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An Easy-to-Use Platform for Reporting COVID-19 Patients by Private Offices and Clinics Without IT Support: A Pilot Study

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Abstract. Background: It is feasible to collect data rapidly and online using IT solutions. Objectives: To present a data collection platform for COVID-19 suspected patients in private offices and clinics without a standard software. Methods: The proposed system for collecting and sharing data of patients with respiratory symptoms was designed to be simple to use, without the need for special technology, and with proper security to authenticate reporters. Results: Two methods were developed to collect data from private physicians and offices. Finally, the data collected by both approaches is integrated and provided to primary healthcare staff to arrange appropriate healthcare measures. Conclusion: Our platform can provide an easy-to-use case reporting system for private physicians.

Keywords. Private offices, COVID-19, Disease reporting

1. Introduction

With the global expansion of COVID-19, health systems are confronting significant challenges in controlling the disease consequences [1]. Iran is also one of the nations with extensive prevalence and mortality. Up to 2022, February the 10th, Iran has 6.7 million cases, and 133,000 deaths [2]. For disease management and timely decision-making, reliable and up-to-date data regarding the disease outbreak is critical [3]. It is

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feasible to collect and evaluate data rapidly using information technology solutions [4]. Decision-makers can use accurate and timely data to define protocols, take priority care, track disease outbreaks, and powered health systems. Also, having access to high-quality data is critical to conducting appropriate studies on this pandemic [5]. Governments, research institutes, universities, and medical institutions throughout the world collect COVID-19 data through different programs including the establishment or upgrading of national health information systems, information dashboards, databases, reporting systems, or registry systems [4, 5].

Since the commencement of COVID-19 outbreak in Iran, Ministry of Health and Medical Education developed two web-based information systems for reporting COVID-19 cases including Medical Care Monitoring Center (MCMC) system for reporting COVID-19 cases from hospitals and the Infectious Disease Control and Prevention Management System (locally called MCDPC) for reporting COVID-19 cases from primary health care facilities. Data quality, inaccurate reporting, high costs, and personnel issues affect these systems for reporting COVID-19 cases [2].

The majority of reporting and surveillance systems are governmental and coverage of private sectors may be limited. In Iran, the majority of public healthcare providers are covered by the above-mentioned government-owned COVID-19 reporting networks. Also, there are some registry systems to collect patient data; however, they are research-based and do not cover private offices appropriately [2, 8]. Iran University of Medical Sciences implemented a modern COVID-19 surveillance system based on electronic health records; however, this system also do not cover private offices [9].

While the private sector provides a substantial portion of healthcare services to Iranians, the majority of these private institutions may not be linked to governmental databases. Therefore, comprehensiveness and coverage of these information systems might be reduced due to the non-participation of private physician offices and clinics. Furthermore, private clinics and physician offices either do not have an electronic information system for data sharing or their information systems do not meet the required interoperability standards to report COVID-19 cases. The shortage of staff also limits these providers to report cases. As a result, a simple platform is needed to report cases and track suspected patients. In this paper, we present our experience with a simple data collection platform for reporting and tracking patients suspected of COVID-19 in private offices and clinics without a standard information system to complete our surveillance system [9].

2. Methods

2.1. National electronic health record system in Iran

The electronic health record system infrastructure (also known as SEPAS in the local language) has been implemented by the ministry of health and medical education in Iran. This national system interoperates with and collects health data from local information systems (such as hospital information systems and laboratory information systems) [7, 10]. In this regard, a national health information network (locally called SHAMS), implemented by the ministry of health, connects healthcare providers. Hospitals interoperate through the SHAMS and share and store health data in SEPAS databases (nodes) through ICD-10 codes and ISO 13606 standards [6, 10]. SHAMS is an Iranian intranet portal for exchanging health data. This network connects all healthcare centers

and allows data to be transmitted between them. Different provinces have different nodes in the SEPAS system. Each node is relevant to a province or medical university, and the healthcare centers in that province provide the requested data to the related "SEPAS" node. Most hospitals (public hospitals) are connected to this network [7, 10]. Primary healthcare providers use other information systems (electronic primary healthcare record systems) developed by private vendors to document patient care. Electronic primary care health records are used by outpatient health care professionals around the country. These primary care centers provide outpatient and primary care, as well as store pertinent data in these information systems. These systems can also interoperate in SHAMS to share data [7]. Iran University of Medical Sciences (IUMS) implemented its COVID-19 surveillance system based on this infrastructure [9].

