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A 6-month prospective randomized controlled trial of remotely delivered group-format epilepsy self-management vs. waitlist control for high-risk people with epilepsy

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Summary:

Objective: In spite of advances in care, many people with epilepsy have negative health events (NHEs) such as accidents, emergency department (ER) visits and poor quality of life. "Self-management for people with epilepsy and a history of negative health events" (SMART) is a novel group-format epilepsy self-management intervention. A community participatory approach informed the refinement of SMART which was then tested in a 6-month randomized controlled trial of SMART (N=60) vs. wait-list control (WL, N=60).

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Ethical Publication Statement:

We confirm that we have read the Journal's position on issues involved in ethical publication and affirm that this report is consistent with those guidelines.

Methods: Participants were adults ≥ age 18 with epilepsy and an NHE within the last six months (seizure, accident, self-harm attempt, ER visit, or hospitalization). Assessments were conducted at screening, baseline, 10 weeks and 24 weeks (six-months). Primary outcome was 6-month change in total NHE count. Additional outcomes included depression on the 9-item Patient Health Questionnaire (PHQ-9) and Montgomery-Asberg Depression Rating Scale (MADRS), quality of life on the 10-item Quality of Life in Epilepsy (QOLIE-10), functioning on the 36-item short-form health survey (SF-36), and seizure severity on the Liverpool Seizure Severity Scale.

Results: Mean age was 41.3 years (SD = 11.82), 69.9% were African-American, 74.2% were unemployed and 87.4% with an annual income < U.S. $25,000. 57.5% had a seizure within 30 days of enrollment. Most NHEs were seizures. Six month study attrition was 14.2% overall and similar between arms. Individuals randomized to SMART had greater reduction in total median NHEs from baseline to 6-months compared to WL (p=.04). SMART was also associated with improved PHQ-9 (p=.032), MADRS (p= .002), QOLIE-10 (p<.001) and SF-36 (p=.015 physical health, p=.003 mental health) vs. WL. There was no difference in seizure severity.

Significance: SMART is associated with reduced health complications and improved mood, quality of life and health functioning in high-risk people with epilepsy. Additional efforts are needed to investigate potential for scale-up.

Keywords

epilepsy; seizures; self-management; depression; quality of life

Introduction:

In spite of advances in antiepileptic drugs (AEDs) and other therapies, many people with epilepsy have negative health events (NHEs) such as accidents and emergency department (ER) visits and poor quality of life.[1–4] Risk factors for poor epilepsy control include medication non-adherence and poor social supports as well as comorbidities like mental illnesses.[4; 5] Minorities and individuals of lower socioeconomic status may be particularly likely to have NHEs and poor quality of life.[2–5]

Health management for people with epilepsy includes active involvement in treatment, taking prescribed AEDs, lifestyle that minimizes seizure risk, and treatment of comorbid conditions. Since 2009, the Centers for Disease Control and Prevention (CDC) Prevention Research Centers' Managing Epilepsy Well (MEW) Network has focused on development and testing of evidence-based epilepsy self-management.[6] One of the MEW Network interventions, Targeted Self-Management for Epilepsy and Mental Illness (TIME) targets individuals with epilepsy and comorbid mental illness, and has demonstrated improved depression outcomes compared to treatment as usual.[7] A key feature of TIME is Peer Educators (people with epilepsy) who serve as experiential guides to support intervention participants.[7; 8] However TIME has some practical limitations including access issues for individuals unable attend in-person meetings and exclusion criteria for many because TIME targets those with clinician-diagnosed comorbid serious mental illness.

To address these limitations, we have adapted TIME and created SMART "Self-management for people with epilepsy and a history of negative health events" (SMART). SMART is a group-format self-management intervention to assist vulnerable sub-groups with epilepsy including those with recent seizures and other health complications. SMART combines the portability and low cost of a web-based intervention with the personally salient components of behavior modeling obtained by interacting with individuals who have "walked the walk" in living with epilepsy.

This report describes the two-step process in refining and testing SMART. First, the TIME intervention was adapted with input from key stakeholders. Second, SMART was tested for feasibility, acceptability and efficacy in a six-month prospective randomized controlled trial (RCT) comparing SMART vs. six-month waitlist control (WL) in people with epilepsy and recent NHEs. Like TIME, SMART uses Peer Educators. As a primary outcome with relevance to health resource use, we hypothesized that at six-month follow-up, SMART would be associated with reduction in total NHE counts compared to WL. As secondary outcomes, we expected that SMART would be associated with reduced depressive symptom severity and improved quality of life, health functioning, and epilepsy control vs. WL.

Methods:

Overview:

This RCT tested a novel self-management intervention in people with epilepsy and is specifically focused on high-risk sub-groups who have recently experienced seizures or epilepsy-related complications. The overall CDC-funded project has three design components 1.) A community participatory approach that informed the adaptation of TIME, from which SMART is derived, 2.) A prospective six-month efficacy RCT of SMART vs. WL in a high-risk sample with epilepsy and 3.) Ongoing follow-up evaluation of both SMART and WL study arms to evaluate longer-term (18-month) outcomes. This report describes the stakeholder refinement of SMART (approximately 3 months in duration) and results of the efficacy RCT conducted over a period of approximately 36 months. The primary RCT outcome was six-month change in NHEs. Secondary outcomes were change in depressive symptom severity, quality of life and functioning.

