

Medication Non-Adherence among Adults: Behavioural Barriers, Existing Interventions and Opportunities for Human Centred Design

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Abstract

Medication adherence is a part of treating chronic diseases well. I have seen in my surroundings that adults don't take their medication routine seriously as instructed by the doctor. As per World Health Organisation, not taking medication as prescribed is a real health problem. As per WHO the patients who tend to follow their medication routine is only 50% in developed countries and it is even lower in developing countries. This research looks at the reasons, barriers and issues associated with why adults do not follow their medication routine. It began with my observation in my own household where older adults don't tend to be disciplined regarding medication so I became curious as to what can be the reasons for the same and what solutions already exist in the market along with what steps they take to counter these problems on their own.

After going through the literature I wanted to know more about the behavioural barriers that become the reason for indisciplined medication routine. I also wanted to analyse the success of the solutions that were designed to tackle this problem or other substitutes like caregivers, traditional pillboxes, reminder tools, alarm systems and mobile health applications. My research shows that in India people often forget their doses, do not know how to take their medication, do not have family support and face issues with accessibility and cost. These problems are barriers to medication adherence. I also found that reminder-based and technology-assisted medication adherence interventions can help people stick to their medication. The results are only moderate.

Additionally one study shows that pharmacist-delivered educational interventions and community health worker-delivered educational interventions have evidence for efficacy. Reminder systems are moderately effective on their own. Become more effective when combined with pharmacist-delivered educational interventions or community health worker-delivered educational interventions. A systematic review of eHealth interventions and medication adherence in adults found that out of 29 interventions 17 showed a statistically significant effect. The research therefore shows that medication adherence is a behaviour-interaction-intensive process and should not be seen as only a reminder issue. It proposes that there is still some opportunity for a new solution that is human centered and has a physical interaction for call to action along with a portable storage that blends into an everyday experience. The findings were accessed to be a research basic for development of a new product that solves medication adherence system

Keywords: medication, adherence, mHealth, non adherence, adults, product design, reminders, human centered

1. Introduction

Medicine is the first and the easiest step to cure a chronic or a long term health condition. However, patients don't seem to follow their medication routine or take their medicine at wrong time or don't remember when to follow their medication routine and this has been an ongoing problem since ages. As per WHO patients with chronic health disease all over the globe have been affected by this problem. Adherence to long term treatment amount patients comes to be around 50% in developed countries and can be even lower in developing countries

The problem becomes especially important as more people live longer and chronic diseases become more common. Taking medicine over periods often means patients have to fit their treatment into daily life for months or even years. This makes taking medicine not a medical matter but also a question of behavior. The idea for this research came from watching how my family took their medicine, my grandparents. They struggled to keep up with their medications while managing tasks. They would remember their medicine one day. Forget it the next. Work, conversations, travel, meals, changes in routine—any of these could cause them to miss a dose. Sometimes the medicine was just not in sight when they needed it.

This experience made me wonder: if people have been struggling with medicine adherence, for years what kinds of solutions have been created?. Why does the problem keep happening despite all the efforts?

Of looking at medication adherence just as a medical or tech problem this study looks at it from a human-centred design angle. It explores how people actually act when it comes to taking their medicine. It asks what gets in the way of them sticking to their routines. It also checks how current programs try to help and where there might be room to create something. The goal is to design a solution that fits naturally into people's lives.

2. Background

Medication adherence means how well a person follows the instructions given by a healthcare professional about taking their medicine.

Not taking medicine as told can happen on purpose or by accident. When it happens on purpose a person might not take the medicine because they are worried about side effects, they can't afford it, they don't think it's needed or their personal beliefs stop them. When it happens by accident a person might mean to take the medicine but forgets, gets distracted and doesn't understand what to do. Can't get the medicine.

This difference matters a lot for design because the reasons behind the problem need solutions. A person who refuses medicine on purpose might not be helped by an alert but someone who misses a dose because they forget might be helped by a good reminder system.

The issue is not just:

"How do we remind people to take their medicine?"

Instead the bigger question, for design is:

"What stops people from finishing their medicine routine and how can a product help them when they need to take their medicine?"

3. Medication Non-Adherence in the Indian Context

India is an useful source of information for looking at Medication adherence as the number of patients dealing with chronic illness is increasing and India needs a solution for patients that helps them in following their medication routine.

A systematic review by Tolley and colleagues analysed different ways to solve medication problems in

the patients dealing with chronic health disease in India. Out of 1,552 records 22 randomized controlled trials were chosen. These trials helped to study conditions such as heart disease, type 2 diabetes, lung disease and depression.

The review synthesised that consultancy done by pharmacists and community health workers proved helpful in improving medication routine. Reminders alone seemed to be very helpful but they worked best when done after the consultation.

