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# Exploring the influence of telehealth on patient engagement with a multidisciplinary Non-Epileptic Seizure (NES) Clinic during the COVID-19 pandemic



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## ABSTRACT

The ILAE task force has identified a gap in treatment access for patients with nonepileptic seizures (NES) [1]. Access to multidisciplinary treatment clinics for adults with NES is limited with only 18 institutions delivering care across the United States [2]. Patient engagement has been low in the University of Colorado, NES Clinic treatment program despite our clinic's status as the only clinic of its kind in the mountain west. We analyzed patient factors of those who engaged in treatment before and after COVID-19 regulations were imposed and found a 23.6% increase in treatment engagement using telehealth. Those who engaged using telehealth were more likely to be of white race, of non-Hispanic ethnicity, publicly insured, employed, have a Charlson Comorbidity Index (CCI) of zero, a daily seizure rate of 0–1, did not have suicidal ideation or attempts, and live greater than 25 miles from the NES clinic. Delivering NES treatment via telehealth reduced the logistical and psychological barriers to initiating recovery and with a severe lack of accessible treatments for patients with NES, barrier reduction is necessary. This study describes patient factors that result in higher engagement with NES treatment using telehealth and emphasizes the importance of telehealth utilization to improve access to available treatment.

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## 1. Introduction

Nonepileptic seizures (NES) are diagnosed in epilepsy monitoring units and neurology clinics worldwide and identified by the International League Against Epilepsy (ILAE) as one of ten key areas of neuropsychiatric disorders associated with epilepsy [3]. Functional disorders are diagnosed in 16% of patients referred to neurology clinics [4]. Approximately 20% of patients presenting to epilepsy clinics have NES [5]. Nonepileptic seizures can resemble the full spectrum of epileptic seizures, but are not associated with electrographic abnormalities specific to epilepsy on an electroencephalogram (EEG).

Initiation, described here as engagement, of NES treatment services is the focus of this paper. This work builds on a relatively

small literature of previous studies looking mainly at overall adherence to recommended care in this population. Research investigating patients with NES' adherence to recommended psychotherapeutic treatment indicates poor retention in long-term treatment [6–9]. A few studies have highlighted the difficulty of engaging patients with NES in behavioral healthcare (BH), with approximately 20–35% of those referred not following treatment recommendations (e.g., follow-up visits) [10,11]. A recent study looked at adherence to all recommended care and demonstrated improved adherence with the use of telehealth [12]. In our observational, retrospective study, patients were offered in-person visits before COVID-19 restrictions or telehealth visits after COVID-19 restrictions to describe the impact of telehealth on patient engagement with first appointments. It is known that the patient's experience of BH treatment once initiated is enhanced by factors such as the quality of the therapeutic alliance, shared decision making, and person-centered care [13]. Participating in BH has been shown to lead to improvement in NES symptoms [14]. However, there is no opportunity to employ these tools for the many patients who simply do not engage in recommended treatment. Identifying

*Abbreviations:* PNES, psychogenic nonepileptic seizures; NES, nonepileptic seizures; BH, behavioral health; CCI, Charlson Comorbidity Index.

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and addressing the factors which limit initial engagement will be expected to improve patient adherence in future recommended treatment.

Prior to the COVID-19 pandemic, patients with a high burden of serious mental illness (SMI) were among the most difficult to engage with traditional in-person BH treatment [13,15]. Likewise, patients with NES have a high burden of illness and psychiatric comorbidity [16,17] and are at risk of those same difficulties [18]. In a recent large, randomized control treatment trial, roughly 43% of patients eligible for evaluation did not engage in care for a variety of reasons [19]. Poor rates of engagement are further exacerbated by patients' inability to drive due to seizure precautions [20–23] and a lack of NES disorder-specific resources [24].

