Grenze International Journal of Engineering and Technology, January Issue

Reducing Polypharmacy: Best Practices and Interventions

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***Abstract*—Polypharmacy, is referred to as the parallel use of multiple medications, in clinical practices, particularly among elderly patients and those with chronic conditions. While necessary in some cases, polypharmacy extends the threat of harmful drug reactions, drug-drug relations, and medication non-compatibility, leading to potential harm and increased healthcare costs. This project, titled "Reducing Polypharmacy: Best Practices and Interventions" aims to identify, evaluate, and recommend effective strategies to mitigate the risks associated with polypharmacy.**

***Index terms*—web applications, mobile applications, ChChSe-Decagon_polypharmacy, QR generator.**

I. Introduction

Polypharmacy, is referred to as the parallel use of multiple medications by patients, is a major tremor in healthcare, particularly among the elderly and those with chronic conditions. While the intake of several medications may be required to manage complex health issues, polypharmacy extends the threat of adverse drug events (ADEs), drug-drug relations, medicinal non-compatibility, and overall healthcare costs. Adverse effects (ADE) refer to the proper or improper use of drugs. Although adverse drug reactions are included in these events, they involve harm directly caused by a drug even when used correctly. As the population ages and the prevalence of chronic diseases rises, addressing polypharmacy has become a crucial aspect of improving patient safety and quality of care. Reducing polypharmacy involves a careful balance between managing multiple conditions and minimizing unnecessary or potentially harmful medications. Best practices and interventions aimed at reducing polypharmacy focus on comprehensive medication reviews, patient-centered care, and collaborative decision-making among healthcare providers. These strategies not only aim to reduce the number of medications but also ensure that the prescribed therapies are appropriate, effective, and aligned with the patient's health goals. Interventions such as deprescribing, which involves the planned and supervised tapering or stopping of medications that may no longer be beneficial, have shown promise in reducing polypharmacy and improving patient outcomes. Additionally, implementing guidelines for appropriate prescribing, enhancing patient education, and utilizing technology for better medication management are key components of effective polypharmacy reduction strategies. This topic explores the various best practices and interventions that can be employed to reduce polypharmacy, highlighting the importance of an individualized approach to medication management that prioritizes patient safety and quality of life.

Grenze ID: 01.GIJET.11.1.35

II. LITERATURE SURVEY

This study Ref. [1] expressed that polypharmacy is a condition where consuming multiple medications for multiple diseases causes adverse drug reactions and adverse drug events. This examines techniques to overcome polypharmacy with the help of a medical translation system, QL4POMR. QL4POMR(Query Language for Problem-Oriented Medical Records) connects the patient's data to biomedical repositories like OpenTargets and DrugBank in the arrangement-SOAP(Subjective, Objective, Assessment, Plan). This layout is used for storing the patient's medical records at the bedside, ensuring clarity and organization in patient care. By means of this assistance, countless spastic disorders like asthma and hypertension have been studied as evidence of this theory[1].

This project Ref.[2] addresses the issue based on CYP450 metabolism. CYP450(Cytochrome P450) is a hemeprotein that controls the metabolism of drugs and its combined reactions. This project focussed on developing a platform-independent java program ,which relies on the list of medications and enzymes.This information was used to commonly identify the reactions caused by the CYP450 enzyme ,which further helped the patients from the polypharmacy effects[2].

This review paper Ref.[5] explains that the elderly population especially in rural areas are unaware of the threats associated with the intake of multiple medicines simultaneously. In elderly people, the risk of harmful drug events is at the rate of 10% than other age groups. In severe cases, polypharmacy becomes the reason for frequent hospitalizations and leads to the death of people with and without non-communicable diseases. For instance, medications, at the time of primary tumor therapy might make older adults face higher toxicity levels, followed by acute myeloid leukemia[5].

This paper Ref. [3] states that inadequate encoding of drug information and failure to capture relationships between side effects have led to the increase of polypharmacy effects in people. This method approaches by building molecular structures for the medicines and based on its biochemical properties, drug representations have been studied clearly. The decoder uses a boundary-guided strategy to predict side effects by learning this dependencies between them.[3].

