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Smart Medicare - Your Digital Health Assistant For Elderly Medication Management

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ABSTRACT

Background : A significant problem is medication non-compliance, particularly among chronically ill and elderly patients. According to studies, almost half of patients do not take their medications as directed, which results in subpar therapeutic results and higher medical expenses (1). One promising remedy for this problem is the use of technology in medication reminder systems (2). However, older adults' ability to use current systems is limited by their frequent lack of features like voice reminders, multilingual support, and direct connectivity to smartphones or healthcare providers (3).

Objective : Through voice alerts, multilingual support, and Bluetooth connectivity with smartphones for improved monitoring and user-friendliness, this study aims to create and assess a smart medication reminder device that improves patient compliance.

Method : In order to provide reminders for medication time, dosage, and schedule, the device combines hardware and software technology. It gathers reminder data and syncs it with a smartphone application that is connected. To help older users and those with low literacy, the system also enables language and tone customization.

Result : In comparison to more conventional reminder techniques like SMS alerts, the suggested reminder system increased adherence by guaranteeing timely medication intake, decreasing missed doses, and raising user satisfaction, according to preliminary evaluation and user feedback (4).

Conclusion - Medication reminders with a technological component are essential for lowering therapeutic failures brought on by non-compliance. The created tool provides a practical, easy-to-use, and efficient way to help older patients and those with long-term illnesses take their medications as prescribed.

KEYWORDS

Medication Reminder Device, Patient Compliance, Bluetooth Connectivity, Voice Alert, Elderly Care, Technology

INTRODUCTION

Due to chronic conditions like diabetes, heart disease, stroke, arthritis, and high blood pressure, older adults are among the groups that use medications the most. Many of them take five or more medications concurrently, a condition known as polypharmacy, which frequently results in poor adherence and increases confusion, side effects, and drug-drug interactions. (5)

Elderly people deal with a variety of practical issues in their daily lives when it comes to managing their medications, including dependence on family members, forgetfulness, poor vision, difficulty reading small labels, and low health literacy. The risk of unsafe self-medication and adverse drug reactions is increased in rural areas, where many elderly people have several chronic illnesses but have limited access to physicians, pharmacists, and appropriate counseling.(6)

In these patients, poor medication adherence is associated with increased hospitalizations, worsening chronic conditions, and increased medical expenses. Research on elderly patients with polypharmacy and multimorbidity reveals that they frequently forget to take their medications, take the incorrect dosage, or stop taking them too soon without consulting a doctor, particularly if they are not completely aware of their treatment. (7)

Simultaneously, basic digital tools such as smartphones, SMS reminders, and simple apps have demonstrated promising potential for enhancing medication adherence in adults with chronic illnesses.

These technologies can support long-term treatment, provide clear schedules and timely reminders, and function even on low-cost phones, which are now widely used in low- and middle-income nations.(8)

Therefore, a low-cost, easily navigable medication reminder device or software that is appropriate for older adults in both urban and rural areas, is designed in local languages, and can play a significant role in safe medication management. A system like this can help seniors remember their dosages, lower errors, and promote better control of chronic diseases at a reasonable cost by offering audio-visual reminders, clear instructions, and easy connectivity with mobile phones.(9)

Figure 01 (Poor eyesight for medicine)

Figure 02 (Dependent on other for medicine)

Figure 03 (Polypharmacy in elders)

APPLICATION

1:-It assists senior citizens in taking their medications on schedule and consistently, preventing missed or delayed doses.

2:-It helps patients who are dependent on others, such as elderly people who get their medications from family members or caregivers.

3:- By clearly reminding users which medication to take and when, it facilitates the management of multiple medications at once (polypharmacy).

4:-It lessens frequent errors like forgetting to take a dose or taking the incorrect medication.

5:- By improving daily medication-taking practices, it aids in the better management of chronic conditions like diabetes, hypertension, heart disease, and asthma.

6:-With voice reminders and straightforward, understandable signals, it helps patients with low vision or reading comprehension.

7:-Through linked apps or reports, it enables family members and caregivers to keep an eye on whether medications are being taken on a regular basis.

8:-It can lessen hospital stays and complications brought on by inconsistent or neglected medication.

9:-It can be customized based on the patient's preferred alarm sound, language, routine, and reminder type.

