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REDUCING ERRORS IN ELECTRONIC MEDICAL RECORDS

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ABSTRACT

As electronic medical records (EMR) are used in e-health by healthcare professionals and by patients themselves, there is a need to facilitate the efficiency and usability of these systems, reducing adverse patient outcomes due to EMR-related user errors. To pinpoint and mitigate errors within the electronic health record, we formulated a methodology designed to uncover entry errors within the electronic health record. This approach involves meticulously examining the electronic health record during data input and cross-referencing it with the patient's medical history to uncover potential entry discrepancies.

Keywords: E-Healthcare, Medical Records, Electronic Records Information, Security, Erroneous Diagnoses

I. INTRODUCTION

With technological advancements and the need to have a patient's medical history, which facilitates diagnosis and the work of health professionals, electronic medical records (EMR) are becoming essential in e-health. This use must be simple, effective, safe, and correct for health professionals and patients.

Healthcare professionals face many challenges that reduce the efficiency of healthcare systems and increase the risk of harm or death to patients because diagnosis is essentially based on medical data identified and extracted from electronic medical records. Hence, errors occurring in medical data increase the risk of harm or death to patients. Errors include entering information into the wrong patient record, recurring ineffective alerts, difficulty locating patient information, incorrectly entering patient information, and inconsistent terminology (Hanauer et al., 2015).

This article suggests using the patient's medical history in the electronic health record to reduce and detect data entry errors. The aim is to detect data entry errors by comparing them with mobile access, ensuring the accuracy of the data always entered.

The rest of the paper is organized as follows: Section II presents an overview of the E-healthcare system and data entry errors. Section III details our proposal. Finally, section IV describes a conclusion and perspectives.

II. RELATED WORKS

A. E-Healthcare System

E-health, or electronic health, refers to the use of information and communication technologies in the field of health. This includes various tools such as health records.

The electronic health record contains the patient's medical data, their medical history, and all the interventions of the healthcare practitioners that have contributed to the patient's care. The medical record reflects the relationship between patients and doctors, which can influence communication, trust, improved efficiency in care, and patient satisfaction. Healthcare providers are faced with diagnostic errors caused by errors in the electronic medical record. The causes of errors in the electronic medical record are as follows:

- Healthcare provider errors (entering incorrect or incomplete information, copying and pasting incorrect information, incorrect patient identification)
- Lack of communication between electronic health record (EHR) systems, leading to fragmented and incomplete records
- EHR System Failures
- Delays in transmitting or recording data, such as test results, new prescriptions, and hospitalizations, being updated

Health providers record medical information and data after each patient service. This data concerns the patient's state of health, and the diagnosis given by the health provider is based on this data.

A patient can help reduce the risk of medical errors related to problems with his/her electronic medical record. The steps such a patient can take are the following:

- Regularly request a copy of the records from all health care providers consulted,
- Verify that all basic information is correct (name, address, date of birth, social security number, health insurance information, emergency contacts).

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- Check medical history (allergies, reported symptoms, diagnoses, prescription medications, diagnostic test results, medical and surgical procedures performed).
- Check that medical information is up to date.
- If an error is detected, contact the healthcare provider to correct the error.

B. Data Entry Errors

This section provides an overview of best practices found in the literature that aim to improve the design and prevent errors in using electronic health records. These practices are watermarking, information control and management, and cross-check methodology.

1 Watermarking

Among the most serious errors encountered in electronic health records, which pose a major problem in making a diagnosis, is the mismatch of patient records entered into the system (Donaldson et al., 2000). Healthcare professionals rely on the patient number rather than the name to enter or modify patient medical data. An error in entering the file number field can cause healthcare providers to open the wrong file and/or not notice the opening of a file other than the one intended (Yamamoto, 2014). This type of error occurs during a significant testing period (about 3 months), which can be committed by several health providers and can generate a significant error rate (about 1.3 on average). This rate indicates that there may be a conceivable number of patient health data errors.

A watermark is used to remedy this type of patient number error. The idea is to add a fixed field number to the patient's file number, allowing users to keep a constant visual of the field number thanks to the text entered on it.

2 Information Control and Management

One of the problems healthcare providers face when using electronic medical records is loss of trace, where they cannot locate documents or test results in a patient's record. This type of problem occurs because some crucial documents, necessary messages, and test results are missing from the electronic inbox (Yachel, 2010).

