



Implementation of virtual clinical pharmacy services by incorporating medical professionals and pharmacy students: A novel patient-oriented system to advance healthcare in India

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ABSTRACT

The healthcare sector is continuously evolving in pace to meet the medical needs of the society. Even though therapeutic reforms are happening, medication discrepancies are the prime cause of hospitalization. This has generated an invincible demand for clinical pharmacy services. Accordingly, a program that collaborates the clinical preceptor and students of department of pharmacy practice with the hospital's medical team, has been established. Any individual who has doubts on medicines can inquire through Dr MED, a virtual clinical pharmacy platform. The operating procedure of the program is presented in the article, where the program's coordinator and the pharmacy students play a significant role in sorting out the queries and finding out the evidences. On the other hand, the medical team composed of physicians and clinical pharmacists acts as a supporting component. Finally, the decision on how and what to respond to the inquirer is upon the opinions put forward by the medical team. Moreover, the system also addresses all the clinical concerns confined to medicines that ultimately enhances the patient's treatment outcome.

1. Introduction

Clinical pharmacy service is an essential component of the healthcare system. Advanced knowledge and skills confined to medicine and medicine-related matters are the pre-requisite to post a pharmacy practitioners in a medical team. Moran et al. recognized their role in optimizing therapy with cost-effective approaches and their contribution towards facilitating antibiotic scrutiny, and educating physicians, nurses, and other healthcare providers.¹ Moreover, the pharmacy authorities of France employed clinical pharmacists to tackle the shortage of essential drugs such as anesthetics and high alert medication during the pandemic. Their efficiency in selecting the appropriate substituent, elevated their role during the COVID 19 era.^{2,3} A collaborative medical team incorporating the clinical pharmacists would supply better patient care and treatment outcomes.⁴

The entry of pharmacy practice discipline to healthcare demonstrated improved quality and safe administration of medicines. Physicians were pleased with the effort put in by the clinical pharmacist. Sensitive streams such as oncology, nephrology, and cardiology significantly benefited from

their interventions.⁵ Despite that, even though people are the beneficiaries, they are less aware of the contribution of pharmacy practitioners in the hospital and community settings.⁶

Our society is very much cautious about their health, and their apprehensions rise when they are offered a treatment for their disease. This would mostly tempt them for a second medical opinion. Dingfield and Kayser recommended an advanced care planning system that would assist patients in knowing more about their diagnosis and prognosis and enable friendly discussions with their medical experts on the possible outcomes and goals. This system has relaxed and reverted those under treatment from anticipations.⁷ Despite that, there are numerous communities in India with limited access to healthcare. George et al. stated that the lack of medical facilities in remote areas had imposed a demand for implementing strategies to counter this situation and establish universal health coverages to all in need.⁸ Moreover, physical accessibility barriers, economic constraints, and social hindrances are the other prevailing factors that restrict many from directing themselves to treat.⁹ In order to occupy and assist a larger population with a wide range of disabilities and negative perceptions, an authentic medical guide is invincible.

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COVID19 had set forth a new online era and web-based services unfurling throughout India.¹⁰ However, this pace is not observed in the health and medical discipline. Even though novel medicine dispensing platforms are sprouting, its utilization can be affected by the unawareness and unavailability of prescribed or required drugs, and social stigmas. In the U.S., an information technology-based pharmaceutical company was prosecuted for counterfeit medications.¹¹ The situation is severe in India, where various drug safety issues are raised through published articles.¹² Nevertheless, e-pharmacy services are growing around cities and towns.¹³ In this context, each pharmacy practitioner should work hand in hand with drug inspectors of that locality to ensure rational utilization of medications. Moreover, proper awareness program for the community pharmacists as well as the public is inevitable and should emphasize the importance of safe administration and consumption of drugs. Hence, clinical pharmacist role in the benign phase of e-pharmacy is unavoidable.

In order to ensure the attainability of the clinical pharmacy service to all people and healthcare providers, a virtual system would be feasible.¹⁴ This opened up for researching how effectively the services could be transformed to online mode with the press on accessibility to the entire population seeking treatment. We developed an online pharmacy practice mobile application considering this as the prime objective and ensuring cost-free clinical pharmacy services. Here, we present a proposed model of the virtual clinical pharmacy service for optimizing the treatment provided to the society.

