

Bartłomiej Labut¹, Miraslau Kabak², Konrad Puchalski³, Kamil Szczepański⁴,
Maria Lewowska⁵, Aleksandra Pudzianowska⁶

Received: 28.11.2025

Accepted: 02.03.2026

Published: 22.04.2026

Mobile applications and wearable devices in epilepsy: effectiveness, safety, and practical recommendations for neurologists

Aplikacje mobilne i urządzenia noszone w padaczce: skuteczność, bezpieczeństwo i praktyczne rekomendacje dla neurologów

¹ Henryk Klimontowicz Specialist Hospital in Gorlice, Gorlice, Poland

² Jan Mikulicz-Radecki University Clinical Hospital, Wrocław, Poland

³ Voivodeship Specialist Hospital in Wrocław, Research and Development Centre, Wrocław, Poland

⁴ 4th Military Clinical Hospital with Polyclinic SP ZOZ, Wrocław, Poland

⁵ University of Opole, Opole, Poland

⁶ Polish Mother's Health Center Institute in Łódź, Łódź, Poland

Correspondence: Bartłomiej Labut, Henryk Klimontowicz Specialist Hospital in Gorlice, Węgierska 21, 38-300 Gorlice, Poland, e-mail: bartlomiej.labut@gmail.com

¹ Szpital Specjalistyczny im. Henryka Klimontowicza w Gorlicach, Gorlice, Polska

² Uniwersytecki Szpital Kliniczny im. Jana Mikulicza-Radeckiego we Wrocławiu, Wrocław, Polska


³ Wojewódzki Szpital Specjalistyczny we Wrocławiu, Ośrodek Badawczo-Rozwojowy, Wrocław, Polska

⁴ 4. Wojskowy Szpital Kliniczny z Polikliniką SP ZOZ, Wrocław, Polska

⁵ Uniwersytet Opolski, Opole, Polska

⁶ Instytut Centrum Zdrowia Matki Polki, Łódź, Polska

Adres do korespondencji: Bartłomiej Labut, Szpital Specjalistyczny im. Henryka Klimontowicza w Gorlicach, ul. Węgierska 21, 38-300 Gorlice, e-mail: bartlomiej.labut@gmail.com

 <https://doi.org/10.15557/AN.2025.0027>

ORCID iDs

1. Bartłomiej Labut <https://orcid.org/0009-0000-7986-1652>

4. Kamil Szczepański <https://orcid.org/0009-0004-7425-9565>

2. Miraslau Kabak <https://orcid.org/0009-0000-4140-7147>

5. Maria Lewowska <https://orcid.org/0009-0001-8043-1729>

3. Konrad Puchalski <https://orcid.org/0009-0002-0452-4904>

6. Aleksandra Pudzianowska <https://orcid.org/0009-0009-6959-578X>

Abstract

Epilepsy is a common chronic neurological disorder that causes recurrent seizures, reduces quality of life, and increases the risk of unexpected death. The development of seizure-detection systems through mobile health technology has become possible due to rapid progress in wearable sensor technology and portable electroencephalography devices, and smartphone-based applications. This review examines existing research on these tools, which help treat epilepsy in both adult and paediatric patients. A medical literature search from 2015 to 2025 included systematic reviews and meta-analyses, randomised controlled trials, and clinical guidelines evaluating seizure-detection precision, self-management tools, telemonitoring functions, and patient-reported outcomes. Mobile applications which allow users to track seizures, send medication alerts, and access educational content show potential to enhance treatment compliance, although more research is needed to confirm their effectiveness. The combination of wearable devices with portable electroencephalography technology allows extended surveillance which successfully identifies generalised tonic-clonic seizures in clinical tests; however, their performance decreases when used in home environments because of increased false alerts. Telemedicine systems that combine application data with detector information allow healthcare providers to track patients remotely, which results in enhanced safety results for patients who have recurring seizures or nocturnal events. Future research should evaluate the medical value and deployment methods of mobile applications, wearable devices, and portable electroencephalography systems which show promise as innovative epilepsy treatment solutions.

