



# Therapeutic Non-adherence: Landscape in India

## Let's begin with a case study:



**Mr X, 72-year-old is a K/C/O T2DM & Hypertension since 22 years.  
Recently, he lost vision of his right eye.**



- He had high HbA1c levels for last several years.
- When enquired, his family members revealed that he was not taking his anti-diabetic medications regularly for last several years



- When asked to him, he shared his fear of hypoglycemic symptoms when medications are taken.
- He also said, he was having too many medications for his T2DM, Hypertension & other comorbidities which he did not like to take everyday

## Another common case in our country:



**Mrs. Q, a 42 years old woman, had to undergo a second surgery for her valvular heart disease**



- She was a case of Rheumatic heart disease since 17 years
- She underwent her first surgery 3 years back for mitral valve replacement
- She was prescribed oral anticoagulants (OACs) and was asked to monitor her INR levels & follow-up every 3 months



- She had stopped taking medications after 7 months of first surgery
- When enquired, she told, the regular medications added financial burden to her family
- She also said, since she was fine and not having any major symptoms, she felt it was fine to stop medications

## Introduction

- Non-communicable diseases (NCDs) are chronic health conditions which represent leading causes of death globally, disproportionately affecting those in low- and middle-income countries like India where more than 75% of NCD deaths occur.<sup>1</sup>
- In India, there is a growing burden of NCDs where cardiovascular disease, respiratory disease and diabetes kill around 4 million people annually and, for the most part, prematurely.<sup>2</sup>
- Treatment of NCDs commonly involves long-term medication use - however approximately 50% of patients do not take their medications as prescribed.<sup>3</sup>

1. World Health Organisation (2022a). Noncommunicable diseases. Available from: <https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases> .  
2. Arokiasamy, P. (2018). India's escalating burden of non-communicable diseases. *Lancet Glob. Health* 6 (12), e1262–e1263. doi:10.1016/S2214-109X(18)30448-0  
3. World Health Organisation (2003). *Adherence to long-term therapies: evidence for action*. Geneva, Switzerland: World Health Organisation.

## What is Medication Adherence:

Medication adherence<sup>1</sup> is understood to include the

- **Initiation:** Taking the first dose of prescribed medication,
- **Implementation:** the extent to which a patient's dosing corresponds to the prescribed instructions and
- **Discontinuation:** Patient stopping taking the treatment components according to standard taxonomy
- **Persistence** is defined as the time between initiation until the last dose is taken

The WHO defines adherence as “the extent to which the persons’ behavior (including medication-taking) corresponds with agreed recommendations from a healthcare provider”.<sup>2</sup>

1. Vrijens, B., De Geest, S., Hughes, D. A., Przemyslaw, K., Demonceau, J., Ruppard, T., et al. (2012). A new taxonomy for describing and defining adherence to medications. *Br. J. Clin. Pharmacol.* 73 (5), 691–705. doi:10.1111/j.1365-2125.2012.04167.x
2. Adherence to long-term therapies: evidence for action. Geneva, World Health Organization, 2003.

## Medication Adherence: Types

- It includes the initiation of the treatment, implementation of the prescribed regime, and discontinuation of the pharmacotherapy.
- **Primary nonadherence** is the frequency with which patients fail to fill prescriptions when new medications are started so it is related to refilling and initiation of the medication therapy.
- **Secondary nonadherence** is defined as the medication being not taken as prescribed when prescriptions are filled. It does not only affect the clinical outcome but also affect the financial outcome of the health system.

# The burden of Non-Adherence in India: 2023 Data from WHO-SAGE2 Study

Weighted non-adherence & adherence rates from SAGE2 dataset by morbidity status and disease

NCD	NON-ADHERENT (%)	ADHERENT (%)
ANY MORBIDITY	48.62	51.38
MULTIMORBID	62.48	37.52
SINGLE MORBIDITY ONLY	43.20	56.80
ANGINA	36.94	63.06
DIABETES	35.89	64.11
ASTHMA	42.69	57.31
HYPERTENSION	42.37	57.63
STROKE	46.60	53.40
LUNG DISEASE	56.77	43.23
DEPRESSION	66.81	33.19

Tolley A, Grewal K, Weiler A, Papameletiou AM, Hassan R, Basu S. Factors influencing adherence to non-communicable disease medication in India: secondary analysis of cross-sectional data from WHO-SAGE2. *Frontiers in Pharmacology*. 2023 Oct 13;14:1183818.

