THE RESEARCH RESERVOIR of Paramedical Sciences
International Peer- Reviewed, Referred, Indexed Journal July - December 2026 Volume: 12 Issue: 2

EVALUATING PATIENT EXPERIENCES WITH MULTIMODAL SENSOR DEVICES FOR SEIZURE DETECTION IN TERTIARY NEURO CARE UNITS, RIYADH, KSA - A DESCRIPTIVE CROSS-SECTIONAL STUDY

Dr. Premalatha Jayachandra*| Ahmed Alrasheedi| Azhar Ali Alazhary***| Dr. Sheeba George******

*Shift Manager, National Neuroscience Institute, Nursing Administration, King Fahad Medical City, Riyadh, Kingdom of Saudi Arabia.
**Director of Nursing, National Neuroscience Institute, Nursing Administration, King Fahad Medical City, Riyadh, Kingdom of Saudi Arabia.
***Unit Manager, National Neuroscience Institute, Nursing Administration, King Fahad Medical City, Riyadh, Kingdom of Saudi Arabia.
****Shift Manager, Obesity, Endocrine & Metabolism Center, Ambulatory Care Nursing Administration, King Fahad Medical City Hospital, Riyadh, Kingdom of Saudi Arabia.

https://doi.org/10.47211/trr.2026.v12i02.001

ABSTRACT

Background: *Multimodal sensor technologies may support seizure monitoring by providing additional information during seizure-related events. Understanding patients' experiences, perceptions, and concerns is important for their appropriate clinical implementation.*

Objective: *This study explored patients' experiences, perceptions, and attitudes toward the use of a multimodal sensor device for seizure detection and identified challenges related to device use and the clinical and technical support provided during monitoring.*

Methods: *A descriptive study was conducted among 50 patients using a multimodal seizure-detection sensor device in an inpatient epilepsy monitoring setting. Data were collected using a structured questionnaire assessing patient experience, nursing care, and EEG technician involvement and support on a five-point Likert scale. Open-ended responses regarding experiences and challenges were summarized descriptively. Descriptive statistics were used to summarize participant characteristics and questionnaire responses.*

Results: *Patients generally reported favorable experiences with the multimodal sensor device. Comfort was rated Good or Very Good by 66.0% of patients, while 74.0% rated ease of use and understanding as Good or Very Good. Confidence in the device's ability to alert staff promptly during a seizure was rated Good or Very Good by 82.0%. Nursing support was positively perceived, with 90.0% rating nurses' confidence in handling the device as Good or Very Good. EEG technician support was also generally favorable, although lower ratings were observed for responsiveness to device-related problems and follow-up. Reported challenges included interference with movement or daily activities (52.0%), skin irritation or physical discomfort (22.0%), difficulty maintaining sensor position (16.0%), and difficulty understanding the device (8.0%). Technical problems were reported by 2.0%.*

Conclusion: *Patients reported generally favorable experiences with multimodal sensor device use. However, challenges related to movement, discomfort, sensor positioning, and technical support remained. Standardized education, continued nursing competency, multidisciplinary communication, and clear technical support pathways may promote patient-centered implementation.*

Keywords: *epilepsy; seizure detection; multimodal sensor; wearable technology; patient experience; nursing care; EEG; seizure monitoring*

INTRODUCTION

Epilepsy is a chronic neurological disorder characterized by recurrent seizures that can adversely affect physical safety, psychological well-being, daily functioning, and quality of life. Fisher et al. (2014) emphasized the importance of accurate seizure identification and classification in epilepsy care, while Mesraoua et al. (2020) highlighted the broader risks associated with uncontrolled seizures, including injury and psychosocial consequences. Because seizures vary considerably in their clinical presentation, timely recognition remains an important aspect of patient management.

The Research Reservoir
THE RESEARCH RESERVOIR of Paramedical Sciences
International Peer- Reviewed, Referred, Indexed Journal July - December 2026 Volume: 12 Issue: 2

Epilepsy Monitoring Units (EMUs) provide continuous video-electroencephalographic (EEG) monitoring to support seizure characterization and clinical decision-making. Elger and Hoppe (2018) noted that seizures may be under-recognized because of impaired awareness, sleep-related events, or subtle clinical manifestations. Continuous observation by nurses, physicians, and EEG technicians therefore remains essential during prolonged monitoring.

Advances in technology have introduced wearable and multimodal systems that detect seizure-related physiological and behavioral changes. Beniczky et al. (2019) described wearable devices as promising tools for seizure detection while highlighting challenges related to clinical performance and implementation. Onorati et al. (2021) evaluated a multimodal convulsive seizure detection system among pediatric and adult patients in an EMU, demonstrating the potential value of combining multiple physiological signals. Frankel et al. (2021) examined reduced-channel EEG technology for remote seizure monitoring, while Elezi et al. (2022) investigated automated seizure detection and seizure-pattern morphology. You et al. (2022) further demonstrated the application of personalized automated detection using behind-the-ear EEG. Lehnen et al. (2025) reported real-time seizure detection using a behind-the-ear wearable system, and Zae et al. (2021) evaluated multimodal wearable seizure detection in the EMU setting.

