The First Digital Immunization Registry for Healthcare Workers in Iran

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Abstract

Background: Health care workers (HCW) are often occupationally exposed to vaccine-preventable diseases. Proper vaccination practices can be highly protective. Yet, healthcare systems ability to ensure vaccination registry accuracy is debatable. Creation of an effective electronic immunization registry system (EIRS) could help overcome this concern. The aim of this study was to develop the first EIRS for use in Namazi Hospital, Shiraz, Iran.

Materials and Methods: A flowchart was designed for each occupationally related vaccine which included decision paths regarding proper immunization. Then, information collection forms were designed based on the flowcharts. After verifying the validity of the paper forms, EIRS data forms were created.

Results: An important result of this study was the development of an EIRS for hospital HCW which is a crucial step in the promotion of a comprehensive vaccination program. An effective and reliable registry could help reduce the chances of occupational disease transmission.

Conclusion: EIRS are more efficient than pencil-and-paper data collection methods and can provide reliable information concerning immunization processes. Other benefits include valid estimations of vaccination coverage rates, development of reminder-and-recall systems that improve vaccine coverage and investigations of factors related to vaccination failure.

Key words: registry, vaccination, hospital, healthcare workers

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Introduction

Proper vaccination is strongly recommended to improve occupational safety and health of healthcare workers (HCW). (1-4) HCW are exposed to a variety of occupational hazards, including infectious disease agents. Vaccination can reduce the risk of some occupational infections, prevent healthcare acquired infections (HAI) and maintain healthcare delivery during outbreaks.

Optimal application of recommended vaccines protects HCW against vaccine-preventable diseases (VPD). Examples include influenza, hepatitis B, rubella, measles, varicella, mumps, diphtheria, tetanus and pertussis. Serious outbreaks of VPD among vulnerable hospitalized patients have been traced to infected HCW. (3-5)

Correct implementation of HCW immunization policies is a crucial step toward reducing healthcare associated infections (HAI) and providing protection for HCW and vulnerable patients. (1)

Several major sets of HCW immunization guidelines have been issued worldwide. (4-8) A study conducted among 30 European countries investigated national HCW occupational vaccine policies. Results indicated each country had specific policies for vaccinating HCW. However, some differences existed concerning the number of recommended vaccines and the target groups involved. (4)

Most countries include influenza and hepatitis B vaccines as part of their HCW vaccination strategy; however, use of vaccines against measles, rubella, varicella mumps, diphtheria, tetanus, anthrax, poliomyelitis, hepatitis A, tuberculosis and Group A meningococcus varied. (4,9-16) HCW immunization not only protects workers and their families, but also vulnerable patients. (1) While countries have different vaccination policies, reports suggest HCW immunity coverage against VPD is often inadequate. (1,6,7,17)

Countries employ different registration methods to determine vaccination status. Performance of healthcare systems concerning the accuracy of their registries has been called into question. (18) Perhaps, an electronic immunization registry system (EIRS) could improve monitoring. (18-21) Investigations indicate traditional methods, such as handwritten charts, vaccination cards and parent reports are not as useful, effective and reliable as EIRS. (18,22,23) EIRS can be an effective source for healthcare center management and staff to access immunity information and generation of accurate analyses. (18) Planning supported by EIRS can improve immunization coverage, including better recall/reminder schemes. (18,24,25)

EIRS can help study vaccine effectiveness through integration and comparison of data relating to HCW vaccination records, VPD experiences and possible vaccine failures. (21) Also, EIRS can be used to update immunization information.

Canada has established a national EIRS that has become a major component of its immunization promotion program. However, Lorache et al. suggested that despite improvements, comprehensive implementation of the registry project has not occurred. Manual and traditional vaccination data registry techniques have not been widely replaced by EIRS. (25)

Several types of registries currently are used worldwide. For example, Australia and United States have implemented efficient and useful EIRS. Much of this is designed to help achieve Centers for Disease Control and Prevention (CDC) goals concerning HAI prevention. (21,26)

EIRS have the potential to provide accurate data over time and gradually have turned into a powerful information bank for research and policy planning. Unfortunately, EIRS problems have occurred during data collection and identification of demographic and/or socioeconomic factors. (21,27)

