

Information on Mapping and Vaccination Data in a Locality System

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Abstract

During the pandemic, technological innovation provided a platform with a range of uses, including in the healthcare industry. Technology is currently being used in vaccination drives run by many governments across the world to help spread vaccines quickly and efficiently. The technology makes healthcare personnel more effective at their professions and greatly raises the standard of service in the industry. The researchers undertook this study to create a suitable and long-lasting immunization database with a mapping method to give a better perspective of the immunization status. To gather essential information for this study, the researchers spoke with the local health officer in the targeted area. The obtained data then served as the basis for the system's capabilities and features, becoming the target problems addressed by the developers. The investigation found that the majority of procedures and interactions are carried out manually and recorded on an unprotected, antiquated Excel spreadsheet. The researchers' technology also shows to be a superior way to deal with the problems and difficulties while making their health-related transactions and operations quicker, safer, and much more effective.

Keywords

Vaccination Database, Mapping Information System, COVID-19, Technology, Health Sector

1. Introduction

The necessity to distribute vaccine and increase the people who have had vaccinations is the current focus of the health sector [1]. The immunization facilities can only hold a certain number of individuals each day due to physical distance

limitations and stay-at-home protocols. A program made specifically to store vaccine data is the vaccination data system. The majority of the systems that are currently in use have a number of shortcomings. The present Global Database on COVID-19 Vaccination [2] for instance, only keeps track of essential information like the total quantity of vaccines given. Only online registration is permitted for the Cebu City Vaccine Information Management System (2021). A disparity between these investigations was discovered by the researchers in this regard. One handles registration, while the other is solely for keeping records. Each of them simply concentrates on the areas within which they fall. In order to better serve the public in the current system, the health sectors are already introducing new technologies [3], but unhappily, the majority of these systems only concentrate on single task and no system is available yet which offers a comprehensive look into vaccination records.

In the backdrop of the pandemic, technological advancements have taken center stage, revolutionizing various sectors, notably the healthcare industry. A significant application of technology emerged in the orchestration of vaccination campaigns worldwide, amplifying the swift and efficient distribution of vaccines. This integration of technology in healthcare not only enhances the efficacy of healthcare professionals but also elevates the overall quality of service in the industry.

An examination of the current practices reveals that a substantial portion of healthcare procedures and interactions are manual in nature, documented on outdated and unprotected Excel spreadsheets. The researchers' technological intervention emerges as a superior alternative, offering a comprehensive solution to the prevailing challenges and intricacies. By facilitating healthcare transactions and operations, the proposed technology promises to not only expedite processes but also enhance security and effectiveness within the healthcare domain.

This research addresses the pressing issue of establishing a robust and sustainable immunization database, accompanied by an integrated mapping method that offers an enhanced understanding of immunization statuses. This study was prompted by the imperative to improve existing processes and cater to the need for enduring solutions within the healthcare domain. To achieve this, the researchers engaged with local health authorities in the targeted locality to gather essential insights. The data collected subsequently served as the foundational framework for devising the capabilities and features of the proposed system, thereby addressing the focal challenges faced by the developers. The purpose of this inquiry was to develop a secured and effective vaccine data storage system that would facilitate easier regulating, keeping track of, and providing access to the vaccine data of a Municipality.

2. PDCA Framework

2.1. Plan

The researchers developed a locality-specific immunization database system as a

result of this circumstance. The suggested vaccination database and mapping system is a technical solution ensuring all vaccine records and data are stored in a data system that is accessible and makes it run effectively and safely. Following the investigation, the researchers would present the municipal health officer with the sample database and the proposed online registration system. These two distinct systems use electronic tools and methods to speed up and simplify access to medical records [4] [5], improves patient happiness and the quality of healthcare services.

2.2. Do and Check

Following the data collection, the researchers move on to creating the proposed system's design. To make it simple for users to navigate and operate the system, it incorporates a fundamental and user-friendly design [6]. Following the initial design, the researchers tested the system's capabilities and functions. The system was then reviewed and fixed by the experts to ensure that it functions smoothly and effectively without any hiccups. The system's overall functions were tested after the initial system test and the modifications, and the results were pleasing and satisfactory. The Tabogon municipality's health administrator then saw a demonstration of the suggested technology from the researchers.

