



Improving Medical Adherence Using Machine Learning Tools and Human Computer Interaction

Vinit Pandey¹, Dr. Amrita Singh², Dr. Prerna Tiwari³

¹ Assistant Programmer, Chhattisgarh State Civil Supplies Corporation Limited, Government of Chhattisgarh

² Ayurved Medical Officer, Govt Ayurved College and Hospital, Bilaspur

³ Assistant Professor, Rogvignyan evum Vikriti in Chhattisgarh Ayurved Medical College & Hospital, Rajnandgaon

Abstract: Medication adherence usually refers to whether patients take their medications as prescribed (eg, twice daily), as well as whether they continue to take a prescribed medication. Medication non adherence is a growing concern to clinicians, healthcare systems, and other stakeholders (e.g., payers) because of mounting evidence that it is prevalent and associated with adverse outcomes and higher costs of care. Engaging patients and the healthcare team is essential to success in achieving medical adherence and persistence. Notable interventions include face-to-face counseling, reminders, regimen simplification, providing cost incentives or savings, and maintaining ongoing communication. This paper provides a review on current challenges faced in medication adherence. The current work aims to design an application that improves medical adherence by reading medical prescriptions of patient from prescription image, searching and extracting the information of the medicine from World Wide Web and providing the information, reminders to patient at regular intervals. The application also uses rewarding techniques to encourage the patient to medical adherence.

Keywords: Primary Non Adherence, Secondary Non Adherence, Intentional Non Adherence, Unintentional non-adherence, Google ML Kit, HCI (Human Computer Interaction)

I. INTRODUCTION

Prescription adherence is characterized by the World Health Organization as "how much the individual's conduct relates with the concurred suggestions from a medical services supplier." It can enormously affect quality and length of life, wellbeing results, and by and large medical care costs. Drawing in patients and the medical services group is crucial for accomplishment in accomplishing clinical adherence and industriousness. Prominent intercessions incorporate guiding, updates, routine improvement, giving expense impetuses or reserve funds, and keeping up with continuous correspondence. It is otherwise called patient adherence and depicts how much a patient effectively follows clinical exhortation. Most ordinarily, it alludes to medicine or medication consistence, yet it can likewise apply to different circumstances, for example, clinical gadget use, self-care, self-coordinated activities, or treatment meetings. Patient adherence to prescriptions has been an issue testing medical services proficient for quite a long time. Adherence rates, reasons for non-adherence, hindrances and empowering influences to medicine taking, intercessions to advance adherence, and the effect of non-adherence on wellbeing results, have been broadly contemplated. There are a few kinds of non-adherence however regularly the classification is undeniable, and there is a level of cross-over:

A. Primary Non Adherence: It is known as essential non adherence, in which suppliers compose solution however the medicine is rarely filled or started. It happens when another prescription is recommended for a patient however the patient neglects to acquire the drug (or it's suitable other option) inside an adequate timeframe after it was at first endorsed.

B. Secondary Non Adherence: It is characterized as a patient filling a solution however not accepting the medicine as it was planned as well as recommended.

C. Intentional Non Adherence: Purposeful non-adherence alludes to a conscious patient activity (regularly connected with the patient's inspiration).

D. Unintentional non-adherence: It is driven by an absence of patient limit or accessible assets to take their endorsed meds. To handle such an issue of clinical non adherence, the initial step is to recognize the basic reason or issue for drug non-adherence for every quiet, then, at that point, clinical experts hence can give individual methodologies to work on their results. By first arrangement why a patient isn't disciple to drugs, really at that time would we be able to discover procedures to change conduct, work on tolerant wellbeing, and keep on keeping one free in their day by day living. There are lot of challenges in medical adherence which are outlined below:

- The significant expense of physician endorsed drugs undermines medical services spending plans, and cutoff points financing accessible for different regions in which public speculation is required. In nations without widespread



medical care, the significant expense of physician endorsed drugs represents an extra danger: exorbitant cash based expenses for individual patients.

- Low wellbeing proficiency has been related with nonadherence to therapy plans and clinical regimens, helpless patient self-care, high medical care costs, and expanded danger of hospitalization and mortality. Tragically, patients are regularly too embarrassed to even consider let their PCP know that they can't satisfactorily peruse or comprehend the data given to them. Doctors must, hence, become skilled at distinguishing more inconspicuous markers that a patient experiences difficulty perusing, for example, reliably 'forgetting' their understanding glasses or conceding to an ally to whom they give composed wellbeing data during the workplace visit.
- At the point when patients experience unfavorable incidental effects from taking drugs, they are more disposed to quit taking meds or attempt to change their routine all alone to counter the impacts. There are various impacts liable to add to non-adherence.
- Patients taking somewhere around five drugs — regularly alluded to as polypharmacy — face a few difficulties straightforwardly connected to this big number of solutions. These incorporate the complex dosing plan, guidance disarray, different incidental effects, and more noteworthy costs.

II. ROLE OF HCI IN MEDICAL ADHERENCE

A research was conducted on 60 patients and the medical adherence was observed for 15 days. The results obtained were alarming as most of the patients missed doses and their medical non adherence was very high.