Technology-assisted seizure management has also developed beyond conventional monitoring. Cook et al. (2013) demonstrated the feasibility of long-term seizure-likelihood prediction using an implanted advisory system, illustrating the potential role of technology in supporting seizure management. Baumgartner et al. (2025) further discussed the expanding role of seizure detection devices and the challenges associated with their clinical application.

However, technical performance alone does not determine the usefulness of wearable devices. Beck et al. (2020) found that willingness to use body-worn monitoring devices was influenced by patients' perceptions of their usefulness and acceptability. Armstrong et al. (2020) similarly highlighted the importance of patient perspectives when considering wearable seizure detection. Simblett et al. (2020) identified comfort, physical burden, mobility, and usability as important aspects of patients' experiences with multimodal sensor devices. Olsen et al. (2021) further reported that experiences during real-life use may influence acceptance and continued use of seizure-monitoring technologies.

Understanding user preferences is therefore essential for successful implementation. Sivathamboo et al. (2022) found that comfort, convenience, usability, and perceived benefits were important considerations in users' experiences with wearable devices. van Westrhenen et al. (2021), examining caregivers' perspectives, also emphasized the importance of reliable monitoring and appropriate support surrounding seizure-detection technologies.

During EMU monitoring, nurses provide continuous patient observation, education, reassurance, and clinical support, while EEG technicians are responsible for technical aspects such as device application, maintenance, and troubleshooting according to institutional protocols. Patient confidence in device alerts, ease of use and understanding, comfort, physical discomfort, and interference with daily activities may therefore influence the overall experience of multimodal sensor monitoring.

Evidence regarding patients' experiences with multimodal seizure-detection devices remains limited in the Saudi Arabian context. Therefore, this study aimed to evaluate the experiences, perceptions, and attitudes of patients with epilepsy using a multimodal sensor device during routine video-EEG monitoring in the EMU at the National Neuroscience Institute, King Fahad Medical City, Riyadh, Saudi Arabia. The study specifically examined patient experience, comfort, physical discomfort, interference with daily activities, ease of use and understanding, confidence in seizure alerts, nursing care, and EEG technician involvement and support.

THE RESEARCH RESERVOIR of Paramedical Sciences
International Peer- Reviewed, Referred, Indexed Journal July - December 2026 Volume: 12 Issue: 2

METHODOLOGY

Research Approach

A quantitative descriptive approach was adopted to examine patients' experiences, perceptions, satisfaction, and challenges associated with the use of a multimodal sensor device for seizure monitoring. A structured questionnaire was used to obtain quantitative data, with one open-ended question included to provide additional contextual information about participants' experiences and suggestions.

Research Design

A descriptive exploratory design was used to describe patients' experiences with the multimodal sensor device during epilepsy monitoring. The study examined comfort, physical discomfort, interference with daily activities, ease of use and understanding, confidence in seizure alerts, nursing support, and EEG technician involvement and support.

Study Setting

The study was conducted in the Epilepsy Monitoring Unit (EMU) of the National Neuroscience Institute (NNI), King Fahad Medical City (KFMC), Riyadh, Saudi Arabia. The EMU provides specialized inpatient monitoring for patients with epilepsy and suspected seizure disorders through continuous video-EEG monitoring and clinical observation. Multimodal sensor monitoring was integrated with video surveillance, EEG monitoring, nursing observation, and physician assessment. EEG technicians provided technical support according to institutional procedures.

Study Population

The study population comprised adult patients with a confirmed diagnosis of epilepsy who were admitted to the EMU and had direct experience using the multimodal sensor device during their admission for seizure monitoring.

Sampling Technique

Purposive sampling was used to recruit participants who met the predefined eligibility criteria and had sufficient experience with the multimodal sensor device. Approximately 5–6 potentially eligible patients were admitted to the EMU each week, depending on clinical diagnosis, admission patterns, and monitoring requirements.

Sample Size

Approximately 60–72 potentially eligible patients were expected during the three-month data-collection period. Based on an accessible population of 72 patients, a single-proportion approach using a 95% confidence level, an expected proportion of 50%, and approximately 8% precision, with finite population consideration, produced an estimated sample of approximately 52 participants. Considering recruitment feasibility and the descriptive nature of the study, a target sample of 50 participants was established. A total of 50 eligible patients completed the questionnaire.

Participant Recruitment

Eligible patients were approached during their EMU admission after they had sufficient exposure to the device to provide meaningful feedback. The study purpose, procedures, voluntary nature of participation, confidentiality, and the right to decline or withdraw without affecting clinical care were explained. Written informed consent was obtained before data collection.

Inclusion Criteria

Participants were eligible if they were aged 18 years or older, had a confirmed diagnosis of epilepsy, had used the multimodal sensor device during their EMU admission, and had sufficient exposure to the device to provide meaningful feedback. Participants were also required to understand the study information, provide informed consent, and communicate their experiences in the language used for questionnaire administration.

