

The Impact of Internet Hospital follow-up on the quality of life of patients with epilepsy: Randomized Controlled Trial

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Table of Contents

Original Manuscript..... 5

Supplementary Files..... 30

 Figures 31

 Figure 1..... 32

 Multimedia Appendixes 33

 Multimedia Appendix 1..... 34

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Abstract

Background: As the second most common neurological disorder, epilepsy requires long-term management to ensure better seizure control and improved patient outcomes. Health education and sustained care play a crucial role in helping people with epilepsy manage their condition effectively. In recent years, internet hospitals have emerged as a promising approach to enhancing healthcare accessibility. These digital platforms have the potential to significantly improve the quality of life for patients with epilepsy. However, despite their growing adoption, research on the application of internet hospitals in the follow-up management of epilepsy remains limited, highlighting the need for further investigation.

Objective: This study has two primary aims. The first aim was to assess and compare the differences in quality of life, anxiety, and depression between internet hospital follow-up and traditional outpatient follow-up for patients with epilepsy. The second aim was to explore chronic disease management models that are tailored to meet the needs of patients with epilepsy, improving their overall care.

Methods: Eligible patients diagnosed with epilepsy were recruited at Sichuan Provincial People's Hospital and randomly assigned to the intervention or control group. Data collected included demographic information, clinical characteristics, and scores from the Quality of Life in Epilepsy-31 (QOLIE-31), Generalized Anxiety Disorder-7 (GAD-7), and Neurological Disorders Depression Inventory for Epilepsy (NDDI-E). The control group received traditional outpatient follow-up, while the intervention group was managed via the internet hospital. Both groups received epilepsy health education. After six months, changes in quality of life, anxiety, and depression were assessed using the same scales. Data analysis followed the intention-to-treat principle, and a linear mixed model was used to examine the intervention effect on primary and secondary outcomes. The effect sizes of group differences were calculated using Hedges g (0.2-0.4: small, 0.5-0.7: medium, and ≥ 0.8 : large).

Results: A total of 214 patients with epilepsy participated in the study (intervention group: $n=107$; control group: $n=107$). At the end of the study, 94.4% (101/107) in the intervention group and 93.5% (100/107) in the control group had completed the follow-up visits. After the intervention, the intention-to-treat analysis revealed evidence for improved quality of life (QOLIE-31 total score) ($F=13.10$, $P<.001$) with small between-group effects (Hedges' g : 0.49, 95% CI 0.22 to 0.76) in favor of the intervention group. We also found evidence of reduced depression, as well as improved seizure worry, overall quality of life, emotional well-being, energy/fatigue, medication side effects, with effects ranging from small to medium (Hedges' g : 0.42-0.79).

Conclusions: Conclusion: Long-term follow-up through internet hospitals can effectively improve the quality of life and reduce anxiety and depression in patients with epilepsy. This model provides effective support, making it an important tool for managing epilepsy. Therefore, internet hospital management is recommended as a feasible approach for epilepsy follow-up in clinical practice.

Conclusion: Long-term follow-up through internet hospitals can effectively improve the quality of life and reduce anxiety and depression in patients with epilepsy. This model provides effective support, making it an important tool for managing epilepsy. Therefore, internet hospital management is recommended as a feasible approach for epilepsy follow-up in clinical practice.

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Original Manuscript

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Abstract

Background: As the second most common neurological disorder, epilepsy requires long-term management to ensure better seizure control and improved patient outcomes. Health education and sustained care play a crucial role in helping people with epilepsy manage their condition effectively. In recent years, internet hospitals have emerged as a promising approach to enhancing healthcare accessibility. These digital platforms have the potential to significantly improve the quality of life for patients with epilepsy. However, despite their growing adoption, research on the application of internet hospitals in the follow-up management of epilepsy remains limited, highlighting the need for further investigation.

Objective: This study has two primary aims. The first aim was to assess and compare the differences in quality of life, anxiety, and depression between internet hospital follow-up and traditional outpatient follow-up for patients with epilepsy. The second aim was to explore chronic disease management models that are tailored to meet the needs of patients with epilepsy, improving their overall care.

Methods: Eligible patients diagnosed with epilepsy were recruited at Sichuan Provincial People's Hospital and randomly assigned to the intervention or control group. Data collected included demographic information, clinical characteristics, and scores from the Quality of Life in Epilepsy-31 (QOLIE-31), Generalized Anxiety Disorder-7 (GAD-7), and Neurological Disorders Depression Inventory for Epilepsy (NDDI-E). The control group received traditional outpatient follow-up, while the intervention group was managed via the internet hospital. Both groups received epilepsy health education. After six months, changes in quality of life, anxiety, and depression were assessed using the same scales. Data analysis followed the intention-to-treat principle, and a linear mixed model was used to examine the intervention effect on primary and secondary outcomes. The effect sizes of group differences were calculated using Hedges g (0.2-0.4: small, 0.5-0.7: medium, and ≥ 0.8 : large).

Results: A total of 214 patients with epilepsy participated in the study (intervention group: $n=107$; control group: $n=107$). At the end of the study, 94.4% (101/107) in the intervention group and 93.5% (100/107) in the control group had completed the follow-up visits. After the intervention, the intention-to-treat analysis revealed evidence for improved quality of life (QOLIE-31 total score) ($F=13.10$, $P<.001$) with small between-group effects (Hedges' g : 0.49, 95% CI 0.22 to 0.76) in favor of the intervention group. We also found evidence of reduced depression, as well as improved seizure worry, overall quality of life, emotional well-being, energy/fatigue, medication side effects, with

effects ranging from small to medium (Hedges'g: 0.42-0.79).