To resolve this type of problem, practices are proposed in the literature: (1) program the EMR parameters to adapt them to the user's needs; (2) monitor the use of inboxes used by health care providers, allowing messages to be viewed as they are received; (3) use of the search functionality which helps locate information in a patient's record using a search engine such as the Electronic Medical Record Search Engine (EMERSE) which allows data to be located and retrieved from EMRs.

3 Cross-check methodology

To reduce errors in electronic health records, healthcare providers cross-check data and health information (Freund et al., 2018). This method encourages healthcare providers to link patient records to reduce the number of adverse events. This method is based on work carried out in emergency rooms (EDs). Emergency practitioners are responsible for many patients, forcing them to make rapid decisions, which can lead to errors and harmful consequences. The cross-check method involves practitioners meeting with colleagues thrice weekly and exchanging relevant patient information via the EMR software. Information includes gender, age, chief complaint, key medical history, key clinical findings, key investigations available or ongoing, treatment given in the emergency department, and a brief plan summary (Freund et al., 2018). All this information was specifically and purposefully reviewed and discussed by the colleague, who then commented on it (Starmer et al., 2013).

III. PROPOSED WORK

We recall that our work aims to address the issue of entry errors in medical health records. We have developed a functional model to detect potential errors within these records to achieve this goal. Our approach involves creating a detection process that systematically identifies and flags discrepancies or inaccuracies in the medical data. Through this innovative system, we aim to enhance the accuracy and reliability of medical health records, ultimately improving patient care and safety.

The process involves monitoring (Figure 3), interpreting, analyzing, and correcting errors in the electronic health record.

A. Previous work

To ensure medical data security in the BAN network, we proposed in Sellami et al. (2023) a novel agent-based intrusion detection system for a wireless body area network.

1 Body Area Network (BAN)

BAN is a wireless networking technology that places miniature devices (sensors) around or in the human body to collect vital parameters or act in specific situations. These sensors interconnect and communicate with each other via radio frequencies. BAN security concerns data security

2 Steps of detection

The detection system is focused on the sensor and the network. The architecture of our network is composed of three levels (see Figure 1):

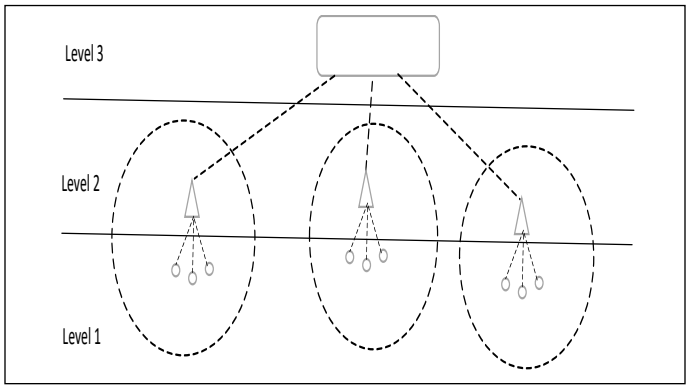

Fig. 1. System Architecture

- First level: represented by sensor network nodes, each with a static agent that collects information and data at the node level.
- Second level: represented by the control agent located at the cluster head level, responsible for controlling the state of the static agent and participating in cooperative detection.
- Third level: represented by the server, the principal agent, that controls the other agents and nodes.

The sensors are placed around or on the patient's body and collect the patient's vital parameters. They then execute the detection algorithm and react to the patient's condition.

Each mobile agent traverses the nodes in its defined route and performs local discovery in each node by aggregating the logs accumulated over time.

Control agents provide global attack detection on interconnected clusters in WBAN. They have a predefined route and a trained pattern and can also target different types of attacks.

When the agent executes the intrusion detection algorithm, it either produces a malicious flag that triggers an alarm response, a regular flag that does nothing (e.g., migrating to the next node in the route), or a suspicious indicator that starts an intervention request.