The Research Reservoir
THE RESEARCH RESERVOIR of Paramedical Sciences
International Peer- Reviewed, Referred, Indexed Journal July - December 2026 Volume: 12 Issue: 2

Exclusion Criteria

Patients were excluded if they had cognitive impairment that could affect reliable self-reporting or a severe psychiatric condition that, according to the treating team's clinical judgment, could interfere with participation or completion of the questionnaire.

Data Collection Instrument

Data were collected using a structured questionnaire developed specifically for this study. The questionnaire comprised demographic and clinical characteristics and items assessing patients' experiences with the multimodal sensor device and the support provided during monitoring. The instrument covered three domains: patient experience with the device, nursing care related to device use, and EEG technician involvement and support. The items assessed comfort, physical discomfort, interference with daily activities, ease of use and understanding, and confidence in seizure alerts. Responses were rated on a five-point Likert scale ranging from 5 = Very Good to 1 = Very Poor, with higher scores indicating more favorable experiences. One open-ended question was included to allow participants to report additional experiences, challenges, concerns, and suggestions related to the device and the clinical and technical support received.

Questionnaire Validity

The questionnaire was reviewed for content validity and clarity by a multidisciplinary panel comprising one physician, one EEG technician, two nursing PhD experts, and one biomedical engineering specialist. The panel evaluated the questionnaire items for relevance, clarity, comprehensiveness, and practical applicability. Their recommendations were incorporated into the final version of the questionnaire before data collection.

Pilot Study

A pilot study was conducted with five eligible participants to assess the feasibility, clarity, comprehensibility, and time required to complete the questionnaire. Participants in the pilot study were excluded from the final study sample. Feedback obtained during the pilot phase was reviewed, and minor modifications were made, where necessary, to improve the clarity and practical administration of the questionnaire.

Data Collection Procedure

Data were collected over a three-month period from eligible patients admitted to the EMU who had used the multimodal sensor device for seizure monitoring. After providing written informed consent, participants completed the questionnaire based on their experience with the device during the monitoring period. Participation was voluntary, and participants were informed that their decision to participate would not affect their clinical care. Privacy and confidentiality of the collected information were maintained throughout the data-collection process.

Data Analysis

Quantitative data were analyzed using the Statistical Package for the Social Sciences (SPSS). Categorical variables were summarized using frequencies and percentages. Questionnaire responses were analyzed using means, standard deviations, medians, and interquartile ranges, as appropriate. Item-level frequencies and percentages were also calculated, with higher scores representing more favorable responses. Open-ended responses were reviewed and grouped descriptively according to recurring experiences, concerns, challenges, and suggestions. These findings were used to complement and contextualize the quantitative results.

ETHICAL CONSIDERATIONS

Ethical approval was obtained from the Institutional Review Board (IRB) of King Fahad Medical City (KFMC) under approval number IRB 26-068 before study commencement. The required administrative approval was also obtained prior to implementation. Eligible participants were informed about the study purpose, procedures, voluntary participation, and confidentiality. Written informed consent was obtained before data collection. Participants were informed of their right to withdraw at any time without affecting their care or treatment.

THE RESEARCH RESEARCH RESERVOIR of Paramedical Sciences
International Peer- Reviewed, Referred, Indexed Journal July - December 2026 Volume: 12 Issue: 2

RESULTS

Demographic and Clinical Characteristics (N = 50)

No	Variables	Category	(n) %
1	Age	19–25 years	28 (56.0)
		≥26 years	22 (44.0)
2	Gender	Male	22 (44.0)
		Female	28 (56.0)
3	Education	Graduate	31 (62.0)
		Non-Graduate	19 (38.0)
4	Marital Status	Single	32 (64.0)
		Married	18 (36.0)
5	Duration of Epilepsy	Less than 1 month	27 (54.0)
		2–6 months	13 (26.0)
		More than 6 months	10 (20.0)
6	Seizure Type	Generalized	12 (24.0)
		Focal	20 (40.0)
		Unknown	18 (36.0)
7	Duration of Multimodal Sensor Device Usage	1 day	12 (24.0)
		2–7 days	20 (40.0)
		7–14 days	15 (30.0)
		More than 14 days	3 (6.0)
8	Education Provided Before Application	EEG Technician	25 (50.0)
		Nursing Staff	23 (46.0)
		Physician	2 (4.0)
		None	0 (0.0)
9	Previous Experience with Seizure Monitoring Device	Yes	19 (38.0)
		No	31 (62.0)
10	Support From Family or Caregivers	Yes	38 (76.0)
		No	12 (24.0)
11	Technical difficulties Experience	Yes	8 (16.0)
		No	42 (84.0)

Note: *Data are presented as frequency (n) and percentage (%). Percentages were calculated based on the total sample (N = 50).*

Table 2. Patient Experience with the Multimodal Sensor Device (N = 50)