2. An evaluation on currently available online platforms

a. For healthcare professionals

The current medical services offers many paid as well as free-to-use medication information websites and mobile applications. Among them, healthcare professionals utilize Wolters Kluwer's UpToDate, Lexicomp, Micromedex etc., that serves updated knowledge on numerous medicines and diseases related topics. These resources have comprehensive and authentic data structured and designed in readable format.¹⁵ However, the current scenario had directed people towards very concise and to-the-point information that easily gained acceptance. Healthcare stream needs quicker responses, and they also sort for such summarized information.^{16,17}

b. For people

The reputed medicine reference tools are payable to subscribe and has limited accessibility for the people. Moreover, pharmacists in both community and hospital settings are disparate with workload and few postings in clinical pharmacy discipline has diminished pharmaceutical care and counseling facilities for people.¹⁸ In these circumstances, Koster et al. recommended the implementation of tele-pharmacy services.¹⁸ Epic, Allscripts, CureMD, eClinicalWorks, and Cerner are some of the well known electronic health records systems that provide patient service portals.¹⁹⁻²² These systems offer virtual pharmaceutical care and are quite beneficial to patients who have access to it. In India, as part of the government's Digital Health Mission, the electronic health records has gained popularity. Pai et al. had put forward a standard, secure and centralized online health record framework for the public sector by incorporating the entire levels of healthcare system.²³ This transformation can set out easy retrieval of complete data of a patient irrespective of where they seek treatment, thereby bestowing maximum care.

People are searching for the best healthcare facilities, and multiple opinions would confuse them on what to choose.²⁴ Establishing a patient portal system would be more challenging, factored by social stigmas. However, convincing the public would be easy if a new medical service is free of cost. Hence, to provide authentic information and opinions on medicines, we had put forward a new system in the clinical pharmacy discipline.

3. Benign stage of development of the new virtual platform

3.1. Formation of an expert panel

A virtual platform for clinical pharmacy services is new to Indians. It is difficult to predict the acceptance of the service deployed in online mode, and this dilemma has to be solved. As a strong pillar, we formulated a medical expert team and a set of pharmacy practice students (Doctor of Pharmacy Interns) and their clinical preceptor to constitute the virtual clinical pharmacy core panel (Fig. 1).

The clinical preceptor for the pharmD interns is the program's organizer and coordinator and will be assisted by four pharmacy practice students posted in the hospital. The medical expert team comprises of one physician from each department and two clinical pharmacists and the willingness letter stating their cooperation for the program was documented.

An inquirer can be an individual who has any doubt confined to medicine. Questions asked through a suitable platform is received by the organizer. This is then modified to answerable question and sent to assigned students, clinical pharmacists, and physicians specialized in that area. The students would surf through published articles in Scopus, Web of Science, Medline, or PubMed indexed journals, and authentic medical web-portal such as Wolters Kluwer's Up-to-date and submit their findings in document format along with references, back to the organizer. Meanwhile, clinical pharmacists can share their view on the matter and retrieve the patient's information from the hospital's electronic medical record for further investigations. This would enable them to identify and rectify the medication errors, therapeutical duplication, drug-drug interactions, and adverse drug reactions. The observations and communications of the clinical pharmacists are also documented and merged with the student's data upon validation and is sent to the physician's desk for further analysis. The physician then conveys their decision on the case which may represent changing the prescribed medicines, adding drug(s), requesting for consultation at their outpatient or inpatient department etc. Finally, the organizer will transfer the final decision, emphasizing the physician's and clinical pharmacist's conclusions. The organizer ensures that the students do not disclose any patient information to any unauthorized individuals.

3.2. A trail platform: the WhatsApp Messenger

Initially, we fixed WhatsApp messenger as the trial platform to know how well the procedure would work. Accordingly, the tertiary care referral hospital, wherein the program was approved, issued a Closed User Group (CUG) mobile number. A separate phone was allotted by the pharmacy college associated with the hospital and the clinical preceptor (PharmD, Ph.D. in Clinical Pharmacy) was the custodian of the number and the device. The promotion wing of the hospital assisted and supplied brochures to attract people towards the service and stamps with the contact number for printing on their patient's discharge summary.