10:-For patients who live alone, in remote locations, or in situations where regular medical supervision is challenging, it serves as a home-based assistant.

11:-It offers brief instructional messages, like "take after food" or "do not stop this medicine suddenly," to enhance treatment comprehension.

12:-Healthcare practitioners can review adherence and make better treatment decisions by connecting it to physicians, pharmacists, and digital health records.

13:-When a patient is discharged from the hospital with a new prescription and may be unsure about dosage and timing, it is very helpful.

14:-Patients with early dementia or memory issues, who are more likely to forget their medications, can benefit from additional support.

NEED OF WORK

According to these kernel density graphs, the majority of chronic illnesses (such as cancer, diabetes, heart disease, arthritis, lung and neurological diseases, and hypertension) start to appear more frequently after the age of 55 to 60 and peak in the 65 and older age range. This indicates that many older adults are coping with multiple chronic illnesses at the same time, beginning at a time when physical strength, memory, and vision frequently deteriorate. As a result, many individuals in the

65+ age group will need to take several medications every day for many years, and they frequently rely on family members or caregivers to remember dosages and schedules.

In order to help older adults with chronic illnesses maintain regular medication use, minimize missed doses, and manage their treatment more independently, these graphs clearly demonstrate the need for a medication reminder device.

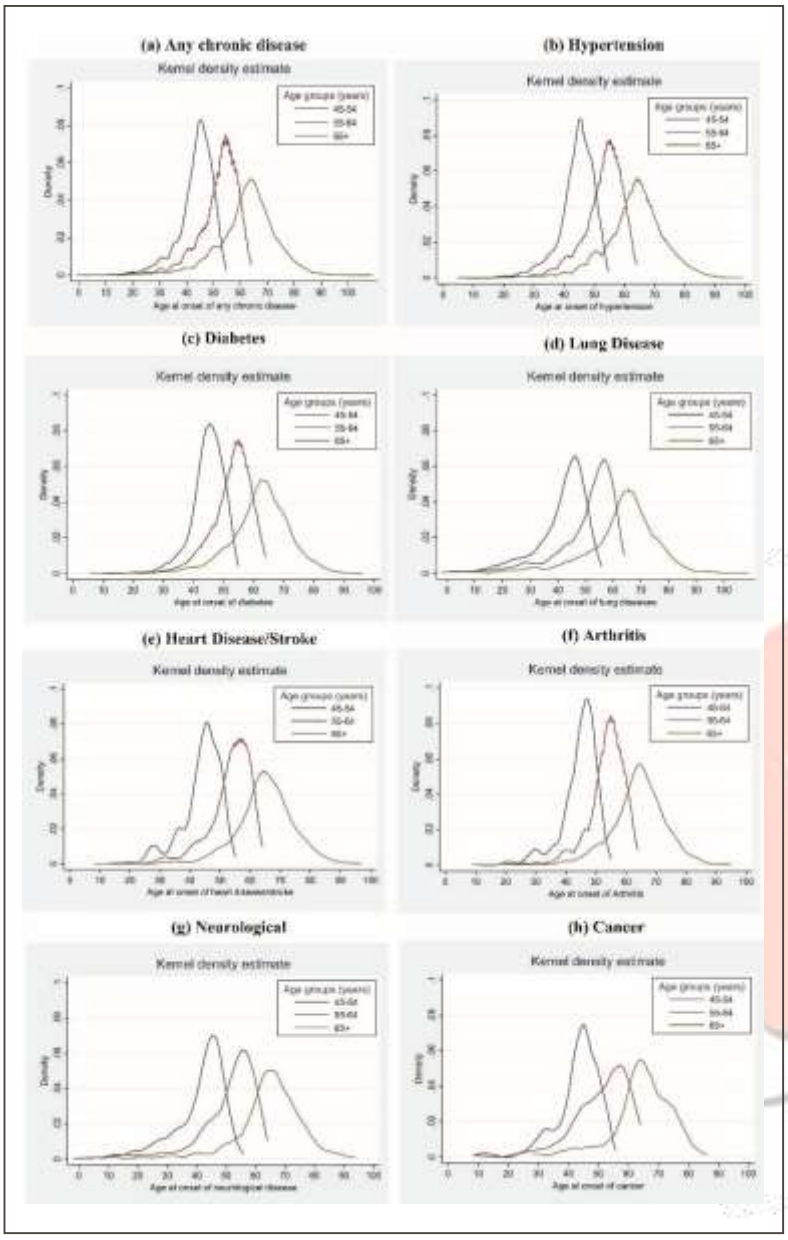

Figure 04 (Chronic disease onset across varying age groups)

