



Hwb Gwyddorau Bywyd Cymru
Life Sciences Hub Wales

Intelligence report: Technologies to support medication adherence

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Contents

1. Executive summary	2
2. Introduction	3
2.1. Background to medication adherence	3
2.2. Technologies to improve medication adherence	4
2.3. European Network to Advance Best practices & technology on medication adherence (ENABLE)	5
3. Medication management apps	6
3.1. Technology description	6
3.2. Quality of medication adherence apps	6
3.3. Prominent medication adherence apps	7
4. Pill boxes	10
4.1. Technology description	10
4.2. Simple pill boxes	10
4.3. Pill boxes with alarms	11
5. Medication reminders/alarms	12
5.1. Technology description	12
5.2. Standalone medication reminder alarms	12
5.3. Wearables	13
5.4. Smart pill bottles/caps	14
6. Automatic pill dispensers	15
6.1. Technology description	15
6.2. Automatic dispensers	15
6.3. Automatic pill organiser and dispenser	16
7. Medication adherence platforms/services	18
7.1. Technology description	18
7.2. Example medication adherence services	18

1. Executive summary

Medication non-adherence is a pervasive problem, affecting up to half of chronic medication users. Technological advances have significant potential to support healthcare professionals and empower patients in managing the scheduling of taking their medicines, particularly in older people who may have difficulty in remembering to take their medications, and who may have multiple medications to manage.

This report discusses the range of technologies that exists to support medication adherence and provides example products within each category. The examples are given to illustrate the range of technologies available worldwide. The list is not exhaustive and some products may not currently be available in the UK:

- **Medication adherence apps**

Smartphone applications that support the managing of medications and issue reminders of when to take medicines. Prominent medication adherence apps include Medisafe, MyMeds, Care4Today, Dosecast, and CareZone.

- **Pill boxes**

Devices that store medications in compartments to be taken on specific days. For those with little to no cognitive impairment, standard pill boxes or organisers can be a sufficient way to manage medication adherence.

- **Medication reminders/alarms**

Devices that will remind users when it is time to take their medications such as alarm clocks and wearable devices. This category of products also includes smart pill bottles which, in addition to providing alarms and reminders to take medication, can monitor adherence by detecting when the bottle is opened.

- **Automatic pill dispensers**

Devices designed to make the process of taking medication as simple as possible for the user by making the right combinations of medication available at the right time and to prevent the taking of the wrong medications at the wrong time. Some products also include a medication organiser that can be programmed to sort the medications into correct doses, which can then be dispensed at the right time.

- **Medication adherence platforms/services**

Services that will provide medications at correct doses or ready-filled pill boxes, as well as platforms that monitor medication adherence of the user.

2. Introduction

2.1. Background to medication adherence

Chronic diseases and multi-morbidity have become more prevalent in the UK and much of Europe in recent decades primarily due to an ageing society. Managing these health issues requires a multidisciplinary response, which often involves lifestyle changes in combination with lifetime medication use. Key to achieving successful health outcomes is adherence to these medication regimens.

Despite the imperativeness of keeping to medication routines, non-adherence is a pervasive problem, affecting up to half of chronic medication users. In Europe, medication non-adherence is associated with almost 200,000 deaths and €80-125 billion of potentially preventable direct and indirect costs¹. Concerted efforts are therefore needed to improve the rates of medication adherence in the UK and across Europe.

In a 2018 review of interventions to improve medication adherence, researchers exploring the literature for clinical trials from 2000-2018 identified six categories of intervention (Table 1)². The choice of intervention to promote adherence was found to depend on feasibility and availability within a practice or health system. Successful interventions that are also clinically practical include using combination pills to reduce daily pill burden, clinical pharmacist consultation for disease co-management, and medication-taking reminders such as telephone calls to prompt refills.

Table 1. Categories of medication adherence interventions. Source: Kini & Ho, 2018³.