Keywords: telemedicine, mobile applications, electroencephalography, epilepsy, wearable electronic devices

Streszczenie

Padaczka to powszechna, przewlekła choroba neurologiczna, która powoduje nawracające napady, obniża jakość życia i zwiększa ryzyko niespodziewanej śmierci. Rozwój systemów wykrywania napadów z wykorzystaniem mobilnych technologii medycznych stał się możliwy dzięki szybkiemu postępowi w dziedzinie czujników noszonych, przenośnych

elektroencefalografów i aplikacji na smartfony. Niniejszy przegląd analizuje dostępne badania dotyczące tych narzędzi, wspierających leczenie pacjentów z padaczką zarówno w wieku dorosłym, jak i dziecięcym. Przegląd literatury medycznej z lat 2015–2025 obejmował przeglądy systematyczne i metaanalizy, randomizowane badania kontrolowane oraz wytyczne, które oceniały precyzję wykrywania napadów, narzędzia do samodzielnego leczenia, funkcje telemonitoringu oraz wyniki informacji zwrotnej od pacjentów. Aplikacje mobilne, które umożliwiają użytkownikom monitorowanie napadów, wysyłanie przypomnień o przyjmowaniu leków i dostarczanie treści edukacyjnych, wykazują potencjał w zakresie poprawy przestrzegania zaleceń terapeutycznych, jednak konieczne są dalsze badania w celu potwierdzenia ich skuteczności. Połączenie urządzeń noszonych z przenośną technologią elektroencefalograficzną umożliwia rozszerzony nadzór, który skutecznie identyfikuje uogólnione napady toniczno-kloniczne podczas badań w warunkach klinicznych, jednak ich skuteczność maleje w warunkach domowych ze względu na zwiększoną liczbę fałszywych alertów. Systemy teledygnetyczne łączące dane z aplikacji z informacjami z detektorów umożliwiają pracownikom ochrony zdrowia monitorowanie pacjentów na odległość, co przekłada się na poprawę bezpieczeństwa, zwłaszcza u osób z napadami nawracającymi lub występującymi w godzinach nocnych. Dalsze badania powinny ocenić wartość medyczną i metody wdrażania aplikacji mobilnych, przenośnych urządzeń i systemów elektroencefalograficznych stanowiących obiecujące, innowacyjne rozwiązania w leczeniu padaczki.

Słowa kluczowe: teledygnetyka, aplikacje mobilne, elektroencefalografia, padaczka, urządzenia elektroniczne do noszenia

INTRODUCTION

Epilepsy affects approximately 70 million individuals worldwide and is associated with recurrent seizures that substantially impair quality of life (Ong et al., 2022). Sudden unexpected death in epilepsy (SUDEP) occurs at an estimated rate of one to nine deaths per 1,000 patients with epilepsy per year (Hampel et al., 2019; Ermongkonchai et al., 2025; Maguire et al., 2020). Around 30–40% of patients remain uncontrolled despite pharmacological interventions, underscoring the need for improved monitoring and additional therapeutic support (Ong et al., 2022). Electroencephalography (EEG) remains the standard diagnostic tool, but long-term ambulatory EEG monitoring is often impractical in everyday life. In recent years, advances in wearable technologies, such as motion sensors, electrocardiography devices, portable EEG systems, and mobile applications, have enabled the development of seizure detection systems designed to support better seizure control (Biondi et al., 2022; Johansson et al., 2018; Ong et al., 2022; Sasseville et al., 2024; van Westrhenen et al., 2019).

This review analyses these technologies in terms of seizure-detection performance and practical usability. In particular, it considers the sensitivity and specificity of motion sensors, the performance of mobile EEG systems, and the value of home monitoring of vital signs such as heart rate, oxygen saturation, and respiration (Biondi et al., 2022; Bruno et al., 2018; Seth et al., 2024; van Westrhenen et al., 2019). It also discusses self-management applications (including seizure diaries and medication reminders) and telemedicine solutions used in epilepsy care (Bahrani et al., 2017; Gotlieb et al., 2025; Khoshkangin et al., 2023; Mohammadzadeh et al., 2021; Sajatovic et al., 2018). Although available studies report encouraging results, most are pilot projects conducted in controlled experimental settings; therefore, further validation is required before these technologies can be

widely adopted in routine clinical practice (Gotlieb et al., 2025; Ong et al., 2022; Sasseville et al., 2024).

The aim of the review is to collect and synthesise current evidence on the use of innovative technologies in the care of patients with epilepsy. Special attention is given to clinical effectiveness: how well wearable devices and mobile EEG systems detect seizures, and how applications and remote monitoring influence treatment adherence and patients' quality of life (Biondi et al., 2022; Gotlieb et al., 2025; Khoshkangin et al., 2023; Michaelis et al., 2024; Ong et al., 2022; Sasseville et al., 2024). The review also examines limitations and barriers to the use of wearable devices, mobile EEG, applications and remote monitoring, as well as their impact on clinical workflows and integration into existing models of care (Gotlieb et al., 2025; Mohammadzadeh et al., 2021; Sasseville et al., 2024; Sudhakar et al., 2020).