METHODS

The goal of this study was to create and assess an intelligent medication reminder system intended to improve the adherence of elderly and chronically ill patients to their medications. To deliver timely medication reminders and usage tracking, the device combines Bluetooth connectivity, voice alerts, multilingual support, and mobile app synchronization.

Identification of the Study

Using the Google Scholar, PubMed, and ScienceDirect databases, a thorough literature review covering the years 2015–2024 was carried out to learn more about current medication reminder systems and how well they work to increase adherence. "Medication Reminder Device," "Smart Pillbox," "Bluetooth Reminder System," "Medication Adherence Technology," and "Elderly Patient Compliance" were among the search terms used. Determining functional requirements and choosing suitable technologies for device design were made easier by the identified studies (10,11).

Design and Development of Devices

Arduino-based microcontrollers were used in the design of the prototype, which also included a voice module for real-time reminders, LED indicators, and a buzzer. To allow for the synchronization of medication schedules, the device was Bluetooth-connected to a mobile application. The mobile app allowed users to enter drug details, dosage time, and frequency; the data was then automatically sent to the device (12,13). The elderly users with mild forgetfulness or visual impairment were the focus of the device's reliability, usability, and reminder accuracy tests. To enhance accessibility for regional users, a multilingual voice system in English, Hindi, and Marathi was incorporated (14).

Population and Assessment of the Study

Twenty participants, ages 50 to 75, who were prescribed several daily medications, participated in a small pilot study. For four weeks, each participant used the device, and user feedback surveys and logs from mobile apps were used to track adherence. Prior to and following device use, compliance improvement was measured using the Morisky Medication Adherence Scale (MMAS-8) (15,16).

Gathering and Analyzing Data

Reminder accuracy rate, missed doses, user satisfaction, and technical problems were among the information gathered. SPSS version 25 was used for statistical analysis, and paired t-tests were used to compare the adherence scores before and after the intervention.

Statistical significance was defined as a p-value of less than 0.05 (17).

Ethical considerations

Every participant gave written consent after being made aware of the study's objectives.

Throughout the study, data confidentiality was upheld.