Study participants:

Study participants were drawn from the community with assistance from the local Ohio Epilepsy Association, MetroHealth System, a regional safety-net healthcare provider, the Lois Stoke VA, and University Hospitals of Cleveland Neurological Institute, a tertiary care center. We used electronic medical record problem lists from the safety-net and university-affiliated systems to preliminarily identify screening participants. Study inclusion criteria included a self-reported diagnosis of epilepsy, age ≥ 18, having at least one NHE within the past six months, and being able to provide written informed consent and participate in study procedures. NHEs were defined as seizures, accidents or traumatic injury, self-harm attempts, ER visits, and hospitalizations Participants were excluded if they were at immediate risk of self-harm, had dementia, were pregnant, or unable to read/understand English. Recruitment was conducted in an urban setting in northeastern Ohio. All

participants provided written informed consent and the study was approved by the local hospital institutional review board (IRB).

Randomization:

Computer-generated 1:1 randomization was based on a randomized block design with random block sizes.

SMART intervention:

SMART is an adjunct to standard epilepsy care that is largely similar to the TIME approach and is informed by chronic disease self-management principles and techniques.[9–11] Consistent with community-based participatory research principles, TIME was refined with iterative input from an 13-member community advisory board (CAB) composed of individuals with epilepsy (N= 6 including one veteran), family members (N= 4), Veterans Administration (VA) and safety-net clinicians (N= 2), and representatives from the Epilepsy Association (N= 1), and Prevention Research Center's Network of Community Advisors (N= 1). Mean CAB participant age was 49.6 (SD=10.1, range 32-64), seven women, and six men. For those with epilepsy, mean epilepsy duration was 17.2 years (SD=16.0, range 0.5-41.4). The CAB met three times. In the first two meetings, input was sought on perceived barriers and facilitators to care for epilepsy and mental health comorbidity.[12] We prioritized modifiable factors which may be addressed via self-management. In the third CAB meeting, a SMART intervention draft was presented and additional feedback was obtained to derive a final curriculum.

Specific features of SMART based on stakeholder input was that it be brief and that participants could participate via computer or phone. Key differences between TIME and SMART are that SMART has 8 sessions conducted over approximately 8 −10 weeks (vs. TIME having 12 sessions over 12 weeks), a less explicit focus on individuals who have been diagnosed with mental health conditions, and the fact only the first SMART session is conducted in –person with the subsequent 7 sessions being conducted remotely (vs. TIME having all sessions done in person).

SMART is operationalized in two steps. Step 1: One group-format, in-person 60-90 minute session (Up to 10 participants), was collaboratively delivered by a Nurse Educator-Peer Educator dyad. Peer Educators were individuals with epilepsy with at least three life-time NHEs. Following the in-person session there were seven group-format sessions delivered via internet on personal computer tablets using posters/graphics and emphasizing interactive discussion. The online communication system used was Adobe Connect, a secure web conferencing software. This use was approved by the IRB.

Telephone call-in was available for those with limited internet access or familiarity. The group-sessions were completed over approximately eight weeks. SMART stresses information-sharing in a way that is accessible to participants, and fosters motivation for active self-management. Topics addressed are noted in Figure 1. SMART sessions are operationalized in written curricula, including an interventionist's manual, participant's manual and slides and handouts. Step 2: Following the group sessions, participants had six telephone maintenance sessions (spaced approximately two weeks apart) with the Peer

Educator and the Nurse Educator alternating calls. Nurse and Peer Educator calls were intended to be brief (no more than 10-15 minutes) and followed a semi-scripted structure in which the Nurse or Peer Educator asked participants how they were doing with attempting to meet their personal care plan (established during the SMART group sessions). Educators were instructed to not introduce new materials, but rather to re-inforce messages from SMART that might help the participant meet their goals. For SMART participants who attended at least one session, Nurse Educators sent standardized brief summaries to care providers letting them know that their patient was in the SMART program, provided a brief program explanation and contact information should providers have questions.

The combined training for Nurse and Peer Educators consisted of a 2-day, in-person intensive followed by regular in-person and telephone group meetings to review the curriculum, trouble-shoot problems, and address questins. Previous work by this study team provides more detail on the training process for Peer and Nurse Educators in similar chronic disease self-management interventions.[13]

Feasibility and fidelity:

Attendance for each SMART session was recorded, and acceptability was evaluated with a brief self-rated checklist at the end of each 8-session group series. Following Fraser,[14] non-interventionist study staff evaluated fidelity quantitatively (i.e. duration and content covered) and qualitatively (i.e. participant-interventionist interaction) at each session. The fidelity checklist contained 8-items using a yes/no format (completed by non-interventionist study staff) that assessed whether the interventionists adhered to study content (1 item), format (1 item), rapport and empathy with group participants (2 items), Peer Educator engagement (1item) and timing/schedule planning (2 items). If there were any “no” responses on the fidelity checklist these were addressed in a de-briefing held immediately after the SMART session.