When the COVID-19 pandemic began, an immediate transition to telehealth was required for continuation of care in the University of Colorado, NES Clinic. This forced transition was due to low rates of vaccination, making face-to-face encounters dangerous and the lack of space to accommodate physical distancing in group treatment. This transition provided a unique opportunity for patients with NES to engage with care, free of logistical barriers like distance to clinic and inability to drive. Yet, while such a prompt response increased overall access to care, it underscored the socioeconomic disparity in the population with NES with many patients still facing obstacles to care such as being unable to afford reliable internet connections and cellular data plans to conduct their visits using telehealth. Furthermore, the immediate transition challenged patients to quickly learn how to utilize technology and interface with their healthcare providers in a new way.

Despite these challenges, studies have indicated that there are no major differences between receiving in-person and telehealth treatment for BH disorders [25,26]. Furthermore, in the veteran population with NES, Dr. Curt LaFrance et al. proved similar treatment outcomes utilizing telehealth versus in-person including significant decrease in seizure frequency and improvement in comorbid symptoms [25]. Our study represents the first results of a series of investigations by the University of Colorado NES Clinic to determine factors influencing a civilian population with NES's initial engagement with a multidisciplinary clinic, adherence to recommended treatment, and treatment outcomes. The present study describes the results of the first investigation focusing on patient factors including but not limited to race, ethnicity, insurance status, and distance to the physical NES Clinic and their effect on initiation of treatment (engagement) between encounters conducted in-person compared to those conducted via telehealth.

## 2. Materials and methods

Permission was obtained for this retrospective, observational study by the Colorado Multiple Institutional Review Board (COMIRB). Secondary use approval allowed for a waiver for informed consent on the basis that all clinical information collected was obtained as routine medical care during treatment in the NES Clinic. Chart review was completed by Professional Research Assistants, with clinical oversight from the NES providers, who were trained in the Epic system electronic medical record (EMR) and FileMaker Pro database (FMP).

### 2.1. Cohort assignment

Our study population consisted of all patients referred to the University of Colorado, NES Clinic between March 2019 and September 2020. All patients had a confirmed vEEG NES diagnosis, met NES Clinic eligibility criteria, and given the opportunity to engage (contacted or scheduled for first appointment) (Fig. 1). Eligibility criteria were independent of in-person or telehealth cohort

assignment. Patients referred to the NES Clinic who were non-English speaking, with active eating disorders, actively abusing substances (excluding marijuana), are routinely provided alternative resources as part of the NES Clinic's standard of care protocols. Patient data were extracted from the FMP database and confirmed with Epic. The telehealth and transition cohorts were defined circumstantially. Our in-person cohort included all patients referred with the opportunity to engage between March 1, 2019 and March 13, 2020.

#### 2.1.1. Engaged cohorts

Engagement in the NES Clinic is defined as the completion of both neurological and behavioral health intake appointments. Patients referred for treatment with an opportunity to engage between March 1, 2019 and March 16, 2020 comprised our in-person cohort as there was no opportunity at that time for patients to engage using telehealth before COVID-19 restrictions. The transition cohort included patients who were receiving care in our clinic as of March 13, 2020 and had to convert from in-person to telehealth appointments to continue treatment after COVID-19 restrictions were implemented. Patients referred for treatment after March 16, 2020 comprised our telehealth cohort as the clinic was unable to provide a space large enough to accommodate our treatment model. Patients in the telehealth cohort had no opportunity to engage in-person due COVID-19 restrictions (Fig. 1).