The researcher Ref.[4] has proposed a study that addresses the critical issues of detecting adverse drug recations(ADRs) in medical practices,particularly with the severe challenges of remedy among elderly population. Since ADRs are often hard to detect during clinical trials and rely on post-market patient reports, there is a pressing need for reliable predictive methods. This study introduces a framework utilizing Graph Neural Networks and selfsupervised learning to model drug-drug interactions by representing drugs as molecular graphs. By leveraging spatial and physical drug properties, the approach mimics chemical interactions. When tested on the TwoSIDES Polypharmacy Dataset, it achieved a precision of 75% and accuracy of 90%. A case study on the DrugBank data record validated the framework, with precision, F1, and accuracy scores reaching 99%. This innovative approach offers a scalable solution to predict ADRs and improve patient safety before drug release[4].

This Analysis Ref.[6] Approaches to analyze the extent of polypharmacy in Medical healthcare. This a field-specific method to minimize the intricacy of the mined process that includes the concepts of text analysis that was used to explore the prescriptions of the affected patients. The author announced that around 62% of the patients were affected by these drug interactions with the use of medicines for a prolonged period of 2 years. This project enforced on proper management of data records and analytical ways to address the threats associated with polypharmacy. This method would surely provide permanent relief to elderly patients with several health conditions[6]. This paper Ref.[7] has studied about 2 datasets [DDI and PDI] and has created a fine tuned models such as GPT-2 and an efficient DistilBERT for handling complex relationships in medical data.A web application was developed using Flask,providing general DDI prediction for the public and personalized PDI predictions for healthcare professionals [7].

III. METHODS

A. Mobile Application for Patients

The mobile application is designed to be user-friendly, with language options in English and Tamil, making it accessible to a wider demographic.

Upon registration, patients can input their details, including name, mobile number, age, and location. The app’s homepage features several tabs—Reminders, Visits, Scans, Tests, and Prescriptions—allowing patients to manage their medical appointments, view lab results, and store their prescriptions securely. The Scan tab includes a QR code functionality that transfers the patient's information to the doctor’s web application.

B. Web Application for Doctors

The web application is designed to facilitate comprehensive medication management by allowing doctors to view all medications prescribed to a patient by different specialists. Upon signing in, doctors can access a list of patient appointments for the day and use the Scan tab to read QR codes from the patient's mobile app. The Reference tab provides a link to a drug interaction dataset, enabling doctors to avoid prescribing medications that could result in adverse DDIs. This system ensures that each doctor is aware of the full scope of the patient's medical conditions, thereby reducing the risk of adverse event.

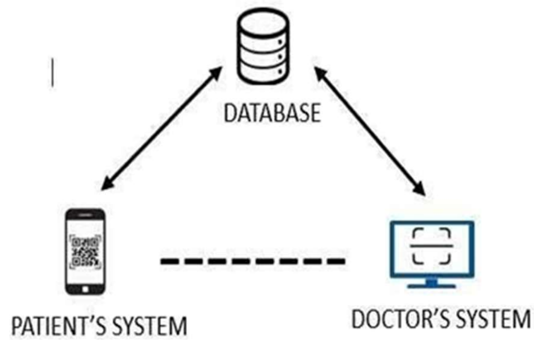


Fig.1: Conceptual outline of the presented findings for elderly people

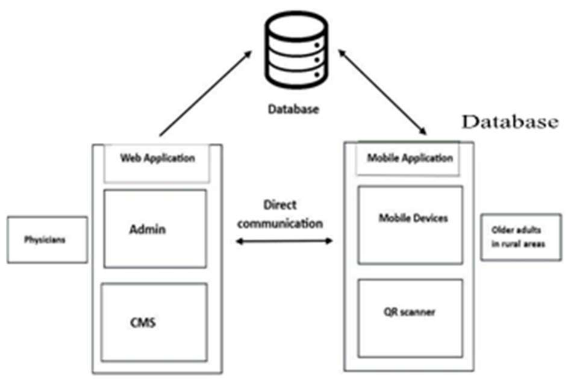


Fig.2: The overview design for our presented the concept of observing elderly people

Fig.1 Our recommended solution completely uses Structured query language (SQL) to store information about the patient and helps doctors retrieve information about the patients using the same database.