2.3. Act

During the systems test, the suggested system is operating effectively. The technical officer expressed satisfaction with the system's functionality and offered a few extra suggestions to enhance and improve the functions of this system. During the rigorous systems testing phase, the suggested system underwent a thorough evaluation to gauge its operational effectiveness. The meticulous examination aimed to ensure that all components and functionalities of the system were performing as intended. As the technical officer spearheaded this assessment, their expertise played a pivotal role in determining the system's performance and efficiency.

The outcome of the systems test yielded positive results, indicating that the suggested system was indeed operating effectively. This successful performance validated the meticulous efforts invested in its development and implementation. The system's ability to execute tasks seamlessly and deliver the expected outcomes was a testament to the comprehensive planning and meticulous execution of the development process.

3. Results

The full findings, discourse, evaluation, and understanding of the data acquired during the data collection procedure are presented in this section. **Figure 1** shows the proposed systems' challenges encountered in a thematic map.

In **Figure 1**, a comprehensive depiction of the anticipated challenges that the proposed system might face is visually presented through a thematic map. This

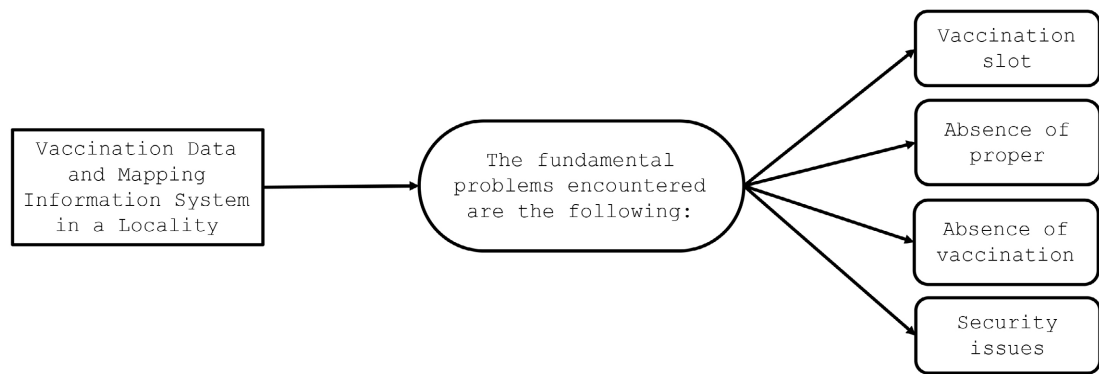


Figure 1. Proposed system's challenges encountered in a thematic map.

map serves as a visual representation that concisely outlines the various obstacles and difficulties that the system could potentially encounter during its implementation and operation. By utilizing a thematic map, the complexities of these challenges are effectively conveyed, allowing stakeholders to gain a deeper understanding of the possible hurdles that need to be addressed. This visualization aids in highlighting the intricacies and interrelationships among the different challenges, offering insights into their potential impact on the overall functioning of the proposed system. Ultimately, **Figure 1** serves as a valuable tool for assessing, strategizing, and planning mitigation measures to ensure the successful navigation of these challenges and the successful implementation of the proposed system. This study found that one of the issues facing the town is the vaccination slot and timetable. The health officer explained that due to the availability of the vaccine and the unforeseen number of applicants, they could not accommodate all of them within a single day. The applicants' chances of being rejected and rescheduled would increase if there was no scheduling or registration system available to help them get vaccination dates. Additionally, the researchers discovered that there is no on-site queueing system. As a result, this results in a less systematic flow of immunization.

Within the municipality, a database is alarmingly lacking. The health officer revealed during the interview that not all of their data is stored in a database. They only use spreadsheets and Excel files to store data. The Department of Health's national database is the only place where the municipality transmits its records. Thus, it is clear that relying too heavily on spreadsheets and Excel files can put critical data at risk. The health administrator went on to say that despite the encryption and security measures on his cellphone, it is still vulnerable to data invasions like shoulder surfing and unauthorized usage of his laptop by other staff members. The health officer manually enters, monitors, and tracks all the immunization data because there isn't a physical database.