#### 2.1.2. Not-engaged cohorts

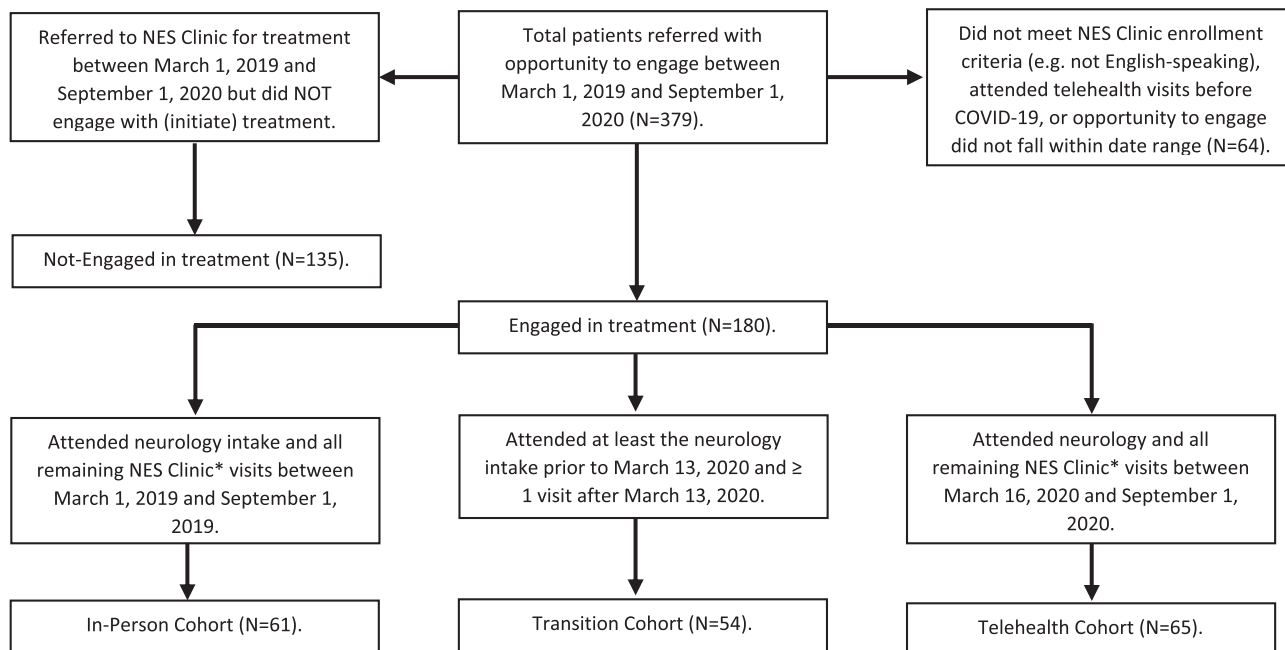
Patients who were referred to the NES Clinic and had the opportunity to engage but did not complete both neurological and behavioral health intake appointments were identified as "not-engaged" and assigned to their respective in-person or telehealth cohort timeframe as "not-engaged" in-person or "not-engaged" telehealth.

### 2.2. Visit inclusion criteria

All patients' scheduling followed the same protocol including three contact attempts after referral. For those we successfully scheduled, all patients received an automated reminder from their electronic medical record (EMR), patient portal 24 hours before the visit start time. If patients no-showed or canceled their appointment, patients were given three opportunities to complete the visit before being discharged from clinic due to non-adherence. Visits rescheduled to a telephone visit or canceled due to telehealth technical difficulties were included.

### 2.3. Demographic characteristics

Relevant patient factors were extracted from either the referral or NES clinic intake notes (Table 1). Medical histories were reviewed and categorized by the NES Clinic neurologist to determine Charlson Comorbidity Index (CCI). The Charlson Comorbidity Index predicts 10-year survival in patients with multiple medical comorbidities and is the most extensively studied and widely used comorbidity index in the medical literature [27]. The NES Clinic routinely calculates CCI to measure and controls for each patient's illness severity on outcomes. Distance to clinic was calculated using the zip code of the Anschutz Medical Campus Neurology Outpatient clinic and the patient's home, and further categorized into greater or less than 25 miles from the clinic. Insurance categories were condensed into public, private, government, or other. Public insurance included only Medicaid and Medicare while the government category included Tricare and Veteran's Administration insurances. Employment status was consolidated into employed versus unemployed. Disability status was categorized based on current use or intention to apply for Social Security Dis-



**Fig. 1.** Cohort selection steps. Opportunity to engage = attempted to contact for neurology intake, Engaged in treatment = attended neurology and behavioral health (BH) intakes. \*NES Clinic = Nonepileptic Seizure Clinic.

ability Insurance or Supplemental Security Income. Education level was grouped by highest level achieved.

