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Title: The Role of Medication Organizers and Supportive Interventions in Improving Adherence Among Patients with Chronic Diseases: A Review of the Current State of Knowledge

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Abstract

Introduction and objective:

Non-adherence to therapeutic recommendations constitutes a significant challenge in the management of chronic diseases and is associated with poorer disease control, increased risk of hospitalization, and higher healthcare costs. It particularly affects older adults, patients with multimorbidity, and those receiving polypharmacy. The aim of this study is to present the current state of knowledge regarding the role of medication organizers and supportive interventions in improving adherence.

Review methods: A narrative review was conducted based mainly on PubMed-indexed publications and references cited in selected studies concerning adherence-supporting interventions in adults with chronic diseases.

Brief description of the current state of knowledge: Available evidence suggests that medication organizers, blister packaging, electronic dispensers, mobile applications, text message reminders, and remote monitoring systems may support regular medication intake. The greatest benefits are observed when non-adherence results from forgetfulness,

organizational difficulties, or complex treatment regimens. Their effectiveness depends on the type of intervention, patient characteristics, follow-up duration, and additional educational or behavioral support.

Summary: Medication organizers and supportive interventions may improve adherence among patients with chronic diseases, particularly in high-risk groups. However, they should not be considered a standalone solution, but rather a component of comprehensive care. Further studies are needed to assess the durability of effects and the optimal selection of interventions.

Keywords: adherence, medication organizers, chronic diseases, telemedicine, pharmacotherapy, therapeutic adherence

1. Introduction

Therapeutic adherence is one of the key determinants of effective treatment in chronic diseases. Low adherence is associated with poorer disease control, an increased risk of complications and hospitalisation, as well as higher healthcare costs. This problem is particularly relevant among older patients, individuals with multimorbidity, patients exposed to polypharmacy, and those following complex dosing regimens [1,2].

The regularity of medication use is influenced by patient-related, therapy-related, and healthcare system-related factors, including cognitive function, health literacy, motivation, adverse effects, the number of prescribed medications, access to care, and the quality of communication with healthcare professionals [1,3].

Various supportive interventions are used to improve adherence, including traditional medication organizers, blister packs, electronic dispensers, mobile applications, SMS reminders, digital monitoring, and educational and behavioural strategies [4,5,6,7]. Their effectiveness depends on the type of tool used, the underlying cause of non-adherence, patient characteristics, and the availability of additional support from healthcare professionals or caregivers [1,4,7].

Therefore, it is justified to present the current state of knowledge regarding the role of medication organizers and supportive interventions in improving adherence among patients with chronic diseases.

2. Aim of the Study

The aim of this study is to present the current state of knowledge regarding the effectiveness of medication organizers and supportive interventions, including electronic dispensers, mobile applications, SMS reminders, digital monitoring, and educational and behavioural interventions, in improving adherence among patients with chronic diseases. The review also considers factors influencing the effectiveness of these interventions and the limitations of available studies.

3. Materials and Methods

A narrative review of the literature was conducted on the role of medication organizers and supportive interventions in improving adherence among patients with chronic diseases. The analysis was based primarily on publications available in the PubMed database and on references cited in selected studies.

The review included randomized controlled trials, observational studies, systematic reviews, meta-analyses, and guidelines concerning the use of traditional medication organizers, electronic dispensers, mobile applications, SMS reminders, digital monitoring systems, and educational and behavioural interventions.

Publications concerning adult patients with chronic diseases were included, particularly those involving patients with cardiovascular diseases, diabetes mellitus, chronic kidney disease, cancer, HIV infection, and mental disorders. Studies of the greatest clinical relevance, high methodological quality, and recent publications were preferred.

4. Review of the Current State of Knowledge

4.1. The Importance of Adherence in Chronic Diseases

Adherence refers to the extent to which a patient's behaviour regarding medication use, diet, and lifestyle modification corresponds with agreed therapeutic recommendations. The contemporary understanding of this concept emphasizes a collaborative partnership between the patient and healthcare professionals, distinguishing it from the older term *compliance*, which implies passive obedience to medical instructions [1,4].

Non-adherence to therapeutic recommendations is a common problem in chronic diseases, such as arterial hypertension, heart failure, diabetes mellitus, chronic kidney disease, HIV infection, mental disorders, and cancers requiring oral therapy [2,6]. It leads to poorer disease control, more frequent exacerbations, a higher number of hospitalisations, and an increased risk of complications [6,8].