WL control:

As with SMART, individuals in WL continued treatment with their regular medical providers. Beyond follow-up research assessments at the same time points a SMART, there was no interaction between participants and the research team over a six-month period. After six months, the SL group received the SMART intervention.

Assessments:

In-person evaluations at the study medical center were conducted at screening, baseline (immediately prior to randomization), at 10-weeks follow-up (shortly after the completion of the SMART sessions) and at 24 weeks (six months) follow-up. Baseline information, all derived from self-report, included demographic variables of age, gender, ethnicity, race, socioeconomic status, marital status, level of education, and employment status. Baseline clinical evaluations included type and duration of epilepsy, AED use, the self-reported Charlson Comorbidity Index which identifies key medical condition known to contribute to mortality risk;[15] mental health history and health literacy assessed with the Rapid Estimate of Adult Literacy in Medicine (REALM-R) 8-item version.[16] For the primary outcome, self-reported NHE counts in the six months prior to enrollment and in the intervening periods

between 10-week and six-month follow-up time-points were assessed. Secondary assessments included depressive symptom severity, quality of life, functional status and epilepsy severity in those with a seizure in the past 30 days. Individuals in either study arm for whom there was a concern regarding risk to self at any point were further assessed by the psychiatrist principle investigator and referred for additional treatment as needed. To assess SMART acceptability, a brief survey was conducted at 10-weeks (after group sessions were done) on perceived benefit vs. burden.

Primary Outcome:

NHEs are both directly and indirectly related to epilepsy. Seizures and ER visits/ hospitalizations are obvious and direct. Other effects such as depression that leads to a suicide attempt may be related to the challenges of living with poorly controlled seizures. Because self-management is a holistic approach that goes beyond seizure management we expected an overall reduction in NHEs. We evaluated self-reported NHEs in the six months prior to study enrollment and during the 6-month RCT. NHEs were all counted independently and a total NHE count was derived by summing NHE numbers in each category. We assessed number of ER visits, hospitalizations (for any cause), self-harm attempts, and accidents/traumatic injuries. As an *a priori* validation of self-reported NHEs, we counted ER visit and hospitalization encounters documented in the electronic medical record of individuals in the safety net system (N=41, 34.1% total enrolled sample).

Secondary Outcomes:

Depressive symptom severity:

Depressive symptom severity was assessed using the 9-item Patient Health Questionnaire (PHQ-9) a widely used and validated self-rated depression scale.[17] The PHQ-9 incorporates diagnostic and statistical manual (DSM) diagnostic criteria, with scores ranging from 0-27. Higher scores indicate worse depression severity. Depressive symptom severity was also assessed with the Montgomery-Asberg Depression rating scale (MADRS), a ten-item rater-administered questionnaire with scores ranging from 0-60.[18] Higher scores indicate worse depressive symptom severity.

Quality of life:

Quality of life was assessed with the 10-item Quality of Life in Epilepsy (QOLIE-10), a self-administered questionnaire with scores ranging from 0.1-5.1 and higher scores indicating worse quality of life.[19] Studies suggest that the QOLIE-10 has good test-retest reliability and correlates well with longer versions of this instrument.[20]

Functional status:

We assessed functional status using the SF-36, a multi-purpose, short-form health survey with 36 questions that yields two psychometrically-based components: a physical component summary (PCS) and mental component summary (MCS).[21] Scores range from 0 (worst functioning) to 100 (best functioning). The SF-36 is a generic measure of functional health status, and has proven useful for comparing the relative burden of diseases.

Epilepsy severity:

We assessed epilepsy severity with the Liverpool Seizure Severity Scale.[22] The 12-item Liverpool Seizure Severity Scale, which is assessed only in individuals who have experienced a seizure in the past 30-days, has scores ranging from 1-40, with lower scores indicating more severe seizures.

Other secondary assessments:

To explore the possible mechanistic underpinnings of SMART, we evaluated change in attitudinal and behavioral factors. Self-efficacy was measured using the 33-item Epilepsy Self-Efficacy Scale (ESES) with scores ranging from 0-330 and higher scores indicating better self-efficacy.[23; 24] Social support was measured with the 12-item Multidimensional Scale of Perceived Social Support (MSPSS), that measures perception of social support provided by family and friends, as well as satisfaction with that support.[25] The MSPSS score ranges from 1-84 with higher scores indicating better social support. Epilepsy self-management was measured using the Epilepsy Self-Management Scale (ESMS); scores range from 1-190 with higher scores indicating better self-management of epilepsy.[26] Stigma for epilepsy was measured using the Epilepsy Stigma Scale (ESS).[23; 27] In the ESS, scores range from 7-70; each item is rated on a 7-point scale from strongly disagree to strongly agree, with higher numbers indicating greater perceived stigma.