2.2. Current problems in reporting COVID-19 patients

Tehran province has a population of more than 13 million people, and IUMS-affiliated healthcare centers provides healthcare to 5.4 million people, the largest covered population in the country. IUMS, as one of three medical universities in Tehran, has several affiliated hospitals and primary care centers. Our affiliated healthcare providers use the above-mentioned systems (SHAMS, SEPAS, and a primary healthcare system, locally called SINA) to provide healthcare to patients, including COVID-19 patients [6, 10]. There are many private physician offices and clinics in our covered area. If these providers have a standard office information system (OIS) that satisfy the "SEPAS" standards and the capability to connect to the Internet or intranet, they can easily report suspected COVID-19 cases to SEPAS via our surveillance system [9]; however, many of these private providers lack a standard office information system, and data from suspected COVID-19 patients from these providers are not adequately reported and these patients may not be adequately tracked. These private offices and clinics are the focus of our proposed simple data collection platform.

2.3. Development of the data collection platform

We initially identified stakeholders and established a steering committee to develop this system. Clinicians and experts in health information management, computer sciences, epidemiology, medical informatics, and public health have all been engaged in the committee to investigate the challenges and capabilities. Firstly, we conducted a feasibility study and site visit to understand the existing status of IT and Internet connection in private offices. We found that only a few centers had Internet connectivity, which was considered when the platform was developed. We also found that our system should collect minimum data, because of the staff shortage in these centers.

Another identified problem was the identification and authentication of reporting physicians. We decided to use data sharing with the Medical Council Organization of Iran. This organization is responsible to register, provide licensure to physicians and issue physician national ID. All physicians in the country have full identification data in this organization. We also found that some physicians may not be responsible for COVID-19 care (for example dentists) but may accidentally visit a suspected patient and these patients may be missed from COVID-19 care. Therefore, we decided to develop a care plan for these accidentally detected patients in our primary healthcare centers. 499 urban and rural primary healthcare centers are affiliated with the IUMS. These centers are in charge of conducting COVID-19 tests, monitoring patients, and refereeing them

to hospitals if required. They use an electronic primary healthcare record system (SINA), as introduced above. SINA is used by healthcare staff to follow up patients.

Therefore, our platform for collecting and sharing data from suspected patients with respiratory symptoms should be simple to use, be applicable without the need for special IT, need a minimum data to be reported, have a proper security mechanism to identify reporters, and provide a mechanism to follow suspected patients to be appropriately treated. Also, a data dashboard is needed, that was developed using Microsoft Power BI.

3. Results

Two approached were finally developed for private offices and clinics, and private healthcare providers should select one of them according to their resources. Finally, the collected data by both approaches are integrated. Figure 1 shows platform architecture.

Approach 1: If a provider does not have a standard OIS but has access to the Internet or an intranet network, they can use a simple web form, developed in Medical Council Organization website, to register patients. The patient's name and surname, national identity number, landline number, mobile phone number, date of diagnosis, and type of infection (confirmed or suspected) are included in this form. The dataset and standard used for this form are based on the COVID-19 reporting guideline of Iran. We collected this data from Medical Council Organization via a web service and distributed these data to our customer relationship management (CRM) module in SINA. To this end, we considered the physicians' address as an indication of patient location, and therefore, our platform chooses the nearest primary care centers and sends the data to the SINA in that primary care center to call the patient for health services.

Approach 2: Many private offices lack adequate software, Internet access or intranet network. These private physicians can report their cases using an SMS with a standard format. For example, if the patient's national ID is 0060000000 and his/her cell phone number is 0912000000, the text message will be 0912000000.0060000000. To prevent the entry of incorrect data by anonymous people who do not have a valid mobile phone number in the Medical Council Organization, our platform receives this SMS, and sender mobile phone number and sends this number through this organization's API to authenticate the sender. If it does not exist, the SMS is registered with an error message. If the physician's identity is authenticated, the physician's data is retrieved via the web service, and the patient data is processed using NIFI technology depending on the physician's geographical region to select the nearest primary care centers, as described above. In addition, the patient's national ID is sent to the SINA system, and a new record is generated for the patient.

After receiving data in the CRM of SINA, the primary care staffs call patients and arrange primary care measures including PCR tests and other examinations, as well as treatment, follow-up, or refereeing patients to hospitals. Then, they complete the electronic records of patients in SINA as their routines.