Older patients and individuals with multimorbidity and polypharmacy are particularly vulnerable to low adherence. In this group, memory impairment, organisational difficulties, and complex dosing regimens play an important role [1,9].

Adherence is influenced by patient-related, therapy-related, and healthcare system-related factors. These include, among others, health literacy, motivation, adverse drug reactions, the number of medications used, treatment costs, the quality of communication with healthcare professionals, and access to healthcare services [1,3].

In clinical practice, intentional non-adherence, resulting from a conscious decision made by the patient, is distinguished from unintentional non-adherence, which is mainly associated with forgetfulness or organisational difficulties. This distinction is important when selecting appropriate interventions, as medication organizers and reminder systems are particularly useful in cases of unintentional non-adherence [1,4,7].

4.2. Traditional Medication Organizers and Reminder Packaging

Traditional medication organizers are among the simplest and most commonly used tools supporting adherence in patients with chronic diseases. They include multi-compartment medication containers, such as pillboxes, daily and weekly organizers, blister packs, and calendar-based packaging labelled with days of the week or times of day [1,4].

Their main purpose is to structure pharmacotherapy, facilitate treatment control, and reduce the risk of missed doses or accidental double dosing. These solutions are particularly useful in

older adults, patients with memory impairment, and individuals taking multiple medications simultaneously [1,9].

The use of medication organizers has been shown to improve the regularity of medication intake. Beneficial effects of pillboxes and blister packs on adherence have also been reported, as well as improved treatment outcomes in selected patient groups, including people living with HIV [10,12,13]. Systematic reviews also suggest that calendar-based packaging may reduce missed doses, particularly when forgetfulness is the predominant cause of non-adherence [1,11].

The advantages of traditional organizers include low cost, wide availability, and ease of implementation in home settings. However, their effectiveness depends on proper preparation, regular refilling, and the patient's ability to use the organizer independently [4,7].

In patients with significant cognitive impairment, manual limitations, or intentional reluctance to follow treatment, the effectiveness of these solutions may be limited. Therefore, manual organizers should be considered part of a broader strategy supporting pharmacotherapy rather than the sole tool for improving adherence.

4.3. Electronic Organizers and Smart Pillboxes

The development of digital technologies has led to the emergence of electronic medication organizers, referred to as smart pillboxes or electronic dispensers. These devices extend the function of traditional organizers by incorporating sound and light alarms, automatic compartment opening, recording of the time of use, and the ability to transmit data to applications or caregivers [9,14,15].

Their main advantage is the combination of organisational, reminder, and therapy-monitoring functions. As a result, they may reduce missed doses, improve treatment regularity, and facilitate the early detection of adherence-related problems [7,14].

Studies indicate the potential effectiveness of these solutions in various patient groups. Improvements in adherence have been demonstrated, among others, in patients with schizophrenia, along with high acceptance of these tools in primary healthcare settings and the usefulness of electronic pillboxes among older adults [9,14,15]. Literature reviews suggest a beneficial effect of such devices, although the magnitude of this effect depends on the population studied and the method used to assess adherence [7].

Limitations include higher purchase costs, the need to charge or power the device, the requirement for basic digital skills, and the risk of technical problems. In some patients, concerns regarding data privacy may also be relevant [7,15].

Electronic organizers appear to be particularly useful in older adults, patients exposed to polypharmacy, and situations requiring increased supervision of treatment regularity. However, they achieve the greatest effectiveness when used as part of comprehensive therapeutic support.

4.4. Mobile Applications, SMS Reminders, and Digital Monitoring

In recent years, the importance of digital interventions supporting adherence has increased. The most commonly used tools include mobile applications that remind patients about medication

doses, SMS reminders, telemonitoring platforms, and remote therapy-monitoring systems [6,16,17].

The mechanism of action of these tools is based on regular reminders, reinforcement of motivation, improved organisation of therapy, and the provision of feedback. Unlike traditional organizers, digital solutions can also collect data on medication use and enable a rapid response from healthcare professionals [8,18].

Study findings indicate that mobile applications may improve adherence, particularly in long-term therapy, including among patients treated for breast cancer [8,19]. Beneficial effects have also been demonstrated for SMS reminders, especially in cardiovascular diseases and heart failure [6,16]. Digital monitoring technologies have also been evaluated in tuberculosis and HIV, where they were associated with improved treatment supervision and high user acceptance [8,20].

However, the effectiveness of digital interventions depends on the patient's age, technological skills, access to a smartphone and the Internet, the frequency of messages, and the degree of tool personalisation. An excessive number of reminders may reduce user engagement [16].