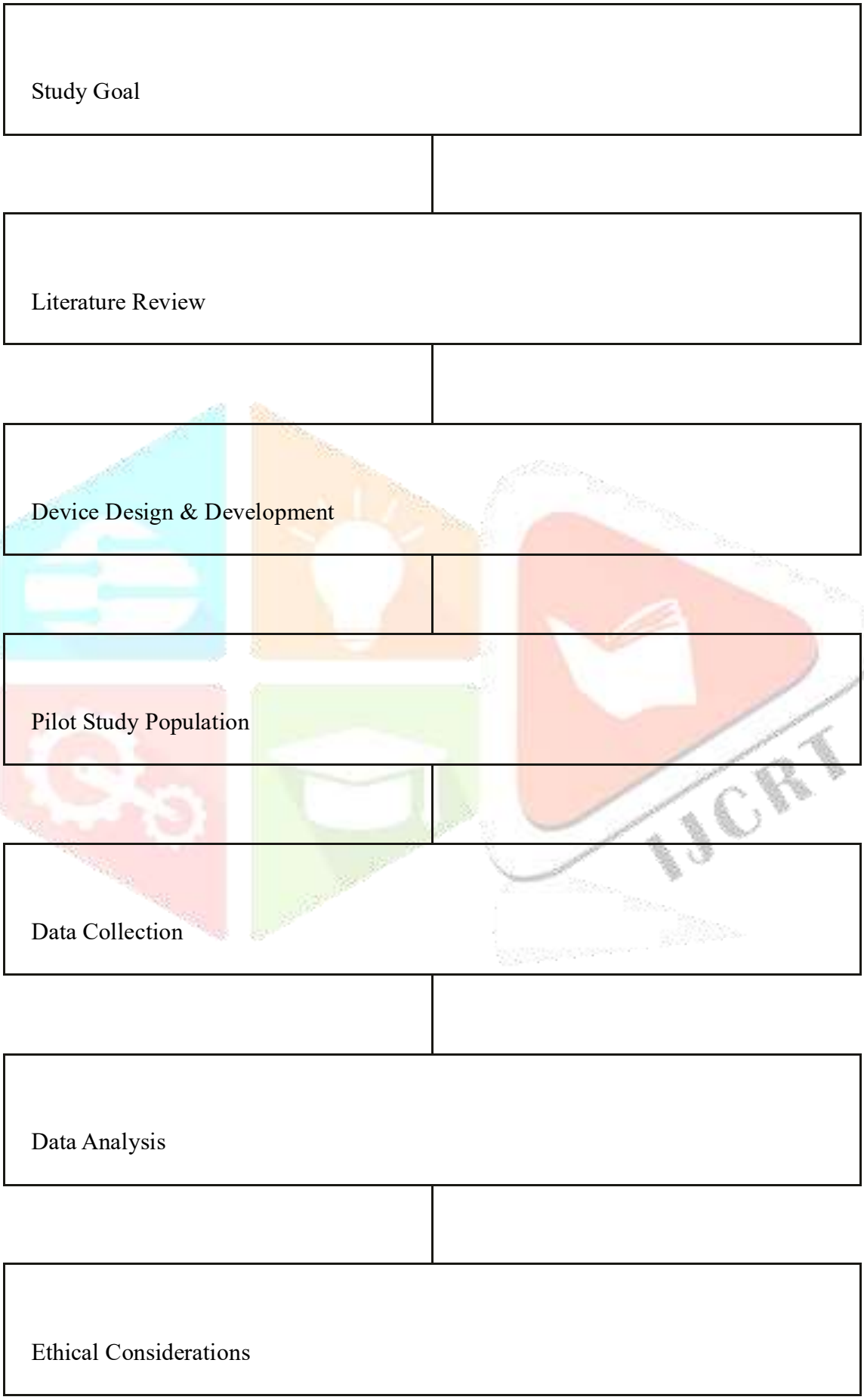

Figure 05 (Flowchart of study methods for medication reminder device)

IMPORTANT ASPECTS OF THE DEVICES

1. Digital Screen

Clearly shows the name of the medication, the time, and the dosage. This makes it simple for elderly individuals with memory or vision impairments to confirm which medications to take when.

2. Voice & Message Alerts

Provides timely reminders via sound or message. For elderly people who might find it difficult to read messages, voice alerts are incredibly helpful in making sure they never miss a dose.

3. Bluetooth Connected

Syncs reminders or receives updates by connecting to a smartphone. Elderly users who don't use mobile apps frequently can benefit from family members or caregivers managing the schedule from their phones.

4. One-Click Info

Users can view or hear immediate information about their medication, including its name, dosage, and timing, by simply pressing a single button. This prevents misunderstandings, particularly when several medications are prescribed.

5. Multilingual Support

The device is appropriate for rural and regional users who are uncomfortable with English because it can provide instructions and alerts in various Indian languages.

6. Foldable & Portable

Elderly people can easily carry it on their trips or fasten it to their bag or keychain because it is small and portable.

7. Reusable

Medicine schedules can be changed at any time without requiring a new device, which is economical and perfect for those living in remote locations where access to new gadgets is restricted.

8. Long Battery Life

This feature is useful in villages where regular electricity may not be available because it only needs to be charged once a week.

9. Offline Use

After reminders are set, it functions fully offline. For rural areas with inadequate network connectivity, this is a significant benefit.

10. Keychain Design

Compact and practical, it can be carried with everyday objects. It can be kept close at hand by elderly people, decreasing the likelihood that they will forget reminders.

Figure 06 (Design features of device)

Figure 07 (Features and working of device)

THE MEDICATION REMINDER DEVICE'S WORKFLOW

Elderly users, including those in rural areas, can easily operate the process because it is simple, automatic, and senior-friendly.

1. Enrollment and Configuration

Basic information like name, age, health status, and prescription medications are entered into the system by the user or caregiver (either directly via the device or through a connected smartphone app).

Why this is important A well-defined configuration guarantees that the system is aware of the user's identity and medications, which is crucial when the user takes several medications.