Patient Experience Item	Very Good n (%)	Good n (%)	Neutral n (%)	Poor n (%)	Very Poor n (%)
Q1. Comfort while wearing the device	22 (44.0)	11 (22.0)	5 (10.0)	7 (14.0)	5 (10.0)
Q2. Interference with daily activities	32 (64.0)	4 (8.0)	5 (10.0)	4 (8.0)	5 (10.0)
Q3. Physical discomfort (skin irritation, pressure, pain, itchiness)	20 (40.0)	10 (20.0)	5 (10.0)	5 (10.0)	10 (20.0)
Q4. Ease of using and understanding the device	23 (46.0)	14 (28.0)	6 (12.0)	2 (4.0)	5 (10.0)
Q5. Confidence that the device will alert staff promptly during a seizure	28 (56.0)	13 (26.0)	5 (10.0)	2 (4.0)	2 (4.0)

Note: *Data are presented as frequency and percentage (n, %). Ratings reflect patients' perceptions and experiences with the multimodal sensor device using a five-point Likert scale.*

The Research Reservoir
THE RESEARCH RESERVOIR of Paramedical Sciences
International Peer- Reviewed, Referred, Indexed Journal July - December 2026 Volume: 12 Issue: 2

Table 3. Nursing Care Related to Multimodal Sensor Device Use (N = 50)

Nursing Care Item	Very Good n (%)	Good n (%)	Neutral n (%)	Poor n (%)	Very Poor n (%)
Q1. Nurse responsiveness when assisting with the device	24 (48.0)	19 (38.0)	4 (8.0)	1 (2.0)	2 (4.0)
Q2. Nurse confidence in handling the device	25 (50.0)	20 (40.0)	4 (8.0)	1 (2.0)	0 (0.0)
Q3. Clarity of explanations provided by nurses regarding device usage and safety	36 (72.0)	7 (14.0)	5 (10.0)	1 (2.0)	1 (2.0)
Q4. Support from nurses during seizure episodes while wearing the device	34 (68.0)	6 (12.0)	6 (12.0)	2 (4.0)	2 (4.0)
Q5. Timeliness of nurses in addressing device-related concerns or troubleshooting issues	33 (66.0)	7 (14.0)	6 (12.0)	2 (4.0)	2(4.0)

Note: *Values are presented as frequency and percentage. Percentages are based on the total sample (N = 50). Ratings reflect participants' perceptions of nursing care and support related to multimodal sensor device use.*

Table 4. EEG Technician Involvement and Support During Multimodal Sensor Device Use (N = 50)

EEG Technician Support Item	Very Good n (%)	Good n (%)	Neutral n (%)	Poor n (%)	Very Poor n (%)
Q1. Helpfulness of the EEG technician during device setup	31 (62.0)	10 (20.0)	3 (6.0)	3 (6.0)	3 (6.0)
Q2. Clarity of explanation provided by the EEG technician about the device	24 (48.0)	13 (26.0)	8 (16.0)	3 (6.0)	2 (4.0)
Q3. Comfort provided by the technician during electrode/sensor application	26 (52.0)	13 (26.0)	3 (6.0)	2 (4.0)	6 (12.0)
Q4. Responsiveness of the technician when device issues occurred	14 (28.0)	12 (24.0)	4 (8.0)	13 (26.0)	7 (14.0)
Q5. Frequency of EEG technician follow-up to ensure device functionality and patient comfort	10 (20.0)	12 (24.0)	10 (20.0)	10 (20.0)	8 (16.0)

Note: *Values are presented as frequency and percentage. Percentages are based on the total sample (N = 50). EEG = electroencephalography. Ratings reflect participants' perceptions of EEG technician involvement and support during multimodal sensor device use.*

Table 5. Reported Challenges and Barriers Associated with Multimodal Sensor Device Use (N = 50)

Challenges/Barriers	n	(%)
Skin irritation/discomfort	26	52.0
Difficulty maintaining sensor position	11	22.0
Device-related technical problems	8	16.0
Interference with movement/daily activities	4	8.0
Difficulty understanding the device	1	2.0

Note: *Data were derived from qualitative analysis of patients' open-ended responses. Some responses contained more than one theme; therefore, participants were represented in more than one category, and frequencies and percentages did not necessarily total 100%.*

The Research Reservoir
THE RESEARCH RESERVOIR of Paramedical Sciences
International Peer- Reviewed, Referred, Indexed Journal July - December 2026 Volume: 12 Issue: 2

Table 6. Patient Experience, Nursing Care, and EEG Technician Support

Item	Patient Experience	Nursing Care	EEG Technician Support
Q1	3.70 ± 1.11; 4 (3–4.75)	3.70 ± 1.11; 4 (3–4.75)	3.38 ± 0.75; 3 (3–4)
Q2	4.30 ± 0.86; 5 (4–5)	4.62 ± 0.70; 5 (4–5)	3.18 ± 1.21; 3 (2–4)
Q3	3.20 ± 0.76; 3 (3–4)	3.26 ± 1.01; 3 (2.25–4)	2.82 ± 0.87; 3 (2–3)
Q4	3.12 ± 1.06; 3 (2–4)	2.70 ± 1.07; 3 (2–3)	2.86 ± 1.03; 3 (2–4)
Q5	2.22 ± 1.17; 2 (1–3)	2.64 ± 1.22; 2 (2–3.75)	1.94 ± 1.10; 2 (1–3)
Overall	16.54 ± 2.11; 16.5 (15–17)	16.92 ± 2.39; 17 (15–19)	14.18 ± 2.23; 15 (13–15)

