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FULL-LENGTH ORIGINAL RESEARCH

Epilepsia

Positive illusions determine quality of life in drug-resistant epilepsy

Sarah J. Wilson[1,2,3,4] | **Genevieve Rayner**[1,3,4] | **Jessamae Pieters**[1]

[1]Melbourne School of Psychological Sciences, University of Melbourne, Melbourne, Victoria, Australia

[2]Florey Institute of Neuroscience and Mental Health, Melbourne, Victoria, Australia

[3]Department of Clinical Neuropsychology, Austin Health, Melbourne, Victoria, Australia

[4]Department of Medicine (Austin Hospital), University of Melbourne, Heidelberg, Victoria, Australia

Correspondence
Sarah Wilson, Melbourne School of Psychological Sciences, University of Melbourne, Parkville, 3010 Victoria, Australia.
Email: sarahw@unimelb.edu.au

Abstract

Objective: Humans use a complex system of protective cognitive biases or "positive illusions" that foster emotional well-being and subjective quality of life. This study examined the role of positive illusions in patient adjustment to drug-resistant epilepsy and its surgical treatment.

Methods: One hundred fifty people participated, including 93 focal epilepsy patients being evaluated for surgery and 57 sociodemographically matched healthy controls. We purpose-built computer software, "Living With Epilepsy," to assess the impact of positive illusions on patient perceptions of their current life, and administered well-validated questionnaires of depression (Neurological Disorders Depression Inventory for Epilepsy), anxiety (Patient Health Questionnaire for Generalized Anxiety Disorder–7 items), and health-related quality of life (HRQOL; Epilepsy Surgery Inventory–55) before and at 3 and 12 months after surgery.

Results: We identified two patient groups: those with "high positive illusions" (53%) about their epilepsy and those with "low positive illusions" (47%), with no differences between sociodemographic or epilepsy variables (all $P > .05$). Before epilepsy surgery, patients with high positive illusions exhibited fewer symptoms of depression ($P < .001$) and anxiety ($P = .002$) and higher HRQOL ($P \geq .002 \leq 0.046$) than those with low positive illusions. A subset of patients proceeded with surgery (n = 34 at 3 months; n = 26 at 12 months). They showed that the beneficial impact of having high positive illusions re-emerged 12 months postsurgery, with patients reporting lower depression and anxiety ($P = .006$) and elevated HRQOL ($P = .036$) compared to low positive illusions patients, independent of seizure outcome ($P > .05$).

Significance: These findings point to an active psychological process in drug-resistant patients, where approximately half generate strong positive illusions about their life with epilepsy, maintaining their mood and subjective well-being. Those who use this psychological mechanism show better adjustment 12 months postsurgery independent of seizure outcome, providing a potential new target for psychological treatment in patients with epilepsy.

KEYWORDS

emotional well-being, epilepsy surgery, focal epilepsy, positive illusions, quality of life

1 | INTRODUCTION

It is well established that humans use protective cognitive biases or "positive illusions" to actively construct a positive view of life irrespective of their objective situation. These include inflating one's own abilities relative to others, exaggerating one's personal control over life events, and being overly optimistic about the future.[1,2] These illusions serve to maintain our emotional well-being and subjective quality of life.[3]

Positive illusions have been extensively examined in the general population and in a range of specific health conditions.[2,4] This research suggests that positive illusions are ubiquitous, with the optimism bias occurring in approximately 80% of the population irrespective of gender, age, race, and nationality. It leads us to underrate our chances of suffering from terminal disease and overrate our chances of recovery from disease, and we expect to live longer than objective measures indicate.[5]

Positive illusions are the only psychological biases considered adaptive, leading to better personal, professional, and physical and mental health outcomes than more accurate beliefs.[4,6,7] They are particularly important when facing challenging or life-threatening events, such as a serious chronic illness like cancer, acting as a psychological buffer against an adverse response and enabling more effective coping.[8] They also promote mental health by lowering stress and anxiety and maintaining positive mood, and instill a sense of control over our destiny, motivating us to work toward future goals.[7,9–11] In this way, positive illusions are considered vital for our survival, providing a psychological mechanism for maintaining our sense of well-being in an equilibrium state, promoting an internal locus of control and resilient or adaptive coping behaviors irrespective of life circumstances.[10]

There has been limited research into the role of positive illusions in patient adjustment to neurological illness. Our previous work with newly diagnosed adults with epilepsy showed that a first seizure may shatter positive illusions, being experienced as a traumatic event in approximately 50% of patients.[12] Notably, this psychological response was characterized by a pervasive sense of loss of control, uncertainty about the future, decreased mood, and disruption of life goals and plans. It was predictive of poor responsiveness to antiepileptic drugs, seizure recurrence, cognitive complaints, and mood disturbance at 3 and 12 months following the first seizure, and triggered the need to restore a sense of control.[12–14] To achieve this, some patients spontaneously engaged in an active process of cognitive reframing and behavioral change, effectively restoring their positive illusions and returning their well-being to an equilibrium state, often accompanied by the experience of psychological growth.[14]

