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Review

Wearable devices for improving medication adherence in older adults with chronic conditions: A systematic review

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ABSTRACT

Background: Medication adherence remains a major public health challenge, especially among older adults managing multiple chronic conditions and complex therapeutic regimens. Poor adherence is linked to increased mortality, complications, hospital readmissions, higher healthcare costs, and reduced quality of life. Wearable devices (WDs), integrated into everyday accessories and equipped with sensors and reminder systems, may offer a practical strategy to support continuous monitoring and improve adherence. Given the still-limited evidence in this area, this review evaluates the impact of wearable devices on medication adherence among adults aged $\geq$ 65 years with at least one chronic condition, compared with usual care or other educational and technological interventions.

Methods: This systematic review was conducted in accordance with PRISMA 2020 guidelines and registered in PROSPERO (CRD420251045757). A comprehensive search was performed in PubMed, CINAHL, Cochrane Library, Ovid, and EBSCO. Eligible studies included quantitative intervention studies involving community-dwelling adults aged $\geq$ 65 years with at least one chronic condition. Risk of bias was assessed using RoB 2 and ROBINS-I tools.

Results: A total of 1,094 records were identified, and nine studies met the inclusion criteria (seven randomized controlled trials, one quasi-experimental study, one crossover trial), with sample sizes ranging from 10 to 498 participants. WDs were classified into three categories: smartwatches (n = 4), wearable blood pressure (WBP) monitors (n = 4), and ECG monitors (n = 1). Seven of nine studies reported statistically significant improvements in medication adherence in the intervention groups compared with control conditions. Positive effects were observed in 3/4 smartwatch interventions and 3/4 WBP monitor interventions, whereas the ECG-based intervention showed no significant between-group differences.

Conclusion: Wearable devices may support medication adherence in older adults, particularly when integrated with reminder systems and healthcare professional involvement. These findings highlight the importance of embedding wearable technologies within digital health systems and technology-enabled care models for chronic disease management.

1. Introduction

Medication adherence to pharmacological therapy is defined as the extent to which a person's medication-taking behaviour corresponds to recommendations from a healthcare provider. It refers to the initiation, correct implementation, and appropriate discontinuation of a prescribed

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drug regimen, ensuring that the right medication is taken at the right dose, at the right times, and for the intended duration [1].

Suboptimal medication adherence is a rising and worldwide problem, and it is linked to the onset of adverse outcomes [2,3]. Increased mortality, complications, disability, hospital readmission, healthcare costs, and reduced quality of life are a few of the consequences of inadequate medication adherence [4–8]. Older adults, commonly defined as a population aged equal to or greater than 65 years old [9], are at an increased risk of a reduction in medication adherence [10]. The older adults are more frequently affected by chronic diseases [11], with an increased comorbidity burden and a higher number of prescriptions [4] that influence medication adherence [12]. According to WHO shows that nearly 50% of aged patients affected by chronic diseases don't follow the medication protocol prescribed [1] and that almost two-thirds of the older patients in home care settings take multiple drugs [13]. Neurological and physical deficits due to the aging process have a further impact on adherence [14], the same applies to the complexity of the medication protocols [15], and the scarce interaction with healthcare professionals [16]. Considering the increase in the aging population worldwide, estimated at 2,1 billion in 2050 [17], it's evident that non-adherence to medication is becoming a clinical burden on the public health system [10,18] that requires new strategies to address this trend [19].

Those strategies include implementing and using technologies and digital equipment designed to improve medication adherence among older adults with chronic diseases [20,21]. The aging population is increasingly relying on technology, such as smartphone apps, telemedicine, and other digital technologies that aid health assistance, personal condition monitoring, and the promotion of independent management of their clinical conditions [22]. Specifically, mobile health (mHealth) has evolved rapidly to support medication adherence, spreading even within the aging population [23–25]. Despite the well-known advantages, mHealth can show some limitations in use for older patients. For example, reduced mobility can impact the ability to hold and use the device with one hand [26], and decreased hearing can negatively affect the ability to hear and receive alarms and reminders [27]. The current technological expansion has led to the development of more advanced mobile devices, with great potential in the health setting [28]. Among such devices, there are Wearable Devices (WDs), which are multidimensional intelligent technologies, built into various accessories and daily use objects worn continuously or sporadically by users [29–31].