B. Traditional and improved medical data entry

Figure 2 illustrates how our solution works; it has four components: medical data entry, data analysis, system control, and action

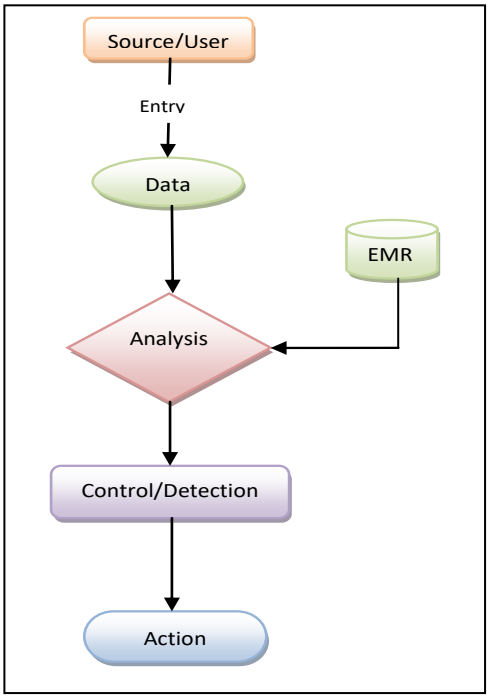

Fig. 2. Step of Proposal

1 Traditional medical data entry

Health providers record medical information and data after each patient service. This data concerns the patient's state of health, and the diagnosis given by the health provider is based on this data.

Medical data can be entered in two ways: by healthcare professionals or by medical sensors

- Healthcare professional: When providing service to a patient, a healthcare worker enters the patient's medical data into the medical file. The data entered concerns symptoms, diagnosis, analysis results, etc.
- Medical sensor: The patient's body is equipped with medical sensors to support the patient. The medical sensor reacts to the modification of the patient's vital parameters. It collects the critical parameters recorded at the level of the patient's device (smartphone). The vital parameters collected are transmitted via the communication network at the health center (hospital and health care enterprises). The transmitted medical data is evaluated, and a decision is taken by the health professionals of the hospital and the health company.

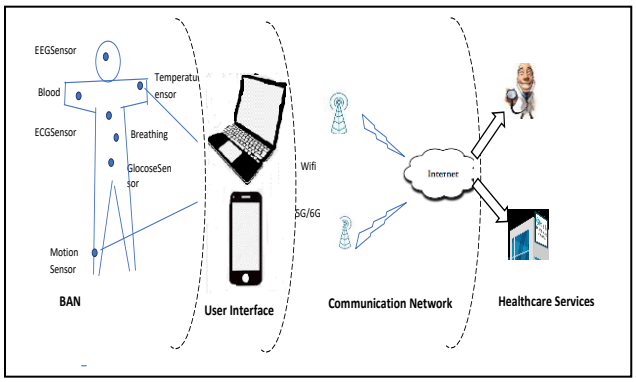

Fig. 3. Patient Monitoring System Architecture

2 Improved medical data entry

We remind you that our work aims to scrutinize the patient's electronic health record, leveraging both their medical history and any pre-existing conditions. We conduct a comparative analysis of the patient's medical history during a new medical data entry. Based on this analysis, we aim to create a new medical data entry. This new entry is then compared to the patient's existing medical history. If a significant difference is detected, an alert is automatically triggered. This alert notifies the healthcare practitioner, prompting them to review and verify the newly introduced medical data. Through this process, we aim to minimize entry errors within the electronic health record.

Detecting medical errors consists of three stages: analysis, detection and control, and action.

1- Analysis: The error detection process starts when healthcare personnel enter new medical data into the patient's records. The newly entered data is compared against the patient's medical history through an analysis and control process.

2- Detection: Any significant deviation in the medical data is identified and cross-referenced with the patient's historical records to mitigate error risks.

3- Action: At this juncture, actions are taken based on the type of error detected:

For generic errors, such as patient status discrepancies, the system is equipped with correction capabilities to rectify the issue.

For specific patient health-related errors, the system alerts the attending healthcare provider to promptly address and correct the error, thereby averting potential medical inaccuracies.

IV. Conclusion

The main objective of our endeavor was to identify and minimize errors within the electronic health record. To accomplish this, we devised a methodology for detecting entry errors in the electronic health record. This method entails scrutinizing the electronic health record during data entry and cross-referencing it with the patient's medical history to identify potential entry errors. Then, after describing our strategy, we outlined a method for detecting input errors.

This article serves as an initial exploration, presenting concepts that will be further developed in our forthcoming work. We aim to finalize the process of analyzing and detecting health errors.

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