

# The Impact of Electronic Health Records on Client Safety in Aged Care Homes

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**Abstract.** This study collects and critically reviews the published literature to synthesize the risk factors for client safety in residential aged care and the potential contributions of electronic health records to reducing these risks. Three major types of risk factors for client safety were identified: risk factors related to the person's health; those related to the health and aged care system serving the person and those related to human error. Multiple strategies at all levels of an aged care organization are needed to reduce risks and improve client safety. Electronic health records can be one of the effective organizational mechanisms because it improves access to better information and integrates intelligent functions to support point-of-care decision making.

**Keywords.** Electronic health records, EHR, nursing documentation, patient safety, risk, residential aged care, long term care, nursing home

## Introduction

With the population ageing, the demands for residential aged care services around the world are steadily increasing. Residential aged care services in Australia provide accommodation, meals and care services for the frail elderly, with assistance from skilled and unskilled nursing services [1]. Associated with the ageing process is increased levels of frailty and chronic diseases, which are the main challenges for nursing staff to provide appropriate and safe care [1]. Generally, people living in residential aged care homes (RACHs) have higher exposure to various risk factors than their counterparts in the community [2].

Nursing documentation is a major clinical information source in aged care [3]. Many RACHs in Australia have introduced electronic health records (EHR) [3] for the purposes of improving the quality and efficiency of client records, to comply with nursing and accreditation standards and to meet legal requirements [3]. However, the relationship between EHR and client safety is yet to be validated in RACHs, and this is the aim of this study.

As little research has investigated the impact of EHR on client safety, in order to establish the relationship between EHR and client safety, we must first review the risks factors for client safety, then the impact of EHR on these risk factors, and then whether EHR can alleviate or eliminate these risk factors. Because the risk factors for client

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safety can be caused by medical treatment, clinical procedures or nursing care practices, the study took a broad view to include inter-professional practices with the care recipients confined to clients in RACHs, without limiting the scope to nursing practices.

## 1. Materials and Methods

This study takes the approach of secondary research of the published literature. It was conducted during the period between April and September, 2013. The key words used for search include: electronic health record/EHR, risk, client/resident/patient safety, residential aged care/long term care/nursing home. The databases searched were: Health Reference Center, Informit Health Collection, MEDLINE, Pub Med Central, Science Direct, Web of Science, IEEE Xplore, CINAHL, and Google Scholar. The inclusion criteria included: (1) peer-reviewed studies published during the period of 2000 to 2013, (2) risk factors for client safety in RACHs and potential contributions of EHR to client safety and (3) articles written in English. Exclusion criteria were: (1) no reasonable definition of risk for client safety, (2) not considering risk factors for client safety, (3) not peer reviewed, (4) not published in English and (5) not in the setting of RACHs, nursing home or long term care. The articles were grouped into two categories: risk factors for client safety in RACHs and the impact of EHR on reducing the risk factors for client safety. An established cognitive taxonomy of medical errors was applied to classify the risks for client safety caused by human factors [4].

The primary search was manually conducted by the first author. Reference lists from high quality articles were also screened to identify the relevant articles. The classification of risk factors and the contributions of EHR were reached through group discussion and consensus.

## 2. Results

In total, 172 abstracts were identified, 132 of them were excluded and 34 articles were reviewed [1-34]. 24 papers addressed the risk factors for client safety. 12 discussed the contributions of EHR to reducing risks for client safety. 6 covered both topics. 24 studies were only conducted in RACHs and 14 covered both RACHs and other healthcare settings. In the rest of the paper, first the risk factors for client safety are discussed in detail in three groups: risk factors related to personal health conditions, those related to the health and aged care systems serving a client and human factors regarding care staff. For each group, the risk factors are discussed in terms of the settings of occurrence, either uniquely in RACHs or both in RACHs and other healthcare settings. Afterwards, the contributions of EHR to reducing these risk factors and improving client safety are analyzed.

### 2.1. *Safety risk factors related to personal health conditions*

Some clients have a higher possibility of exposure to risk than others. These include those who suffer from poor health conditions [5], those who are dying [5], those inclined towards self-harm [11], those suffering from depression [11], poor mobility [5], disability [5], allergy [34] and mental health issues [11]. These all require special care

and first aid [25]. If not dealt with in a timely manner, it may lead to medical accident or falls [11]. If a client suffers from depression for a long time without intervention from nursing care, the situation will deteriorate quickly. Allergy to drug and food also often happen to people suffering from chronic obstructive pulmonary disease (COPD) and Asthma [34]. In some cases, allergy needs to be controlled by first aid services or requires treatment by drugs [22]. Delayed treatment of allergy can cause harm, even death [34]. In summary, personal health conditions are important internal risk factors that require continuous nursing attention. These safety risk factors exist in both RACHs and other healthcare settings.

## *2.2. Safety Risk factors related to health and aged care systems*

Residential age care services frequently interface with other healthcare services to provide continuous, holistic, long term care for the clients [7]. Therefore, the risk factors for client safety exist in the whole health and aged care processes. These include environmental risk factors in RACHs, risk factors in medication and nursing care processes, and risk factors caused by the introduction and use of IT applications.

