

MedReS: A Charged Medication Report System for a General Hospital in the Philippines

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Abstract

The use of information and communication technologies in the healthcare industry has been proven to improve patient care, enhance service quality, and increase productivity. Several medical institutions in the Philippines are still employing the traditional method of producing and managing important documents such as medication reports. This study evaluated the current charged medication report system of a general hospital in the country through causal analysis tools. Results showed that actions like pharmacists manually writing information and transporting the reports to another department were prone to errors and delays in the entire process. Moreover, a stream analysis revealed that the core problem of the inefficient system of producing the report led to deeper problems such as poor document organization and report errors. A medical information system called MedReS was developed using Microsoft Access to produce medical documents accurately and more efficiently. The proposed system streamlined data entry, information updates, and the encoding of receipts. It is also capable of managing the itemized prescriptions of admitted patients, lessen paper usage, accelerate processing time, and improve overall system efficiency and productivity of the hospital.

Keywords

Medication report, information system, causal analysis, Microsoft Access

1. Introduction

Record-keeping is an essential task in hospitals and the pharmacy department is responsible for keeping prescription records. For patient history purposes, it is required to store and manage files on medicines purchased by admitted patients. This job is also important so that doctors on duty would have past information on the medicines their patients have taken. The manual process of doing reports has several disadvantages. These include susceptibility to theft, a higher chance of human errors, slow exchange of data, and they are not beneficial in the long run (Wroblewski, 2020). Health information technology systems (HITS), which are an application of information and communication technologies (ICT), are significant tools resulting in better healthcare safety and quality (Alotaibi & Federico, 2017). Despite the well-known benefits of applying such systems in the healthcare field, some Philippine hospitals have yet to adopt such measures to upgrade their system and optimize their transactions. Thus, there is an increasing need for the full implementation of ICT in big industries such as healthcare nationwide for small and large hospitals alike to improve their system and utilize its advantages.

Most of the hospitals in the Philippines provide patients with prescription reports that are manually written and filled out on paper forms. Since this traditional way uses paper made from limited natural resources, a material shortage is a possibility. For hospitals that have been running a long time, papers accumulate, making it a challenge to keep and organize the patient medication records. Pharmacists and doctors would have to inspect each paper and flip many pages in searching prescription data needed when assessing patients.

The objectives of this study are to assess the present process of producing charged medication reports for patients admitted to a general hospital and develop a proposed information system that will produce the documents more

efficiently. With its implementation, the study would provide a working report system for the use of pharmacists and other hospital staff, lessen paper use because data will be mainly stored in computers, organize patient summary reports more systematically, and enable easier printing should other healthcare professionals need a hard copy.

There is little to no research done on the proposed usage of digital information systems of small private hospitals in the Philippines. This research will contribute to the existing literature by identifying the errors and delays of paper-based methods in such facilities, developing a proposed system of generating and handling medication data, and outlining the potential advantages of its implementation for general medical facilities hospitals in the country. Prior research has evaluated the social, organizational, and clinical benefits of adapting electronic systems in the healthcare setting (Menachemi & Collum, 2011). Social benefits involve an enhanced capability of public health researchers to conduct beneficial research with the available data and better population health. Organizational outcomes include increased revenue and better operational performance. Lastly, clinical outcomes with the adoption were associated with reduced medication errors, higher quality of care, and improved patient safety.

2. Literature Review

The use of ICT in healthcare can lead to prospective changes that improve patient care, reduce data errors, enhance service quality, ease storage and retrieval of medical information, and educate both patients and healthcare professionals (Bashshur et al., 2009; Rouleau et al., 2015). Implementation of HITS worldwide had progressed over the years. The operational status of these systems in Eastern Saudi Arabian hospitals was investigated and electronic health record structures, clinical documentation, and decision supports were some of the categories considered. Results showed that the institutions were applying the systems in stages and the data obtained might be useful for other hospitals within the country in developing and enhancing health care quality offered to Arab citizens (Alsalman et al., 2020). Furthermore, a Pharmacy Information System (PIS) was implemented in the Pharmaceutical Care Department of King Abdulaziz Medical City-Riyadh (KAMC-Riyadh) more than a decade ago. The PIS was developed to help pharmacists in handling the medication process. Alanazi et al. (2018) evaluated the effects of PIS on the job of pharmacists as until their study, there was lacking research that explored its impacts. They discovered that most PIS users had positive experiences with the technology, with most of the items function-related.