3.1. Project Requirements

The non-functional and functional needs for this study are presented in this section.

3.2. Functional Requirements

The specification of actions and procedures that the program is expected to execute is outlined within this requirement. The system encompasses a range of tasks and functionalities, including the following:

To begin with, users are required to sign up using their Google accounts before proceeding with the online registration process. This preliminary step ensures a secure and authenticated registration experience.

The core feature of the system involves the facilitation of online vaccination registration. Individuals seeking immunization can seamlessly register for their required vaccines through the platform, streamlining the overall process.

Moreover, the system incorporates a demographic mapping component specifically designed for immunization purposes. This feature aids in visually representing the distribution of immunization coverage across different demographic segments, offering a comprehensive perspective of the vaccination efforts.

On the administrative end, the system includes a secure login and validation mechanism for authorized administrators. This ensures that only authorized personnel can access and manage the system's functionalities.

For administrators, the system provides a dedicated administrative dashboard. This dashboard serves as a centralized hub, enabling administrators to oversee and manage various aspects of the system. Key components of the dashboard include registration forms, real-time vaccine stockpile tracking, and comprehensive vaccination data analysis.

In essence, the system encompasses a suite of functionalities that collectively enhance the efficiency, accessibility, and management of the immunization process. These capabilities ensure a seamless experience for both individuals seeking vaccination and authorized administrators responsible for its execution.

3.3. Non-Functional Requirements

These specifications go into detail about the performance traits of the system, such as quality aspects. These requirements are frequently referred to as software characteristics.

3.4. Portability/Compatibility

Since this is an online database and mapping system, it may be used with any Windows or Mac operating system. It functions without a hitch as a web application and does not obstruct the operation of other programs or system operations.

3.5. Maintainability

Since it is an online system, regular maintenance is not necessary. Only six to twelve months would be required for maintenance checks and bug fixes. To thoroughly restore and repair the entire system, guaranteeing that it is back on-

line without problems or faults, would only take around a day.

3.6. Security

When logging in, the system requests a username and password. In order to validate online registration, the system also offers a register with Google alternative. Since the system is password secured, the dataset is only accessible to designated employees and the medical supervisor. Because of its security features, including the admin login and online vaccine registration, the system is secure to use.

3.7. Usability

The program's user-friendly design makes it simple for users to understand and operate. The system's standard features and operations may be accessed easily and quickly thanks to the design. As a result of its organization, it is simple to find various options, including navigation windows, buttons, and even text views. It takes less time to learn because of its user interface, which is suitable for beginners. Due to the sizes and designs of the icons, it is very simple to remember where the alternatives are located.

3.8. Design of Software, System, Product, and/or Processes

This section outlines the program's architecture, functional hierarchy, and other activities.

3.9. Context Diagram

It is a type of diagram that depicts significant components that the system has direct interaction with. The interaction between the inhabitants, the health administrator, and the Vaccination Data and Mapping Information System are depicted in **Figure 2** which shows the context diagram of the proposed system. Through this graphical representation, the context diagram effectively conveys the essence of the proposed system's operation and interaction dynamics. This insight enables stakeholders to understand the roles, responsibilities, and contributions of each entity, fostering a comprehensive grasp of the collaborative efforts required for the successful execution of the system's objectives.

The context diagram encapsulates the scope and boundaries of the system, showcasing how the inhabitants engage with the health administrator and the system itself. This visual aid highlights the flow of data, information, and actions between these integral participants, demonstrating the holistic ecosystem in which the proposed system operates. As depicted in the diagram, the health administrator serves as a pivotal bridge, facilitating communication between the inhabitants and the Vaccination Data and Mapping Information System. **Figure 2** serves as a powerful tool for enhancing communication, alignment, and coordination among the different elements, ensuring a coherent and effective operation of the proposed system.