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# Non-adherence: The Indian Scenario from other studies

*Limited resource country like India* →

- *economic instability low literacy level*
- *limited access to healthcare facilities*



Increased incidence of medication non-adherence



**~53% diabetics are non-adherent!!!**

*Chief reasons for non-adherence:*

- *Lack of finance (55.84%)*
- *Forgetfulness (46.75%)*
- *Being busy (44.15%)*
- *Medicine inaccessibility (19.48)*
- *Others*



# Adherence to medications in India, in general, is poor; across all therapies



**49.67%**

*Non-adherence in hypertensive patients <sup>1</sup>*



**~68%**

*Non-adherence in women with PCOS <sup>2</sup>*



**~66.9%**

*Non-adherence in patients with depression <sup>3</sup>*



**~68%**

*Non-adherence in patients with COPD <sup>3</sup>*

1. Thomas D, Meera NK, Binny K, Sekhara MS, Kishore G, Sasidharan S. Medication adherence and associated barriers in hypertension management in India. CVD Prevention and Control. January 2011, 6(1): 9-13
2. Vijayan, Smitha Moonjelly<sup>1</sup>; Kalaivani, H1; Mitra, Subarna<sup>2</sup>; John, Joseph<sup>3</sup>; Anila, A1; Damini, 1; Boban, Linimol<sup>1</sup>; Chowdhury, Pritha<sup>1</sup>; Gayen, Sriparna<sup>1</sup>. Barriers to treatment regimen adherence in Indian women with polycystic ovarian syndrome. Journal of Family Medicine and Primary Care: July 2022 - Volume 11 - Issue 7 - p 3687-3692 doi: 10.4103/jfmpc.jfmpc\_2360\_21.
3. Banerjee S, Varma RP. Factors Affecting Non-Adherence among Patients Diagnosed with Unipolar Depression in a Psychiatric Department of a Tertiary Hospital in Kolkata, India. Depress Res Treat. 2013;2013:809542..
4. Philip A, Mohanan M, Shine M, Benny S, Ashok P. Assessment of Medication Adherence Barriers in COPD Patients in A Secondary Care Teaching Hospital. JDDT [Internet]. 15Apr.2020 [cited 19Sep.2022];10(2-s):80-5. Available from: <https://jddtonline.info/index.php/jddt/article/view/4013>

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## Key Factors Influencing Medication Non-Adherence in India

- The strongest factor predicting non-adherence to medication across these components was multimorbidity.
- Tobacco use and never having attended school were all significantly associated with poor medication adherence
- Older age was significantly associated with improved medication adherence whilst there was a weak association between increased wealth and improved medication use.
- Rural living, feelings of anxiety and feelings of depression were factors lacking statistically significant association with medication adherence.

## Influence of Socio-Economic-demographic factors on Medication non-adherence in India:

- Age group: older people more likely to adhere,
- Rural-urban living: those living rurally less likely to adhere,
- State with Assam showing particularly low adherence and West Bengal particularly high adherence,
- Ethnic groups: those from Scheduled Caste and Scheduled Tribe groups less likely to adhere,
- Schooling status: those who had never been to school less likely to adhere.
- Sex, religion and level of education was not significantly associated with adherence.
- Economic variables significantly associated with adherence were wealth quintile, with wealthier individuals more likely to adhere
- Working status: Those currently working are less likely to adhere.

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## Patterns of Medication Adherence to Various Disease in India:

**Asthma:** Medication adherence was found to be associated with age, with older individuals more likely to adhere and working status, with those currently not working more likely to adhere.

**Diabetes:** Medication adherence was also associated with

- Age, with older individuals more likely to adhere;
- Wealth quintile, with wealthier individuals more likely to adhere;
- Region, with those in Assam and Rajasthan being most likely not to adhere;
- Ethnic group, with those in Schedule Caste and Schedule Tribe groups being less likely to adhere;
- difficulty concentrating with those reporting difficulty concentrating being less likely to adhere ; feeling low or depressed and symptoms of anxiety were also associated with nonadherence to diabetes medication.

## Patterns of Adherence in Various Disease States in India

- **Hypertension:** Adherence to hypertension medication was associated with
  - Age, with those older found to be more likely to adhere;
  - Ethnic group, with those in SC or ST groups being more likely not to adhere;
  - Self-ratings of health; with those in subjective poor health being more likely to adhere;
  - Working status, with those currently working being less likely to adhere;
  - Schooling status, with those who have been to school being more likely to adhere.
- **Lung Diseases:** Adherence to other lung disease medication was found to be associated with
  - Region, with those in Assam, Uttar Pradesh and Rajasthan being most likely to not adhere
  - Feelings of worry or anxiety, with those feeling anxious being less likely to adhere.
- **Stroke:** Adherence to stroke medication was associated with
  - Age, with those older found to be more likely to adhere and
  - Feelings of worry or anxiety, with those feeling anxious being more likely to adhere.
- **Depression:** Adherence to depression medication was not found to be associated with any factors.