Category	Intervention Example
Patient education	Recurrent and personalized telephone counselling sessions with health educators
Medication regimen management	Using combination pills to reduce the number of pills patients take daily
Clinical pharmacist consultation	Including education, increased frequency of disease monitoring via telephone or in-person follow-up visits, and refill reminders
Cognitive behavioural therapies	Motivational interviewing by trained counsellors
Medication-taking reminders	Refill reminder calls or use of electronic drug monitors for real-time monitoring and reminding
Incentives to promote adherence	Reducing co-payments and paying patients and clinicians for achieving disease management goals

¹ European Cooperation in Science & Technology. CA19132 - European Network to Advance Best practices & technoLogY on medication adherence (ENABLE). Accessed 08/08/2022 <https://www.cost.eu/actions/CA19132/>

² Kini, V., & Ho, P. M. (2018). Interventions to improve medication adherence: A review. The Journal of the American Medical Association, 320(23), 2461–2473. <https://doi.org/10.1001/jama.2018.19271>

³ IBID

2.2. Technologies to improve medication adherence

In combatting medication non-adherence, technological advances have significant potential to support healthcare professionals and empower patients in managing the scheduling of taking of their medicines. Particularly in cases involving older people who may have difficulty in remembering to take their medications, which to take and when, or who may have mobility issues affecting their ability to take their medications, the use of technologies could be useful.

Technologies aimed at improving medication adherence include:

- **Medication adherence apps:** Smartphone applications that support the managing of medications and issue reminders of when to take medicines.
- **Pill boxes:** Devices that store medications in compartments to be taken on specific days.
- **Medication reminders/alarms:** Devices that will remind users when it is time to take their medications.
- **Automatic pill dispensers:** Devices that will automatically dispense correct doses of medications at the right times.
- **Medication adherence platforms/services:** Services that will provide medications at correct doses or ready-filled pill boxes, as well as platforms that monitor medication adherence of the user.

This report goes on to discuss this range of technologies and provides example products within each category. The examples are given to illustrate the range of technologies available worldwide. The list is not exhaustive and some products may not currently be available in the UK.

Additionally, the use of technologies to monitor medication habits can provide healthcare professionals with important information regarding adherence, allowing for proactive steps to be taken. A March 2022 narrative review identified a variety of technology applications for monitoring medication adherence⁴. The review summarises the technical features, data capture methods, and various advantages and limitations of medication adherence monitoring technology reported in the literature and the proposed criteria for assessing medication adherence monitoring technologies.

⁴ Mason, M., Cho, Y., Rayo, J., Gong, Y., Harris, M., & Jiang, Y. (2022). Technologies for medication adherence monitoring and technology assessment criteria: narrative review. *JMIR MHealth and UHealth*, 10(3), e35157. <https://doi.org/10.2196/35157>

2.3. European Network to Advance Best practices & technology on medication adherence (ENABLE)

Whilst there are numerous technologies that exist to enhance medication adherence, awareness of these technologies by healthcare professionals is limited. A group of researchers of a Europe-wide group also acknowledged a lack of collaboration between stakeholders, a lack of insight in different European healthcare systems, and reimbursement pathways and policy regulations that significantly differ between countries. This affects not only patients and healthcare professionals, but also manufacturers of technology (mostly SMEs) in their innovation capacity and competitiveness⁵.

To address these challenges, researchers established the European Network to Advance Best practices & technology on medication adherence (ENABLE)⁶. The network aims to:

1. Raise awareness of adherence enhancing technological solutions
2. Foster and extend multidisciplinary knowledge on medication adherence at patient, treatment and system levels
3. Accelerate translation of this knowledge to useful clinical application
4. Work collaboratively towards economically viable implementation of adherence enhancing technology across European healthcare systems.

Further information on ENABLE is available on the network website at: <https://enableadherence.eu/>

Among the main objectives of ENABLE is development of an interactive repository of available medication adherence technologies to facilitate their selection and adoption by different stakeholders. It is anticipated that the repository will be publicly available for interested parties. A 2022 article published by the group in BMJ Open describes the development process, which is currently under way and is supported by European Cooperation in Science & Technology (COST)⁷. The spirit of COST Actions is networking and dissemination of ideas; hence, the action is open for anybody who would wish to join or would like to be informed about its activities.