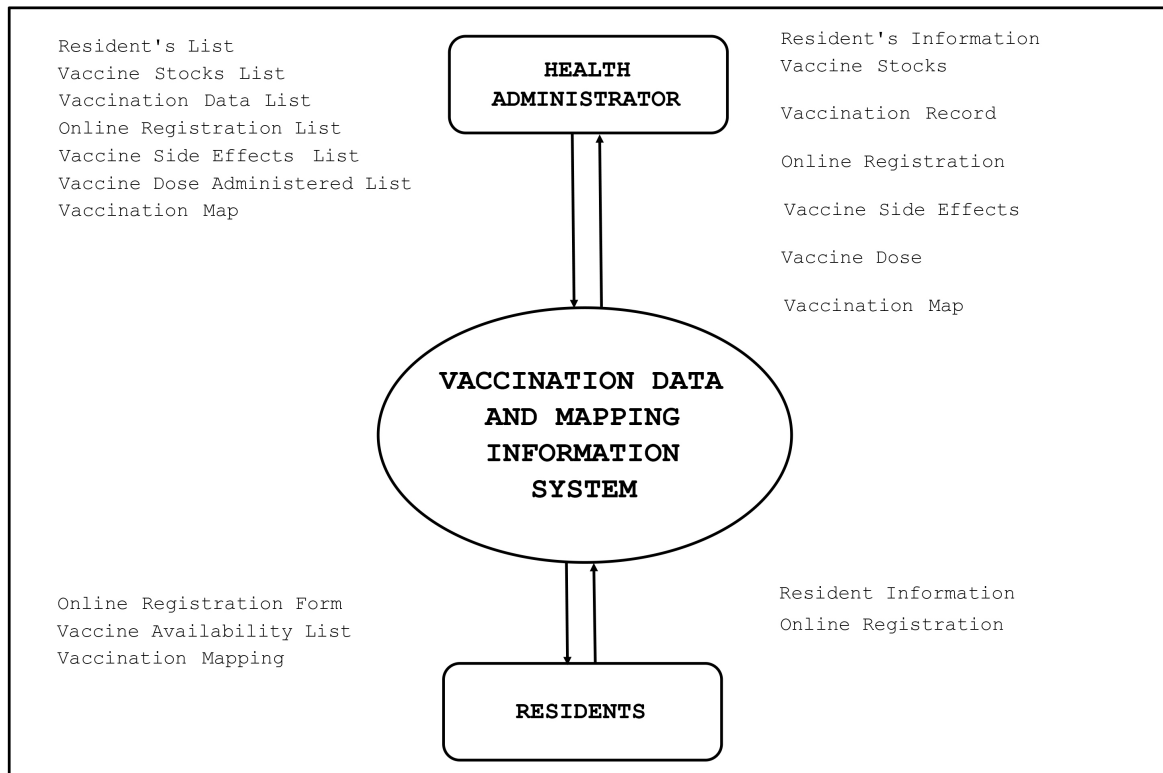


Figure 2. Context diagram of the proposed system.

This diagram serves as a visual representation that elucidates the intricate relationships and exchanges occurring among the inhabitants, the health administrator, and the Vaccination Data and Mapping Information System. By utilizing a context diagram, the intricate network of interactions and dependencies becomes readily apparent, providing stakeholders with a clear overview of how these entities collaboratively function within the proposed system. The administrator enters the required set of information into the system, including resident information, vaccine stockpiles, immunization history, online registration, and vaccine adverse effects.

Additionally, the residents will be required to fill out the online registration form for the system. In exchange, the system will give them access to an online registration form, a list of available vaccinations and information about those vaccinations, data on those vaccinations—including dosages administered and side effects—a resident information list, and, finally, a map of vaccination coverage.

3.10. Use Case Diagram

This is a type of diagram that shows how a user interacts with a system. It demonstrates the connection of the user and the various scenarios that the actor participates when utilizing the program.

Figure 3 shows the interaction of the various actors namely the admin, the workforce, and the resident with the system. The rectangle represents the system

and the encircled features are the systems use cases which in definition are the interaction of the system and the various user requests or processes. The line connecting the users all the way to the use cases depicts the operations each user can perform with the system. The users can access the features of the system such as register and log in user accounts, view the vaccine availability, fill-out online vaccination registration form and view vaccination mapping. The workforce as the secondary to the admin can access features such as register their workforce account, log-in to the system, view vaccine availability and view vaccination mapping.