The WDs are able to measure vital signs such as heart rate, blood pressure, respiratory rate, body temperature, energy expenditure, monitoring of physical activity, and posture [32–34]. Integrated sensors and software in WDs are used to collect and transmit data to external platforms for measurement during daily activities [35,36]. WDs can be classified into four types: (i) Smart accessories are electronic devices worn on the body (e.g. smartwatches, glasses, activity trackers etc.) [37–42]; (ii) Smart textiles are integrated into clothing (e.g. vests, pants, gloves, shoes, and socks) [30,43–45]; (iii) Medical patches are devices that adhere directly to the skin [46]; (iv) Other devices refer to WDs worn sporadically for specific measurements (e.g. blood pressure bracelets, touchable devices, glucometers, and spirometers) [30,47,48].

The WDs are used for prevention [49], to diagnose [50], to monitor the health and safety status [51], for rehabilitation [52], to enhance healthy lifestyles [53], and to improve medication adherence [54,55]. The WDs have proven to be effective devices to improve medication adherence and compliance with the recommendations given by the healthcare professionals, particularly in adult populations [54,56]. This is achieved by using audible alarms, vibrations, reminders, or light signals that prompt taking a medication or to follow specific behaviour, or by identifying and tracking the opening of a medication bottle or by recognizing that the medication was swallowed [40,57–59].

Previous reviews have investigated the efficacy of WDs in improving medication adherence across different chronic conditions [60,61]. However, the direct involvement of the aged population is reduced, and the evidence regarding interventions based on WDs with individuals 65 years old or over has not yet been comprehensively synthesized [32,62]. Due to the relevance of the problem of suboptimal medication adherence in the higher age groups [12] and keeping in mind that older adults show a good acceptance of the WDs [63], it appears useful to understand the influence of these devices on medication adherence compared to the interventions that are available at present. The aim of this systematic review is to identify the impact of WDs on improving medication adherence in older adults with chronic conditions. The results could contribute to considering the WDs as a potential strategy to optimise the care of chronic conditions affecting older patients and to prevent adverse outcomes related to non-medication adherence.

2. Methods

2.1. Selection criteria and search strategy

The systematic review was conducted following the guidelines Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [64] and Cochrane Handbook for Systematic Reviews of Interventions [65]. The protocol of this review was registered in the PROSPERO database (code ID: CRD420251045757) [66].

The primary outcome was the improvement in medication adherence with wearable devices in older adults with chronic diseases, compared with usual care or other educational strategies. The search was conducted from May 2025 across the following databases: PubMed, CINAHL (Cumulative Index to Nursing and Allied Health Literature), Cochrane Library, Ovid, and EBSCO. The search strategy combined keywords and controlled vocabulary (e.g., MeSH terms) related to "wearable devices," "medication adherence," and "older adults," along with their synonyms and correlated terms, adapted as needed to the indexing characteristics of each database (Annex 1). A manual search of the reference lists of all included studies was also performed. The research question was structured according to the PICO framework (Population, Intervention, Comparison, Outcomes) [67], with the corresponding elements summarized in Table 1. The inclusion criteria were defined as follows: (i) primary quantitative intervention studies, with or without a control group, and quantitative components of mixed-methods studies; (ii) studies enrolling community-dwelling older adults aged ≥ 65 years [9] with at least one chronic disease; (iii) use of wearable devices (WDs), including any type of body-worn electronic device. The exclusion criteria were: (i) studies conducted in hospital or institutional settings where healthcare professionals manage medication administration; (ii) qualitative studies, secondary research, development or feasibility studies, grey literature, and study protocols.

2.2. Data extraction and Quality assessment

Two reviewers independently screened the records. In case of disagreement that was not solved via consensus, a third reviewer arbitrated the decision process.

For data extraction, we used a form that included the following features: Study design, type of wearable device employed (including a

Table 1
PICO framework.