The information technology system in healthcare is composed of two elements: electronic health records (EHR), and computerized provider order entry (CPOE). EHR is an electronic patient's medical history. It helps providers in sharing information such as medications with the patients and other clinicians. To have empirical data on the efficiency of health information technology, a quantitative study conducting a systematic review bases its results on the compilation of experiments done by different researchers in hospitals. Eight out of eleven studies have shown that in healthcare facilities with an integrated CPOE in their system, health services had decreased utilization rates (Chaudhry et al., 2006). It seemed that workstations, especially the pharmacy, would have much lesser utilization than those with no HITS because transactions and tasks are much faster for the workers, resulting in more idle time during work hours. A technology that links both EHR and pharmacy dispense claims is one of the many applications of HITS. This is an algorithm where EHR is linked to pharmacy dispensing databases. Patients receiving and taking the right prescribed medications is a matter of life and death yet studies show that about 25% of prescriptions go unfilled (Hoopes et al., 2018). This can be attributed to errors made by either the patient or the pharmacist. This technology was able to help health centers in decreasing the probability of pharmacies giving inpatients or outpatients the wrong medications through its mechanism where EHR of patients is accessible by pharmacists.

Another application of HITS is the Electronic Prescription (EP) system. The use of EP has made positive changes in the operations of some pharmacies. Its services have made the drug dispensing processes more efficient for community pharmacists (Jawla and Rai, 2018). Through this paperless technology, healthcare workers and patients can automatically place an order of certain medications from the pharmacies without the need to undergo a long transaction process in the actual facility. Kenawy and Kett (2019) evaluated the effect of EP on medication error rates in an Egyptian outpatient clinic. They discovered that this system was able to lessen dispensing and prescribing errors, but more advanced forms of this system with decision support may be needed for a better effect on pharmacy operations and error rates. Moreover, it has been reported that this system carries a disadvantage with it—which is its disability to share the discharge information with the community pharmacist. Nonetheless, if paired with another system that allows it to do such a task, a more efficient overall system may be produced.

In the Philippines, the healthcare industry continuously strives to deliver high-quality medical services to all Filipino citizens. Technology is critical in this endeavor because it provides a platform for industry players to modernize and adapt to the changing needs of healthcare. The digitization of patients' medical records, which is now regarded as a basic requirement in most industrialized nations, is at the heart of this technological advancement. As such, it is more important than ever to propose and implement technology-based solutions in handling medical data for small and private hospitals in the country that continue to conduct the traditional method of mainly using paper to produce and manage important patient files.

3. Methods

The study employed a qualitative research design because this study aimed to understand systems, its problems and exploring possible solutions using an interview with open-ended questions. Causal analysis tools such as the systems flowchart and stream diagnostic chart were used to analyze and interpret the problems, inefficiencies, and wastes of the current system. These tools helped in gaining an in-depth understanding of the current structure of the medication report process to formulate a hypothesis and alternative solutions in addressing the identified problems. The staff of the general hospital was interviewed to determine the workflow of the current medication report process. It involved the pharmacy receiving medication orders, dispensing the prescribed medicines, and the billing department documenting the transactions. Other hospital processes involving the patient's admission, stay, and discharge were also included in the process.

Microsoft Access, a database management tool, was used to create the proposed information system. Tables and forms were created for data entry and viewing. A study by Yue, Ma, and Song (2010) utilized this tool to design stock management systems. They explained that the benefits of its application include being able to handle a variety of material inventory information, establishment of data integrity and uniformity, easy navigation around the system, and that only one or two people are required for inputting and analyzing the data.