Conclusion: Long-term follow-up through internet hospitals can effectively improve the quality of life and reduce anxiety and depression in patients with epilepsy. This model provides effective support, making it an important tool for managing epilepsy. Therefore, internet hospital management is recommended as a feasible approach for epilepsy follow-up in clinical practice.

Keywords: Epilepsy, Quality of life in patients with epilepsy, Anxiety, Depression, Chronic disease management of epilepsy



Introduction

Epilepsy, classified by the World Health Organization as one of the five major neuropsychiatric disorders, affects approximately 10 million people in China, with a prevalence of 0.9‰ to 8.5‰ [1]. The primary treatment goal is seizure control and frequency reduction, with antiseizure medications (ASMs) as the first-line therapy. However, about one-third of patients develop drug-resistant epilepsy (DRE), defined as the failure to achieve sustained seizure freedom despite trials of at least two well-tolerated, appropriately chosen, and correctly administered antiseizure drug regimens, whether as monotherapies or in combination [2]. The chronic nature of this condition severely impacts patients' daily lives, as they not only struggle with cognitive impairment caused by seizures but also face challenges such as drug resistance, adverse drug reactions, and comorbid anxiety and depression. Previous studies have shown that the quality of life for patients with epilepsy (PWE) is significantly lower than that of individuals with other chronic diseases and the general population [3]. The quality of life for PWE is influenced by various factors, including seizure frequency, comorbid anxiety and depression, side effects of medication [4]. Anxiety and depression in patients with epilepsy are significantly negatively correlated with their quality of life [5, 6]. Therefore, improving the overall quality of life is crucial for PWE.

Internet healthcare represents an emerging model of medical services that integrates advanced technologies such as cloud computing, the Internet of Things (IoT), big data, and mobile communications, with the internet as its core platform [7]. Unlike traditional in-person consultations, internet healthcare offers enhanced convenience by transcending time and geographical constraints, providing services such as telemedicine and internet hospitals (IHs) [8]. Telemedicine is defined as "the use of medical information exchanged from one site to another via electronic communications to improve a patient's clinical health status [9]. " It encompasses various medical activities, including remote diagnosis, remote consultations and nursing, remote education, and the provision of remote medical information services [10]. Internet hospital refers to hospital-based service platforms that integrate consultation, prescription, payment, and drug delivery, mostly featured in digital follow-up and routine consultations [11]. Internet hospitals represent an innovative business model emerging from China's "Internet +" healthcare initiative, acting as an extension of both telemedicine and conventional brick-and-mortar hospitals. By integrating the medical resources of physical hospitals with internet technologies, internet hospitals offer a seamless combination of online and offline services, as well as front-end and back-end medical support. Patients can communicate with doctors

remotely via the platform, access their medical records, prescriptions, and follow-up plans. The current service quality of Chinese internet hospitals as perceived by patients did not yet meet their expectations, especially in terms of service responsiveness.[11] In general, the concept of internet hospitals can cover telemedicine.[12] Internet hospitals not only perform the functions of telemedicine but also carry out certain roles of traditional physical hospitals. Internet hospitals can provide patients with a full range of online medical and non-medical services related to outpatient care and hospitalization, whereas telemedicine mainly offers medical-related services such as remote diagnosis, remote consultations, and remote education [13]. The COVID-19 pandemic accelerated the growth of internet hospitals in China, with these platforms addressing challenges such as limited access to in-person care, time constraints, and geographic barriers to healthcare.

Long-term management of epilepsy necessitates sustained care and health education. Traditional outpatient follow-up models, while effective, are often constrained by geographic barriers, time costs, and limited accessibility to specialized care. Telemedicine, telephone consultations, mobile health applications, and platforms like WeChat—has emerged as a supplementary approach to address these challenges. For example, studies have demonstrated improved treatment adherence in pediatric PWE through WeChat-based follow-up programs.[14] However, the aforementioned models are not connected to physical hospitals. Previous studies have shown that internet hospitals, in terms of medical experience, are comparable to offline physical hospitals and can effectively establish a physician-patient relationship similar to that of offline physical hospitals [12].

Nevertheless, research on the impact of internet hospital follow-up on quality of life, anxiety, and depression among PWE remains limited, the effectiveness of Internet hospitals for epilepsy patients has not been confirmed. This study aims to compare internet hospital follow-up management with traditional outpatient follow-up in terms of quality of life, anxiety, and depression among PWE, with the goal of exploring innovative follow-up management models tailored to their needs. We hypothesize that internet hospital follow-up can improve quality of life and alleviate anxiety and depression in PWE.

Methods

Study setting

This single-center, parallel-group, randomized controlled study was conducted in accordance with the principles of the Declaration of Helsinki and was approved by the institutional ethics board of Sichuan Provincial People's Hospital (number 2023-587). This study was registered with the Chinese

Clinical Trials Registry (ChiCTR2500097200). Participants were enrolled from November 2023 to April 2024.

Participants

Study participants were conveniently recruited from the Sichuan Provincial People's Hospital outpatient practice.

The inclusion criterias were as follows: participants were over 18 years old; according to the 2014 definition by the International League Against Epilepsy (ILAE), patients who were previously diagnosed with epilepsy and received medication treatment., with seizure types classified according to the 2017 ILAE classification into focal seizures, generalized seizures, and others [15]; able to understand the content of the questionnaires and complete them independently; patients and their families were informed of the study details, consented to participate, understood the purpose and significance of the research, and agreed to the use of relevant data for scientific purposes.