P	*Population*	Older adults, conventionally defined as people aged 65 years or over (9), with at least one chronic disease.
I	*Intervention*	Use of WDs is defined as any multidimensional intelligent technologies, built into various accessories and daily use objects worn continuously or sporadically by clients (29–31) in homecare setting.
C	*Comparator*	Usual care or other strategies/devices
O	*Outcome*	Improvement in medication adherence is defined as the degree to which a person's behaviour in taking drugs corresponds to the recommendations agreed with the health care professional (1).

concise description of the technology, mode of use, and any integrated intervention components), sample characteristics (sample size, mean age, and chronic conditions), follow-up; instruments used to assess medication adherence, comparator conditions (usual care or alternative strategies/devices), risk of bias assessment; and impact on medication adherence.

Two reviewers independently conducted the assessments, and any discrepancies were resolved through discussion with a third reviewer. Following the recommendations of the Cochrane Handbook for Systematic Reviews of Interventions [65], the risk of bias for randomized studies was assessed using the Revised Cochrane Risk-of-Bias Tool for Randomized Trials (RoB 2) [68]. For non-randomized studies, the Risk of Bias in Non-randomized Studies of Interventions (ROBINS-I) tool was applied [69]. For each outcome the domains were analysed by the respective tools and given an overall rating. In the randomized studies, the bias risk was classified as "low", with "some concerns", or high [68]; in the non-randomized studies, it was classified as "low", "moderate", "serious", or "critical" [69].

3. Results

A total of 1,094 records were initially retrieved across the selected databases. After removing duplicates, 379 unique records proceeded to title and abstract screening. Full-text articles were then assessed for eligibility, and nine studies met the predefined inclusion criteria and were ultimately included in the review. The detailed selection process and reasons for exclusion are presented in the PRISMA flowchart (Fig. 1).

3.1. Studies characteristics

In the final analysis, nine studies published between 2009 and 2025 were included. Seven of these studies (77,8%) were randomized clinical trials (RCTs) [70,71,74–78], one (11,1%) a quasi-experimental study with a post-hoc analysis [72], and one (11,1%) a crossover trial [73]. Four studies (44,5%) were conducted in China [71,72,74,77], three (33,3%) in the USA [73,76,78], one (11,1%) in the Republic of Korea