Note: *Values are presented as Mean ± SD; Median (IQR), N = 50.*

Table 7. Association Between Demographic/Clinical Characteristics and Device-Related Experience Domains

Variable	Patient Experience	Nursing Care	EEG Technician Support
Age	U=286.0, p=.670	U=284.0, p=.643	U=297.5, p=.843
Gender	U=322.5, p=.577	U=291.5, p=.960	U=288.5, p=.911
Education level	U=341.0, p=.281	U=295.0, p=.894	U=296.0, p=.878
Marital status	U=270.5, p=.508	U=238.0, p=.964	U=210.5, p=.508
Duration of epilepsy	H=5.35, p=.069	**H=6.53, p=.038***	H=1.32, p=.518
Seizure type	H=1.72, p=.424	H=0.35, p=.839	H=3.91, p=.142
Duration of device use	H=4.24, p=.237	**H=8.83, p=.032***	H=0.22, p=.975
Education before application	H=1.68, p=.431	**H=6.90, p=.032***	H=5.83, p=.054
Previous seizure-device experience	U=312.0, p=.730	**U=446.0, p=.002***	U=360.0, p=.187
Family/caregiver support	U=219.0, p=.845	U=181.0, p=.286	U=230.0, p=.972
Technical difficulties	U=286.5, p=.879	U=223.0, p=.152	U=239.5, p=.269

Note. *U = Mann–Whitney U test; H = Kruskal–Walli's test. p < .05 * was considered statistically significant. Bold values indicate statistically significant associations.*

Interpretation of Results

Overall, patients reported generally favorable experiences with the multimodal sensor device. Most participants rated comfort (66.0%), ease of use and understanding (74.0%), and confidence in prompt seizure alerts (82.0%) as Good or Very Good. Nursing care was positively perceived, particularly nurses' confidence in handling the device (90.0%) and responsiveness (86.0%). EEG technician support was also favorable, although lower ratings were observed for responsiveness to device-related problems and follow-up.

The main reported challenges were skin irritation or discomfort (52.0%), difficulty maintaining sensor position (22.0%), technical difficulties (16.0%), interference with movement or daily activities (8.0%), and difficulty understanding the device (2.0%). Significant associations with nursing-care ratings were found for duration of epilepsy, duration of device use, pre-application education, and previous seizure-device experience ($p < .05$). Overall, the findings reflect patients' perceptions of device usability and clinical and technical support during monitoring.

DISCUSSION

This study explored patients' experiences, perceptions, and attitudes toward the use of a multimodal sensor device for seizure detection. Overall, patients reported favorable experiences, particularly regarding comfort, ease of use, and confidence in timely alerts. However, concerns related to physical discomfort, sensor positioning, technical support, and follow-up were identified. Previous research similarly suggests that acceptance of seizure-detection technologies is influenced by usability, comfort, perceived reliability, and technical support in addition to device performance (Ryvlin et al., 2013)

THE RESEARCH RESERVOIR of Paramedical Sciences
International Peer- Reviewed, Referred, Indexed Journal July - December 2026 Volume: 12 Issue: 2

Patients reported favorable experiences regarding device comfort and ease of use. Confidence in timely alerts was also rated positively. These findings are consistent with previous research identifying convenience, wearability, usability, and perceived reliability as important factors influencing acceptance of wearable seizure-detection technologies (Smeele et al., 2020) Nevertheless, reports of skin irritation, pressure, pain, or itching highlight the importance of routinely assessing skin condition and physical comfort during device use.

Perceived confidence in timely seizure alerts is relevant because patients may view the device as an additional source of information for identifying seizure-related events. Previous studies have identified reliability, timely detection, and perceived accuracy as important factors influencing acceptance of seizure-detection technologies (Hadady et al., 2025). However, the present findings reflect patient perceptions and should not be interpreted as evidence of device sensitivity or accuracy because objective measures such as sensitivity, specificity, false-positive rates, and false-negative rates were not assessed.

Nursing support was generally perceived positively, particularly regarding clarity of explanations, support during seizure episodes, and confidence in handling device-related concerns. These findings highlight the role of nurses in integrating monitoring technology into bedside care. The comparatively lower ratings for some aspects of responsiveness and troubleshooting suggest opportunities to strengthen device-related nursing education, competency, and escalation procedures.

EEG technician support was also generally favorable, although lower ratings for responsiveness to device problems and follow-up suggest areas for improvement. Nurses provide continuous bedside care, whereas EEG technicians have specialized responsibilities related to device application, technical assessment, troubleshooting, and follow-up according to institutional procedures. Clear communication and defined escalation pathways between these professional groups may therefore support continuity of care.