	Gender		Age Group In Years			Employment			Dosage	
	Male	Female	25-35	35-45	45-60	Job	Business	Unemployed	One Dose(OD)	Dual Dose (DD)
	40	20	10	15	35	25	15	20	20	40
Doses Missed (%)	60	20	40	20	80	80	10	20	15	75

Table 1.Doses missed within 15 days

Major reasons for missing doses is as mentioned below:

1. Lack of knowledge about the prescription
2. Lack of discipline
3. Non availability of medicine
4. Multiple medicine intakes scheduled
5. Communication gap from prescriber

Observing the statistics the role of HCI in helping patient in improving medical adherence is important. There are a number of ways in which HCI is useful for patients in medical adherence.

A. Patient portals: Patient portals are supposed to assist vendors join with sufferers in order to assist them take an extra lively position in their fitness and wellness. Recent lookup indicates that information sharing thru digital fitness files (EHR) and affected person portals can in truth enhance remedy adherence, increase delight and enhance affected person engagement. Despite Meaningful Use cut-off dates on the horizon, there are some roadblocks to affected person portal implementation [8].

a. In practices that are nevertheless in a fee-for-service environment, the incentive to make use of affected person portals is a great deal lower—providers aren't reimbursed for the time and power spent caring for sufferers with the aid of the portal, and affected person portal use can limit visits to the office. As greater and greater markets shift to value-based care over volume-based care, portal use will come to be greater frequent.

b. The populations of sufferers that should advantage the most from portal engagement regularly don't use them. Elderly patients, these with persistent prerequisites or comorbidities for example, have a tendency to pass out. Signing patients up to use the portal in the office, referring them to the portal often, following up and emphasizing that the portal is a complement to care can assist inspire sufferers to have interaction digitally .

c. Lack of appropriate staffing can purpose portal efforts to misfire. Messages ought to be replied to in a well-timed manner in order for two-way verbal exchange by using the portal to make an impact. The fees of buying a portal and then staffing correctly can stand in the way of smaller practices getting up and running. However, over time affected person portal use can extend effectively and even decrease prices for providers.

B. Text messages: Mobile phone textual content messaging may additionally be a scalable capability to aid medicine adherence. According to a study about textual content messaging helped adherence costs enhancing from 50% to 67.8%, or an absolute enlarge of 17.8%. While promising, these outcomes must be interpreted with warning given the brief period of trials and reliance on self-reported remedy adherence measures. Future research want to decide the facets of textual content message interventions that enhance success, as properly as fabulous affected person populations, sustained effects, and influences on medical results [9].



C. Smart pill boxes: The most frequently used machine to promote medicinal drug adherence is the pillbox. People can independently control their medications, take a look at whether or not they have taken them or not, keep away from the threat of taking them twice or now not taking them at all, and decrease the charge of medicine errors. Previous research discovered that human beings who used a pillbox had higher remedy adherence [10].

D. Mobile applications: This growth in cell telephones has resulted in these gadgets being used to devise new processes to promote therapeutic adherence. At first, brief message provider (SMS) textual content messages have been dispatched and smartphone calls had been made to remind customers of the want to take medication. These sorts of reminders have been very superb strategies and are nicely widely wide-spread by means of patients. Also with the introduction of smartphones got here cell apps that have additionally afforded new possibilities for carrying out moves that simplify day by day tasks, amongst them caring for health. Mobile apps are a developing variety meant to assist sufferers in the administration of their disorder and their medication, remind customers to take their drugs, and furnish them with data about how they need to do it to promote therapy adherence. These cell apps are now not solely supposed to assist human beings take note to take the medication, such as the digital pillbox; they have extra beneficial facets that no longer solely promote medicine adherence however additionally enlarge remedy adherence[11].

III. LITREATURE REVIEW

Human-Computer Interaction (HCI) is the learn about of how human beings engage with the computer systems and to what extent computer systems are or are no longer developed for profitable interplay with human beings. When the customers have interaction with a laptop system, they do so by way of a User Interface. Interface is a phase of the pc systems, thru which the customers interacts in order to use the device and gain the goal. Recent research have evaluated technology-based interventions to enhance remedy adherence through the use of pharmaceutical databases, tailoring instructional facts to character affected person needs, turning in technology-driven reminders to sufferers and providers, and integrating in-person interventions with digital signals [5].

Pharmaceutical database technological know-how identifies patient-level adherence patterns for filling newly prescribed medicinal drugs and refills, imparting a community-based factor of contact with sufferers past the time constraints of clinic or health facility visits. Pharmacists are reachable and handy for most sufferers and household caregivers, are educated data sources, and are capable to discover and talk about plausible contraindications or issues related to energetic medications. Pharmacy-generated statistics permits identification and evaluation of the share of days that sufferers have get admission to to medication, as both a remedy possession ratio (MPR) or cumulative medicinal drug gaps (CMG) metric.. Besides these metrics, digital information structures can be programmed to generate smartphone call reminders to sufferers related to the want for capsule refill. Also the improvement of Cyber-Physical Systems (CPS) for healthcare is advancing rapidly. More recently, such structures covered few sensing and monitoring units related with cellular gadgets such as clever capsule bottles, clever watches, clever phones, and wearable [6].