⁵ European Cooperation in Science & Technology. CA19132 - European Network to Advance Best practices & technology on medication adherence (ENABLE). Accessed 08/08/2022 <https://www.cost.eu/actions/CA19132/>

⁶ van Boven, J. F., Tsiligianni, I., Potočnjak, I., Mihajlović, J., Dima, A. L., Nabergoj Makovec, U., Ágh, T., Kardas, P., Ghiciuc, C. M., Petrova, G., Bitterman, N., Kamberi, F., Culig, J., & Wettermark, B. (2021). European network to advance best practices and technology on medication adherence: mission statement. *Frontiers in Pharmacology*, 12, 748702. <https://doi.org/10.3389/fphar.2021.748702>

⁷ Nabergoj Makovec, U., Goetzing, C., Ribaut, J., Barnestein-Fonseca, P., Hauptenthal, F., Herdeiro, M. T., Grant, S. P., Jácome, C., Roque, F., Smits, D., Tadic, I., Dima, A. L., European Network to Advance Best practices and technology on medication adherence (ENABLE), (2022). Developing a medication adherence technologies repository: proposed structure and protocol for an online real-time Delphi study. *BMJ Open*, 12(4), e059674. <https://doi.org/10.1136/bmjopen-2021-059674>

3. Medication management apps

3.1. Technology description

Mobile technologies have experienced rapid advancement in recent years. Developments in processing power, artificial intelligence, cloud computing, miniaturisation of technology allowing for wearable tech, wireless communication, Bluetooth, 4G, and now 5G; all these advancements mean that the capability of mobile technologies such as smartphones are far more wide-ranging than they ever were and are likely to become far more prevalent in the future.

As of 2022, it is estimated that there are 6.64 billion smartphone users in the world, or 83% of the world's population⁸ and applications on these devices are becoming a ubiquitous part of people's lives. Mobile apps therefore offer an opportunity in managing medication adherence that is convenient for many. Although, when considering the use of this technology in assisting older people, it is important to note that smartphone use decreases with age. Whilst over 95% of people under 55 in the UK use a smartphone, this rate drops to around 65% in those aged 65 or older⁹. The use of apps in managing medications could therefore be inaccessible for a large proportion of older people (although the rate of smartphone use in older people has been increasing in recent years).

3.2. Quality of medication adherence apps

A huge number of medication management apps exist in app stores. A 2018 review of medication adherence apps identified 5,881 apps of which 681 were examined¹⁰. The results however found a concerning lack of involvement from healthcare professionals in app development, as well as a lack of evidence base of their effectiveness. The authors advocated for more collaboration between relevant stakeholders to ensure development of high quality and relevant adherence apps with well-powered and robust clinical trials investigating the effectiveness of these interventions¹¹. A systematic review of the effectiveness of medication adherence apps indicated that patients who use mobile apps to support them in taking medications are more likely to self-report adherence to medications than those in the comparator groups¹².

⁸ Statista. Number of smartphone subscriptions worldwide from 2016 to 2027. Accessed 08/08/2022 <https://www.statista.com/statistics/330695/number-of-smartphone-users-worldwide/>

⁹ Statista. Do you personally use a smartphone? - by age. Accessed 10/08/2022 <https://www.statista.com/statistics/300402/smartphone-usage-in-the-uk-by-age/>

¹⁰ Ahmed, I., Ahmad, N. S., Ali, S., Ali, S., George, A., Saleem Danish, H., Uppal, E., Soo, J., Mobasheri, M. H., King, D., Cox, B., & Darzi, A. (2018). Medication adherence apps: review and content analysis. *JMIR MHealth and UHealth*, 6(3), e62. <https://doi.org/10.2196/mhealth.6432>

¹¹ IBID

¹² Armitage, L. C., Kassavou, A., & Sutton, S. (2020). Do mobile device apps designed to support medication adherence demonstrate efficacy? A systematic review of randomised controlled trials, with meta-analysis. *BMJ Open*, 10(1), e032045. <https://doi.org/10.1136/bmjopen-2019-032045>

A presentation at the American Pharmacist Association Annual Meeting and Exposition in 2015 reviewed some of the leading adherence apps at the time and identified a number of highly rated applications based on user testing (Figure 1)¹³. The five top rated apps were Medisafe, MyMeds, Care4Today, Dosecast Premium, and CareZone Meds. It should be noted that seven years is a long time in terms of app development and the tested apps are likely to have changed considerably since this review took place, or may no longer be available. A more recent review (last updated 2021) of medication reminder apps by consumer technology website Tech-enhanced Life recommended Medisafe and CareZone¹⁴. Some of the more prominent medication adherence apps are described below.