The open-ended responses identified interference with movement or daily activities as the most frequently reported challenge, followed by skin irritation or discomfort and difficulty maintaining sensor position. Difficulty understanding the device was reported less frequently, while technical problems were uncommon. These findings are broadly consistent with previous research identifying comfort, device displacement, usability, and technical difficulties as factors that may influence experiences with seizure-detection technologies (Simblett et al., 2022; Hadady et al., 2025). Standardized education before device application, routine assessment of sensor position and skin condition, and clear instructions regarding technical concerns may help address these challenges.

The findings also emphasize the importance of a multidisciplinary approach to implementing multimodal seizure-detection technology. Patients should receive clear information regarding the purpose and limitations of the device, expected alerts, and the clinical response process. Nurses should have clearly defined responsibilities for patient assessment and basic device-related support, while EEG technicians should have defined responsibilities for device application, technical assessment, troubleshooting, and follow-up in accordance with institutional procedures. The device should therefore be considered an adjunct to comprehensive clinical observation and professional clinical judgment rather than a replacement for direct patient assessment.

Overall, the findings indicate generally favorable patient experiences with the multimodal sensor device, while also identifying practical challenges related to mobility, physical comfort, sensor positioning, and continuity of technical support. Addressing these factors through patient education, nursing competency, multidisciplinary communication, and structured technical support may enhance patient experience and facilitate safe implementation of multimodal seizure-monitoring technology.

LIMITATIONS

This study should be interpreted in light of several limitations. First, it was conducted at a single tertiary neurological center with a relatively small sample of 50 participants, which may limit the generalizability of the findings to other healthcare settings and patient populations. Second, purposive sampling may have introduced selection bias because participation was limited to eligible patients available during the study period. Third, the

The Research Reservoir
THE RESEARCH RESERVOIR of Paramedical Sciences
International Peer- Reviewed, Referred, Indexed Journal July - December 2026 Volume: 12 Issue: 2

findings were based primarily on patient-reported experiences and may have been influenced by individual expectations, previous experiences, and perceptions of care. Fourth, the study assessed perceived experiences rather than objective device performance; therefore, the findings cannot establish the sensitivity, specificity, false-positive rate, or false-negative rate of the device. Finally, the study was conducted in an inpatient epilepsy monitoring environment, and patients' experiences may differ from those of individuals using similar technologies independently in home or community settings.

Application to Practice

The findings have several implications for clinical practice in epilepsy monitoring units. Although patients generally reported favorable experiences with device comfort and ease of use, challenges were identified regarding movement or daily activities, physical discomfort, sensor positioning, technical support, and follow-up. These findings support a structured, patient-centered approach to multimodal sensor device use.

Patients should receive standardized education before device application, including the purpose of the device, expected alerts, limitations of seizure detection, basic troubleshooting, and the appropriate person to contact when concerns arise. Nurses, as continuous bedside care providers, should remain familiar with seizure recognition and assessment, including the identification and clinical differentiation of true epileptic seizures from non-epileptic events. In the EMU, nurses receive relevant in-service education and training in seizure assessment, EEG lead application, patient monitoring, and device-related procedures, supporting their ability to recognize clinical events and respond appropriately.

EEG technicians also play an important role in the technical aspects of monitoring, including EEG lead application, assessment of signal quality, device positioning, and management of technical concerns. Clear communication and coordination among nurses, EEG technicians, physicians, and relevant technical personnel may facilitate timely identification and management of clinical or device-related concerns.

A clearly defined process for managing technical concerns, including those occurring outside designated EEG technician working hours, may support continuity of care. The multimodal sensor device should remain an adjunct to continuous clinical observation, EEG monitoring, and nursing assessment rather than a replacement for professional clinical judgment. Regular review of patient feedback, device-related concerns, and staff observations may further support patient-centered care and continuous quality improvement within the EMU.

Recommendations

Based on the findings, standardized patient education should be provided before multimodal sensor device application. Education should cover the purpose and operation of the device, expected alerts, limitations of seizure detection, safety considerations, and basic troubleshooting. Clear explanations may help patients understand the role of the device and develop realistic expectations regarding its capabilities and limitations.

The existing competency of Epilepsy Monitoring Unit nurses in seizure recognition should be maintained and strengthened through regular in-service education and competency-based training. Nurses should continue to apply their specialized knowledge in seizure recognition, clinical assessment, continuous video observation, identification of true epileptic and non-epileptic events, EEG-related procedures, and appropriate escalation. Given their continuous bedside presence and training, nurses should maintain a high level of vigilance to support timely recognition and documentation of clinically observable seizure episodes, including events captured through video monitoring. The multimodal sensor device should complement, rather than replace, clinical observation and professional nursing judgment.

A clear and accessible technical support pathway should be established for managing device-related concerns, including problems occurring outside designated EEG technician working hours. EEG technicians should continue to provide technical support related to EEG lead application, signal quality, sensor positioning, and device-related technical issues. Clearly defined responsibilities among nurses, EEG technicians, physicians, and technical support personnel may facilitate timely communication, escalation, and resolution of concerns.