The aggregate of these clever monitoring gadgets with interventions that remind the affected person in case a deviation is detected has validated to enhance remedy adherence. Compared to guide approaches, electronic-based processes can decrease the price and effort from the user's interest. In addition, the accuracy of adherence measure, which is of fantastic significance from the healthcare provider's factor of view, can be better when the use of electronic-based structures modes. One expectation of linked fitness is the computerized functionality of speaking the amassed adherence measurements to the provider, and the function of issuing reminder and alert messages primarily based on the processed information. Moreover, digital size structures can be transportable and therefore furnish well timed and long-term monitoring besides proscribing the user's mobility. Combinations of in-person with automatic reminders or triggers has produced the most high quality outcomes for enhancing medicine adherence and medical outcomes, as properly as affected person and caregiver delight with information, accuracy of the lively remedy list, and enhancements in patient-provider partnership or person-centeredness of care. Providers performed capsule counts, specific a household member to guide medicinal drug adherence behaviors at home, and supplied instructional records to sufferers and families. Patient members had been greater and had higher managed blood strain in contrast to the manipulate team at 6 months [7].

IV. PROPOSED METHODOLOGY

The proposed methodology involves development of mobile based application that reads the prescription from patient along with medicine schedules then displays appropriate information of the medicines prescribed along with its other details. This ensures that patient is aware of the medicines prescribed. The application also has a feature of setting automatic reminder for medicines so that patient never misses medicine dosage. The application also has a rewarding feature that encourages the patient to continue the good work. The major sections of the application are:

1. Input or Scan Prescription : In first step the patient needs to feed the prescription to the application .This can be done in two ways:



- a. Input Prescription: Here the patient can manually enter the prescription details using an entry screen like the name of the medicines and schedule etc.
- b. Scanning Prescription: The prescription document can be scanned using the scanning screen provided by the application. The scanning and text recognition feature is implemented using Google ML Kit. ML Kit is a mobile SDK that brings Google's machine learning expertise to Android and iOS apps in a powerful yet easy-to-use package. Whether you're new or experienced in machine learning, you can implement the functionality you need in just a few lines of code. There's no need to have deep knowledge of neural networks or model optimization to get started
2. Text information extraction: The medicine information extracted from image is feeded in application. The information regarding the prescribed medicines is extracted from web and filtered line medicine details, side effects precautions, dosage details etc. This filtered information is provided to patient to increase his awareness.
3. Setting Reminder: This section of application is responsible for providing notifications to users as per medicine schedule provided. If no medicine schedule is provided by patient then an temporary reminder is set in application automatically using the information filtered from web. This information can be modified by patient as per requirement.
4. Rewarding section: When a patient adheres to the medicine reminders the rewarding section encourages patient by providing an encouraging quotes or badges.

V. CONCLUSION

Since prescription non adherence prompts chronic weakness results and expanded medical care costs. Further developing prescription adherence is, in this manner, critical and uncovered on many investigations, proposing mediations can further develop medicine adherence. One critical part of the techniques to further develop drug adherence is to comprehend its extent. The work proposes an application plan that assists the patient for medical adherence. The future work involves conducting a thorough research for the making the application a reality and increasing its efficiency.

REFERENCES

- [1] <https://www.ahajournals.org/doi/full/10.1161/circulationaha.108.768986>.
- [2] <https://blog.cureatr.com/what-is-medication-adherence>.
- [3] <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3191684/>.
- [4] <https://www.wellthytherapeutics.com/blog/the-importance-of-medical-adherence/>.
- [5] <https://www.hindawi.com/journals/bmri/2015/217047/>.
- [6] <https://cuepath.com/blog/the-4-types-of-medication-non-adherence/>.
- [7] Erie Niagara AHEC . (2018, July 18). Types of Non-Adherence. Retrieved March 2020, from <https://www.erieniagaraahec.org/topic/types-of-non-adherence-2/>.
- [8] Dobbels F, Van Damme-Lombaert R, Vanhaecke J, De Geest S. Growing pains: non-adherence with the immunosuppressive regimen in adolescent transplant recipients. *Pediatr Transplant* 2005. Jun;9(3):381-390 10.1111/j.1399-3046.2005.00356.x [PubMed] [CrossRef] [Google Scholar].
- [9] Roter DL, Hall JA, Merisca R, Nordstrom B, Cretin D, Svarstad B. Effectiveness of interventions to improve patient compliance: a meta-analysis. *Med Care* 1998. Aug;36(8):1138-1161 10.1097/00005650-199808000-00004 [PubMed] [CrossRef] [Google Scholar]
- [10] Grahame-Smith DG, Aronson JK. *Oxford Textbook of Clinical Pharmacology and Drug Therapy*. 3rd Edition. Oxford University Press, USA. 2002. [Google Scholar]