection errors were found as the most common e-prescribing errors associated to the health IT. The errors were also due to failure to pay attention to recognize default value. Healthcare practitioners did not verify default directions or forgot to delete or change auto-populated information. For example, the default time for the first dose administration time is 8:00 am. If an antibiotic was ordered at 15:00 and the default time was not changed, the first dose would be scheduled at 8:00 am on the next day. As a result, there was possible risk of a missed or extra dose being administered.

### 3.4 Copy and Paste Behavior

Copy and paste feature in health IT permits healthcare practitioners to copy a patient note from a past time, insert it under a new date and time, and modify it rather than writing completely a new note [16]. Substantial used of copy and paste feature was due to time constraint and its efficiency to complete many task in a shorter time [16]. Healthcare practitioners who practiced copy and paste routine frequently copied notes prepared by their colleagues, and notes prepared during previous patients' visits or admissions [26]. Excessively coping of notes from previously created documents without verification, or interpreted the data jeopardized the reliability of document content [16,29]. It created information redundancies [16,30] that was possibly misleading or erroneous documentation [16,29]. Besides, inappropriate used of copy and paste feature generated documentation flaw which led to notes contained outdated and inconsistent information, difficult to discover new information, and created confusion or mistake in patient care [26]. It also created cluttered documentation by adding document length, and poor formatting [16]. The resulted lengthy documents proliferated redundant data that required other healthcare practitioners to navigate the document in order to gain whole view of the patient records [19], and possibly the healthcare practitioners did not get the actual clue or idea. Consequently the documents became less meaningful or useful [28,29]. The healthcare practitioners could not find any new information and wasting their valuable times as well can caused

frustration [29]. Moreover, it discouraged educational development by hindering thinking process, and therefore reduced thoughtful assessment in the clinical document [16].

## 4.0 CONCLUSION

SLR based on PRISMA statement had successfully identified the significant use behavior that influence safe health IT adoption. Twenty three studies met the eligible criteria. Workaround, adhere to procedure, vigilant action, and copy and paste behavior were revealed as the use behavior that were often discussed in the literature. Firstly, workaround strategies such as the use of paper in combination with HIS, issuing verbal orders, and changing and making notes on the printed orders are more likely to result in errors and unsafe condition. Second, failure to adhere to procedure such as ignoring alert, and sharing heath IT login password potentially pose risk to patient safety. Third, vigilant action is important to avoid mistake in executing task using heath IT. Lastly, substantial 'copy and paste' behavior without careful examining the accuracy and reliability of the copied information resulted in redundant and erroneous documentation. Hence, inappropriate health IT use behavior can negatively effect on the quality of care and patient outcomes. Healthcare practitioners should practice safe health IT use behavior in order to optimize the potential of health IT to improve patient safety. This review may be of significance in providing useful information on how to safely use health IT.

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## References

[1] Kohn, L. T., J. M., Corrigan, and S., Molla. 2000. *To Err Is Human:: Building a Safer Health System*. National Academies Press.

[2] Sittig, D., and H., Singh. 2011. Defining Health Information Technology–Related Errors: New Developments Since To Err Is Human. *Archives of Internal Medicine*, *171*(14): 1281–1284.

[3] IOM. 2011. *Health IT and Patient Safety: Building Safer Systems for Better Care*. *JAMA*.

[4] Meeks, D. W., M. W., Smith, L., Taylor, D. F., Sittig, J. M.,Scott,and H., Singh. 2014. An Analysis Of Electronic Health Record-Related Patient Safety Concerns. *Journal of the American Medical Informatics Association*. 6 (2014): 1053-1059.

[5] Georgiou, A., E., Vecellio, and G., Toouli. 2013. Monitoring The Impact Of The Electronic Medical Record On The Quality Of Laboratory Test Ordering Practices. *Studies in Health Technology and Informatics*, *188*: 33–38.

[6] Slight, S., Howard, R., and M., Ghaleb. 2013. The Causes Of Prescribing Errors In English General Practices: A Qualitative Study. *British Journal of General Practice*. *63*(615): 713–720.