Statistical analysis:

Statistical analysis was performed using SAS 9.4 (SAS Institute, NC). Descriptive analyses characterized the baseline sample and examined change over time in NHEs as well as the key outcomes of PHQ-9, MADRS, QOLIE-10, SF-36 and Liverpool Seizure Severity Scale. For the primary outcome of change in total NHEs from baseline to 6-months, as there were more outliers in the SMART arm (individuals who had a very high number of seizures), we used Mann-Whitney non-parametric test to assess for significant differences. We also considered longitudinal binary mixed models (no NHEs versus at least one NHE) with a first order auto regressive (AR (1)) covariance structure and subject-level random effects. Longitudinal mixed models from baseline to 10 and 24-weeks were also assessed for PHQ-9, MADRS, QOLIE-10, SF-36 and Liverpool Seizure Severity Scale, after adjustment for age, gender, marital status, education, employment and mental health comorbidity. A Type I error rate of 0.05 was used for all these tests.

Results:

Study enrollment and flow:

Figure 2 illustrates overall study flow. There were 139 individuals screened and 120 randomized. The majority of individuals who failed screening (N=10) were those lost to follow-up between screening and baseline visits. Six-month study attrition was 14.2% overall (N=17) and similar between arms.

Baseline sample:

Table 1 shows baseline demographic and clinical variables in the entire sample, SMART and WL groups. Mean age was 41.3 years (SD = 11.82) with 79 (69.9%) African-Americans. Individuals had epilepsy on average for over two decades. Consistent with the heavy social and socioeconomic burden of epilepsy, 89 (74.2%) were unemployed or disabled and 104 (87.4%) had an annual income of less than U.S. $25,000. Only 38 (31.7%) were married or co-habiting. Nearly 11% (N=13) of the sample were veterans. Most were prescribed between 1-2 AEDs and 69 (57.5%) had a seizure within 30 days of study enrollment. Mental health comorbidity was common, with the most frequent conditions being depression, anxiety and post-traumatic stress disorder (PTSD). The MADRS and PHQ-9 scores suggest a substantial baseline level of depressive symptoms.

SMART vs. WL

Baseline characteristics:

As noted in Table 1, characteristics were similar between SMART and WL with the exception of more individuals in SMART who were married/co-habiting and more individuals in WL who were students, employed, or full-time homemakers.

Adverse events and SMART attendance:

There were 36 clinical trial serious adverse events (SAEs) that occurred in 23 participants over the 6-month study time period. SAEs that occurred were 27 hospitalizations due to seizures (16 individuals having multiple hospitalizations due to seizures), 4 hospitalizations due to medical events not related to seizures (1 individual hospitalized on 2 occasions due to partial bowl obstruction, one for pneumonia, one after tripping down stairs and sustaining a concussion) and 5 individuals that had serious acute suicidal thoughts or behavior (3 hospitalized for this reason). There were no deaths. No SAEs were related to study participation.

For individuals in SMART, the average number of group sessions attended (out of maximum eight possible) was 6.7 (SD 2.3). This included 5.2 (SD 2.4) in-person sessions and 1.5 (SD 1.6) make-up sessions. Of the 60 individuals randomized to SMART, there were four (6.7%) who attended no sessions. Of the 56 individuals who attended at least one SMART session, four (7.1%) never used a computer to access materials and their attendance was only in-person and/or phone participation.

NHEs:

Seizures comprised the majority of NHEs, with other events being far less common. Due to the non-standard distribution of NHEs and relatively high proportion of subjects with no NHEs at 6-month follow-up, we considered longitudinal binary mixed models (no NHE or at least one NHE) as opposed to count regression models. The binary outcome is not precise, and this may be a reason that means in treatment by time interaction for total NHEs did not quite reach statistical significance (p=.055). Individuals in SMART had greater reduction in the total median NHE count change from baseline to 6-months compared to WL (p=.04). There were no significant differences in sub-categories of NHE counts between study arms

(Table 2). We found no significant differences between NHEs (ER visits and hospitalizations) documented in the medical record and self-reported NHEs (see on-line appendix). A generalized linear mixed model approach was used to analyze whether SMART session attendance was associated with change in NHEs among enrollees in SMART. Attendance was not significantly associated with 30-day seizure frequency (p=.844), 6-month ER or hospitalization counts (p=.690), and total 6-month NHE counts (p=.952), but was significantly associated with 6-month seizure frequency (p=.005) in the direction of more seizure reduction occurring in those with better SMART attendance. The linear mixed models were adjusted by the covariates of age, gender, marital status, education, employment and mental health comorbidity.

Secondary outcomes:

As noted in Table 3, SMART was associated with significant improvements in self-rated depressive symptom severity (PHQ-9) (p=.032), observer–rated depressive symptom severity (MADRS) (p= .002), quality of life (QOLIE-10) (p<.001) and health functioning (SF-36 p=.015 physical health, p=.003 mental health) vs. WL. There was no difference in seizure severity on the Liverpool (only administered in individuals with a seizure within the past 30 days). Table 4 shows attitudinal and behavioral outcomes, specifically self-efficacy (ESES), social support (MSPSS), epilepsy self-management (ESMS) and perceived epilepsy stigma (ESS). Compared to WL, individuals in SMART had improvements in ESES (p= .034) and ESMS (p=.005) but not in MSPSS and ESS.