WhatsApp is one of the widely used social media platforms, and it would be easy for people of India to share their doubts through it. As soon as the program was initiated, along with medicine-related queries, other administrative questions rushed in from those under treatment in the hospital and others. Instead of not responding to such out-of-scope queries, we addressed them to create a bond with the inquirer. We also highlighted the actual purpose of the program before ending up the conversation. Accordingly, the CUG number of all the departments in the hospital was collected and those calls and messages not related to medicines were redirected to the concerned discipline.

In the beginning, there was some delay in the data retrieval and sending back of the information to the inquirer. However, later the process became faster, and subsequently, patients of the hospital and the public got valid and authentic information on their medicines.

Our program that was executed through WhatsApp messenger was evaluated for a month and there were queries concerned with pediatric

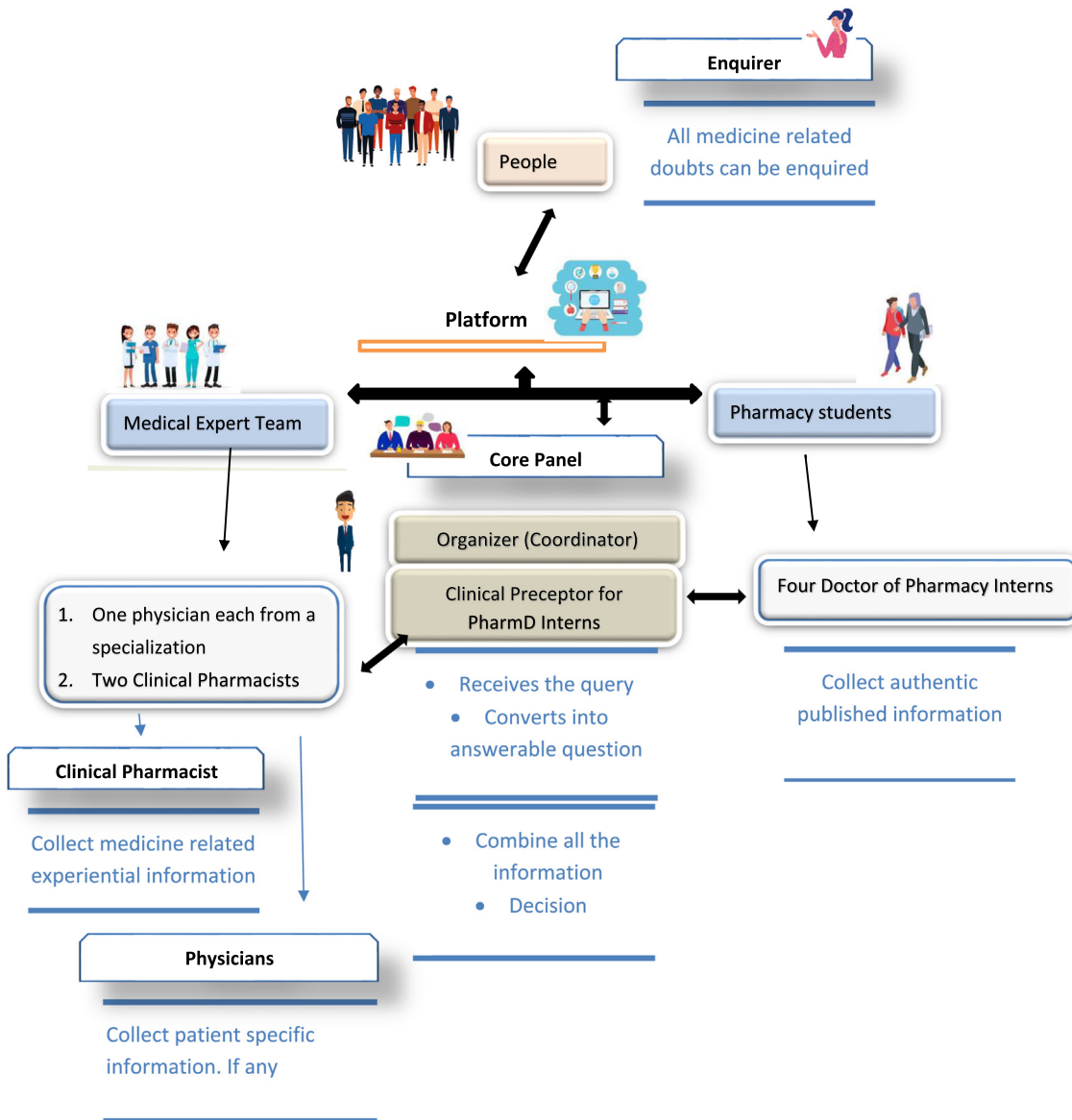


Fig. 1. Constitution and role of the virtual core panel members and their link to people.