# Non-adherence is a Global Issue!!!!



**125bn**

125 billion euro per year in  
excess healthcare services in  
Europe



**105bn**

In the US, 105 billion USD  
per year in avoidable  
hospitalizations alone



1. Organisation for Economic Co-operation and Development, 2018. OECD Health Working Paper No. 105 Investing in medication adherence improves health outcomes and health system efficiency. Adherence to medicines for diabetes, hypertension, and hyperlipidaemia. Available at: [https://www.oecd-ilibrary.org/social-issues-migration-health/investing-in-medication-adherence-improves-health-outcomes-and-health-system-efficiency\\_8178962c-en?sessionid=5fnBKosbWlCKN2vR5TAceihL\\_in-10-240-5-99](https://www.oecd-ilibrary.org/social-issues-migration-health/investing-in-medication-adherence-improves-health-outcomes-and-health-system-efficiency_8178962c-en?sessionid=5fnBKosbWlCKN2vR5TAceihL_in-10-240-5-99).

# Medication adherence can have a more direct impact on patient outcomes than the specific treatment itself: WHO<sup>1</sup>

Medication  
Adherence<sup>2,3</sup>



*Impact on:*

- *quality and length of life*
- *health outcomes*
- *overall healthcare costs*

*Non-adherence in the US can account for up to:*<sup>3</sup>



**50%**  
*treatment  
failures*



**25%**  
*hospital  
admissions*



**125,000**  
*deaths*

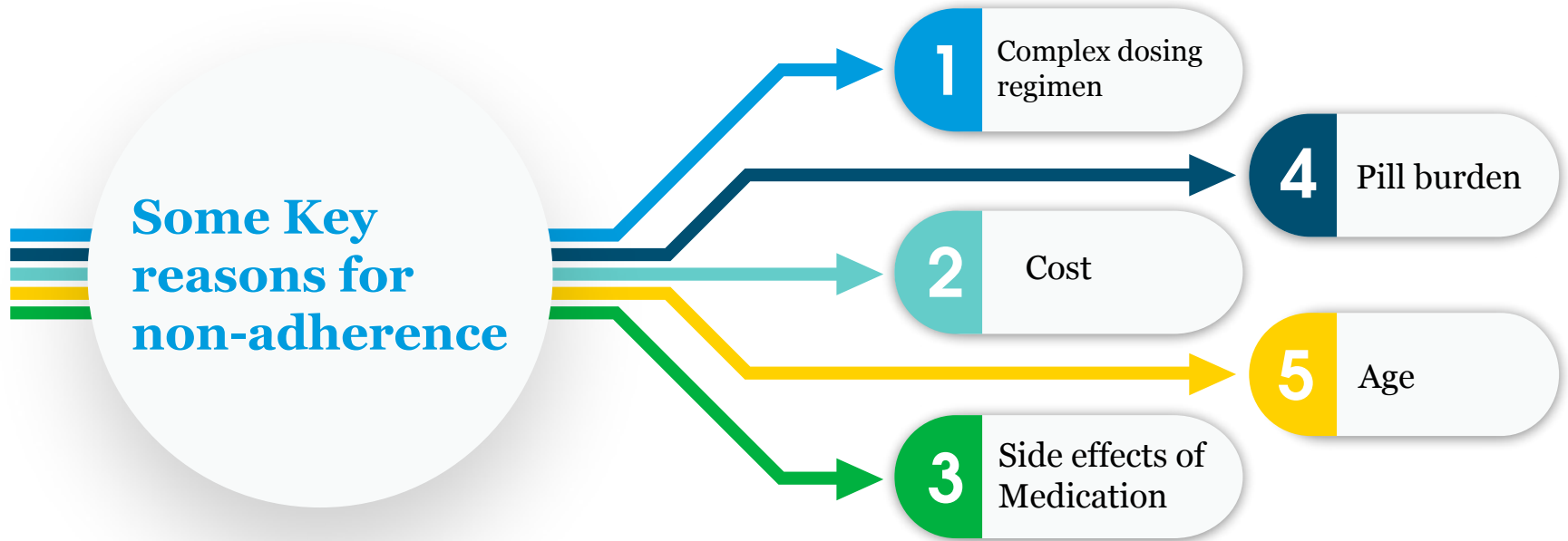
1. Brown MT, Bussell JK. Medication adherence: WHO cares? Mayo Clin Proc. 2011;86(4):304-314.
2. Sabaté E. Adherence to long-term therapies: evidence for action. Geneva: World Health Organization. 2003. [www.who.int/chp/knowledge/publications/adherence\\_report/en/](http://www.who.int/chp/knowledge/publications/adherence_report/en/). Accessed June 10, 2017.
3. DiMatteo MR, Giordani PJ, Lepper HS, et al. Patient adherence and medical treatment outcomes: a meta-analysis. Med Care. 2002;40(9):794-811.