Acceptability survey:

At SMART group completion, 52 participants responded to the acceptability survey. The overwhelming majority (94.2%, N= 49) strongly agreed or agreed that SMART was useful. Similarly, 94.2% (N= 49) strongly agreed or agreed that SMART covered most of the important issues and 94.2% (N=49) strongly agreed or agreed that SMART addressed issues important to their particular situation. A majority (92.3%, N=48) strongly agreed or agreed that the benefit of SMART exceeded the burden or hassle of attending. Additionally, 78.4% (N=40/51) felt that the number of sessions was about right, while 82.4% (N=42/51) felt that the length of each SMART session was about right.

Discussion:

In this six-month prospective RCT testing a novel group-format epilepsy self-management intervention “Self-management for people with epilepsy and a history of negative health events” (SMART), high-risk people with epilepsy had reductions in total median NHE counts and improved mood, quality of life and health functioning compared to controls. The study is significant for a number of reasons including the fact that unlike many standard epilepsy clinical trials, it purposely enrolled high-risk individuals who had recent health complications such as hospitalizations or ER visits, had a substantial proportion of minority participants (approximately 70% African-American), included individuals with mental health comorbidity and used community stake-holders to refine the self-management intervention to maximize saliency and impact for people with epilepsy.

Smith and colleagues recently published a systematic review of group self-management interventions for adults with epilepsy.[28] Interestingly, the review specifically excluded studies that had web or telephone-based interventions. The review by Smith found that seizure frequency was generally reduced among in-person group format epilepsy self-management programs.[28] While the SMART efficacy RCT did not find that seizure frequency was reduced compared to controls, broadly-captured epilepsy-related complications (NHEs) which included seizure counts was improved with SMART. The SMART approach is amenable to remote-delivery and can be administered via the internet or by telephone, maximizing potential for broader scale-up. Acceptability findings in the SMART RCT suggested that the web or telephone-delivered format was satisfactory and that most individuals had good group session attendance.

While this RCT did not specifically include either a diagnosis of depression or any specific depressive symptom severity threshold in study inclusion criteria, we expected that individuals with poorly controlled epilepsy might have substantial depressive symptom severity upon enrollment and this in fact turned out to be the case. The relevance of depressive symptom severity to quality of life and other outcomes in people with epilepsy is substantial, and for this reason the MEW Network has prioritized a focus on mental health comorbidity.[6; 29] A study of people with poorly controlled epilepsy found that in the order of large to small magnitude: depression, low self-mastery, anxiety, stigma, medical and psychiatric comorbidity, poor medication adherence, and more frequent seizures were associated with worse quality of life.[30] A previous report by these investigators found that NHEs confined to ER visits and hospitalizations were more common in people with epilepsy and comorbid mental illness vs. in people with epilepsy who did not have mental health comorbidity.[31]

A number of studies have examined epilepsy self-management interventions on mood outcomes and on quality of life.[28; 32; 33] The literature review by Smith and colleagues showed significant improvement in psychological outcomes in two of six studies.[34; 35] The PACES epilepsy self-management intervention developed by Fraser and colleagues found a significant change in depressive symptom severity measured with the PHQ-9.[34] While PHQ-9 scores were reduced compared to controls at 8-weeks post-intervention, the difference between intervention and control was not statistically significant at six months. Olley et al. found an improvement in depressive symptom severity measured by the Beck Depression Inventory for people with epilepsy participating in group psychoeducation vs. controls, but noted the need for cautious interpretation due to a small sample (N= 15) in each study arm.[35] It is possible that SMART, which uses people with epilepsy as guides to help others learn to cope with the challenges of living with this common chronic neurological condition may help to alleviate some of the factors that prevent people with epilepsy from optimizing their quality of life. While our RCT outcomes did not suggest that stigma and social support were improved in SMART participants vs. controls, epilepsy self-management skills and self-efficacy were improved.

The study has several limitations including a single geographic location, relatively short duration, reliance on self-report for NHEs and non-blinded research assessments. Additionally, individuals with epilepsy who volunteer for a research study may not represent

the full spectrum of individuals with epilepsy. However, a validation exercise with respect to NHEs, broad community sampling and use of electronic health records to reach out to high risk individuals as well as outcome evaluation that included both clinical outcomes and attitudinal measures helps offset some of the methodological limitations.

Other stigmatizing factors such as unemployment and low income which are beyond the scope of the SMART intervention, could have biased epilepsy stigma outcomes. But SMART's strengths are its foundation based on participatory research methods and an evidence-based intervention; its use of peer-educators facilitating empowerment and training; multi-mode delivery using traditional group format and telehealth approaches to eliminate barriers to care; and efficacy even in people who have long-standing epilepsy.