($n = 10$), adults ($n = 87$), and geriatrics ($n = 40$) population. Our team identified 21 drug-drug interactions and 93 adverse drug reactions. The assigned students gathered evidences confined to the drug-related matters and was submitted to the coordinator. Further, the issues were notified to the concerned physician and the clinical pharmacist, where they quickly rectified the issues with suitable interventions. Meanwhile, all those who availed our services were provided medication counseling through telephonic calls or text messages. Before the end of the conversation, we collected their feedback and the responses depicted that they were satisfied with the new system. Moreover, many appreciated the team for starting up such a novel project. This brought confidence in the team to set forth a separate platform that solely executes the clinical pharmacy service through online mode.

4. Origin of a separate platform for clinical pharmacy service: Dr MED

Dr MED is a mobile-based clinical pharmacy service designed to assist healthcare providers and common people for rational consumption of medicine. The application was designed for about 500USD and is free to use

with no advertisement embedded in it. Its simple user interface facilitates the entire population, especially the geriatric population, to easily handle all of its features.

The clinical pharmacy mobile application is available in Android Play Store that can be downloaded and installed in a device.²⁵ The user enrollment process is effortless, and sign-up requires minimal details such as name, profession, and phone number. A one-time password is generated to verify the mobile number. This platform obeys the same operating procedure mentioned in WhatsApp counseling. Moreover, a few additions and modifications were performed to ultimately be the features of *Dr MED*.

5. Features of the clinical pharmacy mobile application

Following are services put forward by the application: -

1. Visual medicine information

The home page of the application displays multi-linguistic medicine and health information enabling all population to view and understand the