In 2009, the Vietnam National Institute of Hygiene and Epidemiology established a National Expanded Program on Immunization which reported an elevated resource burden associated with their manual data registry. (28) This resulted in delayed submission of reports and sometimes inaccurate data. In 2012, Vietnam implemented a pilot EIRS in one southern province and then conducted efficiency studies. Investigated was the rate of timely delivery of pentavalent and BCG vaccines to children before and after implementation. Substantial increases in the rate of vaccination after EIRS use were noted, suggesting a potential for accurate data recording and reminding individuals to be vaccinated. Successful pilot data led the Vietnam Ministry of Health to expand its EIRS system to other areas of the country. (28)

Since 1997, all 50 American states have implemented EIRS; however, efficiency varied. (29) The EIRS in the State of Wisconsin collects a variety of vaccine-related information on children and adults. Important outcomes included faster and better physician access to patient vaccination records, implementation of a reminder system for multi-dose vaccines and increases in vaccination coverage. The Wisconsin EIRS records vaccine type, trade name, manufacturer, serial lot number, vaccination date and any vaccine contraindications and side-effects. CDC considers the Wisconsin EIRS as a model program, recommending it tenets to other states. (29)

Similar reports have pointed out EIRS data can be used in vaccine effectiveness and coverage studies. The system also increased the accuracy and reliability of vaccination data. (30,31)

A 2010 Stockholm conference supported implementation of extended EIRS use throughout Europe to help increase distribution of immunization data. It also requested the vaccine industry to implement a standardized system for bar coding vaccines to better facilitate recording of each vaccine dose. (32) World Health Organization (WHO) lent support to the conference and established a goal that at

least 65% of European children and hopefully other age groups will be covered by an EIRS by 2020. In 1990, Denmark implemented its first immunization registry to record child vaccination data. The aim was to estimate vaccination coverage and conduct vaccine safety and effectiveness studies. In 2008, Denmark's EIRS was upgraded to provide vaccine coverage information and access to vaccination data from all citizens by healthcare personnel. In 2015, these data were used to set up a vaccination reminder system for people with incomplete vaccination histories. Australia, Canada, United Kingdom, Denmark, Italy, Netherlands, Norway and Spain have established effective EIRS programs. (32)

No EIRS currently exists in Iran to collect immunization data. Aims of this study were to develop the first EIRS in Namazi Hospital and to investigate the possibility of extending the program further.

Methods

Phase One
All recorded data came from Namazi Hospital personnel. Exclusion criterion was an unwillingness to be vaccinated. Using a simple sampling method, 50 HCW referred to the hospital's Infection Prevention Clinic were chosen for the first phase of the project.

Software development began with the creation of a paper data collection form. Current HCW occupational vaccination histories were compiled based on WHO, CDC and Iranian national guidelines.

Based on the data collected, specific flowcharts for 10 VPDs were designed. Each flow chart is related to a specific vaccine and was designed by a step-by-step review of current studies, essays, and textbooks and WHO, CDC and Iranian national guidelines, so that the flowchart showed a holistic view of vaccine administration pathways. In fact, they described sequences of events from the arrival of HCW to vaccination decision and follow-up. (2, 4, 33, 34).

Paper data collecting forms then were prepared based on the flowcharts. Forms contained demographic information, workplace position and vaccination information. Forms for each vaccine were prepared and contained information concerning previous immunization , such as disease history, vaccination date(s), allergic responses, side effects and contraindications. Based on responses collected, a determination of vaccine need was made. Forms were given to a group of specialists for verification.

Phase Two
Information was entered electronically using specially designed software. All components of the vaccination process (pathway steps) were evaluated by entering paper form data again and resolving any conflicts. This established software operational precision. After implementation of the electronic registry, all vaccine-related HCW information could be extracted and analyzed statistically.

Results

This study created and evaluated immunization registry software for HCW which can promote vaccination rates and improve infection prevention and control. EIRS is a reliable source of recorded immunization data, capable of replacing paper reporting forms.

As a result, when a HCW was referred to the Center for vaccination evaluation, an initial page containing demographic information is displayed and all related information (e.g., age, sex, education and workplace) is entered (Figure 1). Then, required vaccines appear in 10 separate folders. By entering each folder and following existing options and questions in each folder, users can determine whether a given vaccine is required and records the result in the system (Figures 2-4). Then, a table including all necessary vaccines along with injection dates is printed and given to the HCW to complete his/her vaccination at the specified time. Included is information related to each vaccine (e.g., vaccine name, administration method, place, vaccine serial number, manufacturer country and possible side-effects). Vaccinator information is entered on a separate page.