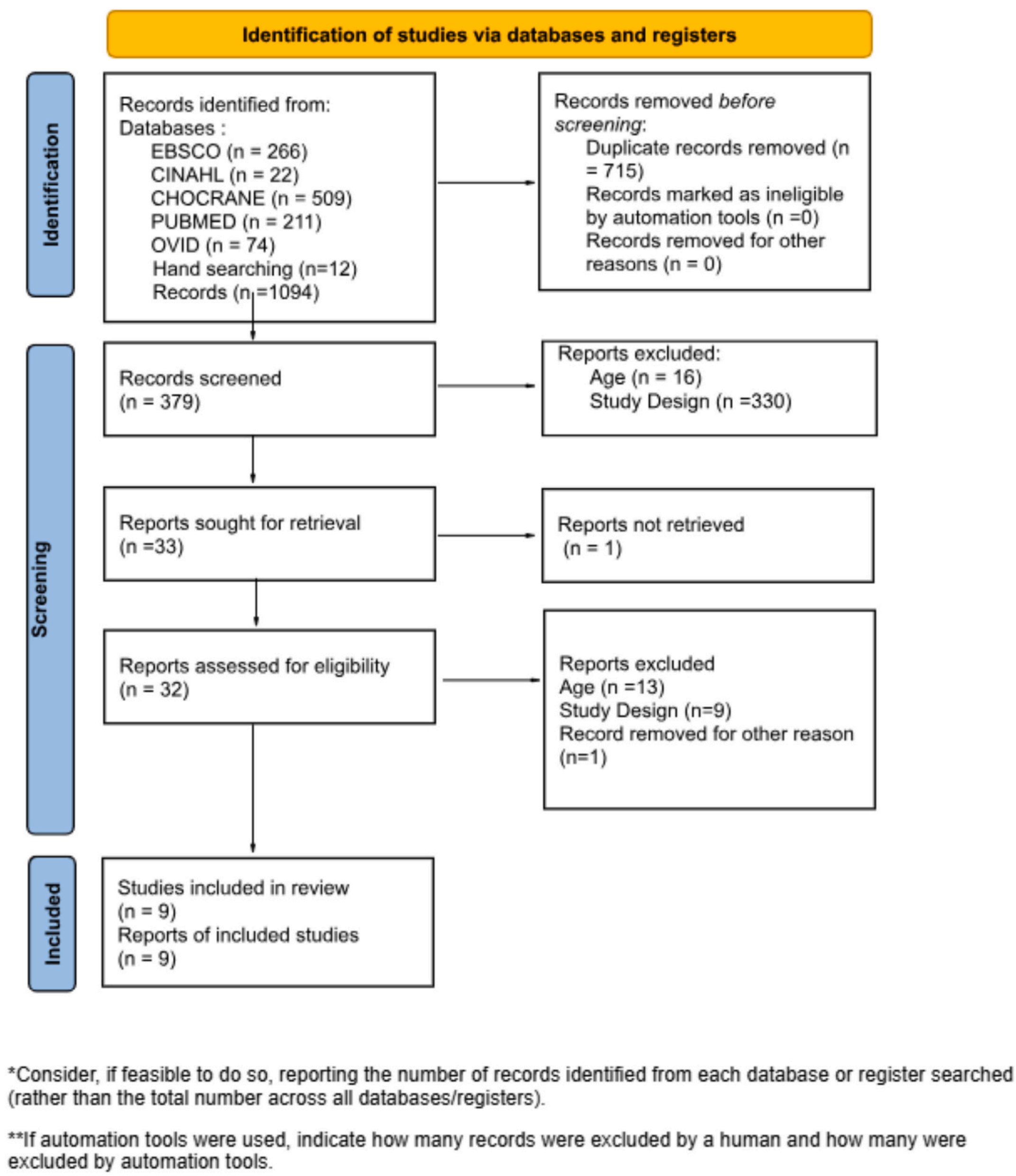

Fig. 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 flowchart for study selection.

[75], and one (11,1%) in Turkey [70]. The study sample ranged from 10 to 498 participants, with a mean age between 65,6 and 82,7 years. The chronic conditions represented in the included study populations primarily encompassed hypertension [70,72,74,76,77] and atrial fibrillation [71,75,78]. In one study, the specific chronic disease affecting participants was not reported [73]. A summary of the main characteristics of the included studies is reported in Table 2**.**

3.2. Classification and characteristics of WDs

Different WDs models were used in the studies. The devices were organized into homogeneous categories, with each category defining the primary distinguishing characteristics to aid comparative analysis. The WDs were classified into three major areas:

Smartwatch, Wearable Blood Pressure (WBP) monitors and ECG monitors.

Smartwatch was defined as a device intended to be worn on the wrist, featuring a small digital screen with a touchscreen or mechanical buttons for operation. The Smartwatch connects via Bluetooth to a smartphone application that sends feedback and notifications, enabling two-way interaction. The smartwatch passively collects data via sensors measuring parameters such as blood pressure [72]. Actively, it gathers data when users confirm or respond to reminders [70,73]. The app can also send collected data to a central hub for healthcare professionals to monitor remotely [71,72]. Within four studies (44,4%), a Smartwatch [70–73] was used; in three studies the devices had an integrated reminder for taking medication [70,71,73], in the other one [72] the Smartwatch had the ability to measure the arterial blood pressure and was linked to a mobile app. Two studies [71,72] reported real-time monitoring, and in one study [73], the Smartwatch was connected to other household devices. Additional services included a treatment training program and telephone counseling service [70]; Hayes et al. [73] employed a context-aware prompting system based on a network of home environmental sensors (motion, contact, telephone, and bed pressure), integrated with an electronic pillbox, an activity beacon with visual and auditory signals, and a messaging watch for personalized notifications.

Wearable Blood Pressure (WBP) monitors were classified as devices intended to be worn intermittently on the body, typically on the wrist or arm, and are usually composed of a bracelet or an adjustable band. Both devices include sensors to measure blood pressure, an analysis unit to process the sensor data, and a communication module to display the results. Specifically, the analog signal generated by the sensors is converted to digital and processed by the internal analysis module. In addition, the bracelet has a wireless connection, such as Bluetooth or Wi-Fi, to synchronize the data with smartphones or a dedicated platform for data visualization and analysis [74,75]. Four studies (44.4%) used WBP monitors with real-time monitoring and connection to other devices [74–77]. In two studies [74,75], the WBP was connected to a mobile app with a reminder function, and in three studies [74,76,77], the real-time data was directly sent to a specific hub. Additional services included management knowledge and psychological support information sent via app [74], telephone contact based on clinical need (counseling or medication adjustment) [76], and continuous monitoring and interaction via digital platform combined with education and active supervision [77].

