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Simulation Study On Integrated Vaccine System (IVS) At Outpatient Clinic: Pilot Project In Malaysia

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Abstract

An Integrated Vaccine System (IVS) has been developed to address the weaknesses in the conventional paper-based method available at outpatient clinics providing childhood vaccination in Malaysia. IVS incorporates the Hospital/Healthcare Information System (HIS) and Telemedicine aspirations. This computer-based patient recording systems and data storage are reasonably comprehensive sources objectively to facilitate health providers in managing parents and installation of a smartphone application to prevent 'delay' in vaccination appointments. We include Malaysian parents reside in Kuantan district of Pahang, aged 18 years and above, who have a baby on day-30 of life or below. Parents with medical backgrounds and without smartphones were excluded. This pilot project was conducted prior to observational study of IVS at outpatient clinic. At the baby's two-month appointment, we collect data which includes i) socio-demographic characteristics; ii) vaccination status; iii) Participant's Satisfaction Scale; and iv) participant's perspective on IVS. This pilot project recruited 12 participants, mostly aged more than 30 years and the majority were Malays ethnic. Out of 12 participants, 10 of them were on time (83%), and 2 participants had a delay (17%) in their vaccination at a one-month appointment. However, 59% were very satisfied and 41% were somewhat satisfied with the use of IVS. The top three perspectives that arose from the participants were that IVS makes

it easy to recall the appointment date for vaccination, it is cost and time-saving, and can be use it everywhere. Our conclusion, the majority of participants were on time for their child's vaccination in the first month. Besides, almost all participants were satisfied with the IVS and participants showed positive perspectives on IVS. Therefore, we believe IVS could be a potential health intervention to ensure the high quality of healthcare and sustainability of the childhood vaccination information system.

Keywords: Childhood Vaccination, Database System, Health Informatics, Healthcare

Introduction

The growth of an integrated information technology system integrates the Hospital/Healthcare Information System (HIS) and Telemedicine aspirations are well developed. Nowadays, the application of HIS is installed throughout the hospital [1]. As we know, the main objectives of HIS implementation are to reduce errors, increase the efficiency of the data, ease data reporting and retrieval, improve the daily healthcare quality, and enhance the communications between providers and healthcare [2]. One of the good HIS systems is Telemedicine. This telemedicine was developed to provide good quality healthcare and health-related services by implementing the system which will provide the information of patients, suppliers, telecommunications, healthcare providers, and multimedia technologies to link the consumers, consumers, and other agencies [3]. In certain countries like South Sudan, Senegal, Vietnam, Albania, and Guatemala, some countries have already implemented their integrated information technology system, especially on vaccination.

For example, the Immunization Information System (IIS) was developed by Albania to provide the number of births, vaccine stock management, hostile events management, and cold chain management [4]. Recorded more on IIS, this system confidential computerized database which is population-based and the data recording for all immunization doses residing in indefinite or specific geopolitical areas. This IIS system, it's can have included providing the immunization histories that are associated with determining proper vaccination and also combined vaccination data for reconnaissance. This is to make sure that the program operations will improve the vaccination rates and reduce diseases that can be prohibited by the vaccine. The IIS system can also provide official immunization records for camping, school, government, or private sector and other activities' admission necessities [5].

In Malaysia, for the existing system, Malaysia's experts from the Immunise4life program have developed a mobile application called MYVaksinBaby. This mobile application, it's can provide information about vaccines and vaccine-preventable diseases. Other than that, the

MYVaksinBaby application also can provide a list of recommended vaccines under Malaysia's National Immunization Programme and additional optional vaccines that can be attained in private hospitals and clinics. Moreover, this mobile application also an issues or questions such as the safety of vaccines and vaccination status in Islam are addressed by the MYVaksinBaby application. Other than that, it's also able to send auto-reminders for the next vaccination date as a notification to the patients [6]. However, in Malaysia, this kind of proper vaccination integrated system has not been developed yet.