[7] Scharein, P., and M., Trendelenburg. 2013. Critical Incidents In A Tertiary Care Clinic For Internal Medicine. *BMC Research Notes*, *6*(1): 276.

[8] Harrington, L., D., Kennedy, and C., Johnson. 2011. Safety Issues Related to the Electronic Medical Record (EMR): Synthesis of the Literature from the Last Decade. 2000-2009. *Journal of Healthcare Management*. *56*(1): 31.

[9] Salahuddin, L., and Z., Ismail. 2015. Safety Use of Hospital Information Systems: A Preliminary Investigation. In *Knowledge Management in Organizations*. 707–721.

[10] Salahuddin, L., and Z., Ismail, 2015. Classification Of Antecedents Towards Safety Use Of Health Information Technology: A Systematic Review. *International Journal of Medical Informatics*, *84*(11): 877–891.

[11] A., Liberati, D. G., Altman, J., Tetzlaff, C., Mulrow, J. P. A., Ioannidis, M., Clarke, P. J., Devereaux, J., Kleijnen, and D., Moher. 2009. Annals of Internal Medicine Academia and Clinic The PRISMA Statement for Reporting Systematic Reviews and Meta-Analyses of Studies That Evaluate Health Care Interventions . *151*(4).

[12] Moher, D., A., Liberati, J., Tetzlaff, and D. G., Altman. 2009. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Annals of Internal Medicine*, *151*(4): 264–269.

[13] Hakimzada, A. F., R. A., Green, O. R., Sayan, J., Zhang, and V. L., Patel. 2008. The Nature And Occurrence Of Registration Errors In The Emergency Department. *International Journal of Medical Informatics*. *77*(3): 169–75.

[14] Niazkhani, Z., H., Pirnejad, H., van der Sijs, and J., Aarts. 2011. Evaluating the medication process in the context of CPOE use: the significance of working around the system. *International Journal of Medical Informatics*. 80(7): 490–506.

[15] Cheng, C. H., M. K., Goldstein, E., Geller, and R. E., Levitt. 2003. The effects of CPOE on ICU workflow: An Observational Study. In *AMIA 2003 Symposium Proceedings*. Washington, DC. 8-12 November 2003.150–154.

[16] Embi, P., T., Yackel, and J., Logan 2004. Impacts Of Computerized Physician Documentation In A Teaching Hospital: Perceptions Of Faculty And Resident Physicians. *Journal of the American.* 11(4): 300–309.

[17] Shulman, R., M., Singer, J., Goldstone, and G., Bellingan, 2005. Medication Errors: A Prospective Cohort Study Of Hand-Written And Computerised Physician Order Entry In The Intensive Care Unit. *Critical Care*. 9(5): R516–21.

[18] Koppel, R., J. P., Metlay, A., Cohen, B., Abaluck, A. R., Localio, S. E., Kimmel, and B. L., Strom. 2005. Role Of Computerized Physician Order Entry Systems In Facilitating Medication Errors. *Jama*, *293*(10): 1197–1203.

[19] Campbell, E. M., D. F., Sittig J. S.,, Ash, K. P., Guappone, and R. H., Dykstra. 2006. Types Of Unintended Consequences Related To Computerized Provider Order Entry. *Journal of the American Medical Informatics Association*. 13(5): 547–556.

[20] Wentzer, H. S., U., Böttger, and N., Boye. 2007. Unintended Transformations Of Clinical Relations With A Computerized Physician Order Entry System. *International Journal of Medical Informatics*, 76 Suppl 3: 456–61.

[21] Ash, J. S., D. F., Sittig, R. H., Dykstra, K., Guappone, J. D., Carpenter, and V., Seshadri. 2007. Categorizing The Unintended Sociotechnical Consequences Of Computerized Provider Order Entry. *International Journal of Medical Informatics*. 76(1): 7–21.

[22] Vogelsmeier, A. A., J. R., Halbesleben and J. R., Scott-Cawiezell. 2008. Technology Implementation And Workarounds In The Nursing Home. *Journal of the American Medical Informatics Association*. *15*(1): 114–119.