THE RESEARCH RESERVOIR of Paramedical Sciences
International Peer- Reviewed, Referred, Indexed Journal July - December 2026 Volume: 12 Issue: 2

Patient feedback regarding comfort, usability, physical discomfort, sensor positioning, interference with activities, technical problems, and perceived reliability should be incorporated into routine quality-improvement activities. Regular review of these experiences may help identify opportunities to improve patient-centered monitoring and the overall implementation of multimodal sensor technology. Finally, larger multicenter studies are recommended to evaluate patient experiences alongside objective measures of device performance, including seizure-detection accuracy, false alarms, missed seizures, technical failures, and quality-of-life outcomes.

CONCLUSION

This study demonstrated generally favorable patient experiences with the multimodal sensor device, particularly regarding comfort, ease of use, and nursing support. However, challenges remained related to interference with movement or daily activities, physical discomfort, sensor positioning, and aspects of technical support and follow-up. The findings emphasize the importance of incorporating patient experience into the evaluation and implementation of seizure-detection technologies. Strengthening patient education, nursing competency, multidisciplinary communication, technical support, and clear escalation procedures may support a safer and more patient-centered approach to multimodal seizure monitoring.

Funding

This study received no external funding.

Conflict of Interest

The authors declare that they have no conflicts of interest related to this study or its publication.

Ethical Considerations

This study was conducted in accordance with institutional ethical requirements and the principles of the Declaration of Helsinki. Ethical approval was obtained from the Institutional Review Board of King Fahad Medical City, Riyadh, Saudi Arabia (IRB No. **26-068**). Written informed consent was obtained from all participants before participation in the study. Participant confidentiality and privacy were maintained throughout the study, and the collected data were used solely for research purposes.

Author Contributions

PJC contributed to the conceptualization, study design, methodology, data analysis and interpretation, manuscript preparation, writing, and review. AAR contributed to data collection, study-related support, and manuscript review. AAA contributed to data collection, study-related support, and manuscript review. All authors approved the final manuscript and agreed to be accountable for all aspects of the work.

Acknowledgments

The authors would like to thank the patients who participated in this study and the nursing and EEG staff who supported the study activities. The authors also acknowledge the support of the epilepsy monitoring unit and the healthcare team involved in patient care and monitoring.

Data Availability Statement

The data generated and/or analyzed during this study are not publicly available because they contain participant-related information and are subject to institutional and ethical requirements. Data may be available from the corresponding author upon reasonable request, subject to appropriate ethical and institutional approval.

THE RESEARCH RESERVOIR of Paramedical Sciences
International Peer- Reviewed, Referred, Indexed Journal July - December 2026 Volume: 12 Issue: 2