ECG monitor is defined as a small, portable ECG device used by placing the fingers on electrodes to obtain a trace sent to a smartphone [78]. It is a single-lead touchable ECG device with no wires or patches, used in combination with a smartphone to perform unlimited cardiac measurements. Using the device requires downloading the specific application and placing the second and third fingers of both hands on the device's sensors. The system provides the recorded results via Bluetooth to the application. All data are automatically saved on the smartphone, allowing easy access and review of the history. Users send the ECGs to a dedicated online portal accessible to healthcare professionals [78]. Additional services included only a reminder for the submission of ECG recordings [78].

Finally, the interaction with healthcare professionals was defined as follows: support from professionals at any stage of the intervention (training, reminders, direct contact, on-demand consultations) and real-time monitoring, with the possibility of bidirectional interaction between professionals and participants. In two studies [70,71], Smartwatches included interaction with a nursing team; three WBP monitors involved a medical team [74,76,77]; and the ECG monitor featured interaction with a healthcare team, reminding patients to submit their ECG recordings [78].

The specific characteristics of each WD are listed in Table 3.

3.3. The impact of WDs on medication adherence

In seven of nine studies, the group that used WDs reported greater improvement in medication adherence than the control group that received traditional care or other interventions and/or devices [70,71,73–75,77,78].

Smartwatch: Three studies that used a Smartwatch with a reminder function reported significant improvements in medication adherence [70–72]. In the Solmaz et al. study [70], participants wearing the Smartwatch had significantly higher scores on the self-report medication adherence scale than those who received only a telephonic consultation ($p < 0.001$) or no intervention ($p = 0.459$). Similar results were achieved in the Chen et al. study [71], in which the intervention group had higher scores on the self-report tool ($p = 0.025$) and on the Proportion of Days Covered (PDC) method ($p < 0.001$). Also, in the cross-over trial study of Hayes et al. [73], during the phase that delivered alarm reminders through different devices, including wearable messaging watches, medication adherence, as measured by the opening of the pillbox, was significantly greater than in the other phases ($p < 0.001$). The Zhang et al. study [72] shows contradictory results. The self-reported medication adherence scores among Smartwatch users were lower than those among non-users ($p < 0.001$). The risk of bias in studies that used smartwatches was evaluated as "low" in three studies [71–73] and as "some concerns" in one [70].

WBP monitor: The WBP monitor was used in four studies [74–77]. In Wang et al.'s study [74], medication adherence scores increased significantly in the intervention group compared with the control group ($p < 0.05$). Yoon et al. study [75] reveals a higher percentage of treatment adherence among WD users ($p = 0.007$). However, in Rifkin et al. study [76] no statistically significant differences were found between the two groups. In Kong et al.'s study [77], medication adherence improved significantly in the WD-wearing group ($p < 0.05$). In three studies [74,76,77], medication adherence was measured with self-report tools, while in one study [75], it was calculated as the difference between the pills dispensed and those remaining in the box, related to the number of days of intake, expressed as a percentage. The risk of bias assessment identified "some concerns" in three studies [74,75,77] and "low" concerns in one [76].

ECG monitor: In Tran et al. study [78], despite the percentage of pill taking in the intervention group were higher, there was no statistically difference with the control group. No differences in the percentage of patients forgetting at least one administration were noticed. The assessment of the risk of bias in this study raised "some concerns" [78].

4. Discussion

The results of this systematic review suggest that the use of WDs in older adults is associated with improved medication adherence in seven of nine studies [70,71,73–75,77,78].

Smartwatches had the greatest and most consistent impact on medication adherence. In particular, the smartwatches that provided a reminder function and interaction with the nurse team [70,71] seemed to be the most promising strategy to enhance medication adherence in

Table 2
Characteristics of included studies.