In conclusion, this RCT efficacy data suggests that SMART is a novel epilepsy self-management intervention that is associated with improved health outcomes in high-risk people with epilepsy. Potential for broader scale-up needs to be explored

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Appendix:: Medical record documentation of emergency room visits and hospitalizations vs. self-reported emergency room visits and hospitalizations

NHE variable	Electronic health record NHEs (Mean, STD, Median, N)	Self-reported NHEs (Mean, STD, Median, N)	P-value[a]
ER visit at baseline	1.32, 1.77, 1, 41	2.63, 9.98, 0, 41	0.18
Hospitalization at baseline	0.07, 0.26, 0, 41	0.46, 2.81, 0, 41	1.00
ER visit at 6-month follow-up	1.15, 1.72, 1, 40	0.52, 0.69, 0, 29	0.07
Hospitalization at 6-month follow-up	0.08, 0.27, 0, 40	0.03, 0.19, 0, 29	1.00

[a]All calculations used Mann-Whitney U test

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Key Point Box

- Many people with epilepsy have health complications such as accidents, emergency department visits and poor quality of life.
- "Self-management for people with epilepsy and a history of negative health events" (SMART) is a novel group-format epilepsy self-management approach.
- This 6-month randomized controlled trial compared SMART (N=60) vs. wait-list control (WL, N=60).
- SMART is associated with reduced health complications and improved mood, quality of life and health functioning in high-risk people with epilepsy.

Session 1	Orientation and introductions; Emphasize ground rules; Establishment of a therapeutic relationship; Facts and myths about epilepsy and general epilepsy management principles
Session 2	Relationship of epilepsy and stress; Stigma and "double stigma"; Strategies to cope with stigma; Introduction to personal goal-setting
Session 3	Treatments for epilepsy; Complications of epilepsy; Minimizing epilepsy complications; The importance of daily routine and good sleep habits
Session 4	Problem-solving skills and the IDEA approach (Identify the problem, Define possible solutions, Evaluate the solutions, Act on the best solution); Talking with your health care providers; Role play of communication with care providers
Session 5	Nutrition for best physical and emotional health; Substance abuse and its effects on epilepsy; Specific stress-management approaches
Session 6	Effects of exercise and being outdoors on physical and emotional health; Medication routines; Prioritizing medication side effects and discussing it with your clinician
Session 7	Social supports and using your available supports; Advocacy groups for epilepsy; A personal care plan to take care of the mind and the body
Session 8	Normalizing your life in spite of having a chronic but unpredictable condition; Self-management as a life-style; Acknowledgement of group progress; Setting the stage for Ongoing Illness Management and Recovery (Step 2)

Figure 1:
Curriculum of "Self-management for people with epilepsy and a history of negative health events" (SMART)