Highest Ranking Applications											
	Operating System			Initial Score	User-Tested Score	Adherence Attributes	Medication Management	Connectivity	General Features	Health Literacy	Overall
	iOS	A	BB	Max of 68	Max of 73						
Medisafe	X	X		44	55	★★★★★	★★★★	★★★★	★★★★★	★★★★★	★★★★★
MyMeds	X	X		47	53	★★★★	★★★★★	★★★★★	★★★★	★★★★★	★★★★★
Care4Today	X	X		41	52	★★★★★	★★★★★	★★★★	★★★★	★★★★★	★★★★★
Dosecast Premium	X	X		37	44	★★★★	★★★★★	★★★★	★★★	★★★	★★★★
CareZone Meds	X	X		29	40	★★★	★★★★	★★★★★	★★★★	★★★★	★★★★
MedCoach	X	X		29	39	★★	★★★★	★★★	★★★★★	★★★★★	★★★★
Pills (Hourly)	X			30	38	★★★	★★★★	★★★★	★★★	★★★★	★★★★
Mango Health	X			23	38	★★★★★	★★★	★★	★★★	★★★★★	★★★★
Walgreens	X	X		24	37	★★★	★★★	★★★	★★★★★	★★★★	★★★★
TRxC (Beta)		X		36	36	★★★★	★★★	★★★★	★★★	★★	★★★★
iPharmacy Pill ID		X		30	36	★★★★	★★★	★★★	★★★★	★★★	★★★★
MyMedRec	X	X	X	29	35	★★★	★★★	★★★	★★★★★	★★	★★★★

Abbreviations Used: iOS, Apple; A, Android; BB, Blackberry
 Excellent: ★★★★★ Above Average: ★★★★ Average: ★★★ Below Average: ★★ Poor: ★

Figure 1. Summary of medication adherence app ratings from user testing. Source: Helenbrand et al., 2015¹⁵.

3.3. Prominent medication adherence apps

Montuno Software: Dosecast

<http://www.montunosoftware.com/>

Dosecast is a medication management app available for Apple, Android, and Amazon devices. Users are able to input details for the medications they take and can set up reminders on a daily, weekly or monthly schedule, every few days or weeks, or for a pre-set number of hours or days after the last

¹³ Heldenbrand, S., Dayer, L., Renna, C., Shilling, R., Martin, B. (2015). Navigating the Flooded Adherence App Marketplace: Rating the Quality of Medication Adherence Apps.

https://www.researchgate.net/publication/276204576_Navigating_the_Flooded_Adherence_App_Marketplace_Rating_the_Quality_of_Medication_Adherence_Apps

¹⁴ Schrempp, J. (2021) Best Pill Reminder App: Explorer Choice. Tech-enhanced Life. Accessed 08/08/2022

<https://www.techenhancedlife.com/citizen-research/best-pill-reminder-app-explorer-choice>

¹⁵ Heldenbrand, S., Dayer, L., Renna, C., Shilling, R., Martin, B. (2015). Navigating the Flooded Adherence App Marketplace: Rating the Quality of Medication Adherence Apps.

https://www.researchgate.net/publication/276204576_Navigating_the_Flooded_Adherence_App_Marketplace_Rating_the_Quality_of_Medication_Adherence_Apps

dose. Remaining quantities are tracked, sends refill reminders, and logs medication adherence. It is available in two editions: Free edition and Pro-edition with CloudSync.

MedHelper: MedHelper App

<https://medhelper.com/>

MedHelper is designed to assist in managing the challenges of remaining on the schedule of taking medication. The app holds numerous categories of information including the name of medicine, instructions on how to take the medicine, side effects and reaction. It sends notification alerts when it's time to take medication and shows the remaining quantity of medicine and details regarding the required next batch. Available for Android and iOS users, the app has a free and pro version.

MyMeds

<https://my-meds.com/>

Using MyMeds, patients can auto-import their medications and set up reminders, read curated news about their health conditions, and chat with a pharmacist about their prescriptions. The app is available on desktop and mobile.