Author Year Country	Study Design	Sample (mean age DS)	%ER eligible rate %RR retention rate	Chronic Disease	Treatment	HCPs in Contact	Comparator Treatment	Follow up	Outcome	Improvement Medication Adherence Measurement Tool	Improvement Medication Adherence	Risk of Bias*
Solmaz et al. (2024) Turkey (70)	RCT	90 older adults (72,4 ± 6,8)	N.A.	Hypertension	**Smartwatch:** Medication reminders; Training/education sessions.	Nurse team	Educational interventions; no interventions	3 months	**Primary outcome:** Medication Adherence **Secondary Outcome:** Blood pressure control; Knowledge about hypertension and treatment	Medication Adherence Self-Efficacy Scale–Short Form (MASES-SF) [79]	WD > CT group 1:(+) WD > CT group 2:(+)	Some concerns
Chen et al. (2022) China (71)	RCT	210 older adults (70,0 ± 8,9)	N.A.	Atrial fibrillation	**Smartwatch:** Medication reminders	Nurse team	Routine home and outpatient follow-up visits	12 months	**Primary outcome:** Medication adherence **Secondary outcomes:** Persistence of therapy; Clinical safety outcomes	Morisky Medication Adherence Scale-8 (MMAS-8) [80] Percentage of Days Covered (PDC) cut off > 80%	WD > CT: (+)	Low
Zhang et al. (2020) China (72)	Quasi-experimental study with post-hoc analysis	212 older adults (71,3 ± 6,8)	N.A. RR = 95,3%	Hypertension	**Smartwatch+ app mobile:** Blood pressure self-monitoring	Not available	Participants who did not use the device daily (not-users)	1 month	**Primary outcome:** Monitoring adherence **Secondary outcomes:** Medication adherence	Compliance of Hypertensive Patients' Scale (CHPS) [81]	CT > WD: (NS)	Low
Hayes et al. (2009) USA (73)	Cross-over trial	10 older adults (82,7 ± 6,4)	N.A. RR = 70%	Not specified	**Smartwatch:** Medication reminders. Multiple sensor devices to detect daily activity patterns and provided context-aware	Not available	No reminder; Visual and audible reminder on pillbox	3 months	**Primary outcome:** Medication adherence **Secondary outcomes:** System usability; Medication-taking patterns	Opening the electronic pillbox (MedTracker) within the prescribed time window (±90 min of the scheduled dosing time)	WD > CT group 1: (+) WD > CT group 2: (+)	Low
Wang et al. (2025) China (74)	RCT	400 older adults (67,5 ± 7,3)	N.A.	Hypertension	**WBP bracelet + app mobile:** Real-time monitoring; Automatic data transmission with medical supervision; Medication reminders. Digital health education; Support for self-	Medical team	Periodic outpatient visits; Standard health education	Not available	**Primary Outcomes:** Medication Adherence, Blood pressure control; **Secondary outcomes:** Quality of life; Hypertension knowledge; Self-management ability	Morisky Medication Adherence Scale-8 (MMAS-8) [80]	WD > CT: (+)	Some concerns

(*continued on next page*)

Table 2 (*continued*)

					management.							
Yoon et al. (2024) Republic of Korea (75)	RCT	498 older adults (65,6 ± 10,3)	ER = 99,4% RR = 80,5%	Atrial fibrillation	**WBP bracelet + app mobile:** Medication reminders; Logging of pill-taking behaviour; Feedback on adherence patterns; Educational interventions	Not available	Standard follow-up and education provided in routine clinical practice	6 Months	**Primary Outcome:** Medication adherence to edoxaban. **Secondary outcome:** Clinical outcomes; Quality of life;	Pill count (cut off > 95%)	WD > CT: (+)	Some concerns
Rifkin et al. (2013) USA (76)	RCT	43 older adults (68,2 ± 7,7)	ER = 39,3% RR = 91,5%	Hypertension	**WBP bracelet Bluetooth-enabled:** Blood pressure self-monitoring; Automatic data transmission; Regular clinical review; Proactive follow-up.	Medical team	Home blood pressure measurements manually and bring those records to clinic visits	6 Months	**Primary outcomes:** Data sharing and data exchange **Secondary outcome:** Medication adherence	Morisky Medication Adherence Scale-8 (MMAS-8) [80]	CT > WD: (NS)	Low
Kong et al. (2022) China (77)	RCT	157 older adults (79,38 ± 9,9)	N.A.	Coronary heart disease, hypertension, diabetes	**WBP bracelet+ monitor:** Multiparameter monitoring of blood pressure and blood glucose; Automatic data transmission with medical supervision and adjustments to care.	Medical team	Visits; routine follow-up; self-care education; daily paper report	3 Months	**Primary outcomes:** Blood pressure control; glycaemic control; lipid profile **Secondary Outcomes:** Medication Adherence; Self-management ability; Quality of life	Morisky Medication Adherence Scale-8 (MMAS-8) [80]	WD > CT: (+)	Some concerns
Tran et al. (2022) USA (78)	RCT	94 older adults (70,8 ± 8,0)	N.A. RR = 94%	Atrial fibrillation	**ECG monitor smartphone-based:** Reminder about ECG record	Nurse and medical team	Monthly visits	6 Months	**Primary outcome:** Medication adherence **Secondary outcomes:** Persistence with therapy; Clinical outcomes; Engagement with ECG monitoring	Pill Count	WD > CT: (NS)	Some concerns