4. Results and Discussion

4.1 Overview of the Current Medication System

The processes done within the boundaries of the pharmacy are illustrated in Figure 1. It shows the current method starting on patient admission and ending on the patient receiving the bill upon their discharge. Also, this gives an overview of how prescribed medications are distributed from the pharmacy to the patient. There are several steps within the process where the nurse in charge must go back and forth to retrieve the medicines for the patient during the patient's stay. This goes the same for the pharmacist who constantly updates the charged medication sheet if additional medicine was prescribed through manually writing on the sheets.

The pharmacist manually writes the prescribed medicines in the paper report. When information is written on paper, it is prone to handwritten errors. Also, the use of paper can result in cluttered files which could affect the time it takes when a pharmacist searches for a particular report. If the patient is given additional medicine, the pharmacist goes back and forth to update the charged medications paper. Otherwise, the medication report is finalized. When it is completed, the pharmacist transports it to the Billing Department where it will be encoded for the receipt. These actions can lead to delays when it involves multiple patients and several medication reports. The application of a computerized charged medication report system will help reduce errors, transport, and encoding delays.

To illustrate the problems that occur in the current medication system, a stream diagnostic chart shown in Figure 2 was created. It was observed that there are four categories of the problem: Organizing Arrangement, Social Factors, Technology, and Physical Setting. Under Organizing Arrangement are the following problems: no formal way of organizing papers, responsibility for file handling not clear, and no computerized charge medication report system established; on Social Factors: handwritten errors, pharmacist goes back and forth to update charged medications; on Technology, problems involve the inefficient system of producing charged medication report, and the use of paper in medications report; and lastly, under Physical Setting are the cluttered paper files and small storage space for the report papers. Interconnections between problems are illustrated through arrows. It is determined which statements are symptoms or the problems caused by deeper problems in the organization, and which is the core problem or root causes of the problem environment. The resulting chart revealed three symptoms namely: no formal way of organizing

papers, handwritten errors, and pharmacist goes back and forth to manually update charged medications. The identified core problem was the inefficient system of producing charged medication reports. This root cause drives many other problems in the hospital. Solving the inefficient medication report system would remove or reduce the identified symptoms.