Medisafe: Medisafe App

<https://www.medisafeapp.com/>

The app includes customisable reminders to take and refill medications, a drug-to-drug interaction checker, and medication reporting logbook that users can share with their healthcare professional. The app also includes Medisafe's proprietary Just-In-Time-Intervention (JITI) technology, a machine learning program that learns which interventions - such as timing and messages - are more successful for each user and tailors their experience, aiming for improved adherence results.

Caring Village

<https://caringvillage.com/>

Caring Village is a medication adherence app notable for being aimed at family caregivers. As well as offering a centralised calendar to track appointments, sharable to-do lists, and document storage, the app allows carers to track the taking of medications, to maintain an accurate list of current and past medications, to store photos of pills and bottle labels to avoid confusion and to track refills.

Carezone

<https://carezone.com/home>

The CareZone app guides users in taking photos of each label on their medications to create a detailed list of drugs on the app. The app sends reminders when medication is due and for refills. The app also

allows for tracking of health measurements such as blood pressure, pain, glucose levels etc.. CareZone also supports multiple users allowing for the handling of medications for someone else.

Care4today

<https://care4today.com/index.html>

Care4today Connect is a healthcare management app that includes medication and refill reminders, appointment reminders and activity reminders. The app also generates easy-to-follow reports, detailed trends, and graphs for all self-reported data. It also includes a database of medications allowing users to find and add medications to their own lists to manage complicated regimens.

4. Pill boxes



4.1. Technology description

For those with little to no cognitive impairment, standard pill boxes or organisers can be a sufficient way to manage medication adherence. In their simplest form, these devices consist of labelled compartments into which medications are placed so that correct doses are taken at the correct times. More sophisticated products may include an alarm to remind users to take their medications. Depending on particular physical impairments of the user, specific additional features to pill boxes may also be beneficial (e.g. visual alarms, easy-to-open compartments)¹⁶.

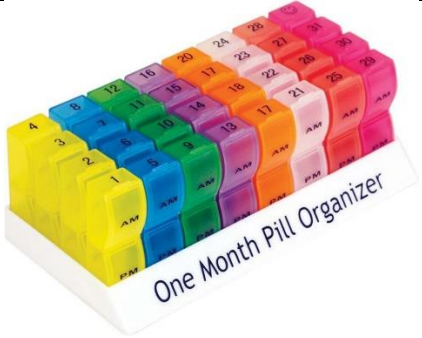
Key features to look for in pill boxes include:

- Legibility of compartment labels: Different days/times are easily distinguishable.
- Number of compartments: Some products include compartments of different times of day (morning, afternoon, evening).
- Compartment size: Are they large enough to store all required medication?
- Build quality – Compartments can close securely and do not break easily.
- Additional features: Visual/audio alarms.



4.2. Simple pill boxes

<p>SE7EN-DAY: 3-Times-A-Day Weekly Pill Organizer https://amzn.eu/d/6EZnusa</p> <ul style="list-style-type: none">• Different coloured compartments for each day.• Three compartments per day – morning, afternoon, evening.	 A 7-day pill organizer with three compartments per day, color-coded by day of the week. The days are labeled: SUN (red), MON (orange), TUE (yellow), WED (green), THU (light blue), FRI (medium blue), and SAT (purple). Each day has three compartments with icons representing morning (sun), afternoon (moon), and evening (sun).
<p>EZY DOSE: Weekly AM/PM Push Button Pill Planner https://ezydose.com/shop/ampm-push-button-pill-planner-xl/</p> <ul style="list-style-type: none">• Designed for those with dexterity or hand sensitivity issues.• Large buttons enable easy opening of compartments.• Rubberised feet that grip the surface for one-handed opening.	 A weekly AM/PM push button pill planner with large buttons and rubberised feet. The days are labeled: Sun, Mon, Tue, Wed, Thu, Fri, and Sat. Each day has two compartments for AM and PM. The AM compartments have a red button and the PM compartments have a purple button.