In this paper, we study the pre-implementation of the Integrated Vaccine System (IVS) with *MyKidVAX* mobile application as a simulation of outpatient clinics to address the advantages and disadvantages of the system. Overall, the IVS is a system that stores vaccine intake information in a database by the healthcare organization and retrieves the data as a reviewed schedule regarding vaccination dates and information by the parents on an application [7-9]. The parents would also be notified of the next vaccination date through the application. The main objective in developing the system is to have proper and organized information storage regarding vaccine intake information and also to alert the parents of the vaccination date which is not able to be fulfilled by the conventional manual method.

Methodology

Study Design and Study Setting

This study was an observational simulation study using face-to-face interviews. Our target participants include Malaysian parents, aged 18 years and above, who have a baby on day 30 of life or below. Parents with medical backgrounds and without smartphones were excluded. Participants were recruited using a purposive and convenience sampling method. This study was carried out among citizens living in the Kuantan District of Pahang. The recruitment of participants took place in the public area in the Kuantan District of Pahang (religious place and playground area). Once the eligible participants were identified, informed consent was commenced. After gaining consent, the selected participant was registered on the same day into the IVS system.

After registration, participants obtained their unique ID. Then a new appointment date for the next vaccination will be set up. Later, participants were guided to download the *MyKidVAX* mobile apps, and they were briefed on the steps to use the apps. Before the participants left, they were reminded to check the apps to get information on the next date for vaccination for their baby. The simulation process of IVS's implementation and *MyKidVAX* mobile apps is shown below in Figure 1.

Data Collection and Data Analysis

On the day of recruitment and registration, we collect socio-demographic information of participants (i.e., name, age, identity number, mobile phone number, address), and their baby's information including birth particular (i.e, name, date of birth, identification number, gender, birth weight, previous vaccination date, etc).

Figure 1. The simulation process of IVS's implementation and MyKidVAX mobile apps

Then, at the 2-month-old appointment, we collect i) vaccination status (i.e., delay, on-time); ii) Participant's Satisfaction Scale on IVS and *MyKidVAX* mobile apps; iii) participants' perspective on IVS and *MyKidVAX* mobile apps.

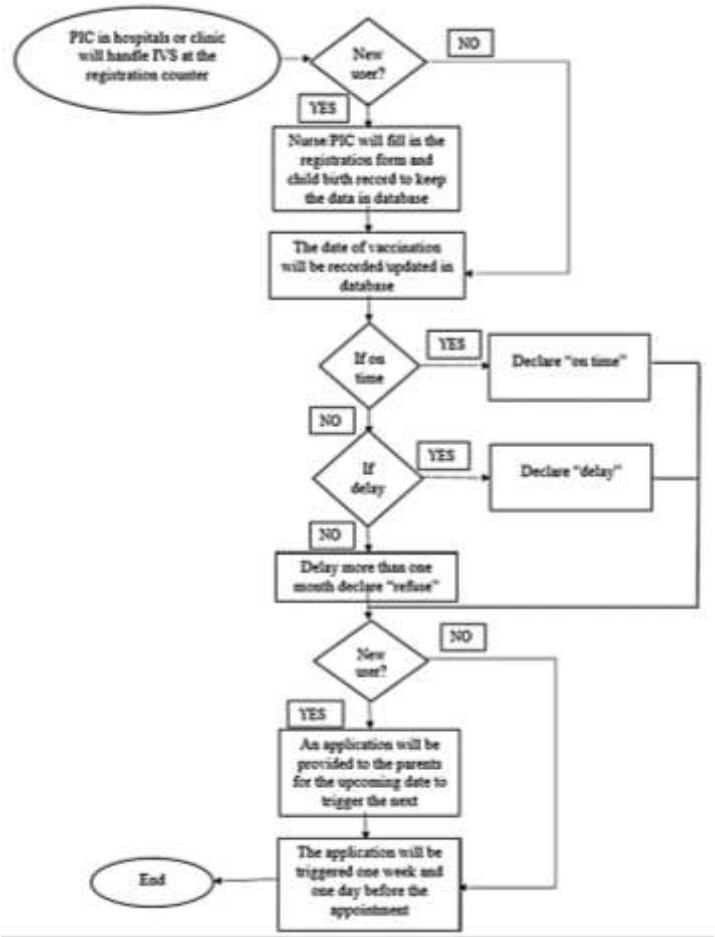
Quantitative data were analyzed using univariate statistics (i.e., age, ethnicity). Audio-recorded interviews were transcribed verbatim into MS Word and translated from Malay into English. Thematic analysis was adopted. The simulation study of IVS and *MyKidVAX* mobile apps involved two components of a personalized computer equipped with cloud storage and enhanced by the *MyKidVAX* for promoting public engagement and supported by the flow process as in the outpatient clinic environment as illustrated in Figure 1 and Figure 3.