### 3. Data collection methods

#### 3.1. Statistical methods

Summary statistics were compared between engaged (completed both neurological and BH intake visits) patients, and not-engaged patients, and among cohorts, in-person, telehealth, and transition, for both engaged and not-engaged patients. The proportion of engaged patients was compared between in person and telehealth cohorts with two-way tables and continuity-adjusted chi squared tests. Similar methods investigated whether patient factors of race (white vs non-white), distance of patient to clinic ( $\leq 25$  miles vs  $> 25$  miles), patient health insurance (public vs non-public a proxy for socioeconomic status), and patient education (high school or less, partial college or 2-year degree, or 4-year college degree or more), current employment (yes vs no), number of psychiatric diagnoses (0–1 vs  $\geq 2$ ), CCI (0 vs 1–3), daily baseline seizure rate (0–1, 2–3, 4–5, or  $\geq 5$ ), the presence of suicidal thoughts (yes vs no) or suicidal attempts (yes vs no or unknown) modified the telehealth effect. All tests were two-sided and were performed with univariate alpha of 0.05 unless otherwise stated. The study is preliminary and multiple testing adjustments were not applied. Univariate 95% confidence intervals were presented for effects. Statistical analyses were performed using SAS 9.4 (Cary, NC).

### 4. Results

#### 4.1. Cohort characteristics

There were 315 participants: 249 (79.0%) female, 270 (85.7%) non-Hispanic white, 206 (65.4%) publicly insured, 173 (54.9%) unemployed, 180 (57.1%) not driving at study entry, 177 (56.2%) live greater than 25 miles from the clinic, 142 (45.1%) with suicidal thoughts, and 86 (27.3%) with suicidal attempts. Of the 315 partic-

ipants, 180 (57.3%) were engaged, and 135 (42.7%) were not-engaged. Excluding the 54-participant transition cohort, there were 261 patients, 126 (48.3%) engaged and 135 (51.7%) not-engaged. Among the 180 engaged patients, 61 (33.7%) were in-person, 65 (35.9%) were telehealth, and 54 (30.4%) were transition. If the transition cohort is excluded, then 48.4% were in-person, and 51.6% were telehealth. Among the 135 not-engaged patients, 96 (71.1%) were in-person, and 39 (28.9%) were telehealth.

#### 4.2. Engagement during in-person and telehealth

Overall engagement in the telehealth group was 62.5% (65/104) (95% CI: [53.0%, 72.0%]), compared to 38.9% (61/157) (95% CI: [31.1%, 46.6%]) in the in-person group, risk ratio (RR) estimate = 1.61 (95% CI: 1.26–2.06). Similarly, engagement in the telehealth cohort compared to the in-person cohort, was higher for those of white race (RR 1.75, CI: 1.33–2.31), those of non-Hispanic ethnicity (RR 1.58, CI: 1.22–2.05), the publicly insured (RR 1.88, CI: 1.40–2.54), the employed (RR 2.08, CI: 1.22–3.54), those living  $> 25$  miles from the clinic (RR 1.87, CI 1.33–2.63), those with a CCI score of zero (RR 1.56 CI: 1.19–2.22), those with a daily baseline seizure rate of 0–1 (RR 3.39, CI: 1.82–6.20), those without documented suicidal thoughts or attempts (RR 2.11, CI: 1.33–3.33; and RR 1.76 CI: 1.28–2.43, respectively) (Table 2).

### 5. Discussion & conclusion

The purpose of this retrospective, observational study was to investigate the potential influence of patient factors on engagement comparing telehealth vs. in-person appointments, and whether telehealth facilitates patient engagement. To the best of our knowledge, this is the first study to report on the initiation in treatment of a civilian population with NES treated in a multidisciplinary NES clinic. These results reflect patients' realistic access to and engagement with NES treatment, representing a pragmatic approach bounded only by healthcare system policies and regulations.