The exclusion criterias were as follows: presence of abnormal mental behavior or a history of diagnosed mental illness; recent severe trauma, such as significant family upheaval or undergoing surgical procedures; presence of other conditions that may affect quality of life, such as malignant tumors or cerebrovascular diseases; drug-resistant epilepsy (DRE)[16]: lack of success in achieving sustained seizure freedom despite trials of two tolerated, appropriately selected, and correctly administered antiepileptic drug regimens (whether as monotherapies or in combination).

Allocation and blinding

Participants will be randomly assigned to groups using a simple randomization method based on computer-generated random numbers, ensuring an equal distribution across groups. The randomization process will be overseen by a designated trial team member. After the participant sequence table is prepared, individuals will be enrolled using a consecutive sampling method. Once randomization is completed, the principal investigator will disclose the allocation and inform the respective investigators in each study arm, ensuring that blinding is maintained prior to allocation. Due to the nature of the intervention, both investigators and participants will be aware of their group assignments. However, data analysis will be conducted independently by two statisticians who remain blinded to group allocation to minimize bias.

Intervention

The follow-up team consisted of two nurses with more than 5 years of experience in epilepsy nursing

and two epileptologists. The health education content was primarily delivered through pamphlets with animations, explaining various aspects of epilepsy. The educational program covered several key topics, including disease knowledge, epilepsy treatment guidelines, healthy living, balanced diet, and psychological guidance. Epilepsy nurses provided one-on-one structured teaching to ensure all aspects of epilepsy care were covered. Each session lasted at least 30 minutes, and each patient randomly assigned to the epilepsy health education group received a total of six sessions. It is important to note that this program was intentionally designed to differ from well-established, more intensive programs like the MOSES program (Modular Service Package Epilepsy) [17]. While the MOSES program is typically more intensive, our program aims to create an intervention that can be implemented both in-person and online, ensuring it is scalable and flexible. The epilepsy nurses provided one-on-one teaching in a structured format, addressing all these aspects of epilepsy. Each session lasted at least 30 minutes, with a total of six sessions for each patient randomly assigned to the epilepsy health education group.

The control group received regular follow-up management in the outpatient department, while the intervention group received follow-up management through the internet hospital. PWE in the outpatient follow-up program received face-to-face follow-up and health education at the outpatient department of Sichuan Provincial People's Hospital. In contrast, PWE in the internet hospital follow-up program could interact with healthcare providers through online consultations or video consultations using methods such as videos, images, and text, via the Sichuan Provincial People's Hospital Internet Hospital platform. A fixed day each month will be scheduled for follow-up visits and epilepsy health education for PWE. PWE will be assessed for quality of life, anxiety, and depression in both groups at the beginning of the study, and after six months, patients will be reassessed to compare changes in quality of life, anxiety, and depression between the two groups.

Primary Outcome

We defined the quality of life as the primary outcome, measured by the American Quality of Life in Epilepsy scale (QOLIE-31), assessed at baseline, 6 months after randomization. The American Quality of Life in Epilepsy scale (QOLIE-31), developed by Cramer and other experts in 1998, was used to assess the quality of life [18]. The QOLIE-31 includes seven subdomains: Seizure Worry, Overall Quality of life, Emotional well-being, Energy/Fatigue, Cognition, Medication side effects, and Social Function. The scale includes a total of 31 items, which collectively evaluate the overall health status.

Secondary Outcomes

The secondary outcomes were Generalized Anxiety Disorder-7 (GAD-7) and Neurological Disorders Depression Inventory for Epilepsy (NDDI-E), measured at baseline, 6 months after randomization.

The Generalized Anxiety Disorder-7 (GAD-7) scale was utilized to assess anxiety levels [19]. It consists of 7 items, each scored on a four-point scale ranging from 0 to 3. The total score of the GAD-7 is 21, with higher scores indicating more severe anxiety symptoms.

Neurological Disorders Depression Inventory for Epilepsy (NDDI-E) is a self-assessment tool consisting of 6 questions. By evaluating depressive symptoms over the past two weeks, it can quickly identify whether PWE have depressive disorders. It is widely used to assess depression in PWE. Each question is scored on a range of 1 to 4 points, with a total score range of 6 to 24 points [20].

Data on demographic and clinical characteristics.

Demographic data included age, gender, education level, family economic status, and household registration type. Clinical data covered seizure type, seizure frequency in the past year, number of

Data availability

The datasets generated and analyzed during the current study are not publicly available because no consent was obtained from the participants in this regard. However, the data are available from the corresponding author upon reasonable request.

Sample size

The sample size estimation was based on the primary outcome—QOLIE-31 scale. Based on literature review, a minimal detectable difference of 5 points was selected and estimated standard deviation of the QOLIE-31 scale score is 10 [21]. The significance level (α) was defined as 0.05, β as 0.1, and the desired statistical power was 90%. Using the formula for sample size calculation, the estimated minimum sample size per group is 86 participants. After considering a 10% dropout rate, it was decided to include 96 participants in both the control and intervention groups.

Data processing and analysis

All data analyses were conducted using an intention-to-treat approach, including all participants, with SPSS (version 25.0). Baseline data were presented as means and standard deviations (SDs) for continuous variables and as counts and percentages for categorical variables. Differences between randomization groups were assessed using independent sample two-tailed t-tests for continuous variables and chi-square tests for categorical variables. Missing values during follow-up were

handled using multiple imputations by predictive mean matching (PMM). For primary and secondary outcomes, a linear mixed model analysis was applied to compare the intervention effects between groups. The models incorporated group, time, and interactions between group and time as fixed covariates and the participants as random intercepts. Multiple contrasts were adjusted using a Bonferroni post hoc test. Effect sizes (Hedges' g) for within-group and between-group differences were calculated using the pooled standard deviation of complete cases only and were classified as small (Hedges' $g = 0.2$), medium (Hedges' $g = 0.5$), and large (Hedges' $g = 0.8$).

