

ForSeizure: Predictive Epilepsy Risk Management

Apps for Good Proposal

Executive Summary

Although epilepsy affects 1 in 26 people on this planet, the most devastating aspect of epilepsy is not seizures; rather, it is the unpredictability of seizures. This unpredictability is life-threatening to a third of epilepsy patients who have drug-resistant epilepsy, as they face a significantly higher risk of sudden, unexpected death. Existing solutions, such as Epsy and Seizure Tracker, are not effective in addressing this because they are only record-keeping tools that show users what happened, not what will happen. None of the existing solutions for epilepsy patients are consumer-grade tools that integrate subjective lifestyle data with objective environmental data to provide predictive risk forecasts.

Our solution is different. It integrates subjective lifestyle data, such as sleep, stress, diet, drug intake, and hormonal cycles, with objective environmental data, such as barometric pressure and air quality. The application will use a refined mathematical model to establish connections between data points and calculate a risk score. Our solution provides epilepsy patients between 13 and 30 years old with a tool that not only shows them what happened but also shows them what will happen. This is a fundamental change in categories. Epilepsy management is no longer record-keeping; epilepsy management is risk navigation.

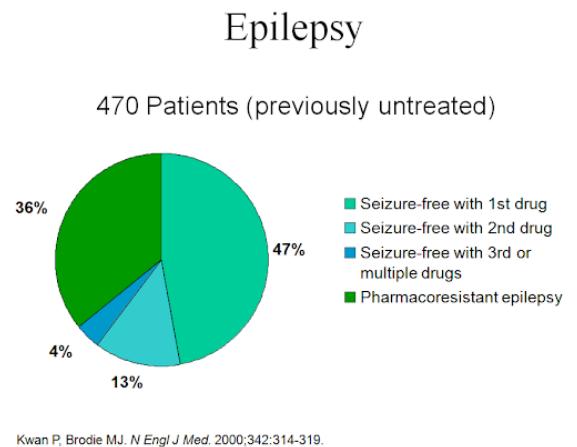
Section I: Introduction

Problem Statement

Epilepsy is a common neurological disorder that affects 1 in 26 people globally (Epilepsy Foundation, 2024). The condition is defined by uncontrollable neuronal hyperactivation, which disrupts normal brain signaling. While the root cause varies significantly from one patient to another, many cases are considered idiopathic, meaning they develop without a single identifiable cause (Sirven, 2015).

Risk Factors and Etiology

Several known factors increase the likelihood of developing the disorder. These include prenatal risks such as eclampsia, maternal infections, or exposure to certain medications during pregnancy. Many other patients develop epilepsy due to physical brain trauma, stroke, or a genetic predisposition (Fisher et al., 2014). To receive an official clinical diagnosis, a person must experience two or more unprovoked seizures that occur at least 24 hours apart.



The Limitations of Current Treatment

There is currently no cure for epilepsy. Most modern medical treatments focus on managing symptoms by balancing the relationship between excitatory and inhibitory neurotransmitters in the brain (Stafstrom & Carmant, 2015). While many patients successfully manage their seizures using a single medication or a specific combination of drugs, a significant gap in care remains.

The Risk of Treatment Resistance

Approximately 1 in 3 epilepsy patients suffers from drug-resistant epilepsy, also known as refractory epilepsy (Kwan & Brodie, 2000). For these individuals, the risk of Sudden Unexpected Death in Epilepsy (SUDEP) is significantly higher. This danger is particularly acute for those who experience frequent tonic-clonic seizures, representing a critical unmet need in neurological research and patient safety (Tomson et al., 2016).

Section II: Audiences

Primary Audience

The main target group of this application would be young people suffering from epilepsy, between the ages of 13 and 30 years. This is a group that is highly engaged with mobile health applications, thus making them a natural fit for such a system. A major characteristic of this group is that their condition, epilepsy, is unpredictable, which is considered one of the most worrying aspects of living with epilepsy. This unpredictability affects their mental health, freedom, and general well-being, thus making any form of partial predictability highly useful (World Health Organization, Epilepsy and Mental Health Reports).