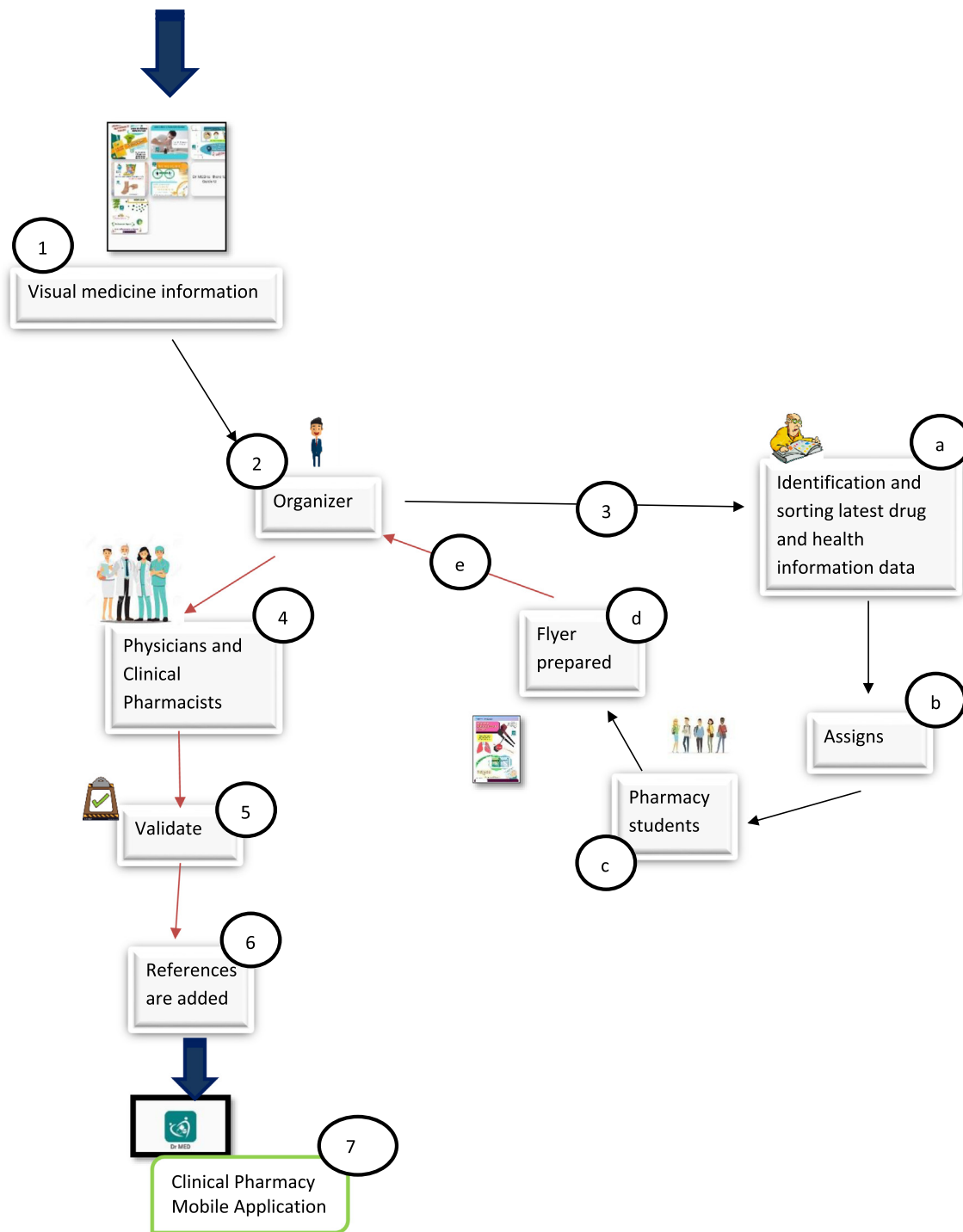


Fig. 2. The process of preparation and validation of health and medicine information.

content. We had further divided the information into those specific for the general population and those for the elderly. Information confined to chronic diseases are preferred for the geriatric section.

The preparation and validation process of the health information flyers are represented in Fig. 2. Upon thorough literature review, the coordinator/organizer identifies the latest topic of potential interest to the public. The students are divided into image editors and content sorters and assigned the duty of developing the respective flyers. Upon completion, the visualized medicine information is validated by the organizer, pharmacy faculty, and the medical expert team. The references are then added and finally posted through the Dr. MED.

2. Communication with inquirer

The application has incorporated a chat utility to have easy communication with the inquirer. There are provisions to upload images and send voice and text commands. Moreover, weblinks can be shared, and the user would be re-directed to the site upon a click. The upload feature enables the client to post their medicines, prescriptions, or any other relevant images that would assist the medical team in drawing a valid conclusion out of it. The voice utility would enhance feasibility, especially for the geriatric population.

The organizer would handle all queries and process accordingly. Being a trained professional in clinical pharmacy, the organizer does not require