%ER = eligible rate; %RR = retention rate; HCPs Healthcare Professional; WD Wearable Device Group; CT Comparator Treatment Group; *(+) Statistically significant results; **NS Not statistically significant results, N.A. = Not available.

* Across the included studies, the main methodological concerns were related to limitations in the randomization process, insufficient reporting of allocation concealment, lack of blinding due to the nature of the interventions, potential confounding in non-randomized studies, and incomplete reporting of adherence outcome assessment.

Table 3
Characteristics of WDs.

Author	WD	Type	Model	App mobile connection	HUB connection	Other devices connection	Monitoring real time	Additional service	Healthcare professional interaction
Solmaz et al. (70)	Smartwatch	Bracelet	–	–		–	–	✔	✔
Chen et al. (71)	Smartwatch	Bracelet	–	–	✔	–	✔	–	✔
Zhang et al. (72)	Smartwatch	Bracelet	–	App smartphone	✔	✔	✔	–	–
Hayes et al. (73)	Smartwatch	Bracelet	–	–	–	✔	–	✔	–
Wang et al. (74)	WBP Monitor	Bracelet	Lox i7 (LS805)	WeChat Tencent	✔	✔	✔	✔	✔
Yoon et al. (75)	WBP Monitor	Bracelet	UA-651BLE, A&D Medical	App smartphone	–	✔	✔	–	–
Rifkin et al. (76)	WBP Monitor	Bracelet	A&D Medical UA-767PBT	–	✔	✔	✔	✔	✔
Kong et al. (77)	WBP Monitor	Bracelet	Shenzhen, BP-88G	–	✔	✔	✔	✔	✔
Tran et al. (78)	ECG Monitor	Electrodes	AliveCor Kardia	App smartphone	–	✔	–	✔	✔

older adults, showing results similar to those of studies conducted in younger populations [82]. This may be due to the frequent use of reminders, even among the older population, and to the low level of technological competencies required to use Smartwatches [21]. In addition, according to the literature, interaction with healthcare professionals amplifies the use and effectiveness of reminders, providing personalized care and assistance absent in automated systems [83]. In one included study [72], older adults who were less compliant with taking medications or healthy lifestyle behaviours were more likely to be wearing the Smartwatch. This result, which differs from those of other studies [84], could be related to the absence of interaction with healthcare professionals or, more likely, to the one-month follow-up window, which is shorter than in the other studies. The literature suggests that technological or digital interventions to improve medication adherence yield greater effects over longer periods, while their short-term impact is less stable [85,86].

The studies that used WBP devices included real-time monitoring and reported significant improvements in treatment adherence among older adults in three of the studies [74,75,77]. Therefore, it could be assumed that the awareness of the monitoring or the monitoring itself could have encouraged the patient to adhere to the medication prescription [87], and the possibility to modify the drug therapy in real time could facilitate it. WBPs were all integrated into other interventions [74–77], which could have helped the patient be more conscious of their health status, thereby indirectly impacting medication adherence, even when the devices were associated with wider intervention [61]. Specifically, studies that used WBPs, which have a higher impact on medication adherence, involved devices linked to a mobile app with a reminder program [74,75]. It is interesting to note that in the Yoon et al. study [75] with the WBPs, the intervention group, aged 65 years and older, showed a higher medication adherence score after 6 months than the younger groups. This suggests that not only is the intervention effective, but it has a lasting, greater, and long-acting impact within this age group.