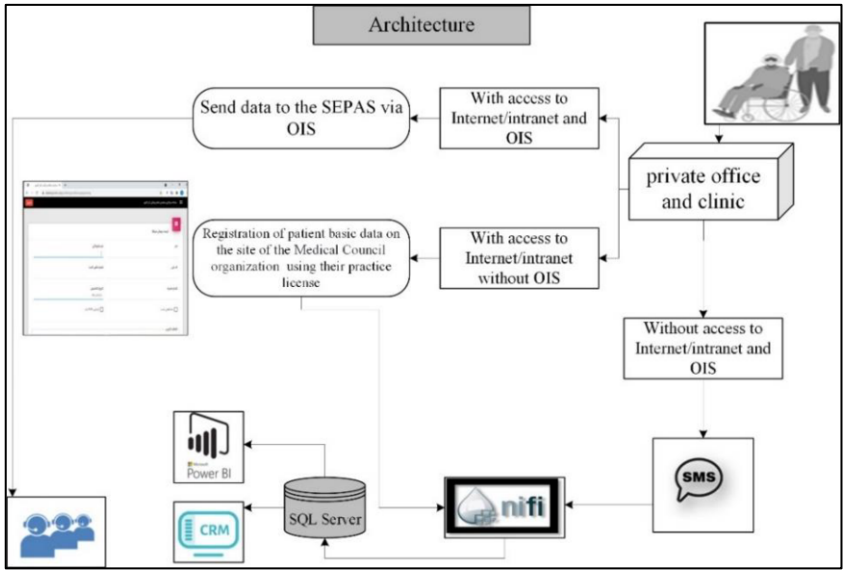

Figure 1. The comprehensive architecture of the proposed system.

The followings are the results of the pilot implementation of this platform. This pilot showed that different physicians in various specialties could quickly and without the need for special technology easily report suspected patients to primary care centers for follow-up and future care. Figure 2 shows the process flowchart.

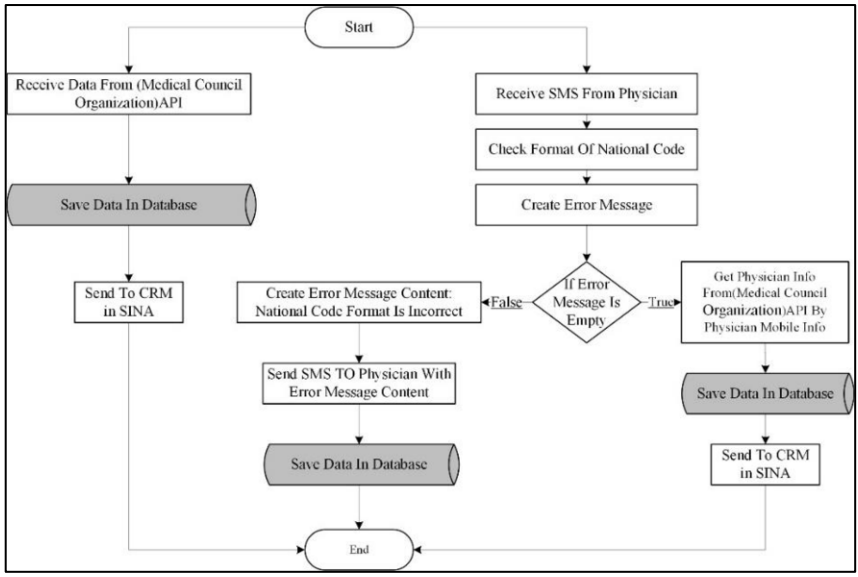

Figure 2. Proposed system process flowchart.

The following data are provided in the dashboard: number of messages, number of messages with/without errors, number of patients by physicians, PCR test results, number of patients by geographical locations, and patient status. Figure 3 shows a view of this dashboard.