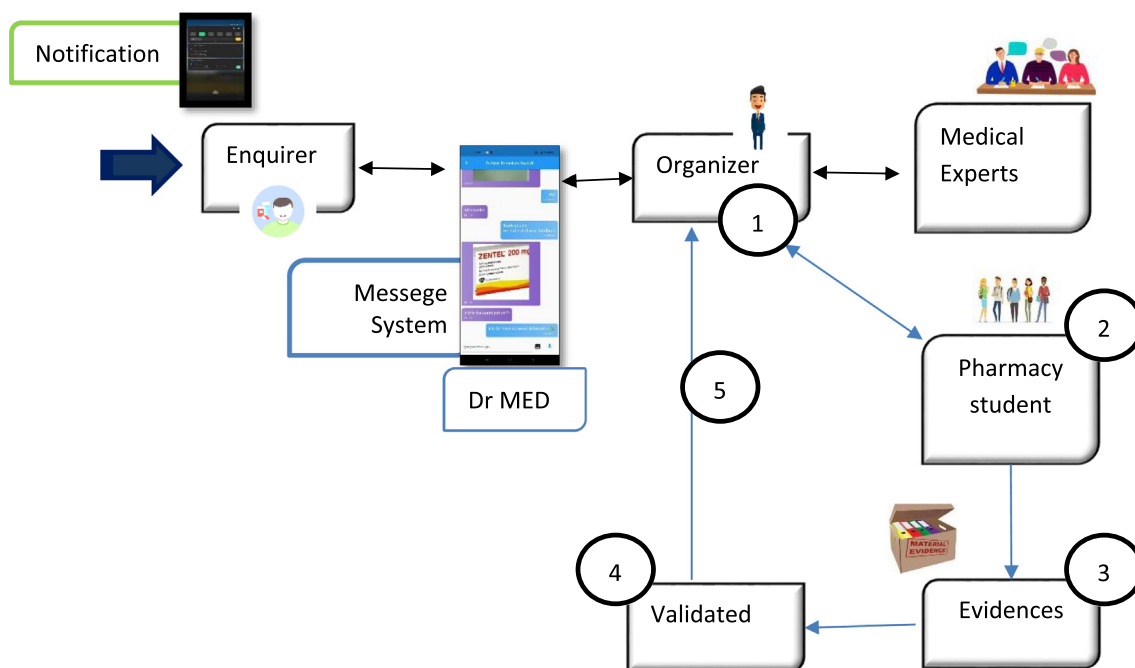


Fig. 3. The flowchart of the communication system in Dr. MED.

to forward the questions if he/she can him/her self answer them. Otherwise, it would be re-directed to physicians and clinical pharmacists as mentioned above. The organizer also ensures all the queries are answered within minimal time with sufficient information until the inquirer is convinced.

Fig. 3 represents the chat interface deployed by Dr. MED. The organizer and the inquirer can see when the message was sent and read using the tick symbol at the bottom of each message. The chat interface of Dr. MED is exclusively for medicine and medicine-related queries, enabling the users to discuss the patient's treatment or their doubt, unlike WhatsApp messenger.²⁶ We also have added notification pop-ups in the Dr. MED user's phone that would aid them in not missing out on any messages or notifications.

3. Learning and education

Dr. MED offers its own online medical courses and medicine and health information videos to its clients. Those interested can register through the application and watch the pre-recorded sessions. The feedback and other matters confined to the classes can be discussed with the organizer through the chat interface.

Fig. 4 picture the preparation flowchart of the videos. The organizer picks up few relevant topics regarding medicine and health that suits the current scenario. This is then assigned to the pharmacy students, physicians, or clinical pharmacists upon their willingness. The video prepared by the assigned professional is screened for authenticity, and any faults in terms of misleading statements, video quality, and poor reference supports are revised. The organizer then edits and posts it in the YouTube channel named Medicine Assist (A supporting channel of Dr. MED).²⁷ After sorting them into appropriate sections, this would also be telecasted in Dr. MED application.

4. Adverse drug reaction monitoring system

Adverse drug reaction (ADR) is any noxious event happening because of medicine to any individual.²⁸ These events can be short or long-term and are presented with varying fatalities. A healthcare provider needs to watch on such occurrences and report them to concerned authorities. A clinical pharmacist or pharmacovigilance associate is the designated medical professional trained to detect, report and solve an ADR.²⁹ Meanwhile, the pharmacovigilance program of India is hosting many programs and

implementing various strategies in creating awareness towards such events to the public as well as healthcare professionals.³⁰ However, ADRs are still under-reported.³¹ In this context, we had incorporated an ADR reporting system in the Dr. MED application.

Once an ADR is detected, the reporter should enter the name of the drug, its dose, frequency, and the time, date, and description of the event. The application asks whether the reaction was resolved after drug withdrawal and if the patient is back to normal.

All the reported ADRs are notified to the organizer. Further inquiries on the event and the casualty assessment can be performed through the message system of Dr. MED. Eventually, those found not to be due to drugs can be deleted from the database. Their phone number in the Dr. MED server would aid to call the concern person to gain additional information, if necessary.

Students collect evidence with regards to the observed adverse events from published and authentic resources and a summary is submitted to the organizer. Moreover, clinical pharmacists' and physicians' opinions are also considered. Once the event is confirmed through causality assessment, the report and details are shared with the pharmacovigilance associate of the pharmacovigilance program of India (Fig. 5). This is then forwarded through Vigiflow to the Indian Pharmacopoeia Commission and ultimately to Uppsala monitoring center, Sweden.³² Additionally, the organizer can also self-report any ADR, if identified during the routine conversation with Dr. MED users.,

There are yet more additional required and the system will be continuously updating for bringing out the best virtual clinical pharmacy services to all the population catering their medical needs.