Several key clinical questions are addressed:

- Which technologies and devices currently offer the highest sensitivity and specificity for detecting and predicting epileptic seizures (Biondi et al., 2022; Johansson et al., 2018; Sasseville et al., 2024; Seth et al., 2024; van Westrhenen et al., 2019)?
- To what extent do mobile self-management applications improve patients' knowledge, adherence to treatment, and overall quality of life (Gotlieb et al., 2025; Khoshkangin et al., 2023; Michaelis et al., 2024; Modi et al., 2023; Mohammadzadeh et al., 2021; Sepulveda et al., 2024)?
- Do remote monitoring and telemedicine, compared with standard care, improve patient safety and reduce risk of SUDEP and other complications (Bahrani et al., 2017; Ermongkonchai et al., 2025; Gotlieb et al., 2025; Maguire et al., 2020; Sajatovic et al., 2018)?

The review aims to provide neurologists with an up-to-date synthesis of the available evidence and practical guidance on the informed use of these innovations in everyday clinical practice.

MATERIALS AND METHODS

This article is a narrative review based on a structured literature search examining mobile applications and wearable devices in epilepsy, with a focus on effectiveness, safety, and practical recommendations. A literature search was performed in the PubMed/MEDLINE database in November 2025, covering publications from 2015 to 2025. Citation tracking and “snowballing” (review of reference lists and similar articles) were also applied.

The search strategy combined MeSH descriptors with free-text terms. Core queries included terms related to epilepsy (“epilepsy”, “seizures”) paired with terms describing mobile technologies and wearable devices (“mobile applications”, “smartphone”, “wearable electronic devices”, “electroencephalography”, “accelerometry”, “actigraphy”, “photoplethysmography/PPG”). These were supplemented with clinical and usability outcomes such as seizure detection, sensitivity and specificity, adherence, usability, safety, privacy, and SUDEP. The search was restricted to studies conducted in humans and to publications in English or Polish, in accordance with methodological standards recommended for narrative and systematic reviews.

The following types of studies were included: systematic reviews, meta-analyses, guidelines, and randomised controlled trials. Articles were considered eligible if they involved patients with epilepsy (adults or children), evaluated wearable or mobile solutions (e.g. seizure detection systems, seizure diaries, telemonitoring) and reported relevant outcomes: seizure-detection metrics (sensitivity, specificity, positive predictive value – PPV, negative predictive value – NPV, alarm burden), adherence, quality of life, safety/privacy, or impact on care (Gotlieb et al., 2025; Ong et al., 2022; Sasseville et al., 2024). Studies conducted in animals or exclusively in healthy volunteers, purely engineering reports without clinical testing, studies using technologies without an appropriate comparator, case reports lacking effectiveness data, and non-peer-reviewed materials were excluded.

Search results were exported and duplicate entries were removed. A two-step selection process was then applied: first, titles and abstracts were screened; second, full texts were assessed for eligibility. From the included studies, the following data were extracted: population characteristics, type of technology, reference (“gold standard”) comparator, effectiveness measures, adherence and quality-of-life indicators, safety and privacy information and reported limitations. Study quality was assessed using AMSTAR 2 (for reviews and meta-analyses), AGREE II (for guidelines) and RoB 2 (for randomised controlled trials). Owing to the heterogeneity of technologies, a qualitative synthesis was performed and key parameters were presented in tables. As this review is based solely on published data, approval from a bioethics committee was not required.

RESULTS

Classes of tools and clinical applications

Recent years have seen the emergence of a wide range of digital tools – mobile applications and wearable devices – that support the care of patients with epilepsy and are gradually changing models of care (Gotlieb et al., 2025; Khoshkangin et al., 2023; Ong et al., 2022; Sasseville et al., 2024). These solutions can be grouped into four main categories: seizure diaries and self-monitoring applications, seizure detection systems, wearable sensors and mobile EEG, and telemonitoring platforms (Tab. 1).

Applications for seizure recording allow patients or caregivers to document seizure frequency, duration, and circumstances. Many also provide medication reminders, educational modules, and options for sharing data with the treating physician (Alzamanan et al., 2024; Gotlieb et al., 2025; Khoshkangin et al., 2023; Michaelis et al., 2024; Mohammadzadeh et al., 2021; Sepulveda et al., 2024). These applications support the assessment of treatment effectiveness and help patients adhere to their management plan,