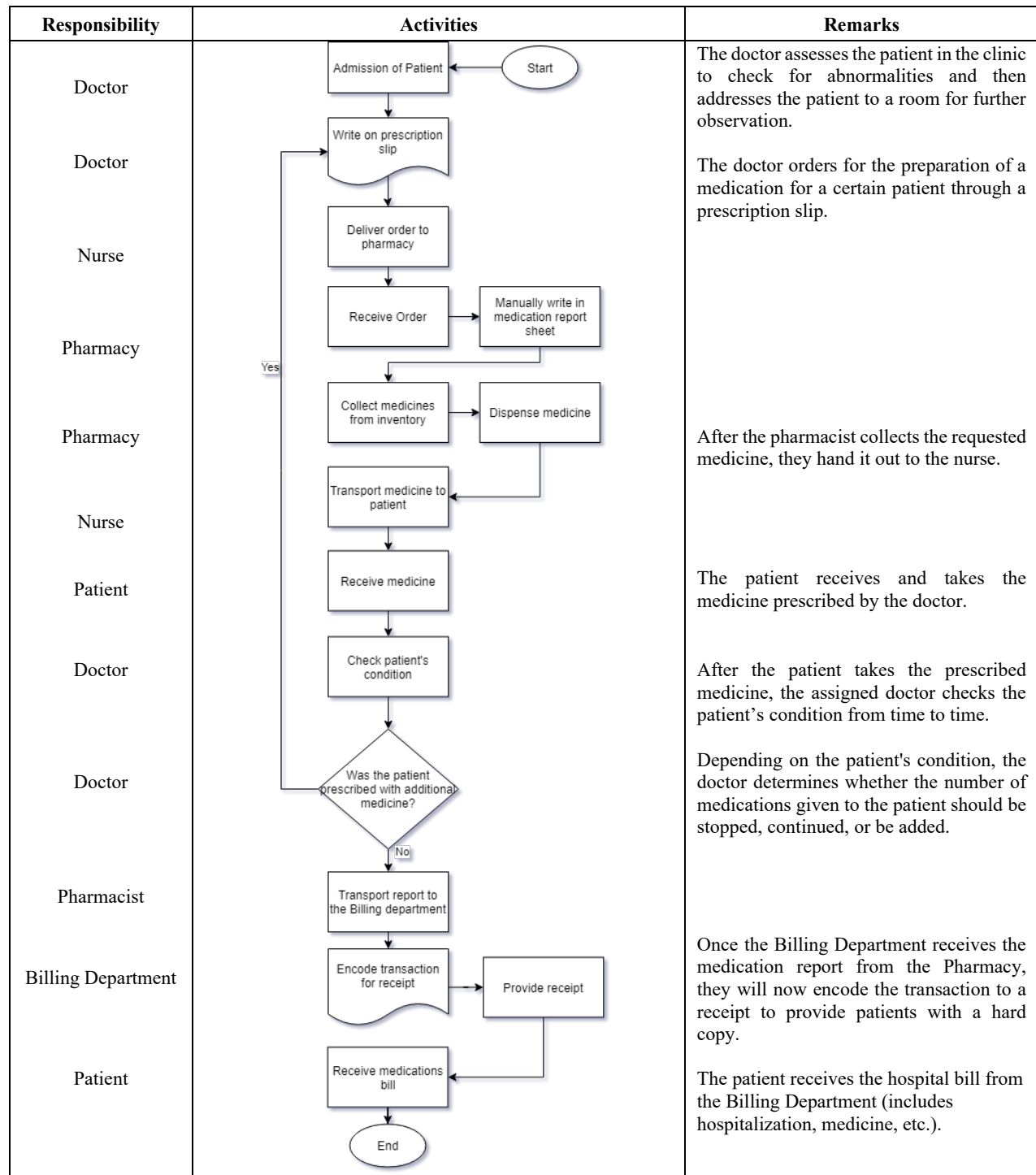


Figure 1. Flowchart of the Current Medication Report System

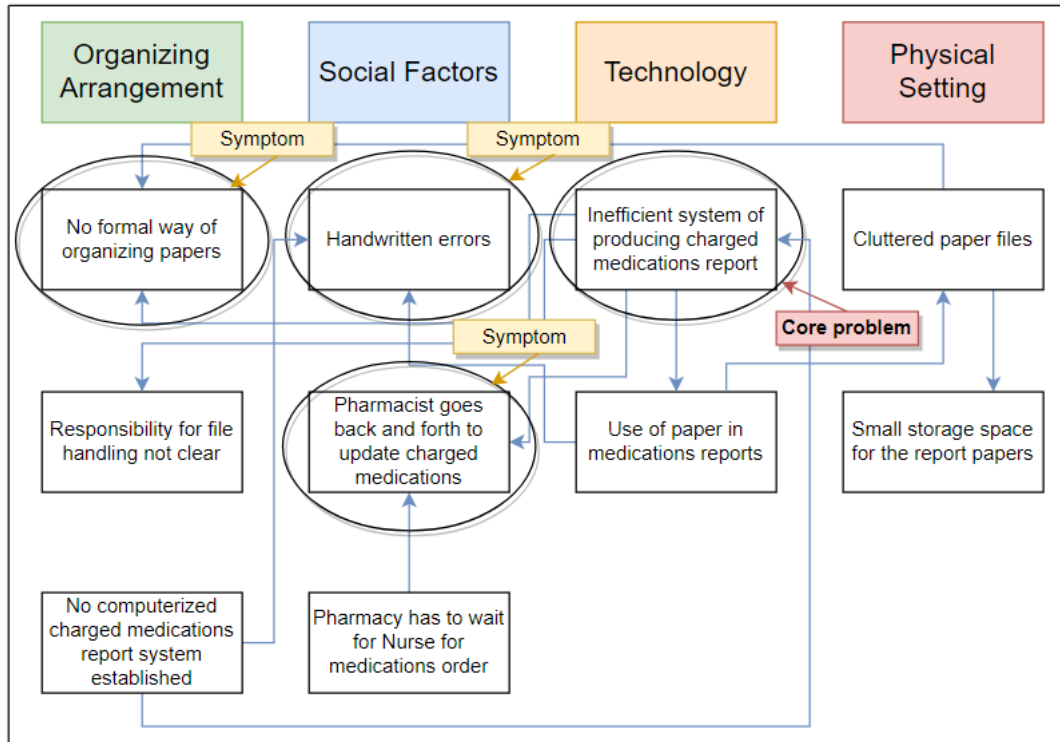


Figure 2. Stream Diagnostic Chart

4.2 MedReS: Medication Report System for a General Hospital

Figure 3 presents the flowchart of the proposed medication report system for a general hospital, including the user roles and responsibilities. The process still begins with the admission of the patient and ends with them receiving the medication bill. Instead of the pharmacist manually writing in the medication report, they will now input it into the computerized database. If the patient is not prescribed additional medicine, the Billing Department will access the medications receipt from the database and subsequently provide the bill to the patient. To improve the efficiency of the charged medication system, the researchers focused on the portion where the Pharmacy and Billing departments interact. The need to remove long processing times and changing the process is a must. In the proposed method, the researchers have removed the activity for the pharmacist to transport the report to the Billing Department, and the encoding of the report to the transaction receipt. This resulted in fewer activities in the proposed system flowchart compared to the current process. This saves time in the long run as hospital staff can then do other productive things with the time usually spent in delivering the report and encoding the receipts. With the database, the inputting of the medicines was also moved at the end of dispensing the medicine to the nurse in charge.

MedReS, the database for the charged medications of admitted patients, was developed using Microsoft Access. In the database, the pharmacists must register the Order ID, Patient ID, Patient Name, Date of Admission, and Room number. The Order ID is the assigned number for the order received; the Patient ID is the assigned number for the patient admitted which corresponds to the name of the patient; the Date of Admission pertains to the date when the patient is confined in the hospital; Lastly, the Room number is the room where the patient is currently admitted. Below the patient information is another form where the medicines purchased for the patient is included. When the pharmacist is done with the record, the data inputted in the form are automatically inserted into the database and can now be navigated with the use of the buttons below the sub form. With that said, the information inputted in the form is transferred. The data are then stored such that the pharmacist can now search them in the query tab.