HCW will have a file with his/her corresponding personal code which contains information on vaccines already administered or need to be given. This information is accessible online. EIRS can provide HCW with a printed vaccination card, documenting immunization status.

Our EIRS has the potential for drawing tables and diagrams (Figures 5 & 6), comparing different information (Tables 1 & 2), estimating the number of vaccines required over time and other statistical analyses. This is a unique capability, rarely found in other similar software.

Figure 1: Example HCW information file

Figure 2: Influenza vaccine file

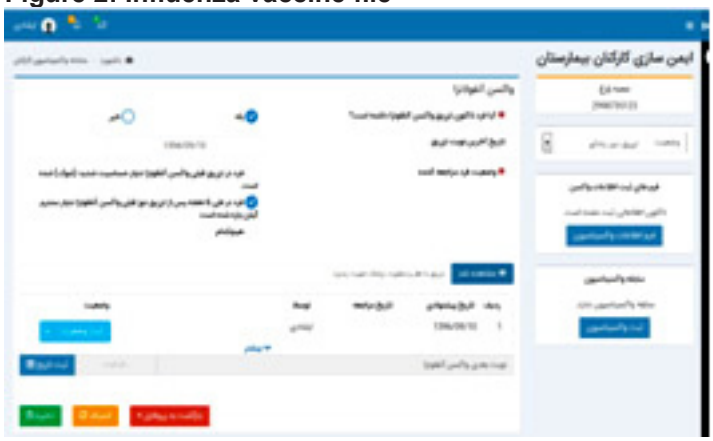


Figure 3. Td vaccine file

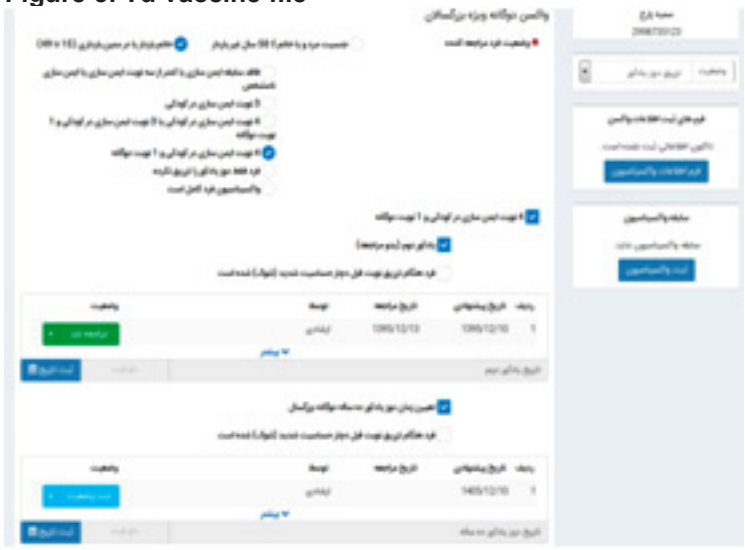