Class of technology	Main clinical purpose	Key signals/data	Typical users and setting
Seizure diaries and self-monitoring apps	Documentation of seizures; support of adherence and education	Self-reported seizures, medication, triggers	Adults and adolescents; home use with outpatient follow-up
Seizure detection systems (wearable alarms)	Automatic detection of generalised tonic-clonic seizures; alerts to caregivers	Accelerometry, electrodermal activity, heart rate	Patients with frequent/generalised seizures; home use, especially nocturnal monitoring
Wearable physiological sensors	Long-term monitoring of physiological parameters; SUDEP risk markers	EEG, PPG, EMG, electrodermal activity, heart rate, respiratory rate	Patients with diagnostically challenging seizures; research and extended monitoring
Mobile EEG systems	Long-term EEG recording outside hospital; support for diagnosis and seizure quantification	EEG	Adults and children requiring extended EEG; home/outpatient settings
Telemonitoring platforms	Remote follow-up and clinical decision-making between visits	Aggregated seizure logs, device events, adherence data, and PROMs	Patients under specialist care; home (patient) and clinic (clinician) use

EEG – electroencephalography; EMG – electromyography; PPG – photoplethysmography; PROMs – patient-reported outcome measures; SUDEP – sudden unexpected death in epilepsy.

Tab. 1. Main classes of mobile and wearable technologies in epilepsy care

particularly adults and adolescents transitioning from paediatric care.

Seizure detection systems – most commonly wristbands or smartwatches equipped with motion and physiological sensors – automatically detect seizures and send alerts to caregivers or other designated recipients (Johansson et al., 2018; Sasseville et al., 2024; Seth et al., 2024; van Westrhenen et al., 2019). They are used in patients with frequent seizures, including children with drug-resistant epilepsy, and are especially valuable for nocturnal seizures, when rapid caregiver intervention may reduce the risk of SUDEP (Ermongkonchai et al., 2025; Hampel et al., 2019; Maguire et al., 2020). Existing devices perform well for generalised motor seizures, although they may generate false alarms (Sasseville et al., 2024; Seth et al., 2024).

Wearable devices that monitor EEG, PPG, EMG (electromyography), and electrodermal activity enable long-term tracking of physiological parameters in the home environment (Biondi et al., 2022; Bruno et al., 2018; Seth et al., 2024; van Westrhenen et al., 2019). They provide objective seizure documentation, help identify subclinical activity, and allow analysis of physiological markers associated with SUDEP risk. These tools are particularly useful in research settings and in patients with diagnostically challenging seizures.

Telemonitoring platforms integrate data from applications, seizure diaries, and detection devices, allowing physicians to monitor disease course remotely (Bahrani et al., 2017; Gotlieb et al., 2025; Sajatovic et al., 2018; Sudhakar et al., 2020). Such platforms can support clinical decision-making between outpatient visits, although further development and standardisation are required before they can be fully integrated into healthcare systems.

These technologies are used at home, in outpatient clinics and, to some extent, in hospital settings. Key challenges include detection reliability, ease of use, patient acceptability, and data security (Gotlieb et al., 2025; Mohammadzadeh et al., 2021; Sasseville et al., 2024). Despite these limitations, modern mobile and wearable tools represent a valuable addition to epilepsy care and have the potential to improve safety, engagement, and quality of life in this patient population.

Effectiveness – what studies tell us

The effectiveness of mobile applications and wearable devices in seizure detection, patient safety, treatment adherence monitoring, and patient-reported outcomes has been evaluated in multiple studies (Gotlieb et al., 2025; Khoshkangin et al., 2023; Ong et al., 2022; Sasseville et al., 2024). Available evidence indicates that these technologies are most effective for specific seizure types, require appropriate monitoring modalities, and must be interpreted within clinical context.

Wearable seizure detection systems based on accelerometry and physiological signal monitoring show the highest effectiveness in detecting generalised tonic-clonic seizures

(Johansson et al., 2018; Sasseville et al., 2024; Seth et al., 2024). Studies evaluating wrist-worn devices that monitor motion, electrodermal activity, and heart rate have demonstrated reliable detection of convulsive seizures, particularly under supervised or controlled conditions (Sasseville et al., 2024; Seth et al., 2024; van Westrhenen et al., 2019). These devices are clinically useful for patients with frequent generalised motor seizures, especially when seizures occur during sleep or in unsupervised situations. Their effectiveness is markedly lower for non-motor seizures, including typical absence seizures and focal impaired-awareness seizures (Johansson et al., 2018; Sasseville et al., 2024; van Westrhenen et al., 2019). These seizure types often lack overt motor manifestations or pronounced autonomic changes, making them difficult to detect using motion- or physiology-based wearables. Consequently, current wearable detectors cannot serve as standalone tools for comprehensive seizure counting across all epilepsy syndromes.