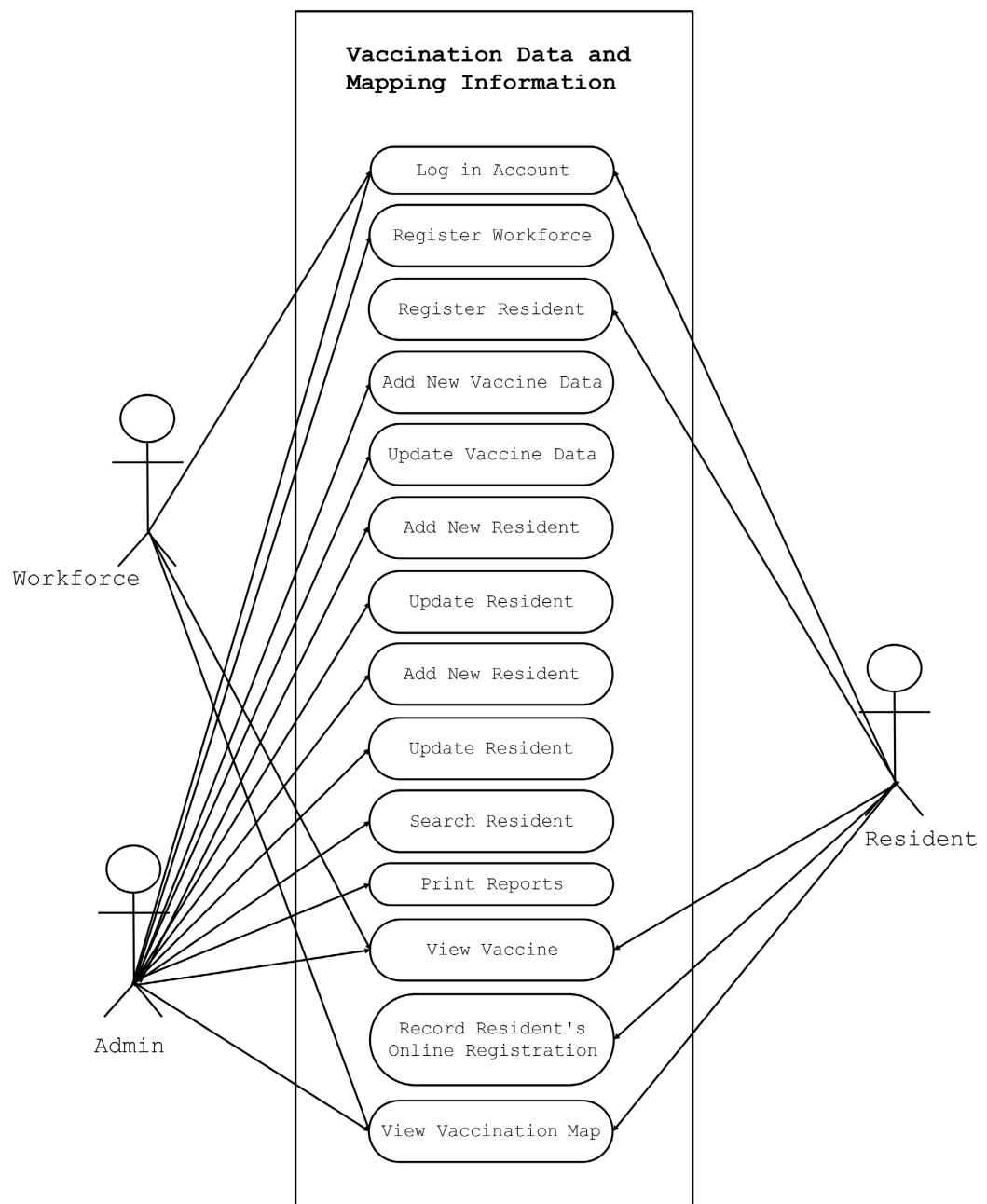


Figure 3. The proposed system’s use case diagram.

Lastly, the admin as the authorized personnel can access all the features of the system namely: log in to the system, add and update vaccine data, add, update and search resident information, add and update resident vaccination data, print reports, view vaccine availability and view vaccination mapping. **Figure 4** shows the processes for login verification. After the credentials such as username and password are inputted, the system then verifies if such data exist which is by default shown as include. If there is a wrong credential or the account doesn't exist, an error display will appear prompting the user to log in again or register.