### *2.2.1. Safety risk factors related to the unique environment in RACHs*

The environmental risk factors in RACHs are system failure and errors. The system failure includes inappropriate or wrong methods in treatment, nursing care, meal services and communication. Risk factors in nursing care processes include miscommunication or lack of communication between nursing staff and clients or between aged care staff and other healthcare providers, such as doctors, hospitals and community pharmacies [29]. For example, lack of communication between a pharmacy and a RACHS lead to errors in medication packaging [29]. It is also found that unhealthy or unclean food can cause malnutrition or health problems [7].

### *2.2.2. Safety Risk factors in both RACHs and other healthcare settings*

Safety risk factors in the medication processes include wrong drug, wrong dose, wrong formulation, wrong route, wrong strength and wrong timing [22, 32]. The powerful drugs can lead to high risk by changing personal health condition [22]. Misuse of drugs includes wrong drugs and wrong dose for the wrong client and inappropriate use of a drug before or after a meal [16, 21, 32]. Adverse drug-drug-interaction often happens when different drugs are used together [22].

Nursing procedural failure is a main risk for care. For example, medication label, patient identification, medication chart and body mass index are often misread and misidentified [17, 29]. Checking and preparation, witness administration, infusion pump set up, dangerous drug register and signing medication chart are all nursing care processes prone to error [17, 29-31]. Inappropriate use of complex technologies can also cause harm to frail people [7, 15, 23]. The adverse effect does not only last during the operation, but also in the care process; thus it requires special attention.

In the situation where IT application is used in nursing care processes, power failure can cause inaccessibility of EHR, without access to personal health information, appropriate medication management is under risk [6, 8, 15]. Portable offline emergency medical record devices are developed and used to deal with this contingent situation [9]. In such case, battery life can be a barrier to continuous function [9, 33]. In addition, system errors from EHR could cause misuse of drugs and wrong identification of client,

which was highly risky [9, 16]. Several studies found EHR were not accepted by nurses because the interface design was not friendly and the users felt difficult to use the functions of the system [13, 28]. Not familiar with the system and misuse of the system can reduce the efficiency and may risk client safety [9].

### *2.3. Human factors for client safety in health and aged care systems*

Human factors that might cause risk to client safety include the provision of inappropriate care by health and aged care staff, their negligence in care, and slips and mistakes in the process of care delivery [29]. ‘Slip’ in this case means error caused by the incorrect execution of a correct action sequence [4]. ‘Mistake’ is the correct execution of an incorrect action sequence [4].

The possible causes for inappropriate care might be care staff’s lack of knowledge about the risk factors [5, 29], which may reflect their lack of training [5, 12] and lack of work experience [5, 18]. Care staff’s negligence in care might be caused by depression or lack of time [5, 20]. These, together with lack of acknowledgement of unfamiliar or unknown situation [5], may lead to nursing error or failure [7].

#### *2.3.1. Inappropriate care caused by lack of training and work experience*

Lack of training for staff is a high risk factor for client safety. It can lead to knowledge related mistakes and intentional slips in care delivery [31], such as error in handling special conditions in first aid situation [7]. In addition, medical technology can be complex and requires nurses to have sufficient training before using it confidently [5]. According to Zhang et al. (2004), incorrect knowledge, incomplete knowledge and misuse of knowledge can lead to execution mistake and evaluation mistake [4]. These risk factors can be alleviated by appropriate and sufficient training.

Lack of work experience can often happen to some new health care workers. It is likely that part-time and less experienced nurses and doctors are more prone to mistakes [8] that are not likely to happen to skillful health care workers [7].

#### *2.3.2. Lack of attention caused by depression or negative feeling or lack of time*

Nursing staff with depression or negative feeling is prone to inattention [13]; therefore, a nursing manager needs to pay attention to staff having such feeling so as to prevent harms to clients [29]. In nursing care services, a nurse is required to spend a certain amount of time with each client.

Lack of time and inadequate care can harm client safety [10]. Time pressure often happens when there is an emerging issue that draws the nurse’s attention away [27]; or one nurse attending to more than one client at a time [9]; or lack of availability of information on time and demand [30].

#### *2.3.3. Overflow of working memory*

Nursing staff in RACHs are often multi-tasking [24]. Multi-tasking can lead to overflow of working memory. This can lead to goal slips and intention slips. Information overload can lead to interpretation slips [4].

#### *2.3.4. Lack of acknowledgement of unfamiliar or unknown situation*

Early acknowledgement of unfamiliar or unknown situation can avoid medical incident from happening [14]. Part-time and less experienced nurses are more likely to make error in these circumstances [31]. Insufficient information and lack of feedback may lead to action evaluation slips [4]. Therefore, a nurse should be given time and adequate information to know and familiar with a new work place [14].

#### *2.4. The possible contributions of EHR to client safety*

Although there is a high potential for EHR to contribute to improving client safety in aged care, empirical evidence is required to validate this claim. We will first present the empirical findings about the contributions of EHR to client safety in RACHs, and describe the potential contributions delineated by other studies.