Mobile EEG systems and long-term ambulatory EEG devices address some limitations of wearable detectors by enabling prolonged recording of cerebral activity in everyday environments (Biondi et al., 2022; Ong et al., 2022). Studies of portable and subscalp EEG systems show that signal quality is comparable to conventional EEG, allowing identification of both motor and non-motor seizures, including focal and absence seizures (Biondi et al., 2022). These technologies are particularly useful in diagnostically challenging cases and in patients requiring extended monitoring over weeks or months. However, current evidence is based mainly on small study populations, and routine clinical use is limited by practical challenges such as data management, high interpretation workload, and restricted system availability (Biondi et al., 2022).

Mobile self-management applications influence epilepsy care indirectly by supporting treatment adherence, patient engagement, and disease awareness (Gotlieb et al., 2025; Khoshkangin et al., 2023; Mohammadzadeh et al., 2021). Research shows that seizure diaries, medication reminders, and educational features facilitate accurate seizure documentation and promote adherence to prescribed antiepileptic drug regimens (Michaelis et al., 2024; Modi et al., 2023; Sepulveda et al., 2024). Improved adherence is clinically relevant, as missed doses are a well-established cause of seizure recurrence. Although most studies do not demonstrate a consistent reduction in seizure frequency attributable solely to application use, users report better self-management, increased sense of control, and improved communication with healthcare professionals (Gotlieb et al., 2025; Khoshkangin et al., 2023). These benefits appear particularly relevant for adolescents and adults receiving outpatient care. Telemedicine and telemonitoring platforms further enhance effectiveness of mobile and wearable technologies by enabling remote clinical supervision (Bahrani et al., 2017; Gotlieb et al., 2025; Sajatovic et al., 2018). Integration of seizure diary data with outputs from wearable detectors allows clinicians to identify changes in seizure patterns, assess treatment response, and intervene promptly when

problems arise. Available evidence suggests that telemedicine-based epilepsy care is feasible and acceptable to both patients and clinicians, with outcomes comparable to conventional in-person follow-up in selected populations (Bahrani et al., 2017; Sajatovic et al., 2018). Although current studies do not demonstrate reductions in seizure frequency or SUDEP incidence, telemonitoring may improve patient safety by enabling earlier intervention and reinforcing adherence (Ermongkonchai et al., 2025; Gotlieb et al., 2025; Maguire et al., 2020).

Overall, current research indicates that mobile and wearable technologies function as adjunctive tools in epilepsy management rather than replacements for established diagnostic and therapeutic approaches (Gotlieb et al., 2025; Ong et al., 2022). Wearable detectors are most effective for generalised tonic-clonic seizures, mobile EEG systems extend diagnostic capabilities for non-motor seizures, and applications together with telemedicine platforms support adherence and continuity of care. Further research is needed to evaluate long-term clinical impact using robust endpoints such as seizure frequency, injury rates, and mortality.

SAFETY AND LIMITATIONS

Mobile and wearable technologies in epilepsy care offer important advantages but also introduce safety concerns and operational constraints (Gotlieb et al., 2025; Mohammadzadeh et al., 2021; Sasseville et al., 2024). A key issue is the reliability of seizure-detection equipment. Wearable seizure detectors using wrist-worn sensors to track motion and heart rate show good performance for convulsive seizures under laboratory conditions; however, in everyday use they often generate numerous false alerts, leading to stress for patients and caregivers, sleep disturbances, and reduced responsiveness to subsequent alarms (Sasseville et al., 2024; Seth et al., 2024). These devices also have limited ability to detect certain seizure types, frequently failing to recognise brief focal seizures and sleep-related seizures that do not produce marked body activity (Johansson et al., 2018; Sasseville et al., 2024; van Westrhenen et al., 2019). Existing detection gaps prevent patients from relying on wearable devices to identify all seizure events.

Use of detectors for generalised tonic-clonic seizures is further complicated by practical issues such as device removal for bathing or recharging, which creates periods without monitoring (Sasseville et al., 2024). Additional limitations include restricted detection capabilities and reduced user comfort. Skin irritation from adhesive electrodes or ear-canal EEG sensors has been reported, and wearable EEG headsets may lose contact or shift position during sleep (Biondi et al., 2022; Sasseville et al., 2024). The visibility and size of some monitoring devices may attract unwanted attention, increasing self-consciousness, and contributing to early discontinuation (Sasseville et al., 2024). Effective use therefore requires an appropriate balance between detection sensitivity and user acceptability, as devices perceived

as overly intrusive or inconvenient are unlikely to be used long term.