# Summary of Factors affecting Medication Adherence:



Adapted from: Dalal JJ, Kerkar P, Guha S, Dasbiswas A, Sawhney JP, Natarajan S, Maddury SR, Kumar AS, Chandra N, Suryaprakash G, Thomas JM. Therapeutic adherence in hypertension: Current evidence and expert opinion from India. Indian heart journal. 2021 Nov 1;73(6):667-73. Available from: <https://www.sciencedirect.com/science/article/pii/S0019483221001905>



## Reasons for non adherence

- 1 Complex dosing regimen:** Administration modes and adherence to medication are co-related. Also the prescribed number of doses per day is inversely associated with medication adherence (Claxton et al )
  - A 10% increase in proportion of days covered (PDC) resulted in an **approximately 0.12% decrease in A1C level** with the use of any diabetes therapy
  - Using the complex combination of oral and injectable therapy, each **10% increase in PDC** was associated with **a significant 0.17% decrease in A1C level (P < 0.001)**
  - Adherence rates for patients with chronic diseases, including T2D, decreased significantly for any medication regimen requiring more than once-daily dosing (79%–94% once daily vs 38%–67% three times daily; P < 0.05)

- National Center for Chronic Disease Prevention and Health Promotion, Division of Diabetes Translation. National diabetes statistics report, 2014. CDC website. [www.cdc.gov/diabetes/pubs/statsreport14/national-diabetes-report-web.pdf](http://www.cdc.gov/diabetes/pubs/statsreport14/national-diabetes-report-web.pdf) Published June 2014.
- Effects of intensive glucose control on microvascular outcomes in patients with type 2 diabetes: a meta-analysis of individual participant data from randomized controlled trials. Lancet Diabetes Endocrinol 2017;5:431–7.

## Reasons for non adherence

### 2 Cost

- Greater out-of-pocket costs for the medications of T2DM are linked to poorer adherence
- **34% of T2DM patients** considered paying for medications as a reason lack of adherence
- In an analysis of medication adherence to treat diabetes, dyslipidemia, and hypertension, direct cost of poor adherence was found to be \$105.8 billion in 2010 across 230 million patients, which represented \$453 per adult

### 3 Side effects of drugs

- Diabetes Patients who reported moderate or worse symptoms of hypoglycemia had poorer medication adherence compared to those with no or mild hypoglycemia (MPR >80%: 46% vs 67%,  $P < 0.01$ )

• Effects of intensive glucose control on microvascular outcomes in patients with type 2 diabetes: a meta-analysis of individual participant data from randomized controlled trials. *Lancet Diabetes Endocrinol* 2017;5:431-7.

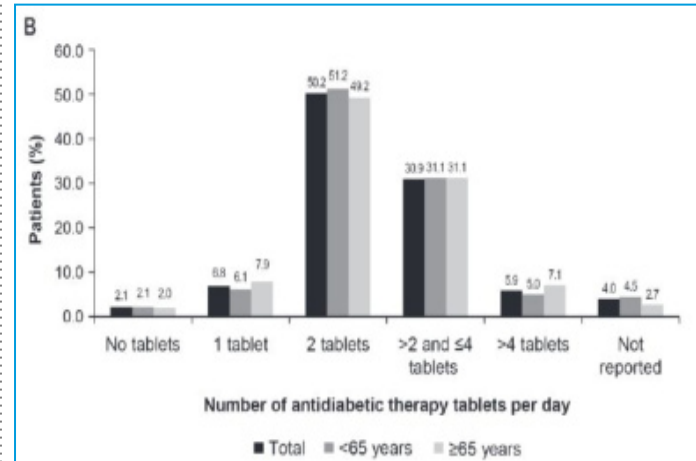
## Reasons for non adherence

### 4 Pill burden:

- High pill burden can negatively impact patient's health and reduce adherence to medications
- PROVIL a prospective, open, observational study on patients with T2DM reported that approximately **half of the patients (50.2%)** were taking two tablets per day for the treatment of T2DM (N = 3,881), **30.9%** of patients were taking three to four tablets and **5.9%** of patients were taking more than four tablets for the treatment of T2DM

### 5 Age:

- 42.5% of patients aged  $\geq 65$  take more than six tablets daily; while in the younger generation, 23.6% take more than eight tablets daily (PROVIL study)



• Pharmacist's Intervention on Pill Burden Effects on the Health-Related Quality of Life of Elderly Diabetic Patients in a Tertiary Hospital in Southwestern Nigeria. International Journal of Diabetes and Metabolism. 2019;25(3-4):148-54.

## Pill burden and non adherence



Two major road blocks in the therapy of any chronic disease **are non adherence to the treatment and the pill burden** of the medications



The number of pills a patient needs to take each day, has a substantial impact on adherence to therapy and quality of life

### Failure to adhere to the therapeutic regimen accelerates the complications of diabetes



- Pharmacist's Intervention on Pill Burden Effects on the Health-Related Quality of Life of Elderly Diabetic Patients in a Tertiary Hospital in Southwestern Nigeria. International Journal of Diabetes and Metabolism. 2019;25(3-4):148-54.
- Pill burden in patients with type 2 diabetes in germany: subanalysis from the prospective, noninterventional PROVIL study. Clinical diabetes. 2015 apr 1;33(2):55-61.