The use of the ECG monitor did not significantly improve medication adherence. The touchable ECG alone is a passive intervention: it records data but does not provide personalized alerts or interaction with healthcare professionals regarding medication intake (only for the correct submission of the ECG recording) [78]. However, greater compliance with ECG monitor use was associated with higher medication adherence. This suggests that touchable devices may not increase adherence on their own but could serve as an indicator of intrinsically motivated patients.

Regardless of the type of WDs used, and in accordance with previous studies, the interaction with nurse or medical team, real-time feedback mechanisms, and reminder systems appeared to be the main factors in improving medication adherence among older adults [86,88,89]. Similar to mHealth interventions, this could underline the importance of integrating WD technology with personalised interventions to have a significant impact on adherence [90]. The older population has accepted wearable technology as a monitoring device, and to modify the behaviour accordingly, despite reported difficulties with the device's usability, as found in the literature [91]. It's worth noting that in the studies no problems were reported in the use of the WDs or in the technological interventions combined with them. Although higher digital health literacy is associated with increased usability of WDs and apps [92] and improved medication adherence [93], this aspect wasn't considered in the studies, because the competencies required for the use of the WDs are minimal. Only one study [72] explicitly considers technological fluidity in the forecast of device adherence but does not correlate it with treatment adherence.

The integration between the WD and the widely available mHealth app could overcome the limitation of reduced usability of technologies and devices, which were not designed to account for the physical limitations frequently present in the aged users [21,26,27,93].

In conclusion, in seven studies, the older population included was affected by cardiovascular diseases (hypertension, atrial fibrillation) [70–72,74–77], underlining an evident interest in applying WDs to manage chronic diseases with high prevalence [94]. Nevertheless, the functions of WDs could expand to handle other equally common chronic conditions. That suggests the need to conduct further studies on populations affected by different diseases to assess the adaptability of wearable technologies.

This systematic review has some limitations that should be acknowledged. First, the number of eligible studies was limited; however, this largely reflects the still-emerging evidence base on wearable-device interventions specifically targeting adults aged $\geq$ 65 years, rather than shortcomings in the search strategy. Second, most interventions combined WDs with additional components (e.g., education, monitoring, or follow-up), which may hinder attribution of effects to the wearable technology alone; nevertheless, multi-component programmes are typical in real-world digital health implementation, and the review explicitly mapped these elements to support interpretation. Furthermore, substantial heterogeneity in both intervention components and adherence operationalization precluded quantitative synthesis and limited cross-study comparability. Finally, none of the included studies reported data on wearable device battery life. This limitation may have influenced device engagement and continuity of monitoring, thereby potentially affecting adherence-related outcomes [96]. Despite these considerations, the review provides a structured and up-to-date synthesis of the available evidence and offers a useful framework for understanding how wearable technologies are currently integrated into adherence-support interventions.

5. Conclusion

Wearable devices represent a promising component of technology-enabled care models for improving medication adherence in older adults. Their effectiveness appears to be enhanced when integrated with reminder functions, real-time monitoring, and healthcare professional support. However, current evidence remains limited and heterogeneous, highlighting the need for further research focusing on scalable and system-integrated digital health interventions across diverse chronic conditions.

CRediT authorship contribution statement

Sofia Taborri: Writing – original draft, Methodology, Investigation, Data curation, Conceptualization. **Erika Renzi:** Writing – review & editing, Visualization, Methodology, Data curation, Conceptualization. **Azzurra Massimi:** Writing – review & editing, Supervision, Methodology, Conceptualization. **Alessandra Improta:** Investigation, Data curation. **Emanuele Di Simone:** Supervision, Investigation, Data curation. **Noemi Giannetta:** Methodology, Investigation, Data curation. **Nicolò Panattoni:** Supervision, Investigation, Data curation. **Sara Dionisi:** Methodology, Investigation, Data curation. **Marco Di Muzio:** Writing – review & editing, Visualization, Supervision, Methodology, Conceptualization. **Leandro Amato:** Writing – original draft, Visualization, Methodology, Investigation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijmedinf.2026.106515.

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