Mobile health applications for epilepsy are generally safe in terms of physical adverse effects, but they raise other concerns. Data security remains an important issue, as applications process sensitive medical information that may be exposed if adequate safeguards are not in place (Gotlieb et al., 2025; Mohammadzadeh et al., 2021). Robust encryption and compliance with privacy standards are essential before widespread clinical implementation. Another limitation is insufficient validation: many available applications do not meet established quality criteria for content and functionality, and few have been evaluated in controlled clinical studies (Gotlieb et al., 2025; Khoshkangin et al., 2023; Mohammadzadeh et al., 2021). Usability challenges also persist, as some applications have complex interfaces, limited language options, or designs poorly suited to individuals with lower health literacy (Mohammadzadeh et al., 2021; Sudhakar et al., 2020). As a result, patients may discontinue use shortly after initial installation if perceived benefits are limited.

Telemonitoring platforms offering remote care services provide several advantages but also introduce operational constraints (Bahrani et al., 2017; Gotlieb et al., 2025; Sajatovic et al., 2018). These systems can improve access to care and support ongoing clinical supervision for patients living in remote areas or during public health emergencies. However, remote monitoring cannot fully replace in-person assessment, as direct examination allows identification of clinical features that may not be captured remotely. The effectiveness of telehealth also depends on reliable internet access and basic digital skills, creating a risk of unequal access for patients with limited technological resources (Sudhakar et al., 2020). Data protection is another concern, as breaches of confidentiality may undermine patient trust. Implementation in routine practice is further challenged by the need to manage large volumes of patient-generated data and to establish clear procedures and adequate resources for responding to remote alerts (Gotlieb et al., 2025).

Overall, these technologies show considerable potential but require careful management of safety-related issues and operational limitations (Gotlieb et al., 2025; Ong et al., 2022; Sasseville et al., 2024). Challenges such as false alarms, missed events, device discomfort, privacy concerns, and implementation barriers highlight the importance of user-centred design and thorough clinical validation. Ongoing efforts focus on improving detection accuracy, enhancing device comfort, and strengthening data protection to support the safe integration of mobile and wearable technologies into epilepsy care.

PRACTICAL RECOMMENDATIONS FOR THE NEUROLOGIST

Neurologists should encourage patients and caregivers to obtain video recordings of seizures whenever it is safe to do so.

Such recordings can greatly facilitate differentiation between epileptic and psychogenic non-epileptic events, and support therapeutic decision-making. Families and patients need guidance on how to obtain good-quality footage and how to maintain safety while filming.

Wearable sensors can support seizure monitoring by recording motion or physiological parameters. Devices such as wristbands with accelerometers, heart rate sensors, or mobile EEG can detect tonic-clonic seizures with good sensitivity but may also generate false alarms (Johansson et al., 2018; Sasseville et al., 2024; Seth et al., 2024). These limitations should be discussed with patients, and device selection should be tailored to the individual's lifestyle and seizure profile.

Use of validated applications that support self-care is recommended. Programmes for seizure recording, medication reminders, and patient education can increase engagement in treatment and improve adherence (Gotlieb et al., 2025; Khoshkangin et al., 2023; Michaelis et al., 2024; Modi et al., 2023; Sepulveda et al., 2024). Applications should be matched to patients' abilities, including interface language and complexity. Regular use should be reviewed during follow-up visits, and implementation can be facilitated through collaboration with an interdisciplinary team, such as health educators, to ensure adequate support in disease management.

In everyday practice, SUDEP prevention must remain a key consideration. Optimising seizure control through appropriate pharmacological treatment and timely referral for neurosurgical evaluation in drug-resistant cases is essential (Ermongkonchai et al., 2025; Hampel et al., 2019; Maguire et al., 2020). In the presence of nocturnal seizure risk, alarm sensors such as bed-mounted motion or respiratory detectors may be considered to enable faster caregiver response (Sasseville et al., 2024; Seth et al., 2024). Cardiovascular and respiratory risk factors should be monitored, and cardiology consultation arranged when indicated (Bruno et al., 2018; Ermongkonchai et al., 2025).

Telemedicine has an important role in modern care. Remote consultations allow clinicians to monitor seizure frequency, assess treatment effectiveness, and provide ongoing support for self-management, particularly when clinic access is limited (Bahrani et al., 2017; Gotlieb et al., 2025; Sajatovic et al., 2018). Progress with telemedicine tools should be reviewed regularly, and their impact on disease course assessed. Integration of information technologies can substantially improve epilepsy care, provided that patients receive appropriate training and that the limitations of these solutions are recognised.

DISCUSSION

Modern technologies – mobile applications, wearable devices, and portable EEG systems – have the potential to support the care of patients with epilepsy (Biondi et al., 2022; Gotlieb et al., 2025; Johansson et al., 2018; Ong et al., 2022).

Mobile applications enable documentation of seizures and medication schedules; wearable devices offer automatic seizure detection; and portable EEG systems provide extended monitoring of brain activity. Each class serves a distinct purpose and brings specific benefits, but each is also associated with important limitations.