**Table 1**  
Participant characteristics analysis, March 2019–September 2020, n = 315.

Participant Characteristics: n (%), or median (95% CI)	Overall (n = 315)	In-Person (n = 157)		Telehealth (n = 104)		Transition (n = 54)
		Engaged (n = 61)	Not Engaged (n = 96)	Engaged (n = 65)	Not Engaged (n = 39)	Engaged (n = 54)
Age, years	35 (25–46)	30 (24–41)	36 (26–47)	37 (28–44)	41 (25–49)	36 (25–46)
Gender						
Female	249 (79.0)	52 (85.2)	72 (75.0)	51 (78.5)	32 (82.1)	42 (77.8)
Male	61 (19.4)	9 (14.8)	23 (24.0)	13 (20.0)	5 (12.8)	11 (20.4)
Non-Binary	5 (1.6)	0 (0.0)	1 (1.0)	1 (1.5)	2 (5.1)	1 (1.8)
Race						
White	270 (85.7)	48 (78.7)	84 (87.5)	56 (86.2)	32 (82.1)	50 (92.6)
Non-White	45 (14.3)	13 (21.3)	12 (12.5)	9 (13.8)	7 (17.9)	4 (7.4)
Ethnicity						
Hispanic/Latinx	43 (13.7)	6 (9.8)	12 (12.5)	10 (15.4)	6 (15.4)	9 (16.7)
Not Hispanic/Latinx	272 (86.3)	55 (90.2)	84 (87.5)	55 (84.6)	33 (84.6)	45 (83.3)
Insurance						
Public	206 (65.4)	39 (63.9)	68 (70.8)	46 (70.8)	21 (53.8)	32 (59.3)
Private	109 (34.6)	22 (36.1)	28 (29.2)	19 (19.2)	18 (45.2)	22 (40.7)
Education						
High School or Less	73 (23.2)	26 (42.6)	5 (5.2)	20 (30.8)	8 (20.5)	14 (25.9)
Partial college or 2-year degree	99 (31.4)	25 (41.0)	13 (13.5)	27 (41.5)	9 (23.1)	25 (46.3)
College degree(s)	44 (14.0)	9 (14.8)	8 (8.3)	12 (18.5)	5 (12.8)	10 (18.5)
Unknown	99 (31.4)	1 (1.6)	70 (72.9)	6 (9.2)	17 (43.6)	5 (9.3)
Employment						
Yes	78 (24.8)	11 (18.0)	21 (22.1)	20 (30.8)	8 (20.5)	18 (33.3)
No	173 (54.9)	50 (82.0)	29 (30.5)	45 (69.2)	13 (33.3)	36 (66.7)
Unknown	64 (20.3)		46 (48.4)		18 (46.2)	
Driving at intake						
Yes	53 (16.8)	11 (18.0)	9 (9.4)	13 (20.0)	2 (5.1)	18 (33.3)
No	180 (57.1)	49 (80.3)	33 (34.4)	42 (64.6)	22 (56.4)	34 (63.0)
Unknown	82 (26.0)	1 (1.6)	54 (56.2)	10 (15.4)	15 (38.5)	2 (3.7)
Distance to Clinic						
≤ 25 miles	138 (43.8)	33 (54.1)	46 (47.9)	20 (30.8)	17 (43.6)	22 (40.7)
> 25 miles	177 (56.2)	28 (45.9)	50 (52.1)	45 (69.2)	22 (56.4)	32 (59.3)
Psychiatric diagnoses, mean number	1.3	1.36	0.79	1.74	1.28	1.46
Psychiatric diagnoses						
0–1	186 (59.0)	37 (60.7)	71 (74.0)	28 (43.1)	25 (64.1)	25 (46.3)
≥ 2	129 (41.0)	24 (39.3)	25 (26.0)	37 (56.9)	14 (35.9)	29 (53.7)
CCI						
0	256 (81.3)	51 (83.6)	74 (77.1)	54 (83.1)	31 (79.5)	46 (85.2)
1–3	59 (18.7)	10 (16.4)	22 (22.9)	11 (16.9)	8 (20.5)	8 (14.8)
Daily baseline seizure rate						
0–1	129 (41.0)	12 (19.7)	65 (67.7)	19 (29.2)	17 (43.6)	16 (29.6)
> 1 to 3	83 (26.3)	24 (39.3)	15 (15.6)	18 (27.7)	12 (30.8)	14 (25.9)
>3 to 5	47 (14.9)	11 (18.0)	6 (6.3)	14 (21.5)	7 (17.9)	9 (16.7)
>5	56 (17.8)	14 (23.0)	10 (10.4)	14 (21.5)	3 (7.7)	15 (27.8)
Suicidal Thoughts						
Yes	142 (45.1)	38 (62.3)	20 (20.8)	41 (63.1)	14 (35.9)	29 (53.7)
No/Unknown	173 (54.9)	23 (37.7)	76 (79.2)	24 (36.9)	25 (64.1)	25 (46.3)
Suicidal Attempts						
Yes	86 (27.3)	20 (32.8)	14 (14.6)	25 (38.5)	11 (28.2)	16 (29.6)
No/Unknown	229 (72.7)	41 (67.2)	82 (85.4)	40 (61.5)	28 (71.8)	38 (70.4)