# Types of Non-adherence

1



## Non-Fulfilment

*Primary non-adherence:  
providers write prescription but the  
medication is never filled or  
initiated*

2



## Non-Persistence

*patients decide to stop taking a  
medication after starting it, without being  
advised by a health professional to do so*

1.

### Unintentional

*arises from capacity and resource  
limitations (accessibility, affordability)*

2.

### Intentional

*beliefs, attitudes and expectations that  
influence patients' motivation to begin and  
persist with the treatment regimen*

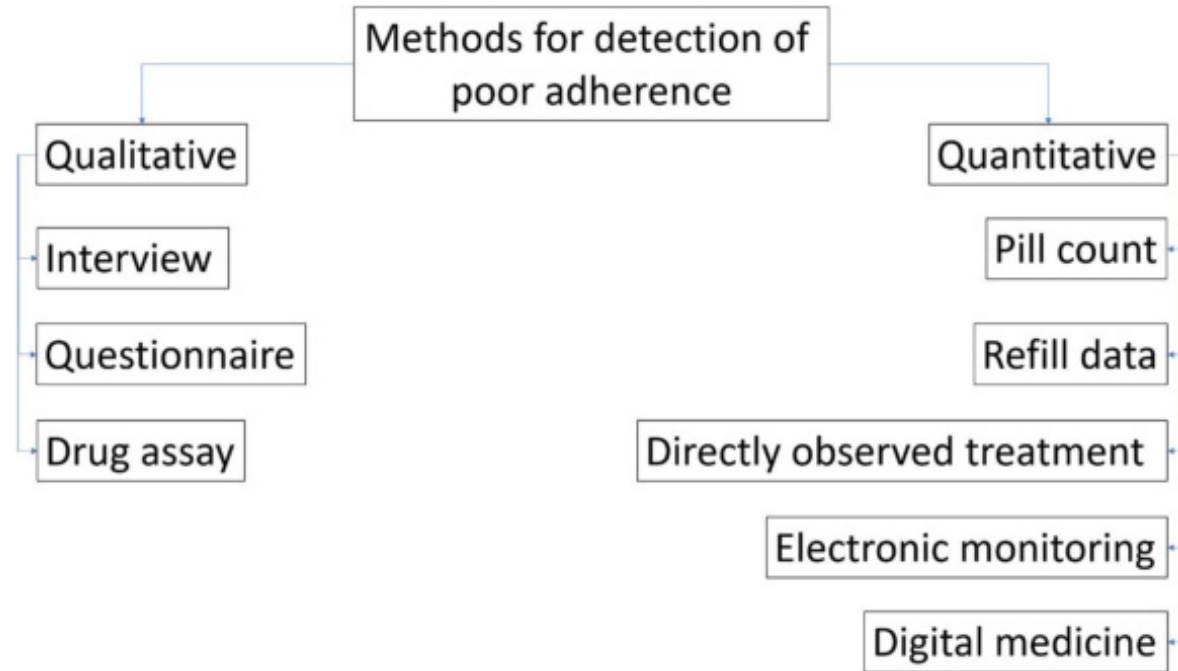
3



## Non-Conforming

*Variety of ways in which medication  
are not taken as prescribed, ranging  
from skipping doses, to taking  
medications at incorrect times or at  
incorrect doses, to even taking more  
than prescribed*

# Detecting non-adherence to medication is important:



Adapted from: Dalal JJ, Kerkar P, Guha S, Dasbiswas A, Sawhney JP, Natarajan S, Maddury SR, Kumar AS, Chandra N, Suryaprakash G, Thomas JM. Therapeutic adherence in hypertension: Current evidence and expert opinion from India. Indian heart journal. 2021 Nov 1;73(6):667-73. Available from: <https://www.sciencedirect.com/science/article/pii/S0019483221001905>



## Detecting Poor adherence:

- **Interview Method:** The interview method is the simplest, cheapest, and highly feasible in a clinical setting. Physician interviews and questions the patients about medication adherence. However, this method lacks reliability and validity.
- **A questionnaire-based assessment of adherence** also offers an easy alternative. However, it can be time-consuming, and patients may or may not be willing to reply to such questionnaires.
- **Pill count:** is a simple and easy method for detecting non-adherence. However, this can't be full-proof, and the patient can mislead with pill counts. A caregiver or family member's involvement in pill count can improve the reliability of this method.
- **Directly observed treatment** is a reliable and valid method. However, practical difficulties in implementation limit its routine clinical use. This strategy has ensured >90% therapeutic adherence in Tuberculosis management in India.
- Other methods such as electronic monitoring, drug assay, and digital medicine can provide data on adherence reliably, but their use in clinical settings is limited. They are expensive and not practical for general use.