Current evidence indicates that mobile applications, SMS reminders, and digital monitoring represent valuable complements to conventional methods of improving adherence. The best outcomes are observed when these solutions are implemented as part of comprehensive therapeutic interventions.

4.5. Multicomponent Interventions and the Role of Healthcare Professionals

An increasing body of evidence indicates that multicomponent interventions are the most effective in improving adherence, particularly when organisational or digital tools are combined with patient education, therapy monitoring, and support from healthcare professionals. Such an approach makes it possible to address both unintentional causes of non-adherence, such as forgetfulness and organisational difficulties, and intentional causes, including low motivation or concerns about treatment [1,4,7].

An important role is played by the attending physician, who can simplify dosing regimens, identify barriers to adherence, and strengthen the patient's motivation. The involvement of pharmacists is also essential in terms of patient education, medication review, and the selection of appropriate supportive tools. In dependent patients, support from nurses, caregivers, or family members is also important [3,9].

Studies have demonstrated the effectiveness of comprehensive adherence-improvement programmes, among others, in patients with arterial hypertension and during the transition from hospital to home among older adults with chronic diseases [2,3,21]. These findings suggest that the mere availability of a medication organizer is often insufficient without proper instruction and continued supervision.

In clinical practice, the choice of intervention should be individualized. In patients with predominantly organisational difficulties, pillboxes or electronic reminders may be effective, whereas in individuals with low motivation, education, motivational interviewing, and regular contact with healthcare professionals are of greater importance.

The best outcomes are usually achieved by combining several supportive methods simultaneously.

Table 1. Types of Interventions Supporting Adherence

Type of intervention	Examples	Main mechanism of action
Manual organizers	Daily and weekly pillboxes	Organisation of dosing
Reminder packaging	Blister packs, calendar packs	Reduction of missed doses
Electronic organizers	Smart pillbox, dispenser with an alarm	Reminders and monitoring
Mobile interventions	SMS reminders, mobile applications	Reminders and motivation
Digital monitoring	Telemonitoring, dose recording	Supervision of therapy
Pharmaceutical interventions	Education, medication review	Improvement of knowledge, safety, and adherence
Multicomponent interventions	Combination of several methods	Addressing multiple barriers to adherence

4.6. Effectiveness in Different Patient Groups

The effectiveness of medication organizers and interventions supporting adherence is not uniform across all patient populations. The greatest benefits are observed in patients whose main causes of non-adherence are forgetfulness, organisational difficulties, or complex dosing regimens [1,4,7].

The effectiveness of these solutions is best documented in older adults. In this group, multimorbidity, polypharmacy, cognitive decline, and manual difficulties that hinder independent pharmacotherapy management are more common [3,9,22].

In cardiovascular diseases, improving adherence is particularly important due to the high risk of complications and hospitalisation. Beneficial effects have been demonstrated for SMS reminders, medication organizers, and other mobile interventions [2,6,16,26].

In oncology, the problem of adherence is especially relevant to long-term oral therapies. Studies indicate that remote monitoring and mobile applications may support treatment regularity and facilitate the monitoring of adverse effects [8,19].

In infectious diseases requiring long-term therapy, such as tuberculosis or HIV infection, monitoring technologies may improve treatment supervision and therapeutic outcomes [18,20]. In mental disorders, beneficial effects have been observed following the use of electronic dispensers and adherence-improvement programmes, particularly in patients who had previously used treatment irregularly [14,24].

These data indicate that the effectiveness of interventions depends on the type of disease, the patient’s needs, and the dominant barriers preventing regular use of pharmacotherapy.

Table 2. Characteristics of Key Studies from the Selected Literature

Author	Year	Population	Intervention	Main outcome
FarzanehRad et al. [26]	2024	Heart failure	SMS reminders vs pillbox	Improvement in adherence
Graetz et al. [8]	2024	Breast cancer	Remote monitoring application	Improvement in adherence
Jerene et al. [18]	2025	Tuberculosis	Digital technologies	Improved treatment outcomes
Schwartz, Ballard [27]	2022	Rehabilitation patients	Customized pillbox	Feasibility and improvement in adherence
Shah et al. [5]	2021	Outpatient polytherapy	Prepacked blister packs	Improvement in adherence
Stip et al. [14]	2013	Schizophrenia	Electronic dispenser	Improvement in treatment regularity
Choi [15]	2019	Primary healthcare	Smart pillbox	High user acceptance
Hartch et al. [17]	2024	Chronic diseases	Adherence application	Improvement in selected adherence indicators

4.7. Limitations and Gaps in Research

Despite the growing number of publications concerning medication organizers and interventions supporting adherence, the available evidence is characterized by considerable heterogeneity. This applies to the study populations, the types of tools used, the duration of follow-up, and the methods of adherence assessment, which makes it difficult to compare findings and formulate unequivocal conclusions [1,4,7,23].