¹⁶ Freedland, R. (2017) Medication Management Systems: Which? Accessed 08/08/2022
<https://www.techenhancedlife.com/articles/medication-management-systems-which>

<p>Aidapt: Monthly Pill Organiser</p> <p>https://www.mobilitysmart.co.uk/monthly-pill-organiser.html</p> <ul style="list-style-type: none"> • 32 brightly coloured compartments, divided into AM and PM. • Allows for longer term medication sorting. • Sections clip into base for secure storage. 	 <p>The image shows a white plastic base labeled 'One Month Pill Organizer'. It has 32 colorful compartments (yellow, blue, green, purple, orange, pink) arranged in two rows. Each compartment is labeled with a number (1-31) and 'AM' or 'PM'.</p>
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4.3. Pill boxes with alarms




<p>Med-Q: Med-Q Pillbox</p> <p>https://medqpillbox.com/</p> <ul style="list-style-type: none"> • Includes audio alarm and LED lights indicating which compartment holds the pills to be taken. • Removeable compartments to ease dispensing. 	 <p>The image shows a blue pillbox with a digital display showing '8:00' and 'Med-Q'. It has buttons for 'SU', 'M', 'TU', 'W', 'TH', 'F', 'SA', 'SUN', 'MON', 'TUE', 'WED', 'THU', 'FRI', 'SAT'. Two white pill compartments are shown in front of it.</p>
<p>Tabtime – Super 8</p> <p>https://tabtime.com/collections/products/products/tabtime-super-8-vat-free</p> <ul style="list-style-type: none"> • Compartments with magnetic, easy-open clasps to help those with hand tremors or reduced strength. • Up to eight fully programmable daily alarms for multiple reminders and an additional countdown timer for regular or timed interval doses. 	 <p>The image shows a teal pillbox with a digital display showing '8:25'. It has buttons for 'SU', 'M', 'TU', 'W', 'TH', 'F', 'SA', 'SUN', 'MON', 'TUE', 'WED', 'THU', 'FRI', 'SAT'. The pillbox is open, showing several compartments with pills.</p>


5. Medication reminders/alarms

5.1. Technology description


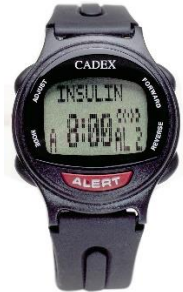
Medication reminders and alarms can be useful in cases of forgetfulness or when trying to manage several medications at a time throughout the day. The alarms offer a simple reminder to take medication at the right time. Features can include clear displays, loud alarms that are difficult to ignore, or portability so they can be carried with the user (e.g. alarm watches). This category of products also includes smart pill bottles which, in addition to providing alarms and reminders to take medication, can monitor adherence by detecting when the bottle is opened.

5.2. Standalone medication reminder alarms



<p>Your Minder</p> <p>https://www.medcentersystems.com/MedCenter-Your-Minder-Personal-Alarm-Clock-p/7326-7.htm</p> <ul style="list-style-type: none"> • Talking alarm clock. • Can be loaded with pre-recorded messages designed to remind the user to take medication. • Can set up to six alerts a day notifying the user of the time, day, and dose of medication. 	 <p>The image shows a black rectangular digital alarm clock with a large LCD display. The display shows the time 10:30 AM, the day FRI, and the date 20. Above the display are several colored buttons (green, blue, yellow, red) and a speaker grille. A black power adapter is plugged into the back.</p>
<p>Robin Clock</p> <p>https://robinclear.com/</p> <ul style="list-style-type: none"> • Large alarm clock with 8" crystal clear high definition colour display. • Talking clock with loud, clear voice. • Create custom alarms, events and reminders. 	 <p>The image shows a white, square-shaped digital alarm clock with a large, clear LCD display. The display shows the day Sunday, the time 10:15 AM, and the date June 14, 2020. The brand name 'robin' is visible at the bottom of the device.</p>
<p>ePill 6 Alarm Pocket Medication Reminder</p> <p>https://www.epill.com/pocketxl.html</p> <ul style="list-style-type: none"> • Pocket-sized device with loud alarm (75 decibels). • Mechanical interface with switches for on-the-hour alarms. 	 <p>The image shows a white, rectangular pocket-sized medication reminder device. It features a digital display showing the time 09:27. Above the display is a row of 12 small red buttons labeled 1 through 12, with 'AM' and 'Noon' indicators. Below the display is a red 'STOP' button and another row of 12 small red buttons labeled 1 through 12, with 'PM' and 'Midnight' indicators. There are also 'H' and 'M' buttons on the right side.</p>