Results

Participant Characteristics

The follow-up assessment ended in November 2024. The CONSORT (Consolidated Standards of Reporting Trials) diagram of the participant flow is shown in Figure 1. A total of 252 participants were screened for eligibility, from which 38 participants (15.1%) were excluded: 20 (7.9%) declined to participate, 10 (3.9%) failed to complete screening and 8 (3.1%) did not complete baseline assessment. 214 (84.9%) individuals completed the baseline survey and were randomized into the intervention ($n=107$) and control ($n=107$) groups. At the end of the study, 94.4% (101/107) in the intervention group and 93.5% (100/107) in the control group had completed the follow-up visits. The demographic, obstetrical characteristics, and outcomes of the participants at baseline were similar between the 2 groups (Table 1).

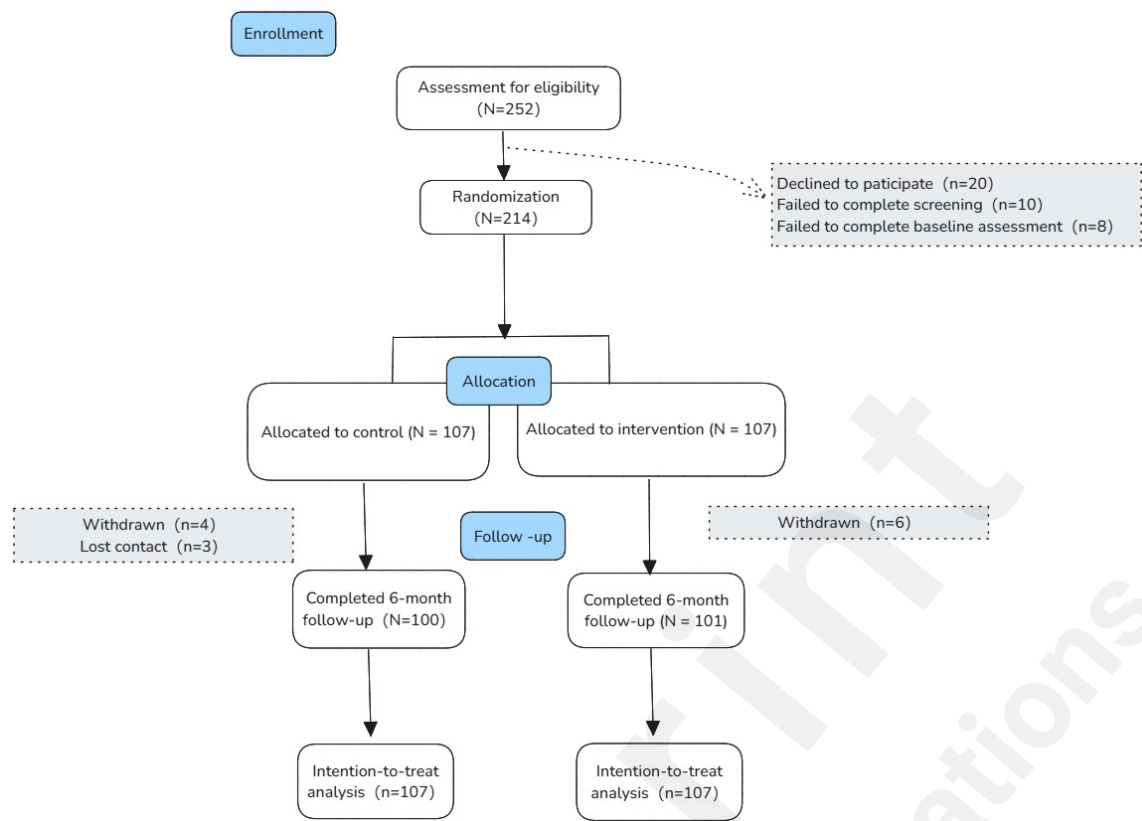


Figure 1 A CONSORT (Consolidated Standards of Reporting Trials) flowchart

Table 1. Baseline characteristics of participants in the intervention and control groups

	Intervention group (n=107)	Control group ((n=107)	P value
Age(y), mean (SD)	34.02.13(12.37)	33.81(12.12)	.43
Age at first onset(y), mean (SD)	24.90(13.56)	23.36(14.566)	.33
Duration of illness(y), mean (SD)	9.12(9.79)	10.45(10.16)	.90
Sex, n (%)			
Male	45(43%)	57(51.5%)	.10
Female	62(57%)	50(48.5%)	
Household registration type, n (%)			
Rural	57(56%)	64 (65.3%)	.33
Non-rural	50(44%)	43(34.7%)	
Educational level, n (%)			
≤12 years	38(34%)	43(40.6%)	.48
≥12 years	69(34%)	64(59.4%)	
Income (month/person), n (%)			
≤3000 yuan	56(54%)	49(43.6%)	.34
≥3000 yuan	51(46%)	58(56.4%)	
Number of drugs, n (%)			
1	41(37%)	37(32.8%)	.57
≥2	66(63%)	70(67.3%)	
Type of seizure, n (%)			
Focal-onset	13(11%)	18(17.8%)	.31
Generalized-onset	82(78%)	72(66.3%)	
Unknow	12(11%)	17(15.8%)	
Seizure frequency, n (%)			
≥1/year	60(63.6%)	71(68.2%)	.12
≤1/year	47(36.4%)	36(31.8%)	
QOLIE-31 ^a total score, mean (SD)	65.22(7.21)	65.23(8.09)	.99
Seizure worry, mean (SD)	58.33(13.72)	59.01(13.82)	.72
Overall quality of life, mean (SD)	72.21(11.35)	75.33(30.29)	.47
Emotional well- being, mean (SD)	65.42(8.69)	64.21(9.85)	.34
Energy/fatigue, mean (SD)	60.13(10.37)	60.40(10.51)	.85
Cognition, mean (SD)	64.94(11.96)	64.29(12.21)	.69
Medication side effects, mean (SD)	53.67(14.63)	50.07(13.90)	.07
Social Function, mean (SD)	66.18(9.02)	65.49(10.911)	.62
GAD-7 ^b , mean (SD)	7.43(5.95)	7.17(5.28)	.73
NDDIE ^c , mean (SD)	13.04(5.63)	12.18(5.10)	.24