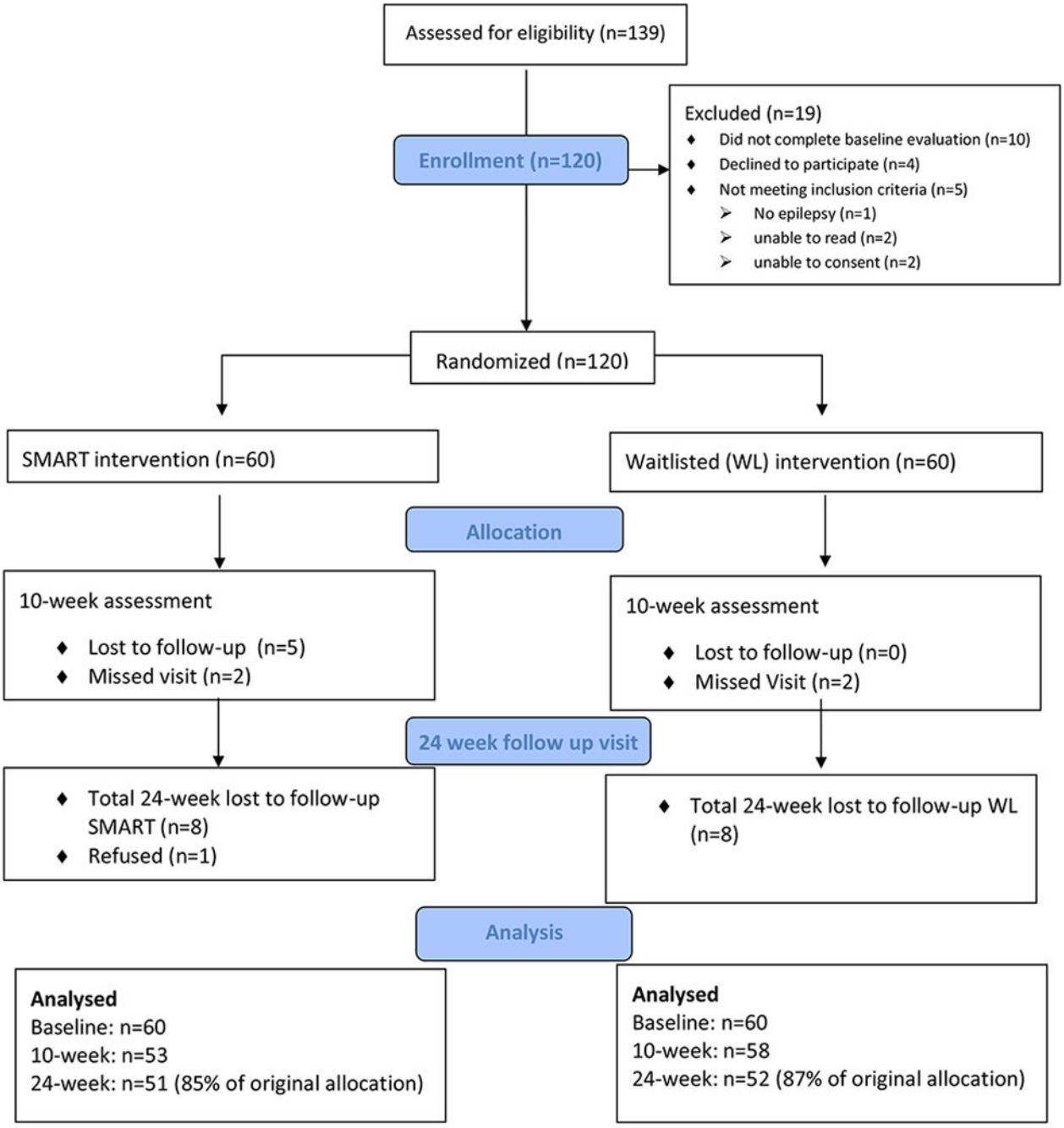

Figure 2:
SMART CONSORT Flow Diagram

Table 1:

Baseline demographic and clinical characteristics of a randomized controlled trial of epilepsy self-management vs. waitlist control

Variable	Total Sample N=120	SMART	Waitlist	P-value[a]
Demographics				
Age – Mean, SD	41.3, 11.8	41.5, 12.3	41.0, 11.4	0.81
Gender- N (%)	119			
Female	81, 68.1%	39, 65.0%	42, 71.2%	
Male	38, 31.9%	21, 35.0%	17, 28.8%	0.47
Race – N (%)	113			
African-American	79, 69.9%	38, 66.7%	41, 73.2%	
White	34, 30.1%	19, 33.3%	15, 26.8%	0.45
Ethnicity- N (%)	118			
Hispanic	9, 7.6%	4, 6.9%	5, 8.3%	1.00[≠]
Marital Status- N (%)	120			
Single/separated/divorced/widowed	82, 68.3%	35, 58.3%	47, 78.3%	
Married/co-habiting	38, 31.7%	25, 41.7%	13, 21.7%	0.02
Education – N (%)	119			
Less than High school	19, 16.0%	8, 13.3%	11, 18.6%	
High school	33, 27.7%	22, 36.7%	11, 18.6%	
More than High school	67, 56.3%	30, 50.0%	37, 62.7%	0.09
Employment Status – N (%)	120			
Unemployed/Retired	27, 22.5%	19, 31.7%	8, 13.3%	
Unable to work/Disabled	62, 51.7%	30, 50.0%	32, 53.3%	
Student, employed, full-time homemaker	31, 25.8%	11, 18.3%	20, 33.3%	0.03
Income – N (%) annual in U.S. dollars	119			
< $25K	104, 87.4%	53, 88.3	51, 86.4	
>=$25	15, 12.6%	7, 11.7	8, 13.6	0.76
Epilepsy Characteristics				
Duration of epilepsy in years (mean, SD)	20.59, 15.2	20.9, 16.7	20.3, 13.7	0.86
Number of prescribed AEDs[*] (mean, SD)	1.6, .8	1.7, .9	1.62, .8	0.77
Epilepsy type – N (%)				
Generalized	85, 71.43%	40, 67.8%	45, 75%	
Generalized non-convulsive	2, 1.68%	2, 3.39%	0, 0%	
Focal	4, 3.36%	3, 5.08%	1, 1.67%	
Focal with loss of consciousness	5, 4.2%	4, 6.78%	1, 1.67%	

Variable	Total Sample N=120	SMART	Waitlist	P-value[a]
Other	23, 19.33%	10, 16.95%	13, 21.67%	0.25
Seizure 30 days prior to enrollment– N (%)	69, 57.5%	33, 55%	36, 60%	0.58
30-day seizure count at baseline (mean, SD)	2.2, 4.9	2.9, 6.6	1.4, 2.1	.72
Other clinical characteristics				
Charlson Comorbidity Index (mean, SD)	2.06, 2.48	2.03, 2.50	2.08, 2.48	.91
Comorbid mental health condition– N (%)				
Yes	79, 65.8%	35, 58.3%	44, 73.3%	
No	41, 34.2%	25, 41.7%	16, 26.7%	.08
Mental health comorbidities– N (%) **				
Depression	69, 57.5%	30, 50.0%	39, 65.0%	
Anxiety	39, 32.5%	20, 33.3%	19, 31.7%	
Bipolar	26, 21.7%	8, 13.3%	18, 30.0%	
Panic Disorder	14, 11.7%	8, 13.3%	6, 10.0%	
Schizophrenia	5, 4.2%	3, 5.0%	2, 3.3%	
Obsessive Compulsive Disorder	3, 2.5%	1, 1.7%	2, 3.3%	
ADHD	7, 5.8%	0, 0%	7, 11.7%	
PTSD	13, 10.8%	6, 10.0%	7, 11.67%	
Other	9, 7.5%	5, 8.3%	4, 6.7%	
REALM-R Health literacy (mean, SD)	6.5, 2.1	6.5, 2.2	6.4, 2.0	.80
Total 6-month NHE *** count at baseline (mean, SD)	15.0, 33.9	19.4, 44.9	10.7, 16.1	.78
Total 6-month seizure count (mean, SD)	13.0, 33.0	17.8, 44.5	8.1, 13.1	.45
Total 6-month ER visits and hospitalizations (mean, SD)	1.8, 6.9	1.2, 2.5	2.4, 9.5	1.00