I have noticed that medication adherence in India cannot be solved by one single solution. All the factors such as Behaviour, knowledge, support and health care interaction all helps in fixing medication routine.

4. Behavioural Barriers to Medication Adherence

A qualitative evidence synthesis looked at medication adherence among adults with diseases and diabetes in India and it examined 18 studies. The main obstacles for medication adherence were that people did not understand the disease and its effects, that people forgot to take medicine, that people did not have family help and that people had problems with how risk was explained. Also how easy it is to get medicine, how much it costs. -+-

How well it fits into the healthcare system were seen as big barriers for medication adherence. These barriers can be sorted into groups.

4.1 Forgetfulness

Forgetfulness has been the most common reason for missed doses due to work, chores, trips or other everyday tasks. So the real challenge is how to remind the person at the correct time to take their medicine.

4.2 Disrupted routines

Medication schedules are pretty basic with regards to time but a person's routine isn't always the same due to sleep schedule or work commitments or travel. So a good product should be accounted for and accessible for all sorts of routines and schedules.

4.3 Lack of immediate consequences

A missed dose does not have an immediate effect but not following a medication routine certainly does have consequences. So a medication reminder has to fight for attention amid everyday tasks so a medication routine is followed.

4.4 Dependence on family members

In India, family members act as the most helpful reminder system for older adults.

But they may not always be available or they may even forget during their own day to day activities. So there's still space for a good alternative that is helpful at all times.

5. Evolution of Medication-Adherence Interventions

I have seen people attempt to address medication non-adherence, with sophisticated interventions.

The evolution can be shown as:

Caregiver → Pillbox → Written Reminder → Alarm → Mobile Phone → mHealth → Smart Medication System

5.1 Caregiver-based reminders

One of the ways is simply having another person remind the patient. This approach reminds the patient with support and can fit the patient's own circumstances. However it needs another person to be available. Creates dependence on the caregiver.

5.2 Traditional pillboxes

Traditional pillboxes arrange medication by days or times. I notice that pillboxes help keep medication in order.

The main advantage of pillboxes is organization. Pillboxes make medication easy to see. Can lower confusion when many medicines are involved.

Studies in India show that dedicated pillboxes, covers and other physical reminder tools help people follow medication schedules. But a regular pillbox only acts as a storage box; it does not inform the patients when to take their medicine. It just changes the way we store it.

5.3 Alarms and electronic reminders

Digital Alarms act as a time based solution

They help mainly to alert user when its the right time to take their medication but it is still a notification that a user can turn off and skip the routine and the medication

This makes a difference: Reminder means awareness while Action means medication taken.

5.4 Mobile health and eHealth

Smartphones have grown a lot. That has helped medication reminders get smarter. Apps can give you medication reminders, set up schedules for medication reminders, keep track of doses for medication reminders, let you talk to others about medication reminders and give you feedback on medication reminders.

A systematic review looked at eHealth tools for adults who take long-term medicine. The review checked 22 trials that covered 29 different interventions. Seventeen out of those 29 interventions showed measurable improvement in medication adherence. Those interventions were SMS texts, interactive voice calls, mobile apps and regular phone calls.

The review said that methods that help patients learn how to manage their medicine and get more involved in their care are especially hopeful, for medication adherence.

6. Existing Intervention Limitations

The research shows that current ways to help people take their medicine as prescribed can work but it also shows some problems.

1. Most ways only fix one part of the issue. A pillbox helps with organizing while an alarm helps with remembering. A helper gives support while a phone app can offer information and track progress.
2. Systems that send reminders still need the person to act on the reminder. A message can be missed, not seen or forgotten.
3. Apps that work on phones need someone to use a phone. This can be hard, for people who do not like technology.
4. Keeping medicine in a place and using digital reminders are usually kept separate.

This means there is a chance to see if these tasks can be put together in one to-use product.

7. Aim

The aim of this research is

To look at the behaviour patterns that stop adults from taking their medicine as they should. It will also review what interventions are already in place and find ways to design products that better support people in taking their medication on time. The focus is on creating solutions that fit real-life needs and help people stick to their treatment plans.

8. Objectives

The research objectives are:

1. To identify the major behavioural factors contributing to medication non-adherence among adults.
2. To understand how adults currently remember, organise and access their medication.
3. To examine existing physical, human and digital interventions for medication adherence.
4. To identify limitations in current medication-management solutions.
5. To investigate the potential role of physical interaction and timely prompting in supporting medication-taking behaviour.
6. To establish design requirements for a simple and portable medication-adherence system.
7. To develop and evaluate a prototype based on the identified user needs and design opportunities.

9. Research Questions

Main Research Question

How can a human centred product make sure the medication is taken as prescribed ?