^a QOLIE-31: Quality of Life in Epilepsy -31

^b GAD-7: Generalized Anxiety Disorder-7

^c NDDIE: Neurological Disorders Depression Inventory for Epilepsy (NDDI-E)

Primary Outcome

Both groups improved over time, showing significant within-group improvements in QOLIE-31 total score compared with baseline ($P<.001$). Effect sizes were medium for the control group (Hedges'g: 0.57, 95% CI 0.29 to 0.86) and large for the intervention group (Hedges'g: 1.38, 95% CI 1.07 to 1.68) (Table2). The linear mixed model also indicated that the interactions between the intervention and follow-up time were statistically significant ($P<.001$) (Table2), the observed (between-group) effect size was small (Hedges'g: 0.49, 95% CI 0.22 to 0.76) (Table2).

As for seven subdomains scores of QOLIE-31: both groups improved over time, showing significant within-group improvements in seven domains scores compared with baseline (all $P<.001$). The effect sizes for the control group were small (eg, overall quality of life, emotional well-being, energy/fatigue, cognition, social function) and medium (eg, seizure worry, medication side effects). The effect sizes for the intervention group were small (eg, overall quality of life, cognition), medium (eg, social function) and large (eg, seizure worry, emotional well-being, energy/fatigue and medication side effects). Refer to Table 2 for further details. For all seven subdomains scores of QOLIE-31, except cognition($P=.57$) and social activities($P=.09$) subdomains, the interactions between the intervention and time remained statistically significant (all $P<.05$). Refer to Table 2 for further details. The effect sizes of seven subdomains scores of QOLIE-31 between groups after the intervention were small (eg, seizure worry, overall quality of life) and medium (eg, emotional well-being, energy/fatigue medication side effects). Refer to Table 2 for further details. The more detailed LMM results are documented in Multimedia Appendix 1.

Secondary Outcomes

Both groups improved over time, showing significant within-group reductions in GAD-7 score compared with baseline ($P<.05$). Effect sizes were small for both group (control group, Hedges'g: -0.29, 95% CI -0.57 to -0.01, intervention group, Hedges'g: -0.22, 95% CI --0.14 to -0.09). (Table2) The linear mixed model indicated that the interactions between the intervention and follow-up time were no statistically significant ($P=.12$) (Table2).

Both groups improved over time, showing significant within-group reductions in NDDIE score compared with baseline ($P<.001$). Effect sizes were small for the control group (Hedges'g: -0.32, 95% CI -0.60 to -0.04) and medium for the intervention group (Hedges'g: -0.57, 95% CI -0.85 to -0.29) (Table3). The linear mixed model also indicated that the interactions between the intervention and follow-up time were statistically significant ($P=.01$) (Table2), the observed (between-group) effect size was small (Hedges'g: 0.42, 95% CI 0.15 to 0.68) (Table2).



Table 2. Results of intention-to-treat (ITT) outcome measures

Measure	Before the intervention, mean (SD)	After the intervention, mean (SD)	Within-group effect sizes, Hedges'g (95% CI)	P value	F(Group×time) ^e	P value (Group×time) ^e	Between-group effect sizes, Hedges'g (95% CI)
Primary outcome							
QOLIE-31^a Total score							
Intervention (n=107)	65.22(7.21)	75.02(6.94)	1.38, (1.07 to 1.68)	<.001	13.10	<.001	0.49, (0.22 to 0.76)
Control(n=107)	65.23(8.09)	69.79(7.16)	0.57, (0.29 to 0.86)	<.001	N/A ^b	N/A	N/A
Secondary outcome							
Seizure worry							
Intervention (n=107)	58.33(13.72)	77.27(18.49)	1.17, (0.87 to 1.47)	<.001	10.18	<.001	0.43, (0.16 to 0.70)
Control(n=107)	59.01(13.82)	68.86(13.72)	0.74, (0.46 to 1.03)	<.001	N/A	N/A	N/A
Overall quality of life							
Intervention (n=107)	72.21(11.35)	83.80(16.02)	0.35, (0.07 to 0.63)	<.001	10.20	.01	0.43, (0.16 to 0.70)
Control(n=107)	75.33(30.29)	81.99(30.72)	0.12, (0.01 to 0.42)	<.001	N/A	N/A	N/A
Emotional well- being							
Intervention (n=107)	65.42(8.69)	80.06(10.10)	1.54, (1.22 to 1.85)	<.001	26.51	<.001	0.70, (0.43 to 0.98)
Control(n=107)	64.21(9.85)	68.63(10.63)	0.45, (0.17 to 0.73)	<.001	N/A	N/A	N/A
Energy/fatigue							
Intervention (n=107)	60.13(10.37)	74.14(10.98)	1.28, (0.98 to 1.59)	<.001	18.74	<.001	0.58, (0.32 to 0.86)
Control(n=107)	60.40(10.51)	65.15(10.56)	0.47, (0.19 to 0.75)	<.001	N/A	N/A	N/A