Adapted from: Dalal JJ, Kerkar P, Guha S, Dasbiswas A, Sawhney JP, Natarajan S, Maddury SR, Kumar AS, Chandra N, Suryaprakash G, Thomas JM. Therapeutic adherence in hypertension: Current evidence and expert opinion from India. Indian heart journal. 2021 Nov 1;73(6):667-73. Available from: <https://www.sciencedirect.com/science/article/pii/S0019483221001905>

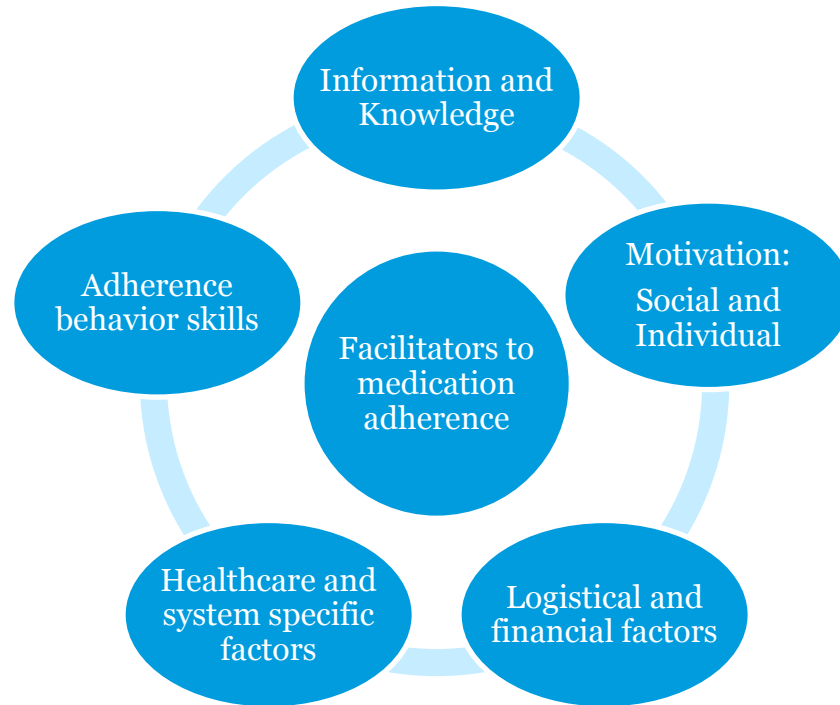
## Strategies to improve medication adherence

Levels	Strategies
<b>Physician Levels</b>	Patient Counseling
	Feedback on clinical/behavioral improvement
	Identification of adherence related issues
	Involvement of healthcare personnel
	Improving health literacy of patients
	Reducing pill burden
<b>Patient Level</b>	Self-monitoring of BP
	Telemonitoring – reminders, apps, etc.
	Motivation – Incentives in insurance premiums, priority physician visit, etc.
	Social support - Family engagement in treatment

Levels	Strategies
<b>Health system</b>	Supporting the development of monitoring systems such as telemonitoring
	Availability of national prescription database
	Increased medication accessibility
	Increased population education and awareness about HTN and treatment
<b>Pharma companies</b>	Reminder packaging
	Development of digital medicine
	Monetary incentive in drug refills
	Patient educational activities

Adapted from: Dalal JJ, Kerkar P, Guha S, Dasbiswas A, Sawhney JP, Natarajan S, Maddury SR, Kumar AS, Chandra N, Suryaprakash G, Thomas JM. Therapeutic adherence in hypertension: Current evidence and expert opinion from India. Indian heart journal. 2021 Nov 1;73(6):667-73. Available from: <https://www.sciencedirect.com/science/article/pii/S0019483221001905>

# Key facilitators to medication adherence



Kvarnström K, Westerholm A, Airaksinen M, Liira H. Factors contributing to medication adherence in patients with a chronic condition: a scoping review of qualitative research. *Pharmaceutics*. 2021 Jul 20;13(7):1100.

## Interventions to address poor medication adherence<sup>20</sup>

- Novel treatment approaches may address many of the factors related to treatment burden (e.g., treatment complexity, hypoglycemia, and side effects) as well as treatment belief factors (e.g., perceived treatment efficacy)
- Sustained delivery of a therapeutic agent is now gaining popularity because of its :
  - Efficacy
  - Safety
  - Improved outcomes
  - Significant reduction observed in:
    - HbA1c levels
    - Weight
    - Favorable side-effect profile to reduce the chance of discontinuation
- Additionally, patients taking fixed-dose combinations versus individual dose combinations showed significantly ( $P < 0.001$ ) higher adherence (57.0% vs 50.7%) and persistence (32% vs 27%) with the fixed-dose combination