A major limitation remains the lack of a standardized method for measuring adherence. Studies have used patient self-reporting, prescription refill analysis, pill counts, data from electronic devices, and indirect indicators. Each of these methods has its own limitations and may lead to different results [1,23].

In many studies, the follow-up period was relatively short; therefore, data on the durability of intervention effects in long-term treatment remain limited. The generalizability of findings is also restricted, as some studies were conducted in selected populations or single-centre settings [8,18,19].

In the case of digital interventions, additional limitations include patients' technological skills, access to the Internet, equipment costs, and issues related to data protection. Manual organizers, in turn, require regular refilling as well as adequate cognitive and manual abilities on the part of the patient [7,16,19].

Further studies are needed to assess cost-effectiveness, compare different types of interventions, and analyse strategies tailored to the underlying cause of non-adherence, particularly in routine clinical practice. However, it should be emphasized that interpretation of the available findings should take their methodological limitations into account.

Table 3. Factors Influencing the Effectiveness of Medication Organizers and Supportive Interventions

Factor	Impact on intervention effectiveness
Patient age	Greater effectiveness in older adults
Polypharmacy	Increases the potential effectiveness of medication organizers
Type of disease	The importance of adherence varies depending on the condition
Cognitive function	Impairment limits the ability to use tools independently
Caregiver/family support	Increases the regularity and safety of therapy use
Type of non-adherence	Interventions are more effective in cases of unintentional non-adherence
Digital skills	Determine the effectiveness of mobile applications and monitoring systems
Follow-up duration	Short-term effects may be greater than long-term effects

4.8. Public Health Significance

Non-adherence to therapeutic recommendations represents an important public health problem, particularly in the context of population ageing and the increasing prevalence of chronic diseases. Low adherence is associated with poorer disease control, more frequent hospitalisations, and increased treatment costs [2,8,26].

Improving adherence may increase the effectiveness of existing therapies without the need to introduce new treatment methods. Even a modest improvement in the regularity of medication use at the population level may reduce the number of complications and the need for costly healthcare services [6,26].

Medication organizers and supportive interventions are relatively simple tools that can be easily implemented in both outpatient and home care settings. Manual pillboxes are inexpensive and widely available, whereas digital solutions additionally enable remote therapy monitoring and the identification of patients at risk of low adherence [1,4,7].

These interventions may be particularly important for older adults, patients exposed to polypharmacy, and individuals requiring continuous support in the independent management of pharmacotherapy [9,22].

From a public health perspective, however, the key issue is not only the availability of these tools, but also their appropriate adjustment to patients' needs and their integration with health education, pharmaceutical care, and treatment monitoring.

5. Conclusion

Medication organizers and interventions supporting adherence are useful tools in the treatment of patients with chronic diseases. The findings of available studies indicate that traditional pillboxes, reminder packaging, electronic dispensers, mobile applications, SMS reminders, and digital monitoring systems may improve the regularity of pharmacotherapy, particularly when

the main cause of non-adherence is forgetfulness, organisational difficulties, or complex dosing regimens [7,16,19,25,26].

The greatest benefits are observed in older adults, patients exposed to polypharmacy, and individuals requiring long-term treatment. However, the effectiveness of interventions depends on the type of disease, patient characteristics, level of motivation, digital skills, and support from caregivers [1,9,22].

The most promising approach appears to be a multicomponent strategy combining organisational and digital tools with patient education, regular contact with healthcare professionals, and therapy monitoring [1,3,7].

Further studies are needed, including long-term follow-up, cost-effectiveness assessment, and comparisons of different intervention models in routine clinical practice.

AI Disclosure

The authors used artificial intelligence (AI) tools to support language editing, stylistic refinement, and translation of selected parts of the manuscript and English-language source materials. AI was also used to assist in preparing the English version of the Abstract and in formatting the references according to the required citation style. All AI-assisted content was subsequently thoroughly reviewed and verified by the authors for accuracy, consistency, and compliance with the original sources. The authors take full responsibility for the content of the manuscript and confirm that AI tools were used solely as a supportive tool and that AI was not involved as a co-author of the work.

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