**Abbreviations:** CCI, Charlson comorbidity Index; CI, confidence interval.

Our results suggest patients are more likely to engage with NES treatment when the initial neurological and BH intake appointments are conducted using telehealth. Among the telehealth cohort, we engaged more patients who self-identify as white race and those who identify as non-Hispanic. We attribute higher engagement of these groups to the overall Colorado population. As of 2021, the U.S (United States) Census Bureau estimates the Colorado population as 86% White and 21.8% Hispanic and Latino. We suspect the low engagement in treatment of non-White individuals reflects the multi-faceted stigmatization experienced by this population, producing lower BH treatment engagement rates

[28–30]. The extent to which non-White individuals engage in BH treatment is a result of the phenomenon known as the intersectional impact of stigma [26]. Several studies have shown the negative impact of the intersection of different stigmas on utilization of mental health services including race, HIV-status, and gender [31–33]. Furthermore, the consequences of mental illness stigma are found to be more severe when patient demographic characteristics, like race, coincide with other social adversities like poverty or sexual minority status (e.g. identified gender) [26]. Considering that NES has not been classified as a racial or ethnic specific disorder, we should consider the effect of stigma on engagement with

**Table 2**  
Proportion of engaged participants to total participants analysis, by timeframe, March 2019–September 2020, n = 261.