Figure 4: Hepatitis B vaccine files

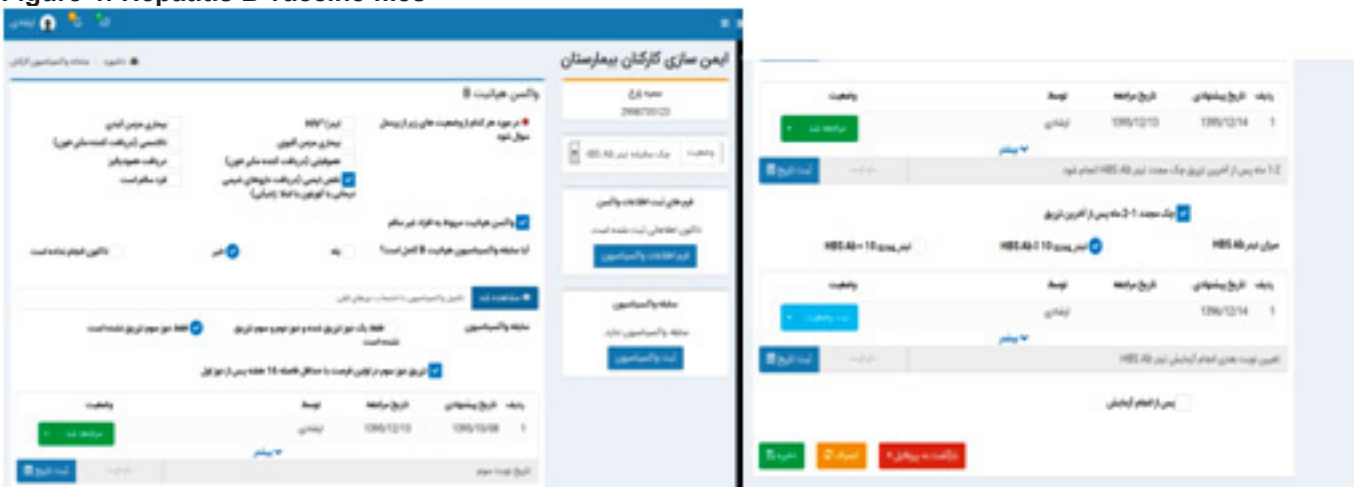


Figure 5. Declination to influenza vaccine based on educational level

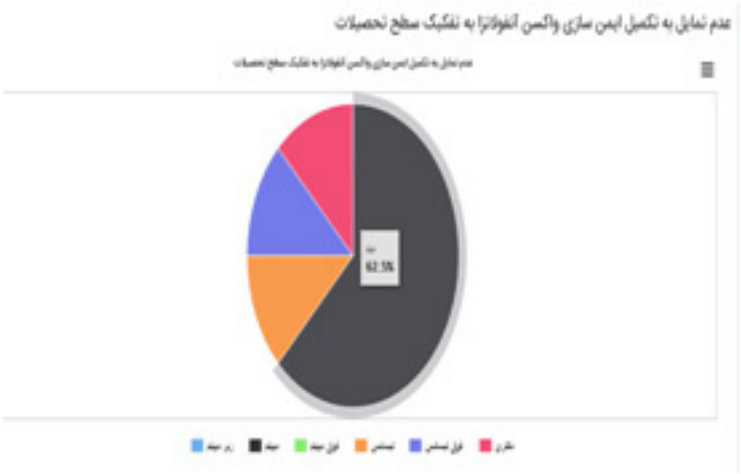


Figure 6. Influenza vaccine coverage

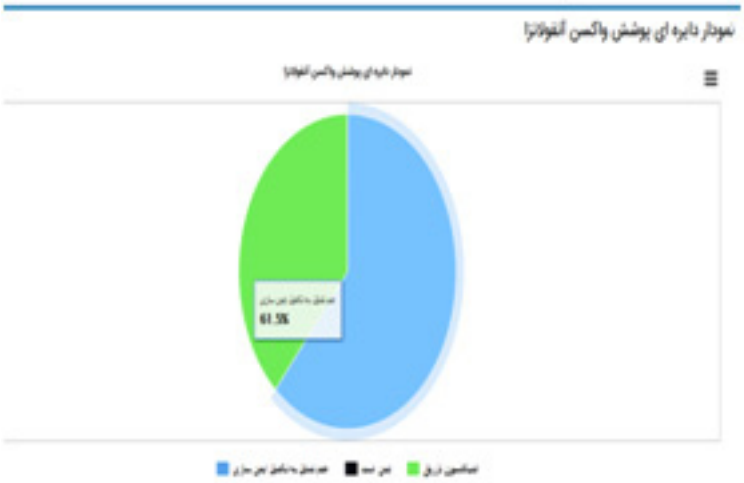
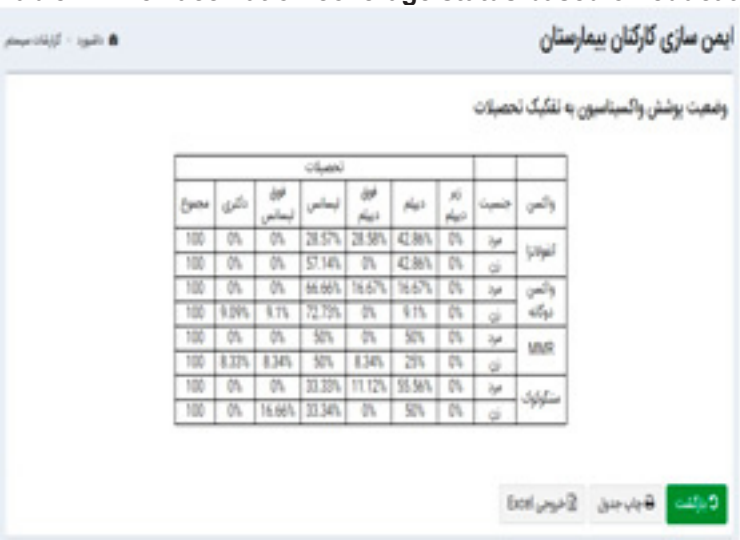


Table 1: General information of influenza vaccination based on sex

Table 2: The vaccination coverage status based on educational level



Discussion

To improve hospital infection prevention and control program, especially HCW occupational safety and health, vaccination is strongly recommended for all susceptible individuals. Universal HCW coverage also protects high-risk hospitalized patients, HCW families and the local community.