Mobile applications may improve adherence and patient engagement, which in turn can contribute to better seizure control (Gotlieb et al., 2025; Khoshkangin et al., 2023; Michaelis et al., 2024; Modi et al., 2023). Their quality and functionality, however, vary considerably, and only a minority have undergone formal validation. Evidence that application use improves hard clinical outcomes remains limited, and no formal recommendations exist regarding their implementation. Consequently, use of such tools should be considered on an individual basis, with careful attention to their constraints (Gotlieb et al., 2025; Mohammadzadeh et al., 2021).

Wearable devices such as wristbands and watches equipped with motion and physiological sensors can automatically detect generalised seizures. In controlled settings, reported sensitivities reach approximately 90%, enabling rapid caregiver alerts and facilitating timely intervention, such as injury prevention (Johansson et al., 2018; Sasseville et al., 2024; Seth et al., 2024; van Westrhenen et al., 2019). In home environments, performance is less reliable; false alarms are frequent, and non-motor seizures may be missed. Although many users report feeling safer when using seizure detectors, robust evidence that these devices reduce injuries, hospitalisations, or epilepsy-related deaths is lacking (Ermongkonchai et al., 2025; Hampel et al., 2019; Maguire et al., 2020; Sasseville et al., 2024). Further development is needed to improve accuracy, reduce false alarms, and expand detection to a broader spectrum of seizures, as well as to quantify their impact on clinically meaningful outcomes (Sasseville et al., 2024; Seth et al., 2024).

Mobile EEG systems, including headbands and implantable recorders, allow long-term recording of brain activity in the home environment (Biondi et al., 2022; Ong et al., 2022). These technologies can facilitate diagnosis and long-term monitoring outside hospital settings. Preliminary studies suggest signal quality comparable to conventional EEG and promising seizure detection sensitivity; however, routine clinical use remains limited. Additional research is required to confirm effectiveness and reliability in larger cohorts and to address practical barriers, including the management and analysis of large data volumes. At present, mobile EEG should be viewed as a complement to established diagnostic and monitoring methods rather than a replacement (Biondi et al., 2022) (Tab. 2).

In summary, the technologies discussed offer opportunities to improve disease control, quality of life, and safety through enhanced seizure detection and monitoring. Given their current limitations, they should be regarded as supportive tools rather than substitutes for standard treatment. Further research, including well-controlled clinical

Class of technology	Main clinical benefits	Key limitations	Level/strength of evidence
Mobile self-management applications	Improved engagement, better adherence, improved seizure documentation	Heterogeneous quality, few validated apps, scarce hard clinical outcome data	Observational and feasibility studies, few RCTs
Seizure detection wearables (alarms)	High sensitivity for generalised motor seizures in controlled settings, faster caregiver response, increased perceived safety	Frequent false alarms; poorer real-world performance, non-motor seizures often missed, uncertain impact on injuries/SUDEP	Pilot and prospective validation studies, expert guidance
Mobile EEG systems	Extended EEG monitoring at home, improved seizure quantification, support for diagnosis	Limited routine availability; data management burden; need for specialised expertise	Early clinical and feasibility studies, small cohorts
Telemedicine and telemonitoring platforms	Improved access to specialist care, structured remote follow-up, support for treatment adjustment and self-management	Heterogeneous platforms, limited integration with healthcare systems, organisational, legal, and reimbursement barriers	Observational studies; heterogeneous systematic reviews, guidelines and expert opinions

EEG – electroencephalography; **RCT** – randomised controlled trial; **SUDEP** – sudden unexpected death in epilepsy.

Tab. 2. Effectiveness, limitations, and evidence for digital technologies in epilepsy

trials, is needed to determine their impact on seizure frequency, injuries, mortality, and SUDEP, and to develop evidence-based guidelines for their use, particularly given the absence of national recommendations in Poland (Ermongonchai et al., 2025; Gotlieb et al., 2025; Maguire et al., 2020; Ong et al., 2022).

CONCLUSIONS

Mobile applications and wearable devices represent a valuable adjunct to the care of patients with epilepsy. These tools can support seizure monitoring and improve treatment adherence, thereby enhancing patient safety – for example, by detecting tonic-clonic seizures and notifying caregivers – and increasing patient engagement in therapy (Gotlieb et al., 2025; Khoshkangin et al., 2023; Ong et al., 2022; Sas-seville et al., 2024). Given the limited clinical validation and absence of formal guidelines, they should be used as supportive rather than replacement methods for standard diagnostic and therapeutic approaches. Each tool should be selected on an individual basis, and patients should be provided with clear information about its capabilities and limitations (Biondi et al., 2022; Gotlieb et al., 2025; Mohammadzadeh et al., 2021).