Cognition							
Intervention (n=107)	64.94(11.96)	69.19(11.74)	0.37, (0.09 to 0.65)	<.001	.083	0.57	0.04, (-0.23 to 0.31)
Control(n=107)	64.29(12.21)	67.97(11.31)	0.30, (0.03 to 0.58)	<.001	N/A	N/A	N/A
Medication side effects							
Intervention (n=107)	53.67(14.63)	79.57(14.50)	1.74, (1.42 to 2.07)	<.001	33.89	<.001	0.79, (0.52 to 1.07)
Control(n=107)	50.07(13.90)	58.68(15.85)	0.56, (0.28 to 0.84)	<.001	N/A	N/A	N/A

Measure	Before intervention, the mean (SD)	After intervention, the mean (SD)	Within-group effect sizes, Hedges'g (95% CI)	P value	F(Group×time)e	P value (Group×time) e	Between-group effect sizes, Hedges'g (95% CI)
Social Function							
Intervention (n=107)	66.18(9.02)	72.07(10.48)	0.59, (0.30 to 0.87)	<.001	1.91	.09	0.19, (-0.08 to 0.46)
Control(n=107)	65.49(10.91)	69.40(10.44)	0.34, (0.06 to 0.62)	<.001	N/A	N/A	N/A
GAD-7^c							
Intervention (n=107)	7.43(5.95)	6.76(5.06)	-0.22, (-0.14 to -0.09)	.008	.493	.12	010, (-0.17 to 0.36)
Control(n=107)	7.17(5.28)	5.70 (4.55)	-0.29, (-0.57 to -0.01)	<.001	N/A	N/A	N/A

NDDIE ^d							
Intervention (n=107)	13.04(5.63)	10.21(4.286)	-0.57, (-0.85 to -0.29)	<.001	9.28	.01	0.42, (0.15 to 0.68)
Control(n=107)	12.18(5.10)	10.63(4.4.40)	-0.32, (-0.60 to -0.04)	<.001	N/A	N/A	N/A

^a QOLIE-31: Quality of Life in Epilepsy -31
^b N/A: not applicable.
^c GAD-7: Generalized Anxiety Disorder-7
^d Neurological Disorders Depression Inventory for Epilepsy (NDDI-E)
^eResults of intention-to-treat (ITT) outcome analysis using linear mixed models

Discussion

Principal Findings and Comparison With Prior Work

This study aims to compare internet hospital follow-up management with traditional outpatient follow-up in terms of quality of life, anxiety, and depression among PWE. The results indicated that, except for the cognitive and social function dimensions, the improvements in total QOLIE-31 scale score (Hedges'g: 0.49) and other dimension scores for patients with epilepsy under internet hospital follow-up management were significantly greater compared to those under hospital outpatient follow-up management. Greater reductions in the depression were observed at 6 months after randomization in the intervention group than in the control group (Hedges'g: 0.42).

The findings of this study indicate that both hospital outpatient follow-up and internet hospital follow-up significantly improved the quality of life and reduced anxiety and depression in people with epilepsy (PWE). However, it is important to note that in the assessment of anxiety using the GAD-7 scale, while the effect of time was significant, the difference between groups was not statistically significant. This suggests that the observed improvement in anxiety levels may have been influenced, at least in part, by natural changes over time rather than solely by the intervention itself. Therefore, caution should be exercised in interpreting this result, and future studies should employ more rigorous research designs to further verify the specific effects of internet-based follow-up.

As a chronic neurological disorder, epilepsy requires a strong focus on standardized long-term management. Effective management involves multiple components, including health education, seizure monitoring, treatment adjustments, monitoring drug side effects, and addressing comorbidities [22]. Successful management depends on collaboration between patients and healthcare providers to establish a sustainable long-term follow-up relationship. Epilepsy management can be approached through different follow-up models. Traditional outpatient follow-up is the most common, but emerging models, such as using platforms like WeChat for long-term management, have also gained attention. For example, studies like that of Tong Qianxi [14] have demonstrated improved treatment adherence in pediatric PWE through such platforms, highlighting their potential for long-term management. The model used in

this study combines outpatient care, either traditional or internet-based, with comprehensive epilepsy health education, addressing not only medical needs but also empowering patients with knowledge for better self-management.

Both outpatient and internet hospital follow-up, when coupled with health education, resulted in improved quality of life for PWE. Health education plays a crucial role in epilepsy management. Ridsdale L [23] and colleagues conducted health education programs focusing on self-management for PWE. Their study demonstrated that, after 12 months, patients showed improved quality of life and alleviated symptoms of anxiety and depression. Health education helps patients understand the causes and progression of epilepsy, treatment options, and daily care strategies [24]. With a better understanding of the disease, patients and their families are better equipped to respond rationally, take appropriate treatment measures, reduce unnecessary panic and anxiety, and enhance their confidence in managing the disease [25].