EIRS help HCW receive all needed vaccines, properly. Timely immunization and post-vaccination follow-up are essential requirements. (34) Electronic data collection and storage also improves precision, accuracy and reliability of information. Manual data handling is slower and less accurate when compared to digital registries. (35)

For the first time in Iran, comprehensive immunization registry software was developed and implemented with an analytic capacity to evaluate HCW vaccine-related information. It began as a pilot project in Namazi Hospital in Shiraz.

Our EIRS possesses several valuable capabilities. Electronic files for any HCW are easily accessible through individual identifying codes and can help decide which immunizations are needed. Accurate information will help avoid missing an injection, maintain timely vaccine schedules, revaccination when not needed, identify possible side-effects and reduce costs.

An electronic registry will help hospitals estimate the number of vaccine doses needed over a given period and better assure adequate supplies. The registry was developed in such a way that it will increase vaccine coverage and equipped with a reminder messaging system.

Also, reports can be made for individuals, groups, any number of vaccines or even total coverage. Such reports help hospital employee safety and health committees to make informed decisions.

During hospital disease outbreaks, possible vaccine failures can be identified by comparing incidence rates with HCW immunization records using registry software.

Plausible causes of failure could be studied based on information recorded in the system. Registry information also can be used as a reliable source in cohort studies in the future.

Objectives of the prepared software are like those of other registries. A 2014 systematic review indicated that electronic immunization registries can increase vaccination coverage. (36) Specifically, better registries: 1) have "client reminder and recall systems;" 2) can generate and evaluate public health responses to outbreaks of VPD; 3) facilitate vaccine management and accountability; 4) can determine HCW vaccination status, helping make proper decisions and 5) can aid outbreak surveillance, including HCW vaccination rates, missed vaccination opportunities, invalid dose administration and disparities in vaccination coverage.

Immunization registries can provide surveillance information or support specific investigations of changes, trends or gaps in vaccination coverage. In such cases, registries can provide information for decision makers when planning and/or implementing additional interventions. (36)

Goals for the registry system implemented in Vietnam were to increase accuracy and timeliness of immunization records, improving the rate of on-time immunization and reduce the amount of time needed for reporting. (28)

Like the other registries, our software's aim was to promote standards and facilitate sharing of vaccination information. The Canadian registry system is the major tool to evaluate vaccination status, facilitating accurate data collection and assessing and improving immunization rates. (25) The Wisconsin registry system provided physician access to vaccination records and immunization status of their patients, enhancing proper decision making and patient interaction. (29) Such capabilities were designed into our software.

Mahon et al. investigated the role of digital registries in vaccine effectiveness and suggested that registry-based studies on vaccine effectiveness possess advantages compared to traditional observational studies. Registries provide better access to comprehensive immunization data of a population enabling more extensive cohort studies with fewer errors compared to case-control studies. This is especially valid in communities with lower incidence rates of VPD because if an epidemic occurs, it may involve underestimation of vaccine effectiveness. However, vaccine effectiveness studies should not be conducted during an epidemic because this may affect correct estimations of effectiveness. Comprehensive access to accurate immunization data in a registry may avoid errors caused by immunization differences between healthy and ill individuals. (31)

Conclusion

We established the first web-based Iranian immunization registry software for HCW which could be valuable for on-time registration, promoting immunization rates, accurate data registering and subsequently HAI prevention and control. Also, it is available as a source of recorded immunization data. The analytic capability of our EIRS is unique and the comprehensive capabilities of this software can help health providers adopt better procedures, compare coverage of immunization at the national level and finally managers implement better policies.

Limitations

As a pilot project only 50 HCW were involved. There were difficulties obtaining complete vaccination histories and designing registry software and establishing policies for transfer of information from paper forms to the electronic registry.

Despite experiencing challenges, we designed and developed a digital immunization registry for HCW in Iran for the first time. It been implemented in Namazi Hospital in Shiraz; however, the hope is that it could be used by more Iranian hospitals which would require the support of local and national healthcare officials.

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