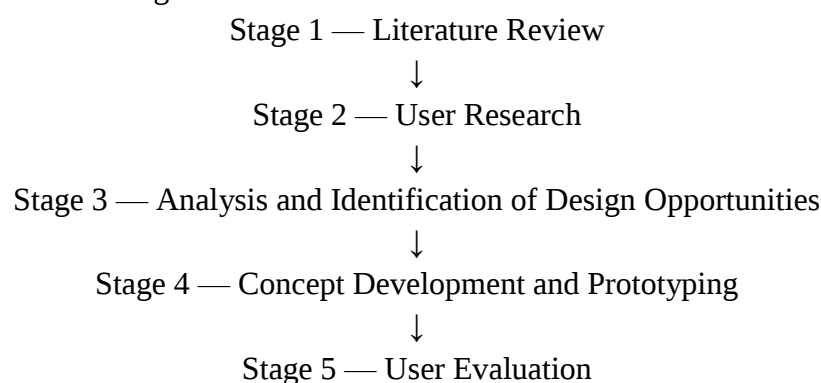
Sub-questions

1. What are the primary behavioural barriers that makes medication non adherence common among adults
2. How do adults currently carry their medication routines?
3. What physical, human and digital interventions are currently used to improve medication adherence?
4. What limitations do users experience with existing medication-management solutions?
5. How can medication storage, timely reminders and physical interaction be integrated into a simple and portable system?

10. Methodology

A mixed method human centred design methodology is done for this research.

The research consists of five stages:



11.1 Literature Review

Academic literature was reviewed to establish:

- The scale of medication non-adherence
- Reason for non adherence
- Behavioural barriers
- Existing medication-management interventions
- Reminder systems

- Pillboxes and physical medication organisation
- mHealth and eHealth interventions
- Research conducted in India

Priority was given to systematic reviews, meta-analyses and studies focused on adults and long-term medication.

11.2 User Research

Primary research was conducted to understand how adults manage their medication and supplements in their everyday lives, the difficulties they experience, and their expectations from possible medication-management solutions.

The research used online surveys and informal interviews with patients and caregivers, covering respondents from the 18–70+ age group, including people taking supplements as well as those managing chronic illnesses. The research focused on three key areas: medication routines, existing reminder methods, and challenges related to storage, tracking and portability.

The survey explored:

- Number of pills taken per day
- Frequency of forgotten medication
- Current reminder methods
- Existing pill-storage methods
- Problems experienced while managing medication
- Difficulties while travelling with medication
- Preferences for additional features
- Expectations from a possible medication-management solution

12. Data Analysis

The collected responses were looked at using both numbers based methods and word based methods. Survey answers were checked to find things that happened over and over again with how people take their medicine, how they remember to take it and the problems they have when doing so. Talks that were not formal and answers that were not short were looked at by finding topics to get an idea of why people act that way.

The study paid attention to ideas like forgetting to take medicine, changes in daily habits, how to keep medicine organized, being able to carry it around keeping track of doses, how well reminders work and how much people want to use technology to help them.

The results were then looked at next, to see if what people said matched the problems that were already found with taking medicine as it should be taken.

13. Key Research Findings

13.1 Forgetfulness is a major barrier

Forgetting to take medication was one of the problems reported by people in the study. This shows that not taking medication on time can happen even if people know how important it is to take their medicine.

13.2 Medication routines are easily disrupted

For people whose daily routine changes due to their work commitments, they are more vulnerable to a disrupted medication routine. This sets up a base as to how important it is to develop a solution around real life routines.

13.3 Existing reminders are easy to separate from action

Nowadays people set up alarms or reminders to help them know when to take their medicine.

These reminders are usually just notifications not a physical reminder that comes with the medicine itself. A reminder can just remind them of the perfect time of when to take the medicine but they still need to look for it and take it.

This creates a gap, between:

REMEMBER → ACCESS → TAKE

13.4 Carrying medication can be inconvenient

Travelling with medication is another difficulty that keeps coming up. Holding pills, separate boxes or big organisers can make medication management less easy when people travel between home, work, school or other places. This shows that portability is a point for medication-management products.

13.5 Dose tracking can be difficult

Participants also said they had trouble remembering their medications. They showed interest in tools that could help them keep track of what they took and what was still left. This shows that a medication-management system could be useful. It could do more than just send reminders. It could also give updates, about how much medication is available and whether it has been taken.

13.6 Interest in technology exists, but simplicity remains important

Participants were interested in technology assisted features such, as notifications and medication tracking. Still the results show that a medication management solution must be simple and require little extra effort. Technology must therefore support the medication routine of becoming another routine that the user has to manage.

14. Research Gap

Existing research informs us that Medication non adherence is influenced by many factors such as behavioral, social, economic and health care related factors. Existing solutions available in the market are limited to just caregiver support. Traditional pillbox, phone reminders, alarms etc.