In this study, the regular follow-up model, combining either outpatient care (hospital-based or internet hospital) with epilepsy health education, led to improvements in quality of life, anxiety, and depression. The management of chronic diseases, including epilepsy, is a key area of ongoing research. Hospital-based models, particularly those involving multidisciplinary epilepsy teams, are best suited for patients with severe epilepsy [26]. Another approach involves community-centered models, which provide an alternative for managing epilepsy in areas with limited medical resources. However, these models may be constrained by economic, regional, and privacy factors [27]. In contrast, internet hospital follow-up, coupled with health education, addresses key challenges such as time constraints and geographic limitations. This model offers an accessible, sustainable option for long-term management, particularly for patients with stable epilepsy (non-DRE) who may benefit from continuous monitoring and support without the need for frequent in-person visits.

The results of this study demonstrated that internet hospital follow-up management, as a medical service model, led to significant improvements in the overall quality of life score, as well as reductions in anxiety among PWE, compared to traditional outpatient follow-up management, suggesting that internet hospital follow-up is an effective and feasible approach for chronic disease management in PWE. This is similar to previous

research on internet hospital models for chronic disease management, such as studies focused on diabetes and hypertension, which have also reported positive outcomes [28, 29]. This may be because internet hospital follow-up improves patients' adherence to treatment plans through remote prescriptions, medication reminders, and health education, reducing epilepsy seizures caused by missed doses or unauthorized medication adjustments. Traditional offline follow-up is often limited by time and space, making it difficult for patients to receive timely medical guidance when their symptoms change between visits. Internet hospitals enable patients to access professional medical advice more quickly through remote consultations and online inquiries, reducing unnecessary medical actions caused by misinformation or anxiety. Prior studies have explored internet-based platforms for epilepsy care, most have focused on specific tools, such as mobile health applications [30], however, our study provides an in-depth analysis of the unique role of internet hospitals.

While internet hospital follow-up offers several advantages, the traditional outpatient follow-up model still remains prevalent. It faces several significant challenges, such as information asymmetry, high time costs, difficulties securing appointments with specialists, and limited accessibility for patients in remote areas. Internet hospitals address these issues by offering a more convenient option for patients who are constrained by time or geographic location [31]. For PWE with relatively stable conditions who require long-term medication management, frequent hospital visits for prescriptions are often hindered by time and logistical barriers, leading to higher accommodation and transportation costs. Internet hospitals offer a more efficient alternative by enabling real-time symptom reporting, personalized treatment consultations, and immediate prescription refills, which are crucial for managing epilepsy and improving patient adherence to long-term medication regimens. This eliminates the inconvenience and delays caused by travel, long waiting times, and geographic constraints [32]. Consequently, it enhances the overall convenience and efficiency of medical services, reduces travel-related fatigue, and lessens the financial burden on patients. Additionally, the timeliness of internet hospital care alleviates concerns about the inability to consult doctors promptly in case of changes in the patient's condition or adverse drug reactions. However, no significant improvements were observed in the cognitive and social function dimensions for patients managed through internet hospital follow-up compared to those managed through traditional

outpatient follow-up. The improvement of cognitive and social function relies on long-term environmental stimulation, psychological support, and real-life social interactions, which internet hospital follow-up cannot fully provide. Additionally, cognitive and social function improvement is often closely related to changes in the patient's condition (e.g., epilepsy seizure frequency), and such changes may not show significant improvements within a short-term follow-up period.

For newly diagnosed PWE or those experiencing significant changes in their condition, face-to-face consultations are often necessary. For these non-DRE, whose conditions are relatively stable, follow-up through internet hospitals is more suitable. Epilepsy requires comprehensive evaluation, including physical examination, detailed medical history inquiry, assessment of the patient's overall health, and relevant tests to formulate a tailored diagnosis and treatment plan, which cannot be fully replaced by internet hospitals or other telemedicine methods.

Limitations

The follow-up period in this study was six months. While this duration was sufficient to assess the short-term impact of internet-based follow-up on the quality of life, anxiety, and depression in patients with epilepsy, it may not fully capture long-term trends or impacts on cognitive and social functions. Future studies could consider extending the follow-up period to at least one year or longer to explore the long-term effects of internet-based follow-up on cognitive and social function in patients with epilepsy. Additionally, longer follow-up could help reveal the sustained impact of internet-based follow-up on patients' quality of life and whether there are fluctuations or improvements over time.

We have explicitly acknowledged the limitations of using self-reported measures, such as the GAD-7 and NDDI-E, for assessing anxiety and depression in patients with epilepsy (PWE). While these tools are validated and widely used, they rely on patient self-reporting, which can be influenced by subjective factors such as patients' emotional state, social desirability bias, or misunderstanding of the questions.

We also acknowledge that differences in nurse experience may have contributed to the observed differences, with one nurse having 10 years of experience in epilepsy specialty care and the other having 8 years. These factors should be further explored

and controlled for in future research. Additionally, we have noted that the internet hospital follow-up group may have received extra online educational materials, which could introduce potential confounding effects, particularly in terms of educational support and access to information. To ensure a more equitable comparison between the two groups, future research should consider balancing non-digital support, such as providing similar educational materials and support resources to the traditional outpatient group.

This study was conducted at a single hospital, which introduces selection bias and limits its generalizability. Furthermore, cultural factors may influence patients' willingness to adopt internet hospital services or their expectations of healthcare. Therefore, future research should explore the application of internet hospital models in diverse settings to assess their adaptability and effectiveness across different healthcare systems and cultural contexts.

While internet hospitals offer many advantages, they also face challenges in implementation, particularly among resource-limited populations or those with low digital literacy. For example, patients may lack the skills to use the internet or face device limitations, which can impact their engagement and outcomes. Additionally, data security and privacy issues are critical concerns that internet hospitals need to address. Therefore, future research should consider ways to improve digital literacy, ensure the availability of devices, and strengthen data protection.