6. Dr MED's Services provided to common people

1. Clarification of medicine-related doubts
2. Modification of treatment in case of any discrepancy, in consultation with the physician
3. Identification and early detection of adverse drug reactions and recommendations to prevent fatality and re-occurrence of such events
4. Patient medication counseling on their latest and newly prescribed treatment
5. Medicine awareness and education program
6. Medication reconciliation and checks on continuation and adherence to treatment

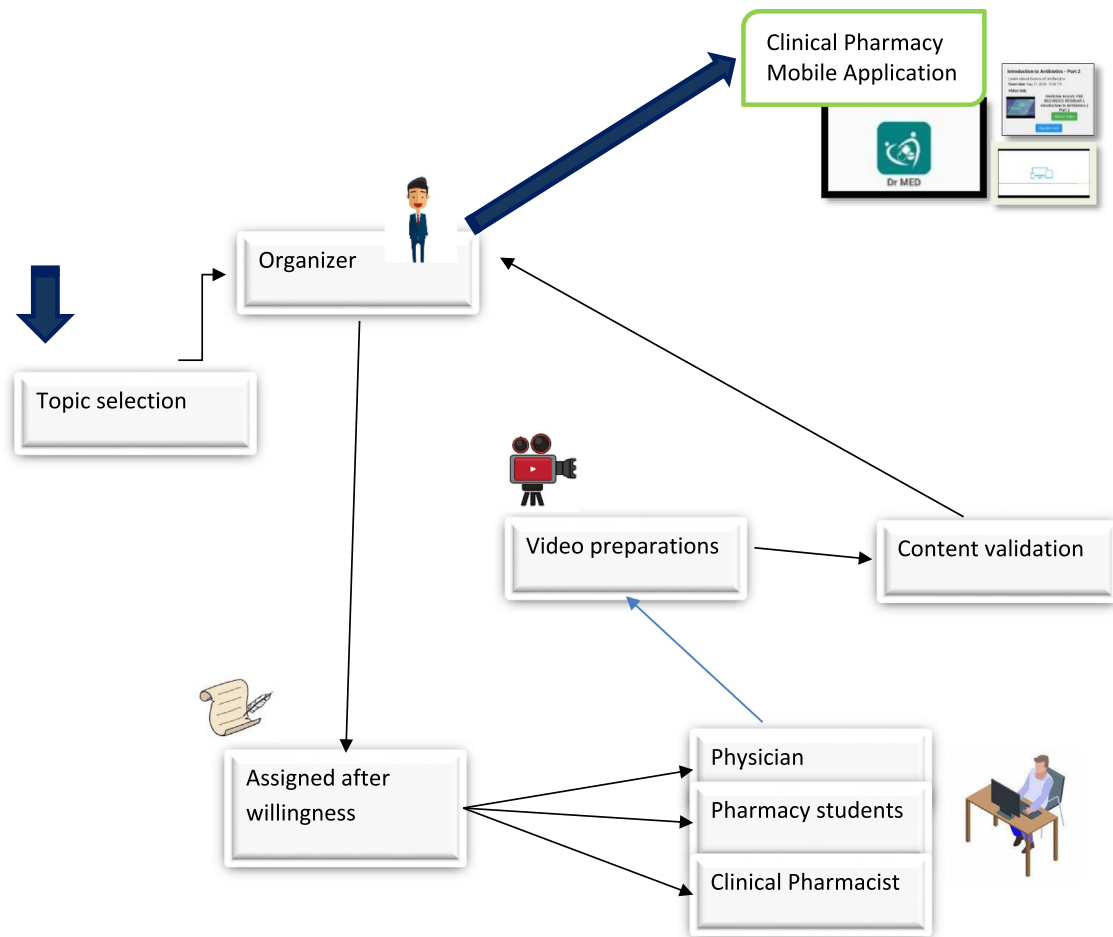


Fig. 4. The flowchart of the video preparation system for Dr. MED.