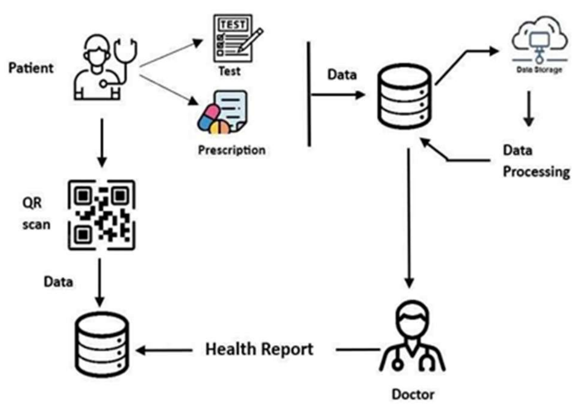


Fig.3

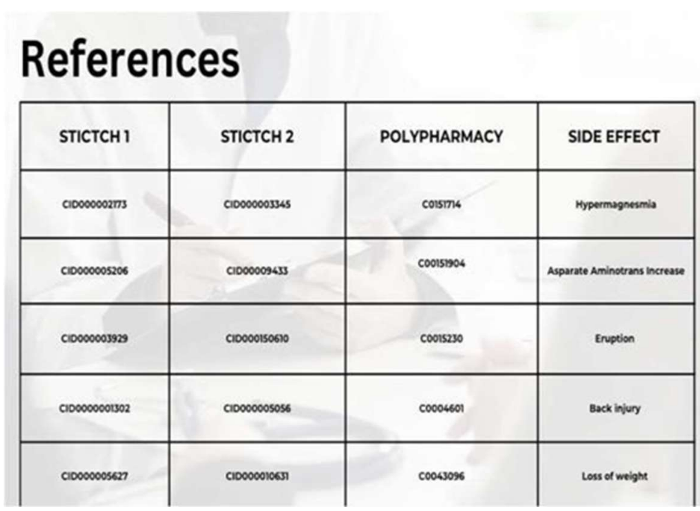
Fig.2 depicts the overview design for our proposed solution for observing older adults. Fig.3 figures out how the data is collected from the patients, what are the information collected from patients, where it is stored, and how it is made available to doctors to help manage and reduce polypharmacy risks.

Fig.4: Screen capture of the web application of Doctor (Homepage)

TABLE I. DATA SOURCE: CHCHSE-DECAGON_POLYPHARMACY

# STITCH 1	# STITCH 2	Polypharmacy Side Effect	Side Effect Name
CID000002173	CID000003345	C0003578	Apnea
CID000002173	CID000003345	C0013182	Drug hypersensitivity
CID000002173	CID000003345	C0016204	flatulence
CID000002173	CID000003345	C0151714	hypermagnesemia
CID000002173	CID000003345	C0035344	retinopathy of prematurity
CID000002173	CID000003345	C0002063	alkalosis

The above data source consists of a dataset(ChChSe-Decagon_polypharmacy) that describes the interaction of drugs and their associated side effects. The table consists of four columns with fields of the composition of the two medicines and their resulting interactions composition with their side effect names. This dataset would be used by the doctors while prescribing medicines to the patients as a reference to overcome the effects of polypharmacy.



References

STICTCH 1	STICTCH 2	POLYPHARMACY	SIDE EFFECT
CID000002173	CID000003345	C0151714	Hypermagnesmia
CID000005206	CID00009433	C00151904	Asparate Aminotrans Increase
CID000003929	CID000150610	C0015230	Eruption
CID0000001302	CID000005056	C0004601	Back injury
CID000005627	CID000010631	C0043096	Loss of weight

Fig.5: Screenshot of the web application of Doctor (reference tab)

Fig.6: Sample image of the web application of Doctor(Scan tab)