*= Antiepileptic drug

**self-reported, some individuals endorsed more than one mental health comorbidity, PTSD= post-traumatic stress disorder, REALM-R=Rapid Estimate of Adult Literacy in Medicine, 8-item version

***= Negative Health Event defined as a seizure, accident or traumatic injury, self-harm attempt, ER visit, or hospitalization

ǂ:Fisher's Exact

a:Comparison of SMART vs. WL variable at baseline

Table 2:

Change in median number of negative health events (NHEs) between SMART vs. WL over 10 and 24- weeks follow-up

Variable	SMART (Mean, SD, Median, N)	WL (Mean, SD, Median, N)	Statistic (p-value)[a]
Primary Outcome:			
Change in total NHE count[*]	−10.16, 39.2, −2, 45	−1.93, 18.6, −0.5, 46	0.04[**]
NHE sub-types:			
Past 30-day seizure count			
Change baseline to 10-week	−1.40, 5.12, 0, 53	5.5, .62, 0, 58	0.60
Change baseline to 24-week	−0.25, 8.44, 0, 51	−.15, 1.8, 0, 52	0.65
Past 6-month seizure count			
Change baseline to 24-week	−7.83, 40, −1, 47	−0.88, 15.7, 0, 49	0.15
Past 6-month ER and Hospitalization count			
Change baseline to 24-week	−0.44, 1.84, 0, 45	−1.26, 8.80, 0, 47	0.69

[*] Difference between baseline and 24-week follow-up.

[a] Comparison of change from baseline in SMART vs. WL. All calculations used Mann-Whitney U test

[**] Statistical significant at α=0.05 with 2-tailed.

Table 3:

Secondary outcomes for SMART vs. WL participants over 10 and 24- weeks follow-up

	Baseline		10 weeks		24 weeks		
Variable	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**p** [a]
PHQ-9							
SMART	10.03	6.6	7.85	6.2	7.27	6.6	0.03
WL	11.45	7.8	11.93	7.4	10.82	7.0	
MADRS							
SMART	16.52	10.7	11.94	10.6	10.92	11.5	0.002
WL	19.72	12.1	20.66	11.5	18.38	11.5	
QOLIE-10							
SMART	3.00	0.9	2.52	0.9	2.46	1.0	< 0.001
WL	2.99	0.9	2.99	0.8	2.97	0.9	
SF-36							
PCS							
SMART	−0.03	1.0	0.10	1.0	0.09	1.1	0.02
WL	0.03	0.9	−0.09	0.9	−0.09	0.9	
MCS							
SMART	0.02	1.0	0.29	1.0	0.24	1.1	0.003
WL	−0.02	1.0	−0.27	1.0	−0.22	0.9	
Liverpool							
SMART	17.94	8.0	19.52	8.3	14.72	8.6	0.06
WL	16.60	7.3	17.97	7.8	19.29	8.7	

[a]Group × time interaction, calculated by linear mixed-effects analysis and adjusted by covariates age, gender, marital status, education, employment and comorbidity of mental health condition.

WL= Waitlist control, PHQ-9= 9-item Patient Health Questionnaire for Depression, MADRS= Montgomery Asberg Depression Rating Scale, QOLIE-10= Quality of Life in Epilepsy, 10-item version, SF-36= Short-from 36 item functional health index

Table 4:

Attitudinal and behavioral outcomes for SMART vs. WL participants over 10 and 24-weeks follow-up

	Baseline		10 weeks		24 weeks		
Variable	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**p** *a*
ESES							
SMART	252.77	51.0	266.36	49.2	279.65	54.2	0.03
WL	244.05	54.4	239.97	62.1	247.71	66.8	
MSPSS							
SMART	67.08	16.5	67.42	15.6	68.53	16.4	0.72
WL	62.80	15.6	61.88	16.6	60.41	17.2	
ESMS							
SMART	141.97	17.7	150.31	17.7	152.75	16.1	0.005
WL	138.57	16.8	141.31	17.7	139.82	17.4	
ESS							
SMART	39.13	17.8	34.58	18.4	33.18	17.9	0.35
WL	42.27	16.5	39.55	17.3	40.47	17.6	

*a*Group × time interaction, calculated by linear mixed-effects analysis and adjusted by covariates age, gender, marital status, education, employment and comorbidity of mental health condition.

ESES= Epilepsy Self-Efficacy Scale, MSPSS= Multidimensional Scale of Perceived Social Support, ESMS= Epilepsy Self-Management Scale, ESS= Epilepsy Stigma Scale WL = Waitlist control