Participant Characteristics:	In-Person (n = 157, engaged = 61)	Telehealth (n = 104, engaged = 65)	Telehealth vs. In-Person Ratio (95% CI)	P-value*
	Estimate, (95% CI)	Estimate, (95% CI)		
Total	38.9 (31.1–46.6)	62.5 (53.0–72.0)	1.61 (1.26–2.06)	< 0.001
Gender				
Female	41.9 (33.1–50.7)	61.4 (50.8–72.1)	1.47 (1.12–1.92)	0.009
Male	28.1 (11.7–44.6)	72.2 (49.3–95.1)	2.44 (1.30–4.61)	0.010
Race				
White	36.4 (28.0–44.7)	63.6 (53.4–73.9)	1.75 (1.33–2.31)	< 0.001
Non-White	52.0 (31.0–73.0)	56.3 (28.9–83.6)	1.08 (0.61–1.92)	1.00
Ethnicity				
Hispanic/Latinx	33.3 (9.2–57.5)	62.5 (35.9–89.1)	1.88 (0.88–3.99)	0.17
Not Hispanic/Latinx	39.6 (31.3–47.8)	62.5 (52.2–72.8)	1.58 (1.22–2.05)	0.001
Insurance				
Public	36.4 (27.2–45.7)	68.7 (57.6–79.8)	1.88 (1.40–2.54)	< 0.001
Private	44.0 (29.7–58.3)	51.4 (34.5–68.2)	1.17 (0.75–1.82)	0.64
Education				
High School or Less	83.9 (70.2–97.6)	71.4 (53.6–89.3)	0.85 (0.64–1.13)	0.40
Partial college or 2-year degree	65.8 (50.0–81.6)	75.0 (60.1–89.9)	1.14 (0.85–1.53)	0.54
College degree(s)	52.9 (26.4–79.3)	70.6 (46.4–94.7)	1.33 (0.77–2.30)	0.48
Employment				
Yes	34.4 (17.0–51.8)	71.4 (53.6–89.3)	2.08 (1.22–3.54)	0.009
No	63.3 (52.4–74.2)	77.6 (66.5–88.6)	1.23 (0.99–1.52)	0.11
Distance to Clinic				
≤ 25 miles	41.8 (30.7–52.9)	54.1 (37.2–70.9)	1.29 (0.87–1.92)	0.30
> 25 miles	35.9 (25.0–46.8)	67.2 (55.6–78.7)	1.87 (1.33–2.63)	< 0.001
Psychiatric diagnoses				
0–1	0.34 (0.25–0.43)	0.53 (0.39–0.67)	1.54 (1.07–2.22)	0.037
≥ 2	0.49 (0.34–0.63)	0.73 (0.60–0.85)	1.48 (1.06–2.06)	0.027
CCI				
0	0.41 (0.32–0.50)	0.64 (0.53–0.74)	1.56 (1.19–2.03)	0.002
1–3	0.31 (0.14–0.48)	0.58 (0.33–0.82)	1.85 (0.98–3.52)	0.12
Daily baseline seizure rate				
0–1	0.16 (0.07–0.24)	0.53 (0.36–0.70)	3.39 (1.82–6.20)	< 0.001
> 1 to 3	0.62 (0.46–0.78)	0.60 (0.41–0.79)	0.98 (0.66–1.43)	1.00
>3 to 5	0.65 (0.39–0.90)	0.67 (0.45–0.89)	1.03 (0.65–1.64)	1.00
>5	0.58 (0.37–0.80)	0.82 (0.62–1.03)	1.41 (0.94–2.11)	0.20
Suicidal Thoughts				
Yes	0.66 (0.53–0.78)	0.75 (0.63–0.86)	1.14 (0.89–1.45)	0.40
No/Unknown	0.23 (0.15–0.32)	0.49 (0.34–0.63)	2.11 (1.33–3.33)	0.003
Suicidal Attempts				
Yes	0.59 (0.41–0.76)	0.69 (0.54–0.85)	1.18 (0.83–1.68)	0.50
No/Unknown	0.33 (0.25–0.42)	0.59 (0.47–0.71)	1.76 (1.28–2.43)	0.001

**Abbreviations:** CCI, Charlson Comorbidity Index; CI, confidence interval.

\* Continuity-adjusted chi-square test.

treatment. We suspect that the overall population prevalence of NES is underestimated and further under reported when stratified by race or other minority statuses. Future development of NES Clinic’s and treatment should be informed by Critical Race Theory to ensure patients from all backgrounds and orientations have equal access to treatment [34].

In alignment with our initial hypotheses, we successfully engaged more publicly insured patients. Considering that only four patients in the publicly insured category were on Medicare and above age 65, we can consider this a proxy measure of lower socioeconomic status. We also engaged higher rates of employed patients. These results paired together paint an interesting picture as we would have expected them to vary inversely. However, the transition to telehealth has allowed for medical and BH treatment to enter the home. We suspect that the increase in engagement of employed patients reflects the systemic changes and new regulations surrounding the national response to COVID-19, supporting the expansion of tele-medicine and increased accessibility to

healthcare when working from home. That same expansion of access to care was extended to those who are publicly insured. Even though the NES Clinic treatment program is time limited, it is a substantial time commitment, requiring the patient to be available during a weekday at the same time each week for up to 18 weeks [11]. Free of strict employer and school attendance policies, working from home increases the flexibility of work and life schedules (e.g., childcare) and combined with telehealth, eliminates many of the daily logistical barriers to seeking treatment. This not only increases physical access to treatment, but indirectly encourages patients to prioritize their well-being through reduction of psychological barriers, like stigma in NES and asking for time off for BH treatment [12].