Conflict of interest

The authors do not report any financial or personal connections with other persons or organisations which might negatively affect the content of this publication and/or claim authorship rights to this publication.

Author contribution

Original concept of study: BL, ML. Collection, recording and/or compilation of data; analysis and interpretation of data: BL, MK, KP, KS, ML, AP. Writing of manuscript: BL, KP, AP.

References

- Alzamanan MZ, Lim KS, Ismail MA et al.: Development of an epilepsy self-management mobile health app framework: content validity study results. *PLoS One* 2024; 19: e0302844.
- Bahrani K, Singh MB, Bhatia R et al.: Telephonic review for outpatients with epilepsy – a prospective randomized, parallel group study. *Seizure* 2017; 53: 55–61.
- Biondi A, Santoro V, Viana PF et al.: Noninvasive mobile EEG as a tool for seizure monitoring and management: a systematic review. *Epilepsia* 2022; 63: 1041–1063.
- Bruno E, Maira G, Biondi A et al.: Ictal hypoxemia: a systematic review and meta-analysis. *Seizure* 2018; 63: 7–13.
- Ermongkonchai T, Kwok M, Prinsloo D et al.: Cardiac arrhythmias in sudden unexpected death in epilepsy: a systematic review. *Epilepsy Behav* 2025; 171: 110582.
- Gotlieb E, Marzoughi S, Kwon CS et al.: Clinical effectiveness, feasibility, acceptability, and usability of mobile health applications for epilepsy: a systematic review. *Epilepsia* 2025; 66: 1349–1373.
- Hampel KG, Rocamora Zuñiga R, Quesada CM: Unravelling the mysteries of sudden unexpected death in epilepsy. *Neurologia (Engl Ed)* 2019; 34: 527–535.
- Johansson D, Malmgren K, Alt Murphy M: Wearable sensors for clinical applications in epilepsy, Parkinson's disease, and stroke: a mixed-methods systematic review. *J Neurol* 2018; 265: 1740–1752.
- Khoshkangin A, Agha Seyyed Esmail Amiri FS, Ghaddaripouri K et al.: Investigating the role of mobile health in epilepsy management: a systematic review. *J Educ Health Promot* 2023; 12: 304.
- Maguire MJ, Jackson CF, Marson AG et al.: Treatments for the prevention of Sudden Unexpected Death in Epilepsy (SUDEP). *Cochrane Database Syst Rev* 2020; 4: CD011792.
- Michaelis R, Knake S, Rosenow F et al.: A multicenter randomized controlled feasibility trial of a digital self-management intervention for adults with epilepsy. *Epilepsia Open* 2024; 9: 1021–1033.
- Modi AC, Patel AD, Mara CA et al.: Pilot randomized controlled clinical trial of an adherence social norms intervention for adolescents with epilepsy. *Epilepsy Behav* 2023; 140: 109082.
- Mohammadzadeh N, Khenarinezhad S, Ghazanfarisavadkoobi E et al.: Evaluation of m-health applications use in epilepsy: a systematic review. *Iran J Public Health* 2021; 50: 459–469.
- Ong JS, Wong SN, Arulsamy A et al.: Medical technology: a systematic review on medical devices utilized for epilepsy prediction and management. *Curr Neuropharmacol* 2022; 20: 950–964.
- Sajatovic M, Colon-Zimmermann K, Kahrman M et al.: A 6-month prospective randomized controlled trial of remotely delivered group format epilepsy self-management versus waitlist control for high-risk people with epilepsy. *Epilepsia* 2018; 59: 1684–1695.

Sasseville M, Attisso E, Gagnon MP et al.: Performance, impact and experiences of using wearable devices for seizure detection in community-based settings: a mixed methods systematic review. *Mhealth* 2024; 10: 27.

Sepulveda R, Chong J, Shegog R et al.: Experiences of using the MINDSET self-management mobile health app among Hispanic patients: results of a qualitative study. *Epilepsy Behav* 2024; 153: 109702.

Seth EA, Watterson J, Xie J et al.: Feasibility of cardiac-based seizure detection and prediction: a systematic review of non-invasive wearable sensor-based studies. *Epilepsia Open* 2024; 9: 41–59.

Sudhakar S, Aebi ME, Burant CJ et al.: Health literacy and education level correlates of participation and outcome in a remotely delivered epilepsy self-management program. *Epilepsy Behav* 2020; 107: 107026.

van Westrhenen A, De Cooman T, Lazeron RHC et al.: Ictal autonomic changes as a tool for seizure detection: a systematic review. *Clin Auton Res* 2019; 29: 161–181.