2. Data Entry for Medicines

The name, dosage, frequency, and duration of each medication are entered. A daily dose schedule is automatically generated by the software. Why this matters: Automating the creation of schedules reduces user error and streamlines complicated regimens, which is crucial when several medications are used, as is frequently the case with chronic conditions.

3. Automated reminders

The device sounds or vibrates (or sounds an alert) to remind users when each dose is due.

Until the user confirms that they have taken the medication, the alert remains active. Why this is important aids in overcoming forgetfulness, a major factor in missed doses that is particularly common in older users or in less supervised rural areas.

4. Tracking and Confirmation of Doses

The system logs the intake when the user confirms taking the medication (either by pressing a button or by syncing via Bluetooth). This makes it possible to track missed doses and helps with monitoring adherence.

Why this is important allows health professionals or caregivers to For chronic or elderly care, it is very helpful to recognize when doses are missed and take appropriate action. The system discovered that adherence rates were greatly increased by real-time monitoring and feedback.

5. One-Click Access to Data

To obtain information about a medication, including its purpose, dosage guidelines, potential adverse effects, etc., the user (or caregiver) can press a button at any time.

Why this is important supports the safe use of medications in rural areas where access to a pharmacist may be limited and offers clarity to elderly users who might have trouble reading or remembering instructions.

6. Doctor/Caregiver Monitoring (Optional)

Updates regarding the patient's medication schedule and any missed doses can be sent to caregivers or physicians if the user is connected via Bluetooth or a phone. They can offer alerts or remote assistance.

Why this matters: It provides an additional degree of security for elderly individuals who live alone or in isolated locations, allowing for intervention in the event that doses are missed.

7. Reusing and Erasing Data

The user's data can be safely deleted at the conclusion of the treatment period, and the same device can be used again. Why this matters: It makes the device sustainable and affordable for rural health programs or communities with limited funding.

Figure 08 (Working of smart device)

FUTURE SCOPE

Integration with AI and predictive analysis

Artificial intelligence will eventually be able to learn each patient's routine, spot missed dose patterns, and send more intelligent, tailored reminders (e.g., increasing reminders on days/times when the patient typically forgets). Similar algorithms could be added to this device to increase its efficacy and enable risk-based alerts for high-risk patients, as Al-based digital interventions are already improving adherence in chronic diseases. (18,19)

2. Telehealth connectivity and remote monitoring

Through a secure cloud or telemedicine platform, the device can be enhanced to automatically share adherence data (missed doses, delay, frequency) with physicians, pharmacists, or caregivers. For older patients who are unable to visit hospitals regularly, this will help clinicians modify therapy earlier, lower complications, and support "virtual home care." (18,20)

3. Integration with the ecosystem of smart homes and wearables

In order to provide multimodal alerts (vibration, watch notification, smart speaker voice alert), the reminder system can eventually be connected to smartwatches, fitness bands, and voice assistants (Alexa/Google Assistant). For patients with visual or hearing impairments, it can also be linked to smart home appliances (TV, lights) to provide powerful visual and auditory cues. (19,20)

4. Cutting-edge features for low-resource and rural environments

In order for the device to function even in the absence of smartphones or constant internet, future iterations may incorporate offline functionality, inexpensive GSM/SMS alerts, and regional language voice prompts. Because of this, it can be incorporated into community health worker programs and is appropriate for older patients in rural areas where smartphone use and digital literacy are low. (17)

5. Information for tailored interventions and public health

By identifying common adherence issues in particular regions or diseases, aggregated, anonymized adherence data from multiple devices can be used in the future to help government and public health programs design targeted interventions (e.g., additional counseling for diabetes or TB patients with poor adherence). Additionally, this can help with outcome-based studies that show how reminder systems lower hospital stays and medical expenses. (18,19)