Additionally, using telehealth we were able to engage more patients living >25 miles from the physical location of the NES Clinic. Utilizing telehealth relieves not just the patients with NES’s real barrier of driving restrictions, but also the high burden of weekly travel for treatment [12]. Furthermore, there is a significant

geographical barrier for patients with NES, with a striking proportion of patients unable to find specialized BH providers local to them forcing them to travel long distances and across states [12].

To control for the effect of poor medical health on engagement [35], we measured the CCI [27]. We found that patients with a score of zero, meaning they are not significantly burdened with other medical health needs, were more likely to engage using telehealth. We also found an effect on engagement of those with less than one seizure per day. Because the CCI does not consider psychiatric diagnoses, we also analyzed the effect of mean number of psychiatric diagnoses on engagement. While this showed no difference between patients who engaged with in-person vs. telehealth, an effect emerged with patients who had suicidal thoughts or attempts. Patients who did not have documented history of suicidal ideation or attempts were more likely to engage with telehealth vs. in-person treatment services. This finding highlights the pragmatic nature of this research as the University of Colorado NES Clinic only excludes patients from treatment (in-person and telehealth) if they are actively abusing substances (except marijuana) or have an active eating disorder. The NES Clinic does not discourage those with active or chronic suicidal ideation from completing initial intakes.

There are several important limitations to this study. As an observational, retrospective study, causal relationships between patient factors and engagement with initial neurological and BH intakes with the University of Colorado, NES Clinic cannot be inferred. Regardless, this study highlights that conducting telehealth visits with patients with NES is associated with higher engagement with initial treatment services. This finding alone is imperative for hospitals and clinics with a desire to develop treatment services for patients with NES, and for the patients themselves, as we cannot deploy best practices to retain patients in treatment unless we can first bring them in the door. If patients are unable to engage, they are unable to adhere to recommended treatment. If they are unable to adhere, their prognosis is worse, exacerbating the vicious cycle of inappropriate healthcare utilization by both the patient and the healthcare system [36]. This study indicates that telehealth has the potential to reduce logistical barriers for individuals with NES in the United States and decrease the effort needed from patients to engage with NES treatment services. Although we collected information about technical limitations in our patient population, we did not do this in a way that allowed us to control for race with this factor. The present study does not provide a comprehensive patient profile that would be “most likely” to engage as another important limitation. To better understand this, we recommend that future studies pursue research that can systematically evaluate a patient’s “readiness” to undergo NES treatment and investigate patient factors that can influence readiness such as illness perception, history of trauma, attachment styles, and social support. Furthermore, the authors recognize the scope of these findings being limited to patients with NES in the United States and being referred to a quaternary epilepsy care center as some of the barriers discussed (e.g., paid time off, transportation) may not be applicable in other countries. Finally, we did not measure the influence of the COVID public health crisis on patients’ decisions to adopt telehealth in a way that may have affected our results.

The paucity of accessible BH treatments is the norm for patient with NES in the United States, leaving us with two primary options as dedicated clinicians and practitioners serving the population with NES. We either improve access to available treatment by increasing the number of sites that offer it, or better understand how to effectively and efficiently use the treatment programs that are available. This retrospective, observational chart review study confirms that civilian patients with NES are more likely to engage with treatment using telehealth. The patient factors, race, public

insurance, distance to clinic are all correlated with engagement in treatment via telehealth and will be useful for screening after the public health crisis ends. These results were obtained at a quaternary epilepsy center, but will provide a starting point to those offering treatment programs, with the option to deliver either telehealth and in-person treatment modality. The goal is to improve engagement in NES treatment with telehealth options and to provide choices to patients which may optimize their care. Through this identification of those more likely to engage, the University of Colorado, NES Clinic and NES treatment programs alike, can make a more conscious effort to extend care and cater to the needs of this vulnerable and underserved population.

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## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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