Secondary Audiences

Two of the app's secondary audiences are also of great importance. Caregivers and parents are the primary managers of seizure tracking, safety, and health monitoring, especially for pediatric patients (CDC; Pediatric Epilepsy Management Studies). Evidence shows that caregiver involvement in digital health tools significantly improves adherence and outcomes, making this group a natural secondary user. Clinicians and epilepsy specialists represent the second secondary audience; they rely on longitudinal patient data to assess treatment

effectiveness, and digital logs have been shown to meaningfully improve clinical decision-making (Epilepsy Foundation; Clinical Epilepsy Management Research).

Behavioral and User Profile

It is expected that the users of the app will be engaged in a process of health self-management. Patients with chronic neurological disorders often monitor their symptoms and medications as part of their regular health routine (NIH; Digital Health and Self-Management Research). The underlying motivations for health self-management include the need for safety, certainty, autonomy, and self-efficacy in health outcomes, all of which this app is intended to fulfill (National Institute of Neurological Disorders and Stroke; Epilepsy and Quality-of-Life Studies).

Goals for the Audience

The purpose of this application is to meet the needs of its users in three important aspects. First, it is designed to increase the user's awareness of their risk by helping them identify their individual patterns of seizures and the daily factors that may lead to them (National Library of Medicine; Epilepsy Self-Monitoring Studies). Second, it is designed to decrease the uncertainty and anxiety that people with epilepsy face by providing them with a better understanding of their seizure risk, which is arguably the biggest psychological challenge for people living with epilepsy (WHO; Neurological Disorders and Mental Health Reports). Third, it is designed to increase the quality of health care communication through consistent health data that the user can share with their health care providers, leading to improved health care decisions (NIH; Patient Data Integration Research).

Section III: Research on Predictability and Value of Logging

Patient Diaries and Seizure Prediction

In a neurology-focused comparative study, researchers aimed to determine if adults with epilepsy can predict their seizures using prospective seizure diaries. The study was carried out on 71 patients, where 15,635 diary entries were recorded. The results showed that patients who were able to positively predict seizures experienced more than double the risk of seizures in 24 hours compared to those who did not make any predictions (OR 2.25). Even though the positive predictions were highly specific at 83.2%, they were not very sensitive at 31.9%. It was also observed that 21% of patients exhibited stronger predictive abilities, and these patients were younger and experienced seizures more frequently. This shows that patients may be able to predict seizures, which could lead to the creation of new methods of prevention for patients with epilepsy.

Seizure Forecasting Based on Cyclical Patterns

This study aimed at determining whether seizure diary apps have the potential to be used in forecasting seizure risks among individuals suffering from epilepsy. The study utilized information from 50 individuals who used the app and analyzed the circadian and multiday seizure cycles for the purpose of developing individualized forecasts. The study was validated through the use of EEG from the Neurovista dataset. The results showed that cycle-based predictions were accurate for half of the users, while most users (67.1%) spent the majority of their time in a low-risk state, and 69.1% of seizures took place in the high-risk state.

Machine Learning Models with Diary Data

This study investigates whether machine learning can predict seizures in patients suffering from refractory epilepsy using self-reported seizure diaries. After analyzing data from 153 patients, totaling more than 8,000 seizures, researchers used statistical and machine learning techniques, such as SVM and LSTM, to predict future seizures. The best-performing techniques, such as SVM regression, were able to predict up to 87% of future seizures within a few days of error. More accurate predictions were made in patients whose seizure patterns were more frequent. Therefore, this study shows that seizure patterns can be effectively predicted using machine learning techniques.

Precision of App-Based Diaries

In this study, researchers compared app and paper diaries for their accuracy in recording seizure occurrences using video-EEG as a standard method. The researchers analyzed data from 89 focal epilepsy patients and discovered that the app diaries were significantly more precise in recording seizure occurrences compared to paper diaries, showing a higher rate of precision at 85.7%, compared to paper diaries at 66.9%. Although the sensitivity for both diaries was similar, this indicates that a large number of seizures were not recorded by both diaries. This shows that even though using diaries for seizure occurrences is not entirely effective, app-based diaries are substantially better.

Need Statement

The unpredictable nature of seizures remains a very large challenge for individuals with epilepsy, as it can affect many aspects of their daily lives. Applications that can provide insight into the risk of a certain patient having a seizure greatly benefit epilepsy patients and their families, allowing them to reduce their uncertainties and provide for safer planning.