These solutions help differently in making patients follow their medication routine. Some help in the storage, some in reminding the correct time, some in just morale support and rest in tracking and communication.

However, this gives us clues and opportunities about how we can make a single product that incorporates all these features into one to solve the big issue.

This shifts the whole perspective to one single solution that could be helpful for most if not all by solving the problems that were yet to be looked upon.

REMINDER + MEDICATION + USER ACTION

15. Design Opportunity

Based on the literature review and primary research the design opportunity identified is **To explore a portable medication-management system that integrates organised medication storage, timely reminders and basic tracking, into a single everyday experience.**

To Design a portable, easy to use solution that stores and gives the user a call to action to follow their medication routine

The opportunity can be represented as:

STORE → REMIND → TRACK → TAKE

STORE

Keeps medicine in place to access

REMIND

Informs about the correct time to intake

TRACK

Maintains a log of the medication

TAKE

Call to action feature to make sure medicine is taken

16. Design Requirements

The research findings were turned into the design requirements

Functional Requirements

The proposed concept should:

- Store medication, in a manner.
- Provide scheduled reminders that're clear and easy to see.
- Clearly indicate when medication is due.
- Allow user interaction.
- Provide medication tracking.
- Indicate when medication needs to be refilled.
- Require smartphone dependence.
- Support everyday portability.

Usability Requirements

The system should:

- Be simple and intuitive.
- Require minimal interaction.
- Provide clear visual feedback.
- Use audio or tactile feedback where appropriate.
- Be easy to open and refill.
- Avoid unnecessary controls.
- Be understandable to users with different levels of technological familiarity.

Portability Requirements

The concept should:

- Be compact.
- Be lightweight.
- Be Pocket size
- Keep medication secure.
- Allow quick access.
- Be suitable for everyday carry.

Accessibility Requirements

The design should consider:

- Clear and readable information.
- Large and distinguishable interaction areas.
- Easy-to-open compartments.

- Minimal fine-motor requirements.
- Clear visual indicators.
- Simple interaction for older users.

Emotional Requirements

The product should:

- Feel like an everyday personal object rather than a clinical device.
- Avoid creating unnecessary anxiety.
- Encourage independence.
- Provide reassurance through clear feedback.
- Integrate naturally into the user's daily routine.

17. Proposed Concept

Based on the findings from the literature review and primary research, a compact medication-management concept is proposed.

The concept combines medication storage, scheduled reminders and basic medication tracking into a single portable system.

The proposed concept directly responds to the main challenges identified through the research: forgetting medication, difficulty carrying medication and difficulty tracking doses.

The concept is intended to create a stronger relationship between:

TIME → REMINDER → MEDICATION → ACTION

Instead of treating the reminder and medication as two separate experiences, the proposed approach brings them closer together within one physical system.

The idea looks at taking medicine as something that involves behavior and how things are designed to be used, not just about getting reminders.

The system that is suggested is meant to help people take their medicine properly. It does not take the place of medical advice, the instructions from a doctor or help, from healthcare professionals.

18. Limitations

This research has several limitations.

Limited sample

The main study involved a small group of participants. Therefore the results give some understanding of user experiences. Cannot be considered as something that represents all adults.

Broad participant group

The research included people taking both supplements and medication, as well as participants from different age groups. Their medication routines and motivations may differ considerably.

Self-reported behaviour

The primary research relied on participants describing their own medication habits and experiences. Self-reported behaviour may not always correspond exactly to actual behaviour.

Limited duration

The research captures participants' experiences at a particular point in time and does not establish how medication-management behaviours may change over longer periods.

Conceptual stage

The proposed concept is derived from research findings and design requirements. Its success in improving medication routines has not been tested in the real world.

19. Conclusion

Medication non adherence has been a long term problem for ages. Existing research helped us understand the factors that make it hard to follow a proper medication routine such as Forgetting, different routines, accessibility, storage and transportation.

The main research in this study pointed out the design interventions done till now and concluded that users do like technology assisted features but still they prefer simple and convenient solutions.

The study also helped us understand how the interventions have evolved from a caregiver to pillbox to reminders each of which helped in solving a particular step and still lacks a seamless smooth medication intake system.

The research gave us an opportunity to fix the medication system through a human centred design view. To look at it as a problem about routine, storage, transportation and how things work around medication. After analysing all the findings a new design idea is proposed that combines storage, portability, reminder and a call to action. This aims to bridge the gap between reminders and actually taking the Medication. The research shows how observing everyday user behavior can turn into a design idea. And with more research and understanding of the topic you can test a proposed idea with the concerned set of people to see if it is actually solving the Medication related problems over the long term.

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