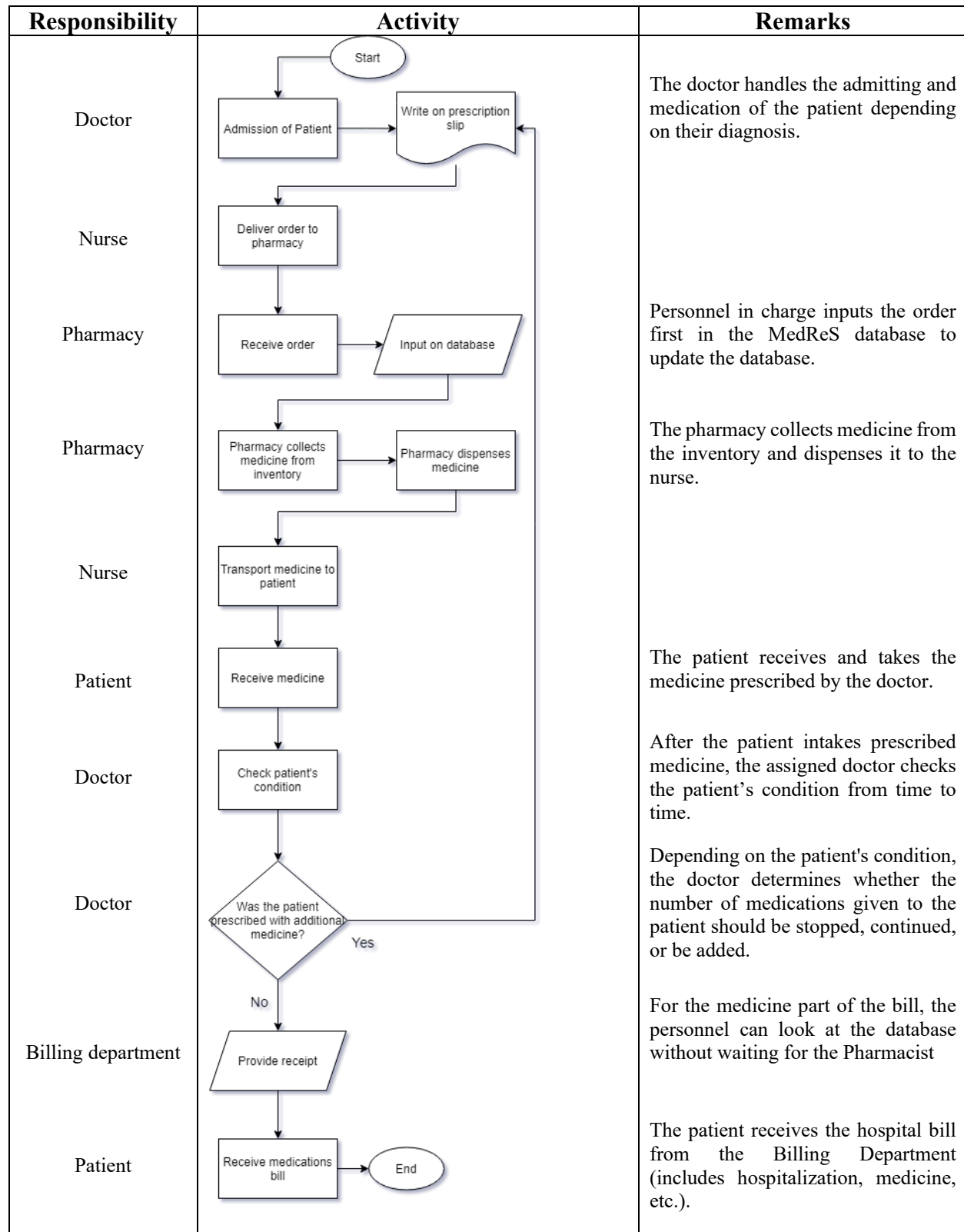


Figure 3. Flowchart of the Proposed Medication Report System

The MedReS serves as a database for the hospital, particularly in the Pharmacy. It is built to manage and organize data for both the admitted patient and the medicines bought for them. This system was created so that the Pharmacists would not have any trouble navigating through the interface since the database tool has functionalities that are simple and user-friendly. Moreover, the database allows a cross-platform link between multiple computers within one network. This way, once a record is saved in the form, it automatically updates the system and is accessible for both the Pharmacy and Billing department. This removes the need for the pharmacists to transport the report manually to the billing office and shorten the processing time of the receipt.