##### *2.4.1. Benefits of EHR that have been empirically tested*

###### *2.4.1.1. Improving information management and allowing nurses fast access to enter data and retrieve health information*

When adequate number of computers are placed in the appropriate place to give the healthcare workers and nursing staff access to enter data or retrieve information by keyword search when needs arise, this saved time and improved efficiency in information retrieval [33]. The flow-on benefit was facilitating nurse following up of care when needs arose. It has contributed to avoid the risks of sub-optimal care or wrong procedures [33]. Helping with the development of better care plans was another advantage of EHR for client safety [15]. By saving time for nurses in managing information [15], this EHR system had contributed to improving efficiency and relieving time pressure of nursing care. It thus gave nurses more time to spend with a client to improve the quality of care [15].

###### *2.4.1.2. Improving communication among nurses and between nurses and clients*

Communication breakdown could be a serious system failure in aged care. Better communication in nursing care always requires a nurse to acquire feedback from a client and record observation about the person's condition in EHR on time [19]. The feedback from a client and from a nurse's observation could be put into EHR system and be classified. This had led to improved communication among nurses to avoid medical error and inappropriate care for a client [19].

###### *2.4.1.3. Facilitating nursing compliance with procedure*

Electronic health records can provide the detail information about the steps of nursing care processes [18]. This can provide in-time support for nurses to comply with the right procedure. It was found that the health care workers made fewer mistakes with the suggestion and support from an EHR with such functions [15, 19].

###### *2.4.1.4. The educational benefit of EHR*

For new health care workers such as part-time nurses, an EHR system could provide practical cases for learning to deliver nursing care. It helped the nursing staff to enhance their skills and practice [15]. It also provided an opportunity of peer learning among nurses and facilitated the development of better care plans for various problems [33] with decision support functions [26].

#### 2.4.1.5. Clinical decision support (CDS) in EHR can support care decision making

Decision support is a potential solution for intention mistake and action specification mistake [4] which might lead to medical error. In addition to its use in normal condition, clinical decision support (CDS) functionality that facilitates fast care decision making is particularly useful in emergency situation. For example, in Kawamoto's study, CDS provided suggestions to nurses about what was the right interaction with client in first aid situation [15]. Menachemi found that clinical support offered by a CDS system in medical treatment had helped to avoid the incorrect medical procedure [19] by providing guidelines for treatment and care [16].

#### 2.4.2. The potential contributions of EHR for improving client safety

##### 2.4.2.1. Electronic health records may provide guidelines for treatment and care

Memory aid is the potential solution of preventing interpretation slips, action evaluation slips, and action execution slips which can lead to medical errors [4]. An EHR system can provide clinical guidelines or memory aid for health care workers and nurses [33] to relieve their burden to remember all the detail care procedures [33]. For example, the special guidelines for caring of clients with diabetics could be useful for the provision of safe care [33].

##### 2.4.2.2. Electronic health records may alert nurses about vital test results

Bell's research shows that body mass index such as blood pressure and heart rate, which relate to client safety, can be recorded in the EHR systems [30]. When an EHR system provides alert of the dangerous level of body mass index, the risk such as heart attack can be avoided [30].

##### 2.4.2.3. Electronic health records may reduce medication mistake or slips

By recording data about adverse drug interactions in an EHR system and providing alerts to the users when the high probability situation occurs, the risk of medication mistake, which can lead to allergenic reaction, can be reduced. Westbrook suggests that misuse of drug often happens when health care workers handle 'sound-like' or 'look-like' drugs [32] and these safety risk factors might be reduced by memory aid [4] or coding drugs in certain numbering system [34]. An EHR system with photo of a client who takes the medication will also help with identification of the right client [13].

### 3. Discussion

This research synthesized three major types of risk factors for client safety in residential aged care: risk factors from the personal health conditions, from the health and aged care systems and the human factors from health and aged care staff serving the clients. The risk factors that are related to the personal health conditions include loss of cognitive function, depression, disability, allergy to drugs, etc. The risk factors from the health and aged care systems include system failure or errors generated from inadequate allocation of human resources for care, sub-optimal processes in medication management and nursing care, etc. Human factors from health and aged care staff include lack of experience in providing appropriate care, negligence, possibly caused by time pressure in delivery of care. The cause for inappropriate and unsafe care may be a lack of training, thus no knowledge about a care procedure to client's safety.

As an important structural component for aged care service delivery, EHR systems have great potential to mitigate or avoid the risk factors and enhance client safety. For example, it can provide fast access to enter data and retrieve health information, and better support for care decision making. Otherwise, it can improve feedback and communication among care staff, facilitate compliance with nursing procedure, and improve efficiency in information management and education. Test results easily found in EHR can alert nurses about resident's risk health conditions. An EHR system with alert function about adverse drug interaction can reduce medication error.

#### 4. Conclusion

There is a paucity of research evidence on the impact of EHR on client safety in residential aged care. By synthesizing the research literature, this study has identified three major types of risk factors for client safety in residential aged care. It documented the identified impacts of EHR to reduce risk factors and improve client safety. Multiple strategies at all levels of an aged care organization are required to improve client safety. Electronic health record is one of these essential, effective organizational mechanisms.

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