<p>Talking Labels</p> <p>https://www.talkingproducts.com/collections/talking-labels-independent-daily-living/products/talking-label-medication-management</p> <ul style="list-style-type: none"> • Provides audible guidance in identifying and taking medications. • Allows the recording and storing of a voice message. • Simple interface. The recording can be played back at any time with the push of a button. • Attaches to standard medication packaging. 	
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5.3. Wearables

<p>TabTime Vibrating Alarm Watch</p> <p>https://tabtime.com/collections/pill-reminders-and-watches/products/tabtime-vibrating-alarm-watch-with-10-alarms</p> <ul style="list-style-type: none"> • Ability to set up to 10 alarms activated daily until turned off. • Alarm will vibrate for up to 40 seconds and can be cancelled with a button press. • Also includes a hydration reminder, indicated with a water drop icon. 	
<p>ePill CADEX 12 Alarm Watch</p> <p>https://www.epill.com/cadexb.html</p> <ul style="list-style-type: none"> • Can set up to 12 alarms. • Text display. • Includes "Alert" button to access the Medical ID Databank, which stores critical health information. 	

5.4. Smart pill bottles/caps

<p>Pillsy Smart Cap</p> <p>https://www.pillsy.com/</p> <ul style="list-style-type: none">• Bluetooth-enabled smart pill bottle.• Tracks adherence based on when bottle is opened.• Sends reminders, beeping and blinking when it's time to take a dose if the bottle hasn't been opened within the scheduled dose period.• Notifications can be sent to the patient's phone as well as to caregivers so that they are notified if a dose is missed.• Has an accompanying mobile app and clinical support portal to complete the adherence support network.	 The image shows the Pillsy Smart Cap system. It consists of two pill bottles: one orange and one white, both with white caps. In the center is a white smartphone displaying a mobile application interface. The app screen shows a greeting "Hi, Amanda!", a notification for a dose in 7 minutes, and a list of medications including "Phenol Women" and "New Supplement". There are "Take now" and "Label" buttons at the bottom of the app screen.
<p>CleverCap Pro</p> <p>https://cmtcares.com/smartcaps/</p> <ul style="list-style-type: none">• Records date and time of each individual medication dispensed.• Dose-control design to ensure the correct dose administration.• Can dispense multiple pills per dosing window.• Dispensing door can lock between dosing windows.• Attaches to standard industry vials.• Configurable visual and sound reminders.	 The image shows three CleverCap Pro smart caps. Each cap is a white plastic base with a colored top section: the first is orange, the second is yellow, and the third is purple. The caps are designed to fit onto standard pill bottles. The middle cap has the "clevercap" logo on its white base.

6. Automatic pill dispensers

6.1. Technology description

In cases where a person starts experiencing difficulties in adhering to the medication routine prescribed by their doctor, or when they or their caregiver begins to find it a burdensome to fill pill boxes with complex combinations of pills, automatic pill dispensers may be a solution. These devices are designed to make the process of taking medication as simple as possible for the user by making the right combinations of medication available as the right time and to prevent the taking of the wrong medications at the wrong time.

Automatic pill dispensers typically feature a combination of reminders and notifications as well as a system that is designed to dispense the right medication at the right time, and avoid the possibility of taking the wrong medications by using a locking mechanism¹⁷.

Some products also include a medication organiser, designed to eliminate the need for a person to do the repetitive task of sorting numerous pills into individual pill box slots every week. These products can be programmed using an accompanying App or Portal to dispense the medications at specific times and quantities. After the initial setup process, medications can simply be poured into designated containers and the device will dispense them whenever they have been programmed to¹⁸. Compared with simple automatic pill dispensers, these more sophisticated machines are more expensive and have a larger footprint, around the size of a countertop appliance.

6.2. Automatic dispensers

Medelert automatic pill dispenser


<https://www.medelert.com/>

- Up to 6 daily audio & visual alarms with 30-minute duration buzzer alarm and flashing LED reminder light
- Set and forget alarms – Set an alarm once, and it will continue to sound at the same time daily until deprogrammed.