## Need for Technological Advancements

- Conventional dosage forms are associated with problems like
  - Small duration of action due to their short half-lives
  - Frequent dosing
  - Risk of side effects
  - Low bioavailability and high protein binding in some cases
- These problems can lead to poor patient compliance and lower therapeutic effectiveness
- To alleviate these problems different novel and sustained delivery systems have been developed to:
  - Deliver the drug at a constant rate over a specified duration of time in the body (sustain release)
  - Reduce side effects, dose and frequency of administration,
  - Achieve optimal glycemic control
  - Increase bioavailability and therapeutic efficiency of the drug
  - Improve patient compliance

## Special coating technologies for tablets

To address the growing concern of swallowability and to overcome the “fear” of “choking/gagging” during administration of tablet:

Special coating technologies are available which makes the surface of tablet slippery upon contact with water to provide “glide” effect during oropharyngeal transit.

## Ease of Swallowing

### **Ease of Swallowing – *Improved compliance & Better adherence to the treatment***



- Unique characteristic of coating with specialized polymer system to enables the tablet to “glide” from mouth to stomach and improve ease of swallowing by patients
- Easy Glide coated tablets demonstrates **better wet-slip behavior** upon contact with water & differentiates prominently from other conventional film coating systems that often tend to stick and impacts oropharyngeal transit of tablet
- The Easy Glide coating technology will reduce the side effects (e.g., choking perception) during tablet ingestion and improve the patient compliance.

Data on file with Abbott R&D.

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## Interventions to increase adherence

<b>Behavioral interventions</b>	Cognitive–behavioral techniques to modify patients’ behavior toward treatment
<b>Educational interventions</b>	Health care providers can educate patients to promote medication adherence
<b>Integrated care interventions</b>	Enhance connectivity, alignment, and collaboration within and between health care providers at different levels
<b>Self-management interventions</b>	Self-care, self-monitoring, adherence, health behavior change, patient education, and collaborative care,
<b>Risk communication interventions</b>	Effective risk communication by doctors to ensure information about risks and benefits.
<b>Packaging and daily reminders</b>	Reminder calls, SMS, interactive voice response (IVR) systems, video telephone calls, medication boxes, or personalized blisters.

Costa E, Giardini A, Savin M, Menditto E, Lehane E, Laosa O, Pecorelli S, Monaco A, Marengoni A. Interventional tools to improve medication adherence: review of literature. Patient preference and adherence. 2015;9:1303.



# Physician strategies for improving medication adherence

Can be remembered through the mnemonic “SIMPLE”

## **S** Simplifying regimen characteristics

- *Adjusting timing, frequency, amount, and dosage*
- *matching to patients' activities of daily living*
- *using adherence aids, such as medication boxes and alarms*

## **I** Imparting Knowledge

- *Discussion with physician, nurse, or pharmacist*
- *Distribution of written information or pamphlets*
- *Accessing health-education information on the Web*

## **M** Modifying patient beliefs

- *Assessing perceived susceptibility, severity, benefit, and barriers*
- *Rewarding, tailoring, and contingency contracting*

## **P** Patient Communication

- *Active listening and providing clear, direct messages*
- *Including patients in decisions*
- *Sending reminders via mail, email, or telephone*
- *Convenience of care, scheduled appointment*
- *Home visits, family support, counseling*

## **L** Leaving the bias

- *Tailoring the education to patients' level of understanding*

## **E** Evaluating Adherence

- *Self-reports (most commonly used)*
- *Pill counting, measuring serum or urine drug levels*



**Abbott**

**CONGRESS 2024**

# A:Care Congress 2024

August 2024

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# In India, digital interventions based on behavioral understanding, have shown significant promise in improving medication adherence

## mDiabetes Initiative

By MoHFW in collaboration  
with WHO and ITU

**Technology used:** SMS-based mobile health intervention

**Mechanism:** Periodic SMS messages to registered participants on information regarding – lifestyle management, diet and physical activity and reminders on medication adherence

**Impact on Adherence:** **20% improvement in medication adherence** among participants. The SMS reminders helped **reinforce positive health behaviors and encouraged patients to adhere** to their prescribed treatments.

**Health Outcomes:** The improved adherence led to better glycemic control among participants, reducing the risk of diabetes-related complications such as cardiovascular disease, neuropathy, and retinopathy.

## 99DOTs

(Tuberculosis Treatment)

**Tech used:** SMS and Missed Calls

**Mechanism:** The TB Medication is packaged with a series of hidden phone numbers printed behind each dose. After taking their medication, patients reveal and dial the hidden number (missed call). This free call confirms the dose has been taken, data is recorded on a central server.