5. Conclusion

In hospitals, medication reports or prescription records are kept for patient history purposes. Pharmacy departments oversee producing and managing such documents. However, some Philippine hospitals still manually process the reports which results to slow data exchange, cluttered paper files, and information inaccuracies. The application of information systems in the healthcare industry has the potential to improve safety and service quality. This study was focused on assessing the current charged medication report system of a general hospital and developing a system that could be more efficient in producing prescription reports for admitted patients. Results showed that the present system involved actions that were prone to errors, transport, and encoding delays in the overall process. A stream analysis identified that the core problem is the inefficient system of producing the medications report, and the symptoms it drives include handwritten errors, no formal organization of papers, and the pharmacist goes back and forth to manually update the charged medication report. The MedReS was developed to serve as a more efficient system of providing patient medication reports in a general hospital in the Philippines. Implementation of the proposed information system could decrease the processing time of the reports as encoding and waiting time between the pharmacy and billing department are reduced. Additionally, it can lessen the need for unnecessary repetition of tasks such as manual transportation of medication reports and encoding of receipts. Thus, hospital personnel can better focus on more urgent tasks with the help of the proposed system. Utilizing Microsoft Access to input purchased medicines, update information, and provide receipts would result in an overall faster process. The automation would provide quick access to information that is linked between the Pharmacy and Billing sections. Furthermore, other benefits to the application of MedReS are that paper use is lessened, patient summary reports are more organized, medication receipts are printed faster, a smaller amount of waste is generated, and system efficiency and productivity are improved. Future researchers who will replicate the study may consider enhancing the developed proposed information system through integrating the database with another software that would allow users to preorder medications and would notify the pharmacist about the placed orders. Additionally, more factors may be added to provide more favorable results in creating an efficient system. These factors could include the performance of the hospital personnel, the span of their knowledge in utilizing Microsoft Access, etc. Productivity and system efficiency can further be increased by utilizing macros to automate some tasks and add more functionality to tables, queries, and forms.

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Biographies

Cielo Jefferson F. de Castro is an undergraduate student of Mapúa University taking up Bachelor of Science in Industrial Engineering. He is a member of the Philippine Institute of Industrial Engineers (PIIE) and Operations Research Society of the Philippines (ORSP). He has recently finished an internationally accredited program to become a Certified Lean Six Sigma Yellow Belt. An industrious and inquisitive student, he is willing to learn new things, easily adapts based on the environment, and constantly strives to improve processes, operations, and overall quality of living. With this, he is eager to bring positive and meaningful change to the industry, nation, and the world at large. His research interests include optimization, information systems, and lean manufacturing.

Klarence Emmanuel F. Decena is an undergraduate student of Mapúa University taking up Bachelor of Science in Industrial Engineering. He is currently a member of the Philippine Institute of Industrial Engineers (PIIE) and Operations Research Society of the Philippines (ORSP). During his academic years, he has participated in research fairs such as Kuala Lumpur Engineering Science Fair (KLESF) and UP ALCHEMES Research Fair, where his researches were aligned with programming, automation, and optimization. He has a collective mindset which makes him work well within groups. That said, he is willing to help others as long as he is told to do so. With a background in being a freelance artist, he has experience in working with clients. This also gives him the quality of creativity and good design essence which is fit for product design and development.

Ken Joshua U. Rebosura is an undergraduate student of Mapúa University taking up Bachelor of Science in Industrial Engineering. He is currently the president of Operations Research Society of the Philippines – Mapua Student Chapter (ORSP-MS), and the Finance Director of ORSP – Student Federation. He participated in the 7th IEEE International

Conference on Engineering, Technologies, and Applied Sciences, where his research covers an application of Systems Engineering and Information Systems Design. He possesses a versatile characteristic that allows him to easily adapt and apply his knowledge to new environments. He has interests in continually practicing his understandings of Product Design, Work Study, Information Systems, and Systems Engineering.

Josephine D. German is a faculty member of the School of Industrial Engineering and Engineering Management at Mapua University in Manila, Philippines. She has earned her BS in Industrial Engineering and Master's in Engineering (major in IE) from the same University. She is a Professional Industrial Engineer (PIE) with over 15 years of experience and has taught several courses in IE. She has done several research projects in the field of logistics and supply chain management, systems modelling, entrepreneurship, risk management, vulnerability assessments, and ergonomics and has an extensive experience in academic audits and accreditations. She is also a member of the Philippine Institute of Industrial Engineers (PIIE).