Section IV: Competitor Analysis and Product Differentiation

Current epilepsy management tools, such as Epsy, Seizure Tracker, and EpiDiary, primarily function as retrospective digital logs designed for clinical reporting. While these platforms are effective at documenting past events for medical professionals, they fail to provide patients with immediate and actionable insights for daily life. This utility gap exists because legacy apps rely heavily on manual data entry, which often leads to user fatigue and inconsistent records.

ForSeizure improves on existing offerings in three concrete ways:

- Predictive forecasting rather than retrospective logging: Existing apps such as Epsy and EpiDiary show users what happened after a seizure occurs; ForSeizure uses machine learning and cyclical pattern analysis to estimate seizure risk before it occurs, shifting the paradigm from reactive documentation to proactive risk navigation.
- Integration of objective environmental data: No current consumer-grade epilepsy app automatically incorporates barometric pressure, air quality, or weather data. ForSeizure pulls this data passively and cross-references it with user-reported lifestyle factors, providing a richer and more accurate risk profile without increasing user burden.
- Personalized risk scores for daily autonomy: Existing tools produce records for clinicians but offer nothing actionable for patients on a given day. ForSeizure outputs a daily risk score that allows users to make informed decisions about driving, exercise, travel, and other activities, directly addressing the autonomy and safety needs identified in our audience research.

Section V: Specifications

Core Features: Minimum Viable Product (MVP)

The application is designed to help users with seizure disorders understand, predict, and manage their condition. The MVP consists of three core features:

1. Trigger Data Collection

- Logs lifestyle, environmental, and physiological factors including sleep, stress, diet, hormonal changes, and exposure to flashing lights.
- Automatically pulls external environmental data such as barometric pressure and air quality using location-based APIs, reducing manual entry burden.

2. Seizure Risk Prediction

- Uses a predictive model trained on the user's historical seizure and lifestyle data to estimate daily seizure likelihood.
- Sends timely notifications to prepare users for high-risk periods, drawing on research showing that timely interventions can reduce seizure-related injuries.

3. Support and Education Resources

- Provides contextual guidance, educational content, and links to medical or community resources.
- Includes actionable recommendations for lifestyle adjustments during high-risk periods, such as stress reduction or medication compliance reminders.

Required Data

The application needs to collect both user-reported data and external data:

A. Seizure and Symptom Tracking

- Day, time, and duration of seizures
- Type of seizure and symptoms (e.g., tonic-clonic, absence)
- Aura or pre-seizure signs

B. Lifestyle and Environmental Factors

- Sleep patterns (hours, quality, consistency)
- Stress levels (self-reported or sensor-derived)
- Alcohol and drug consumption (type, amount, frequency)
- Diet (food type, portion, meal timing)
- Menstrual cycle tracking and hormone changes
- Illness or infection records
- Exposure to potential triggers (e.g., flashing lights, environmental stimuli)

C. Medication and Treatment Data

- Type, dosage, and timing of medications

Feedback

To ensure the platform remains aligned with user needs, we will implement a continuous feedback loop with a clear response protocol. Data collection will begin with in-app feedback prompts on key screens and periodic user interviews and focus groups to capture qualitative

insights. We will respond to feedback through a structured triage process: bugs and usability issues will be addressed within two sprint cycles; feature requests will be logged in a public roadmap and prioritized based on frequency and user impact; and requests from clinical users will be escalated to our medical advisory review. Users will receive in-app notifications when their reported feedback has been reviewed, and a quarterly changelog will document what changed as a direct result of user input. This transparency model ensures users understand that their feedback has a direct impact on the product.

Potential Future Additions

Future iterations of the platform will focus on transitioning from a data-collection tool to an active safety intervention system. The first priority is the implementation of real-time predictive alerts, notifying users when their risk score exceeds a defined threshold and providing actionable suggestions such as physiological stress reduction or immediate medication compliance.

The second priority is integration of wearable sensor technology to automate the collection of heart rate, sleep architecture, and movement data. Drawing inspiration from specialized medical devices like Empatica, this integration will remove the burden of manual logging and provide a continuous stream of high-fidelity data for more precise forecasting.

Third, we intend to incorporate community and peer support features, including curated professional resources and peer forums, to address the holistic mental health needs of users and caregivers. This will foster a collaborative environment and support long-term self-management.

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