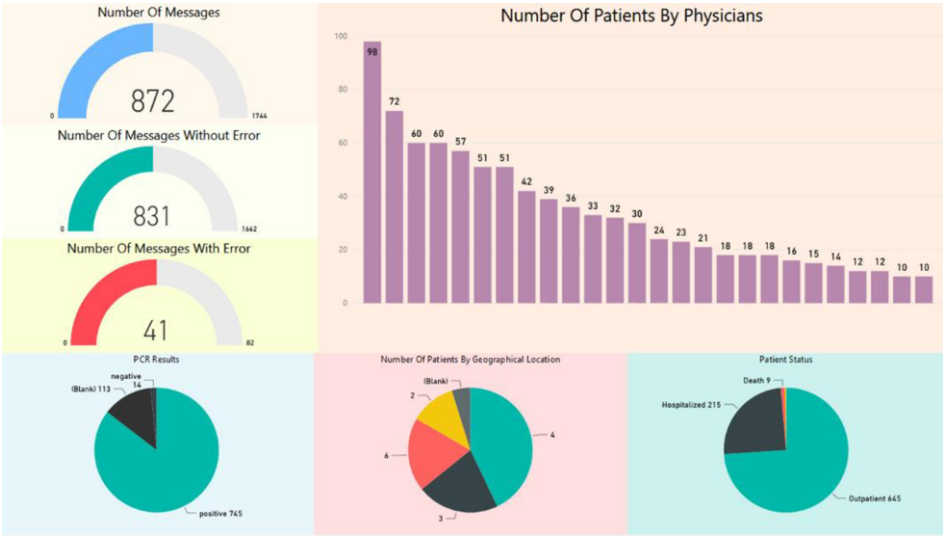

Figure 3. Sample view of the developed dashboard. (Physicians' names were hidden due to privacy)

4. Discussion

Obtaining data on COVID-19 patients under the supervision of health providers can offer access to quality information about the disease and medical treatment. Experiments demonstrated that in prospective data gathering approaches, recording information while delivering patient care is the best way to assure accurate and complete data collection [11, 12]. One of the most prevalent disease registration issues that demand suitable and innovative solutions is employees' reluctance to report a disease due to deficiency of time and increased workload [11]. Our proposed solution requires the least amount of resources for reporting COVID-19 cases. Many COVID-19 data gathering and registry systems have been developed for research purposes; however, our platform allows patients to be quickly registered and reported for therapeutic purposes and follow-up.

Manual data collection can be reduced by getting certain data by linking the proposed system with HIS, MCMC, and MCDPC systems. According to earlier studies, despite some challenges, automatic data entry in a registration system utilizing electronic tools by linking a registry system with existing information systems can speed up data collection and reduce data collection costs, if properly implemented. Similarly, our solution allows for quick case finding, data collection, and the generation of patient profiles in electronic health record systems [6, 10].

Several data collection and visualizations have been reported for COVID-19. A Citizenship Science Project for Open Data and Illustrations of COVID-19 Outbreaks is an example of a system in India. Real-time surveillance was carried out with this system to determine the level of the outbreak, as well as centers that would provide services to COVID-19 patients, prospective intervention measures, resource allocation, and crisis management [13].

In a separate study, researchers developed a dashboard to view real-time data on the distribution of COVID-19 patients. The dataset for this system was developed using the Ministry of Health's daily bulletins and numerous government news sources. This data

was modified, and a live structured database was established to analyze and present the data in real-time. Volunteers were also allowed to provide the relevant data via virtual network channels, which were then examined and approved by the data validation team [13]. Researchers in the United States compared three COVID-19 information dashboards, including "The New York Times (NYT) COVID-19 data system", "Johns Hopkins University COVID-19 data", and the "COVID-19 Tracking Project data system" and developed a system for visualizing COVID-19 data in the Metropolitan area of the United States. The "COVID-19 Watcher" monitors the NYT and COVID-19 Tracking Project information every hour, downloads new information, and displays it in a dashboard after quality control. Tables and graphs can be used to represent patient information and mortality rates in the municipality, state, and national levels, as well as the number of performed [14]. The solutions listed above are mostly used for dashboards and visualization of COVID-19 patient statistics data [13-15].

There are other platforms in which data are gathered from EHRs of COVID-19 patients [4, 9, 16]; however, these are dependent on existence of standard and interoperable information systems. Furthermore, the disease registries are also designed primarily for scientific purposes, not patient care and require a lot of resources. However, our platform provides for the identification of disease cases in private offices and clinics without the need for any advanced technology support, which has been rarely mentioned in previous studies. In our study, we developed a dashboard for managing information on patients in private sectors that might not be detected from other sources to better reflect the disease outbreak. Additionally, one of the main goals of our platform is to be able to follow patient care and treatment, although other reported systems mainly focused on policy or research. Finally, because of its affordability, this platform could be used to identify cases of other diseases, such as syndromic surveillance.

Some limitation should also be considered. Due to the importance of timely disease management, the proposed system has been developed and implemented rapidly However, the developers of this system also consider evaluation issues, and the results of the evaluations will be reported in future studies.

5. Conclusion

Disease registry and reporting systems can provide useful information about COVID-19 disease to track the disease incidence and support research; however, most registry systems are often used for research. Furthermore, mostly governmental centers with sufficient technology are more involved in disease reporting systems, reducing the population coverage of these projects. The findings of this study demonstrated that physicians in private offices could simply utilize a basic platform based on short messages and a short reporting form to identify and register suspected patients and introduce them to the primary care services for follow-up and treatment. Future studies are needed to evaluate the physicians' and patients' satisfaction and also the effectiveness of patient care provided using this platform.

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