**Impact on Adherence:** In various pilots, 99DOTs demonstrated over 90% medication adherence rates, reducing patients lost to follow-up

**Health Outcomes:** Higher cure rates among patients enrolled

MoHFW: Ministry of Health and Family Welfare | WHO: World Health Organization | ITU: International Telecommunication Union

References: Evaluation of mDiabetes Initiative: Impact of Mobile Health Interventions on Diabetes Control in India. (2018). Ministry of Health and Family Welfare, Government of India.

mDiabetes initiative using text messages to improve lifestyle and health-seeking behaviour in India : <https://innovations.bmj.com/content/4/4/155>

[https://www.researchgate.net/publication/330272562\\_99DOTs\\_a\\_low-cost\\_approach\\_to\\_monitoring\\_and\\_improving\\_medication\\_adherence](https://www.researchgate.net/publication/330272562_99DOTs_a_low-cost_approach_to_monitoring_and_improving_medication_adherence)

## Advanced Digital Interventions are also making significant in-roads into improving medication adherence, and thereby health outcomes

- 1. Mobile Apps:** Apps like Medisafe and Gather help patients manage their medication schedules by providing reminders, tracking medication intake, and facilitating communication with healthcare providers. These apps have been particularly effective in managing chronic conditions like diabetes, leading to better glycemic control and increased patient engagement<sup>1</sup>
- 2. Smart Inhalers:** For asthma patients, smart inhalers equipped with sensors can track medication usage and provide feedback. Studies have shown that these devices improve adherence, leading to better asthma control and a reduction in asthma attacks<sup>2</sup>.
- 3. Telemonitoring:** This involves remote monitoring of patients' health data, which can be shared with healthcare providers in real-time. This approach has been beneficial in managing conditions like hypertension and heart failure, leading to improved health outcomes<sup>1</sup>.
- 4. Artificial Intelligence (AI):** AI tools can analyze patient data to predict non-adherence and provide personalized interventions. These tools have been used to manage non-communicable diseases (NCDs) and have shown potential in improving medication adherence<sup>3</sup>.

### Reference:

1. [Diabetes Mellitus&mdash;Digital Solutions to Improve Medication Adherence: Scoping Review \(mdpi.com\)](#)
2. [Digital technologies to help people with asthma take their medication as prescribed | Cochrane](#)
3. [Frontiers | Artificial Intelligence Solutions to Increase Medication Adherence in Patients With Non-communicable Diseases \(frontiersin.org\)](#)

## Innovative approaches that combine behavioral insights with the power of Artificial Intelligence have the potential to further enhance patient engagement (1/2)

- **Personalized Reminders:** AI can send tailored reminders and notifications to patients, ensuring they take their medication on time. These reminders can be customized based on individual preferences and habits<sup>1</sup>.
- **Predictive Analytics:** By analyzing data from electronic health records and other sources, AI can predict which patients are at risk of non-adherence. This allows healthcare providers to intervene proactively and address potential issues before they become problematic<sup>2</sup>.
- **Behavioral Insights:** AI can monitor patient behavior and provide insights into patterns that may affect adherence. For example, it can identify if a patient is likely to forget their medication due to a busy schedule or other factors<sup>1</sup>.

1. [AI-Driven Solutions Promote Medication Adherence](#)

2. [Enhancing Medication Adherence through AI-Powered Reminders for Optimal Health Management](#)

## Innovative approaches that combine behavioral insights with the power of Artificial Intelligence have the potential to further enhance patient engagement (2/2)

- **Tailored Interventions:** AI can offer personalized interventions to address the specific reasons behind a patient's non-adherence. This could include educational content, motivational messages, or adjustments to the medication regimen<sup>3</sup>.
- **Integration with Wearables:** AI can work with wearable devices to monitor health metrics and remind patients to take their medication based on real-time data. This integration helps in maintaining a consistent medication routine<sup>4</sup>.
- **Virtual Health Assistants:** AI-powered virtual assistants can provide 24/7 support to patients, answering questions about their medication and offering guidance on managing side effects or other concerns<sup>5</sup>.

### References:

3. [Enhancing medication adherence with AI-driven personalization - Acare HCP Global \(abbott.com\)](#)
4. [How Clinical AI Can Help Improve Medication Adherence \(clinicalresearchnewsonline.com\)](#)
5. [AI-Driven Solutions Promote Medication Adherence \(pharmacytimes.com\)](#)

## Summary

- The potential benefits of enhancing medication adherence as a health care priority are considerable.
- Improving medication adherence may have a greater influence on the health of the population than any new medical discovery.
- Poor adherence to medications among patients with chronic diseases is a lost opportunity in terms of maximizing health outcomes and health system efficiency.
- Adherence to prescribed therapies for patients with chronic diseases can prevent or delay the onset of complications, reduce hospitalization risks and decrease healthcare costs.
- Addressing nonadherence through a patient-centered approach to health care necessitates the involvement of all health system stakeholders: patients, policy makers, health care organizations and professionals, payers, educators, professional regulatory bodies, industry and the research community.



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