Figure 2. The integrated vaccine system (IVS) and *MyKidVAX* mobile apps.

The overall process flow of this IVS implementation normally takes around 20 to 30 minutes to start from patient registration and informed

consent until finished mobile application is finished. However, the distribution time depends on how the person in charge handles the situation. Figure 2 clearly shows the operation of IVS in real situations. The system is controlled by the three main components which are the desktop as a registration element, the cloud system as a data storage, and the mobile application as a monitoring and notification element. This IVS will integrate each other to make sure this system functions well.

Figure 3. Process flow of IVS implementation



Result And Discussion

This study recruited 12 participants, mostly aged more than 30 years, whereas the rest were aged between 18 to 29 years. All of the participants involved in this study were Malays ethnic as shown in Table 1. As of 2022, Pahang total population was 1.6 million, top three population resides in Kuantan, Temerloh, and Pekan which contribute about 34.5%, 10.6%, and 7.6% respectively. Malays ethnic comprise 70% of the total population in Kuantan district [10].

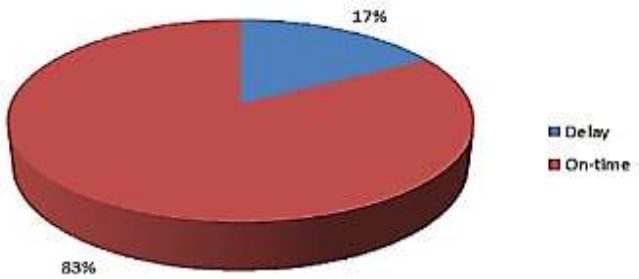
Figure 4 shows a vaccination status observed at one month of age. Out of 12 participants, 10 of them were on-time (83%) for bringing their children for vaccination as scheduled, however, 2 participants had a delay (17%) in their appointments for vaccination of their children. During this study period, there was a one-week public holiday which was likely to confound the study findings. Based on further questioning, these two parents were delayed because the participants prolonged their vacation period and therefore affected the kid's vaccination appointment date. However, in general observation, the good implementation of IVS and *MyKidVAX* is obtained. Malaysian National Immunization Programme (NIP) protects against 13 major childhood illnesses including Diphtheria, Haemophilus Influenza Type B (Hib), Hepatitis B, Human papillomavirus (HPV), Japanese encephalitis (JE), Measles, Mumps, Pertussis (Whooping Cough), Poliomyelitis, Rubella, Tetanus, Tuberculosis (TB), and Pneumococcal. In daily practice, at 2 months of age, Hexaxim® DTPa-hepB-IPV-Hib vaccine was scheduled for babies for the prevention of diphtheria, tetanus, pertussis, hepatitis B, polio, and Haemophilus influenza. It requires 3 doses at the age of two, three, and five months old and one booster dose at the age of 18 months [11].

Nevertheless, almost all of the participants were satisfied with the IVS and '*MyKidVAX* mobile apps. Figure 5 shows the participant's satisfaction scale on IVS and '*MyKidVAX*' mobile apps. 59% stated that they were 'very satisfied' and 41% stated that they were 'Somewhat satisfied'. Meaning that none of the participants said 'not satisfied'. The MySejahtera mobile apps. was developed by the Ministry of Health Malaysia during the pandemic era in 2020. The main function as a tool for case detection and reporting, case monitoring, and evaluating COVID-19 cases. In 2021, MySejahtera will enable users to receive COVID-19 vaccination appointment dates and offer the ability to generate a COVID-19 vaccination e-certificate. In 2022, the digitalization of the Ministry of Health Malaysia following the pandemic was the digitalization of the National Immunisation Program. The ability to record and store vaccination records digitally proves to provide a more efficient recording and vaccination mechanism and MOH immunization record. Whereas to the public, MySejahtera apps resolve issues such as parents losing immunization books or forgetting to bring vaccination books to health facilities on the day of vaccination [12].