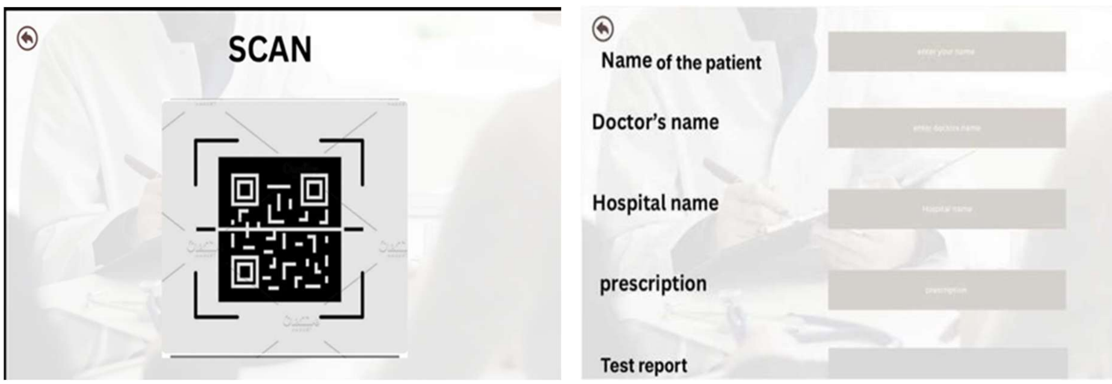


Fig. 7: Sample image of the web application of the doctor (Display of patient details)

Fig.4, and 5,6 clearly illustrate the workflow of the doctor's web application. The web application of the doctor has a homepage that consists of an appointment list, and a reference tab that consists of data sources that help doctors prescribe medicines without causing polypharmacy side effects. Fig.7 shows the scan tab that helps the doctors scan the QR code generated in the mobile application of the patients's device that consists of their medical history. Once scanning is done by the doctor,the information about the patients is viewed in the web application of the doctor. This helps the doctor to prescribe medicines to elderly people accurately without any polypharmacy effects.

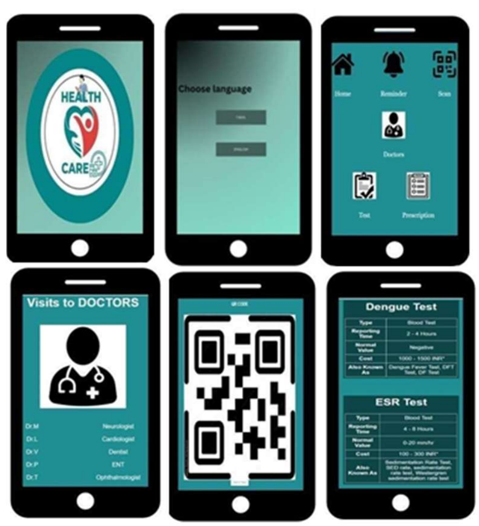


Fig. 8: Mobile application of patient

Fig.8 demonstrates the mobile application of the patients that consists of a reminder tab to enable the elderly people of their appointments with the doctors and it also includes their prescription details, test reports, and the doctors who visited them for their regular check-ups and the scan tab to transfer their health reports to the doctor to prescribe medicines efficiently.

IV. CONCLUSION

The project titled Reducing Polypharmacy: Best Practices and Interventions aims to tackle the complex issue of polypharmacy by introducing a system of mobile and web-based applications that can help patients and doctors manage and track medication intake efficiently. This project completely focuses on the elderly population in rural areas. Elderly individuals often visit different doctors for each of their health conditions. One doctor may not be aware of what another doctor has prescribed. The mobile application is built to store the individuals' prescriptions and test reports so that they do not need to carry all their prescriptions each time they visit the doctor. This allows doctors to have full visibility of a patient's medication history, ensuring that all drugs prescribed are safe and do not interact adversely. This greatly reduces the chances of drug-drug interactions. Here, SQL is used to store the information of individual patients in their respective devices so that no unauthorized person can access the patient’s medical data. The system uses QR scanning technology to allow seamless data sharing between patients and healthcare providers. This ensures that doctors always have up-to-date information when treating a patient. The app's language selection feature (English/Tamil) makes it more accessible to users from diverse backgrounds, particularly the elderly in rural areas.Doctors can collaborate effectively with the data stored in the reference dataset, ensuring that prescribed medications do not cause harmful interactions, leading to safer and more effective treatments.Further improvements include algorithms to determine possible drug interactions and alert doctors of possible risks automatically. This could be based on real-time patient data, prescriptions, and health records. Incorporating telemedicine features for remote consultations, especially useful for patients in rural areas, enabling doctors to advise patients virtually and manage polypharmacy risks. This would help elderly/rural patients, reducing the need for frequent in-person visits. Expand language options beyond English and Tamil to make the app more accessible to a broader range of patients. Integrate voice-activated controls for elderly patients who may find it difficult to use the mobile app.

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