¹⁷ Caro, R. (2021) Automatic Pill Dispenser Evaluations: Hands-on. Tech-enhanced Life. Accessed 08/08/2022 <https://www.techenhancedlife.com/citizen-research/automatic-pill-dispenser-evaluations>

¹⁸ IBID

<p>DosentRx ReX https://www.dosentrx.com/</p> <ul style="list-style-type: none"> • Composed of a reusable drug dispensing unit, disposable cassette, mobile app, and a Dose-E Analytics cloud system. • Medication can only be released at the appropriate time, at the correct dose, and directly into the patient’s mouth. • Accompanying mobile app transfers patient medication adherence data from the drug dispensing unit to the Dose-E Analytics. 	
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6.3. Automatic pill organiser and dispenser

<p>Hero Medication Dispenser https://herohealth.com/</p> <ul style="list-style-type: none"> • Includes audio alarm and blinking light for reminders. • One-button press sorts and dispenses doses. • Holds up to 90-day supply of 10 medications. • Supports any pill size or shape. • Fits standard kitchen counters. 	
<p>MedaCube https://www.medacube.com/</p> <ul style="list-style-type: none"> • Up to 90-day supply of up to 16 different medicines. • Lockable. • Picks and dispenses each dose as set. • Shows a picture of the pills for each dose given. • Tilt sensor alerts for possible tampering or incorrect dosing/spillage. 	
<p>Livi Medication Dispenser https://www.liviathome.com/</p> <ul style="list-style-type: none"> • Up to 90-day supply of up to 15 different medicines • Dispenses up to 24 times a day, accommodating both scheduled and as-needed medications. • Audio and visual alarms. • Dispenses for portable travel packs for up to 14 days. • Battery backup in event of power loss. 	

HiDO

<https://us.hidohealth.com/>

- Designed to monitor medication consumption, patient behaviours, adverse events, and patient study protocols.
- Medications are filled into the device, which detects the medication, dosage, and frequency of each container.
- Users are alerted when it is time to take the medication, at which point it is dispensed to them.
- Includes a front-facing video camera used to confirm the right medications are given at right time to the right patient.





7. Medication adherence platforms/services

7.1. Technology description

Whilst automatic dispensing devices can relieve some of the burden of organising medications, a degree of responsibility and technical knowhow still lies with the user to manage and programme the device. An alternative solution is to arrange for a service that will organise and manage the medication for you. Various such services exist. These will dispense the medications into their own devices or systems which are then delivered to the user.

Additional features are offered to improve adherence such as clear, unambiguous packaging, availability of supplementary devices into which the medication can be dispensed, and linking to an app that can monitor adherence and alert caregivers if a dose is not taken.

7.2. Example medication adherence services

<p>MedMinder https://www.medminder.com/</p> <ul style="list-style-type: none">• A medication adherence platform offering varying levels of service.• Option to have pharmacy fill medication trays which are then sent to users each month by mail.• Also offers pill dispenser products allowing users to remotely manage and pre-set reminders and for caregivers to monitor adherence.	 A photograph of a MedMinder medication adherence tray. It is a white, rectangular tray with a brown lid. The lid is open, revealing a grid of 24 compartments. Each compartment contains a small, white, rectangular pill. The tray is shown from a slightly elevated angle, highlighting its depth and the organized layout of the pills.
<p>PillPack (owned by Amazon) https://www.pillpack.com/</p> <ul style="list-style-type: none">• A web-based pharmaceutical service provider with improved medical adherence in mind.• Their app is the central point of communication, supplemented by phone or fax communication between the physician, health insurer and pharmacy.• Prepacked medications arrive at the door in packs that are clearly marked by date and time of day for the dosages inside.	 A photograph of several PillPack medication packs. The packs are white, rectangular, and feature a clear window showing the pills inside. Each pack is labeled with the time of day and the date, such as '6:00 PM Monday' and '8:00 AM Monday'. The packs are shown from a slightly elevated angle, highlighting their individual design and the clear labeling.

YOURmeds

<https://yourmeds.net/>

- A smart medication management system that is filled by pharmacists and delivered to the user.
- Device features audio and visual reminders when it is time to take the medication.
- Accompanying app can be used to inform caregivers when medication is accessed.
- NICE has a Medtech Innovation Briefing on YOURmeds available at: <https://www.nice.org.uk/advice/mib289>