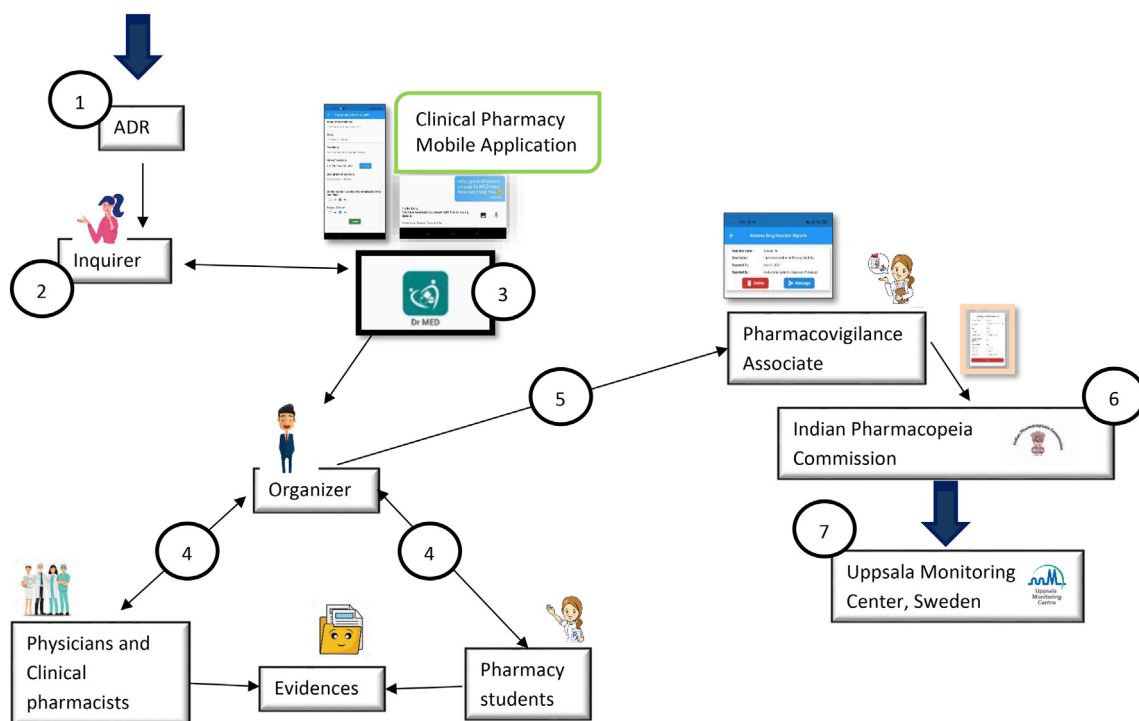


Fig. 5. The workflow of Dr. MED ADR reporting system.

7. Any therapeutic duplications because of poly-pharmacy
8. Recommendation and suggestions confined to their treatment
9. Assessment of drug-drug interactions and drug-food interactions.

7. Incorporation of virtual platform with online pharmacies

The next phase of our mobile application is to join hands with e-pharmacy portals. We can ensure authentic and standard information are conveyed to people who receive their medicines through couriers and untrained staffs.

8. Challenges and opportunities

8.1. Hurdles faced during implementation

Designing and establishing the mobile application was a big task. After strenuous effort and continuous discussion, the Dr. MED mobile application came into existence. Getting a link with the core panel members was difficult initially, but later it became easy owing to the mutual benefits imparted by the program. The organizer had to put extra effort into validating the findings and documents submitted by the students. Gradually, the operation smoothened because of the periodic training sessions hosted to the students and other healthcare providers. Moreover, convincing the Dr. MED clients was also challenging. We had to maintain a strategic approach to ensure the answers provided do not hurt their feelings and treatment adherence.

8.2. Scope

Implementing a virtual clinical pharmacy program in its advanced form would enable people to be in touch with their pharmacists. Such a system can enhance the recognition and possible contributions a pharmacy professional can impart towards patient care.

9. Conclusion

The clinical pharmacy services to the society is awaiting reforms. This evolution, even though slow, requires enormous efforts and steady awareness to the public. The development of a virtual platform for practicing pharmacy would gain more acceptance considering the encroachment of electronic and information technology even to rural communities. Clinical pharmacists and the pharmacy faculty joined hands with other healthcare providers collaboratively would define the program's success. Nevertheless, students should deal with real-time practices and their desire to contribute to society's health would upgrade them to be trained pharmacy profession in the future.

Declaration of Competing Interest

All author shares no conflict of interest.

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