Table 1. A socio-demographic characteristic among participants.

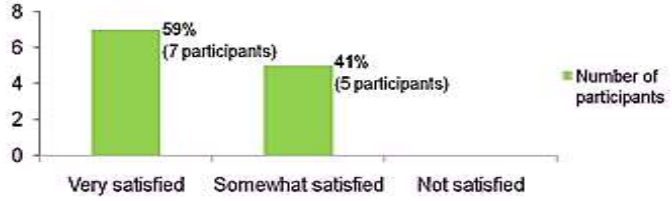
Socio-demographics	Total
No. of participant	12
Age	
18-29 years	3
30 years above	9
Ethnic	
Malay	12
Chinese	0
Indian	0

Figure 4. Vaccination status observed at one month of age



As compared to the existing mobile apps, Table 2 shows that the positive perspective was compiled from the participants. Out of 11 participants quoted "IVS made easy" and best explained as 'easy to recall the appointment date for vaccination'. Five participants said IVS and *MyKidVAX* mobile apps 'can bring everywhere' and are 'useful for kindergarten/school registration'. Print-ready vaccination data was efficient with a simple click and a hassle-free concept was applied. Four participants said 'IVS and *MyKidVAX* cost-saving and time-saving'. The essential component that they have to provide is just a smartphone with an internet connection. Current study findings are consistent with Hoover et. al. in his research that patients had the benefit of practicing electronic health records (HER) which enables them to access their own EHR through patient portals and can read, print, and send their health information to providers. This empowers patients to be their own advocates [13].

Figure 5. Participant's Satisfaction Scale on IVS and *MyKidVAX* mobile application



Technically, through this simulation study, we identified several problems during the registration process such as restricted access to the internet, participants not bringing smartphones, and a lack of records from participants who gave birth in private hospitals. Menachemi et. al. 2011, highlighted the disadvantages of electronic health records including financial issues, changes in workflow, temporary loss of productivity associated with EHR adoption, privacy, and security concerns, and several unintended consequences [14].

Table 2: Participant's perspective on IVS and *MyKidVAX* application

No.	Advantages	Frequency (n=12)
1.	Easy to recall the appointment date for vaccination	11
2.	Cost and time-saving	4
3.	Can bring everywhere	5
4.	Useful during kindergarten/school registration	5
5.	Others	0

These feedbacks were beneficial for further improvement during the real implementation of IVS in the future. The other components of healthcare networks are the points of secondary and tertiary care, the network nodes where they offer certain specialized services, for example, the mobile application service. For the sustainability of digital health intervention and application, the Malaysian government has established a Digital Health Research & Innovation Unit (DHRi) that aims to identify, address, explore, and eventually apply these disruptive digital health solutions in the real world [15]. The *MyKidVAX* mobile apps. appearance is shown in Figure 6.

Figure 6. Represented the appearance of *MyKidVAX* with the unique ID for the patient during login and overall schedule of the IVS appointment date.

The *MyKidVAX* mobile application offers a details schedule or appointment dates for the baby vaccination. Figure 7 shows the barcode of the *MyKidVAX* app for installation which we can find from Google Play Store.

Figure 7. Illustrated the barcode of *MyKidVAX* apps. for installation obtained from the Google Play Store.

Conclusion

The practical use of IVS in health clinics is suitable to manage and speed up the registration process and date reference for babies to receive vaccines regularly. In addition, the implementation of IVS also increased the productivity of nurses in handling daily tasks. As a conclusion, from the simulation study, the majority of participants were on time for their child's vaccination in the second month. Besides, almost all participants were satisfied with the IVS and *MyKidVAX* apps and participants showed positive perspectives on IVS and *MyKidVAX* apps. Therefore, we believe IVS could be a potential health intervention to ensure the high quality of healthcare and sustainability of the childhood vaccination information system.

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