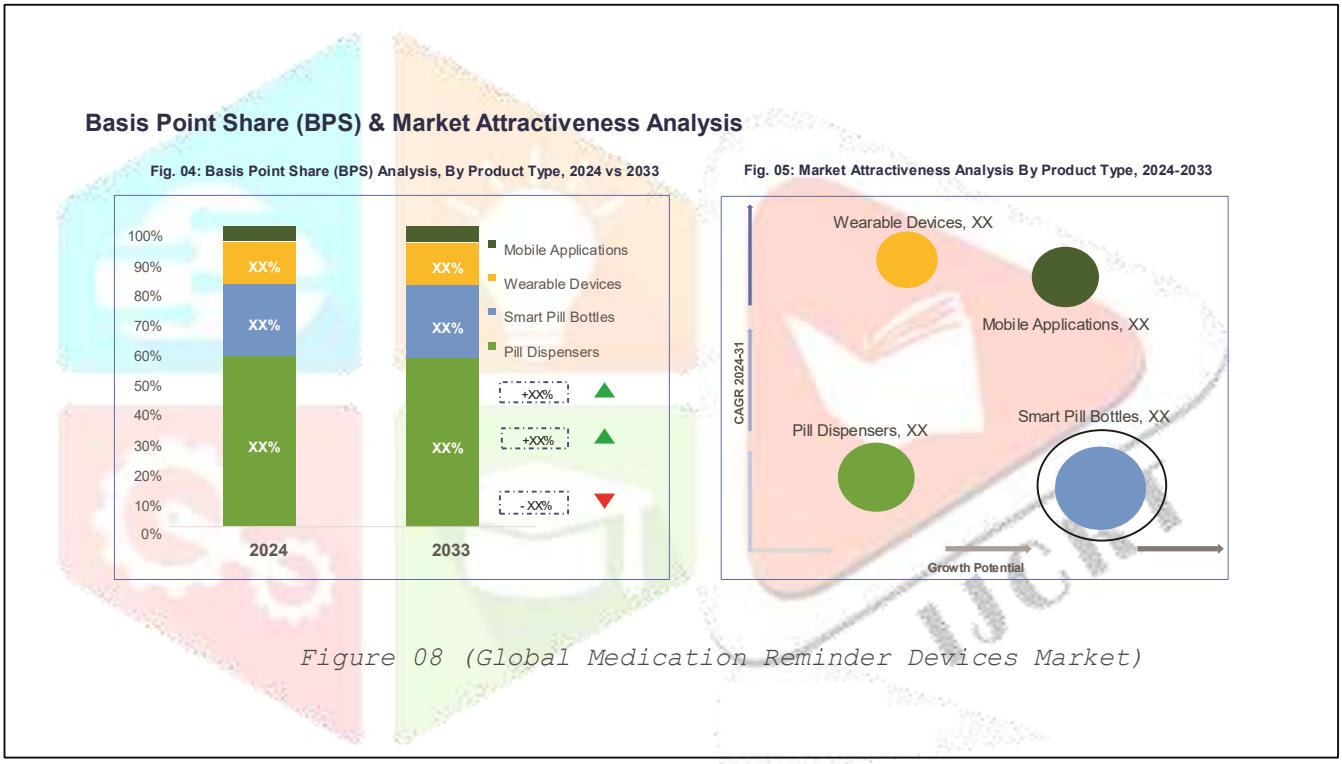

Figure 08 (Global Medication Reminder Devices Market)

The market for medication reminder devices was estimated to be worth USD 1.2 billion in 2023 and is expected to grow at a compound annual growth rate (CAGR) of 13.5% to reach USD 3.8 billion by 2032. The growing elderly population, growing awareness of medication adherence, and the incorporation of technology into healthcare solutions are the main drivers of this significant growth.

CONCLUSION

According to the current review, elderly and chronically ill patients' medication adherence may be significantly increased by an intelligent medication reminder device that incorporates features like Bluetooth connectivity, voice alerts, multilingual guidance, and mobile app synchronization. In keeping with recent smart medicine reminder and healthcare assistant solutions that have demonstrated improved adherence and safety in real-world settings, these systems directly address common barriers like forgetfulness, complex regimens, poor vision, and dependence on caregivers by providing timely, clear, and context-appropriate reminders. (21)

Furthermore, this device's potential impact is increased by placing it within the larger mHealth ecosystem, where smartphones and other connected devices facilitate communication with healthcare providers, adherence monitoring, and remote care, particularly in rural and resource-constrained areas. The suggested device could be a scalable, affordable tool for enhancing health outcomes and quality of life. Evidence from mobile health and medication-reminder applications shows that digital tools can support long-term treatment, lower errors, and empower patients and caregivers to manage chronic diseases more effectively. (22)

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