4. Discussions

Due to the municipality's lack of a vaccination program, the town lacks technology solutions that are simple to use. The administrator acknowledged that they lack a current immunization system and are overly dependent on Microsoft Excel for their database. Their procedures are almost entirely manual. They carry out their operations manually by entering all the vaccination data and verifying the availability of their vaccinations and vaccination records. As a result, they lack the appropriate channel and are unable to offer the public an online transparency report. The health officer adds that since their sole platform and registry is Microsoft Excel concurrently, they are unable to provide the municipality's vaccination demography, the availability of vaccines, the registration process, including protected data warehouses.

The protection of all of the municipality's data is one of the issues it faces. Since it is on spreadsheets, errors in the software or hardware might put the entire set of data in danger. Despite having a password lock while turning on his computer, the medical supervisor acknowledged that there are no further locks utilized to safeguard the records. The town has just a couple of laptops with all the vaccination information, and it is discovered that every piece of data that is manually entered each day is transferred immediately to the Department of Health's national database. While working, the health officer assures the researchers that the data sets are secure, but once his device is open and he is not around, he is unsure of the data's security.

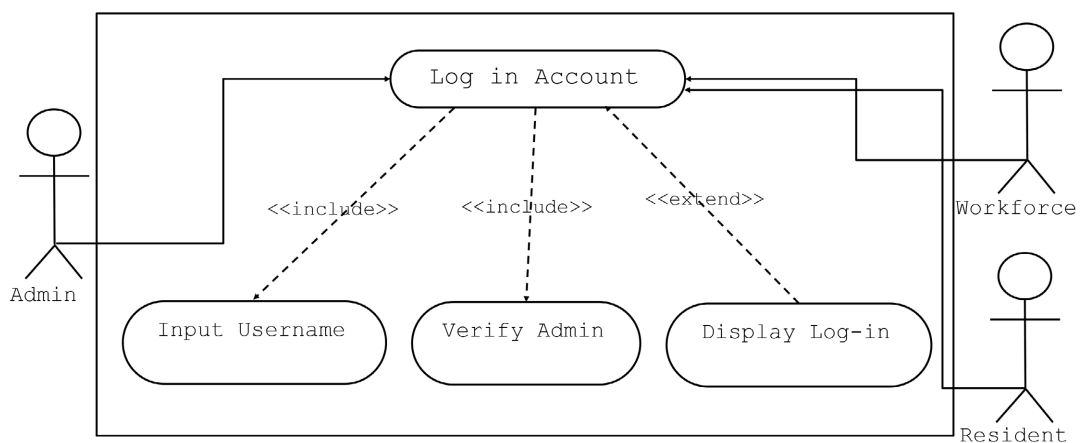


Figure 4. Use case diagram for log in account.

Through meticulous organization and meaningful conversations with the local health officer, the researchers successfully acquired crucial insights that formed the foundation of their investigative endeavor. The key information obtained highlighted several noteworthy issues within the current immunization landscape, pointing towards areas that required attention and improvement [7].

Among the identified challenges were the absence of guaranteed vaccination slots, efficient scheduling procedures, streamlined line-waiting arrangements, and an effective online registration method. These shortcomings were indicative of the existing gaps in the vaccination process, underscoring the need for a more structured and user-friendly approach [8].

Furthermore, a significant concern was the lack of a robust and functional database to manage vaccination-related data. The prevalent practice of relying heavily on spreadsheets, particularly Microsoft Excel, for data storage, posed limitations and hindered the potential for effective data management [9].

The absence of a well-established immunization program and the prevalence of manual processing for vaccination procedures emerged as another area of concern. The lack of a standardized process contributed to inefficiencies and discrepancies in the immunization process [10].

In addition to these challenges, the researchers also uncovered vulnerabilities associated with software-related issues. Threats like malware and viruses posed risks to the integrity, safety, and availability of crucial immunization data. Moreover, physical hazards such as unauthorized access by unauthorized personnel and hardware malfunctions further compounded the potential risks to data security [11].