REFERENCES

1. Armstrong, L., Mikkelsen, S., & Cross, J. H. (2020). Patient perspectives on wearable seizure detection devices: A qualitative study. *Epilepsy & Behavior, 108*, 107111. https://doi.org/10.1016/j.yebeh.2020.107111
2. Baumgartner, C., Baumgartner, J., Lang, C., Lisy, T., & Koren, J. P. (2025). Seizure detection devices. *Journal of Clinical Medicine, 14*(3), 863. https://doi.org/10.3390/jcm14030863
3. Beck, M., Simony, C., Zibrandtsen, I., & Kjaer, T. W. (2020). Readiness among people with epilepsy to carry body-worn monitor devices in everyday life: A qualitative study. *Epilepsy & Behavior, 112*, 107390. https://doi.org/10.1016/j.yebeh.2020.107390
4. Beniczky, S., Polster, T., Lomax, C., Veltmann, C., & Ryvlin, P. (2019). Wearable devices for seizure detection: Promise and challenges. *Epilepsia, 60*(Suppl. 1), S48–S55. https://doi.org/10.1111/epi.14698
5. Cook, M. J., O'Brien, T. J., Berkovic, S. F., Murphy, M., Morokoff, A., Fabó, D., Scheffer, I. E., & O'Brien, T. J. (2013). Prediction of seizure likelihood with a long-term, implanted seizure advisory system in patients with drug-resistant epilepsy: A first-in-man study. *The Lancet Neurology, 12*(6), 563–571. https://doi.org/10.1016/S1474-4422(13)70075-9
6. Elger, C. E., & Hoppe, C. (2018). Diagnostic challenges in epilepsy: Seizure under-reporting and seizure detection. *The Lancet Neurology, 17*(3), 279–288. https://doi.org/10.1016/S1474-4422(18)30038-3
7. Elezi, L., Koren, J. P., Pirker, S., & Baumgartner, C. (2022). Automatic seizure detection and seizure pattern morphology. *Clinical Neurophysiology, 138*, 214–220. https://doi.org/10.1016/j.clinph.2022.02.027
8. Fisher, R. S., Acevedo, C., Arzimanoglou, A., Bogacz, A., Cross, J. H., Elger, C. E., Engel, J., Forsgren, L., French, J. A., Glynn, M., Hesdorffer, D. C., Lee, B. I., Mathern, G. W., Moshé, S. L., Perucca, E., Scheffer, I. E., Tomson, T., Watanabe, M., & Wiebe, S. (2014). ILAE official report: A practical clinical definition of epilepsy. *Epilepsia, 55*(4), 475–482. https://doi.org/10.1111/epi.12550
9. Frankel, M. A., Lehmkuhle, M. J., Spitz, M. C., Newman, B. J., Richards, S. V., & Arain, A. M. (2021). Wearable reduced-channel EEG system for remote seizure monitoring. *Frontiers in Neurology, 12*, 728484. https://doi.org/10.3389/fneur.2021.728484
10. Hadady, L., Robinson, T., Bruno, E., Richardson, M. P., & Beniczky, S. (2025). Users' perspectives and preferences on using wearables in epilepsy: A critical review. *Epilepsia, 66*(Suppl. 3), 4–13. https://doi.org/10.1111/epi.18280
11. Lehnen, J., Venkatesh, P., Yao, Z., Aziz, A., Nguyen, P. V. P., Harvey, J., Alick-Lindstrom, S., Doyle, A., Podkorytova, I., Perven, G., Hays, R., Zepeda, R., Das, R. R., & Ding, K. (2025). Real-time seizure detection using behind-the-ear wearable system. *Journal of Clinical Neurophysiology, 42*(2), 118–125. https://doi.org/10.1097/WNP.0000000000001076
12. Mesraoua, B., Deleu, D., Hassan, A. H., Gayane, M., Alsheikh, L., Ali, M. A., Tomson, T., Abou-Khalil, B., Cross, J. H., & Asadi-Pooya, A. A. (2020). Dramatic outcomes in epilepsy: Depression, suicide, injuries, and mortality. *Current Medical Research and Opinion, 36*(9), 1473–1480. https://doi.org/10.1080/03007995.2020.1776234
13. Onorati, F., Regalia, G., Caborni, C., LaFrance, W. C., Jr., Blum, A. S., Bidwell, J., De Liso, P., El Atrache, R., Loddenkemper, T., Mohammadpour-Touserkani, F., Sarkis, R. A., Friedman, D., Jeschke, J., & Picard, R. (2021). Prospective study of a multimodal convulsive seizure detection wearable system on pediatric and adult patients in the epilepsy monitoring unit. *Frontiers in Neurology, 12*, 724904. https://doi.org/10.3389/fneur.2021.724904
14. Olsen, L. S., Nielsen, J. M., Simony, C., & Kjaer, T. W. (2021). Wearables in real life: A qualitative study of experiences of people with epilepsy who use home seizure monitoring devices. *Epilepsy & Behavior, 125*, 108398. https://doi.org/10.1016/j.yebeh.2021.108398

The Research Reservoir
THE RESEARCH RESERVOIR of Paramedical Sciences
International Peer- Reviewed, Referred, Indexed Journal July - December 2026 Volume: 12 Issue: 2

15. Ryvlin, P., Nashef, L., & Tomson, T. (2013). Prevention of sudden unexpected death in epilepsy: A realistic goal? *Epilepsia, 54*(Suppl. 2), 23–28. https://doi.org/10.1111/epi.12180
16. Simblett, S. K., Biondi, A., Bruno, E., Ballard, D., Stoneman, A., Lees, S., Richardson, M. P., & Wykes, T. (2020). Patients' experience of wearing multimodal sensor devices intended to detect epileptic seizures: A qualitative analysis. *Epilepsy & Behavior, 102*, 106717. https://doi.org/10.1016/j.yebeh.2019.106717
17. Sivathamboo, S., Nhu, D., Piccenna, L., Yang, A., Antonic-Baker, A., Vishwanath, S., Todaro, M., Yap, L. W., Kuhlmann, L., Cheng, W., O'Brien, T. J., Lannin, N. A., & Kwan, P. (2022). Preferences and user experiences of wearable devices in epilepsy: A systematic review and mixed-methods synthesis. *Neurology, 99*(13), e1380–e1392. https://doi.org/10.1212/WNL.0000000000200794
18. van Westrhenen, A., Souhoka, T., Ballieux, M. E., & Thijs, R. D. (2021). Seizure detection devices: Exploring caregivers' needs and wishes. *Epilepsy & Behavior, 116*, 107723. https://doi.org/10.1016/j.yebeh.2020.107723
19. You, S., Hwan Cho, B., Shon, Y. M., et al. (2022). Semi-supervised automatic seizure detection using personalized anomaly detecting variational autoencoder with behind-the-ear EEG. *Computer Methods and Programs in Biomedicine, 213*, 106542. https://doi.org/10.1016/j.cmpb.2021.106542
20. Zae, U., Hostettler, I., Tricklebank, M., et al. (2021). Prospective study of a multimodal convulsive seizure detection wearable system on pediatric and adult patients in the epilepsy monitoring unit. *Epilepsia, 62*(8), 1900–1911. https://doi.org/10.1111/epi.16939