[23] Santell, J. P., J. G., Kowiatek, R. J., Weber, R. W., Hicks, and C. A., Sirio. 2009. Medication Errors Resulting From

Computer Entry By Nonprescribers. *American Journal of Health-System Pharmacy*. *66*(9): 843–853.
[24] Pirnejad, H., Z., Niazkhani, H., Sijs, M., van der, Berg, and R., Bal. 2009. Evaluation of the Impact of a CPOE System on Nurse-physician Communication-A Mixed Method Study. *Methods of Information in Medicine*. *48*(4): 350–60.
[25] Shachak, A., M., Hadas-Dayagi, A., Ziv, and S., Reis. 2009. Primary Care Physicians' Use Of An Electronic Medical Record System: A Cognitive Task Analysis. *Journal of General Internal Medicine*. *24*(3): 341–348.
[26] O'Donnell, H. C., R., Kaushal, Y., Barrón, M. a, Callahan, R. D., Adelman, and E. L., Siegler. 2009. Physicians' Attitudes Towards Copy And Pasting In Electronic Note Writing. *Journal of General Internal Medicine*. *24*(1): 63–68.
[27] Magrabi, F., M. S., Ong, W., Runciman, and E., Coiera. 2010. An Analysis Of Computer-Related Patient Safety Incidents To Inform The Development Of A Classification. *Journal of the American Medical Informatics Association : JAMIA*. *17*(6); 663–670.
[28] O'Malley, A. S., Grossman, J. M., Cohen, G. R., Kemper, N. M., & Pham, H. H. 2010. Are Electronic Medical Records Helpful For Care Coordination? Experiences Of Physician Practices. *Journal of General Internal Medicine*, *25*(3), 177–85. doi:10.1007/s11606-009-1195-2
[29] Holden, R. J. 2011. Cognitive Performance-Altering Effects Of Electronic Medical Records: An Application Of The Human Factors Paradigm For Patient Safety. *Cognition, Technology & Work*. *13*(1): 11–29.
[30] Saleem, J. J., A. L., Russ, A., Neddo, P. T., Blades, B. N., Doebbeling, and B. H., Foresman. 2011. Paper Persistence, Workarounds, And Communication Breakdowns In Computerized Consultation Management. *International Journal of Medical Informatics*. 80(7): 466–79.
[31] Redwood, S., A., Rajakumar, J., Hodson, and J. J., Coleman. 2011. Does The Implementation Of An Electronic Prescribing System Create Unintended Medication Errors? A Study Of The Sociotechnical Context Through The Analysis Of Reported Medication Incidents. *BMC Medical Informatics and Decision Making*. 11: 29.
[32] Abramson, E. L., V., Patel, S., Malhotra, E. R., Pfoh, S., Nena Osorio, A., Cheriff, C. L., Cole, A., Bunce, J., Ash, And R.,Kaushal. 2012. Physician Experiences Transitioning Between An Older Versus Newer Electronic Health Record For Electronic Prescribing. *International Journal of Medical Informatics*. 81(8): 539–48.
[33] Hincapie, A. L., T., Warholak, A., Altyar, R., Snead, and T., Modisett. 2014. Electronic Prescribing Problems Reported to the Pharmacy and Provider ePrescribing Experience Reporting (PEER) portal. *Research in Social & Administrative Pharmacy*. *10*; 647–655.
[34] Westbrook, J. I., M. T., Baysari, Li, L., Burke, R., Richardson, K. L., and Day, R. O. 2013. The Safety Of Electronic Prescribing : Manifestations , Mechanisms , And Rates Of System-Related Errors Associated With Two Commercial Systems In Hospitals. *Journal of the American Medical Association*. *20*(6): 1159–1167.
[35] Odukoya, O. K., J. A., Stone, and M. A., Chui. 2014. E-prescribing Errors In Community Pharmacies: Exploring Consequences And Contributing Factors. *International Journal of Medical Informatics*. 83(6): 427–37.