While the study received ethical approval and participant consent, we acknowledge potential biases, particularly related to participants' access to technology. Disparities in internet service availability may affect patient participation. Future research should ensure equal access to internet resources and control for differences in service availability.

Conclusion

Regular follow-up management through either internet hospitals or hospital outpatient clinics can improve the quality of life for patients with epilepsy and alleviate their anxiety and depression. For patients with epilepsy managed through internet hospital follow-up, their quality of life and depression are more likely to improve. Therefore, internet hospital follow-up management is recommended for wider use in the follow-

up care of patients with epilepsy. In clinical practice, it is essential not only to focus on controlling seizures and reducing related harm but also to thoroughly understand the patient's emotional state and provide proactive health education, along with necessary medication treatment.

Authors' Contributions

JL, TTL, HYL and MZ designed the study concept. TTL, MZ, HYL, and YWZ drafted the manuscript. XYH and XG provided one-on-one structured teaching. TTL, MZ, LL, LM, CSL and MMZ were responsible for data collection and quality control. LL was responsible for statistical analysis. TTL, MZ and LL critically revised the manuscript. All authors provided administrative, technical, and material support and agreed with the final version of the article.

Conflict of Interest

None.

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Data Availability

The datasets generated and analyzed during the current study are not publicly available due to the lack of participant consent for public sharing. However, the data can be obtained from the corresponding author upon reasonable request.

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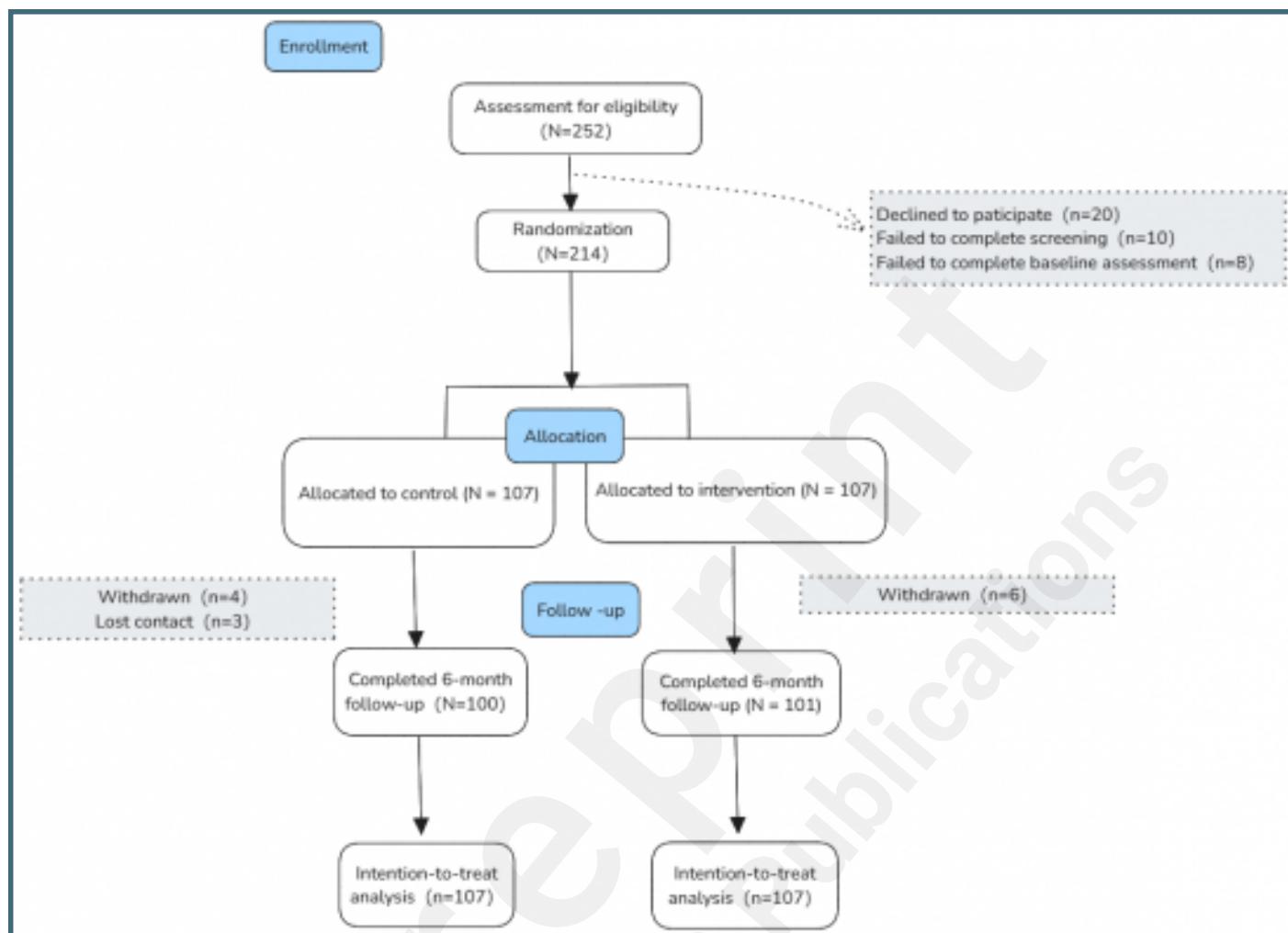
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Supplementary Files

Figures

A CONSORT (Consolidated Standards of Reporting Trials) flowchart.



Multimedia Appendixes

Additional analyses and statistics.

URL: <http://asset.jmir.pub/assets/77db3446b86801f48f571d55be1e091b.docx>