Overall, the insights gathered through this comprehensive investigation illuminated the critical areas that demanded immediate attention and improvement within the immunization framework. The information acquired through the conversations and analysis guided the researchers in their pursuit of developing a robust and efficient system to address these challenges and enhance the overall immunization process [12].

5. Conclusion

The researchers came to the conclusion that a system needs to be developed to help the community with its vaccination effort. Since most of their procedures are manual, it is clear that technology must be incorporated to reduce their workloads and boost their effectiveness. Numerous issues develop as a result of the lack of technical solutions, keeping the local health workers restricted to manual procedures. Because there is no system in place, manual processing and uncertain vaccination slots can happen, causing inconvenience for both the health officer and the citizens. The primary emphasis of this study and the system functions that are suggested are the issues that the area confronted.

6. Recommendations

The researchers strongly advise keeping all vaccination information in a sepa-

rate, safe database. They heavily rely on Excel spreadsheets for their inconvenient, less secure, and impractical database, according to the results of the interview. The researchers suggest that the technical staff at the neighborhood hospital receive training on how to operate and use the system for storing vaccination and immunization data. In order to secure slots and timetables and avoid inconvenience, the researchers also want to emphasize the need of having an on-line system that residents can use. As a result, the system would also give users a comprehensive view of the vaccination data, which would include mapping for monitoring and demography.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- [1] Research Protocol. (2019, December) Research Protocol: Communication and Dissemination Strategies to Facilitate the Use of Health-Related Evidence reuters.com. (2022, July 15). COVID-19 Vaccination Tracker.
- [2] Mathieu, E. R.-O. (2021) A Global Database of COVID-19 Vaccinations. *Natural Human Behavior*, **5**, 947-953.
- [3] Future Hospital Commission (2013) Future Hospital: Caring for Medical Patients. Royal College of Physicians, London.
- [4] Penchansky, R. and Thomas, J.W. (1981) The Concept of Access: Definition and Relationship to Consumer Satisfaction. *Med Care*, **19**, 127-140.
- [5] Saurman, E. (2016) Improving Access: Modifying Penchansky and Thomas's Theory of Access. *Journal of Health Services Research & Policy*, **21**, 36-39.
- [6] Richardson, S. (2006) Healthcare Information Systems: Design Theory, Principles and Application. Electronic Theses and Dissertations, 50-62.
- [7] Alderwick, H., Hutchings, A., Briggs, A., *et al.* (2021) The Impacts of Collaboration between Local Health Care and Non-Health Care Organizations and Factors Shaping How They Work: A Systematic Review of Reviews. *BMC Public Health*, **21**, Article Number: 753.
- [8] Department of Health and Social Care (2021) Integration and Innovation: Working together to Improve Health and Social Care for All. <https://www.gov.uk/government/publications/working-together-to-improve-health>

[-and-social-care-for-all/integration-and-innovation-working-together-to-improve-health-and-social-care-for-all-html-version](#)

- [9] Acosta, J., Howard, S., Chandra, A., Varda, D., Sprong, S. and Uscher-Pines, L. (2015) Contributions of Health Care Coalitions to Preparedness and Resilience: Perspectives from Hospital Preparedness Program and Health Care Preparedness Coalitions. *Disaster Medicine and Public Health Preparedness*, **9**, 690-697.
- [10] Fiorati, R.C., Arcêncio, R.A., Segura Del Pozo, J., Ramasco-Gutiérrez, M. and Serrano-Gallardo, P. (2018) Intersectorality and Social Participation as Coping Policies for Health Inequities-Worldwide. *Gaceta Sanitaria*, **32**, 304-314.
- [11] Valaitis, R.K., Carter, N., Lam, A., Nicholl, J., Feather, J. and Cleghorn, L. (2017) Implementation and Maintenance of Patient Navigation Programs Linking Primary Care with Community-Based Health and Social Services: A Scoping Literature Review. *BMC Health Services Research*, **17**, 116.
- [12] Threapleton, D.E., Chung, R.Y., Wong, S.Y.S., Wong, E., Chau, P., Woo, J., Chung, V.C.H. and Yeoh, E.K. (2017) Integrated Care for Older Populations and Its Implementation Facilitators and Barriers: A Rapid Scoping Review. *International Journal for Quality in Health Care*, **29**, 327-334.