Little is known about the process of maintaining positive illusions in the face of recurring seizures, particularly in patients who develop drug-resistant epilepsy and may be candidates for surgery. The negative impact of drug-resistant epilepsy on a patient's perceived abilities, self-worth, and control over life events is well documented. Patients may view epilepsy as stigmatizing, undermining their dignity and self-esteem[15,16] and limiting their personal, vocational, and social choices.[17] They also report higher levels of learned helplessness and a more external locus of control.[18,19] Puzzlingly, these effects are not evident in all patients, producing heterogeneity in the psychosocial impact of epilepsy. Reasons for this are largely unknown but may, in part, reflect variable erosion of positive illusions, negating their protective role in psychological adjustment. Asked another way, in the face of drug-resistant seizures and characterization for surgery, is there evidence that some patients manage to maintain an overly positive or "illusory" view of their epilepsy, in terms of its impact on their sense of self, level of control, and optimism for the future? Does this shape the outcomes of their epilepsy surgery?

These questions formed the basis of this empirical study, which aimed to examine the protective role of positive illusions in patient adjustment to drug-resistant focal epilepsy relative to healthy controls, and to identify any clinical or sociodemographic factors that might distinguish patients with highly positive views of their epilepsy. We hypothesized that high positive illusions about life with epilepsy would be associated with (1) better psychological adjustment before surgery, as indicated by better mood and health-related quality of life (HRQOL); and (2) better seizure outcome and psychological adjustment after surgery.

Key Points

- Humans use protective cognitive biases or "positive illusions" to maintain emotional well-being and subjective quality of life
- Drug-resistant epilepsy may disrupt generation of illusions, negating their protective role in psychological adjustment and well-being
- Highly positive illusions predict mood and subjective well-being after epilepsy surgery, independent of seizure outcome
- These findings point to a new target for personalized psychological treatment to actively maintain positive illusions pre- and postsurgery

2 | MATERIALS AND METHODS

2.1 | Participants

We prospectively assessed a cohort of 93 consecutive patients with drug-resistant focal epilepsy between

2010 and 2016 as part of a wider behavioral study in the Comprehensive Epilepsy Program at Austin Health, Melbourne. Patients were being evaluated for epilepsy surgery with epileptogenic foci identified by established methods,[20] including clinical history, ictal semiology on video-electroencephalographic monitoring, structural magnetic resonance imaging (MRI), interictal fluorodeoxyglucose positron emission tomography, ictal and interictal single photon emission computed tomography, and neuropsychological evaluation. From the families of patients, we recruited a sociodemographically matched control sample with no neurological or psychiatric history (n = 57; N = 150). Of these, 50% were parents, 42% were partners, and the remainder were siblings or children, tested independently of the patient. A sample size of 150 participants was estimated a priori to optimize statistical power using well-established guidelines for behavioral research.[21]

Of the 93 patients, 40 (43%) went on to have surgery. Of these, 34 (85%) were assessed 3 months postsurgery and 26 of these (65%) were assessed again at 12 months via our Seizure Surgery Follow-up & Rehabilitation program.[22] Reasons for participant dropout 1 year after surgery included failure to respond to requests for review (n = 7), follow-up through other hospitals for which we did not have ethics clearance (n = 6), and in one rare case, cognitive decline due to a longstanding frontal lobe syndrome severe enough to preclude completing the measures in an insightful manner.

Inclusion criteria for all participants comprised: (1) age ≥ 18 years, (2) intelligence quotient (IQ) in the normal range, (3) no history of neurosurgery, and (4) a functional level of English. The study was approved by relevant human research ethics committees, and all participants gave informed written consent. The characteristics of the participants are shown in Table 1. There were no differences in sex, education, IQ, or employment status between the patient and control groups ($P > .05$ for all comparisons). However, because the controls largely comprised parents of patients, they were significantly older ($t_{148} = -4.510$, 95% confidence interval [CI] = −14.942 to −5.611, $P < .001$; Cohen $d = -0.760$, large effect size) and more likely to be in a romantic relationship ($\chi^2_1 = 4.184$, $P = .041$ with continuity correction; $\phi = 0.132$, small effect size).

TABLE 1 Characteristics of the patient and healthy control sample (N = 150)

	Patients, n = 93	Controls, n = 57
Age, y, mean ± SD	40.530 ± 12.872	51.020 ± 15.270***
Range	18-69	22-82
Female, n (%)	53 (57%)	40 (70%)
Education, y, mean ± SD	13.570 ± 3.198	13.544 ± 3.088
Range	5-24	9-21
Full-scale IQ, mean ± SD	101.370 ± 12.860	104.960 ± 12.495
Range	74-132	71-132
Married/partner, n (%)	61 (66%)	47 (83%)*
Employed, n (%)	49 (53%)	36 (63%)
Age of seizure onset, y, mean ± SD	21.110 ± 13.449	
Range	1-63	
Duration of epilepsy, y, mean ± SD	19.740 ± 13.000	
Range	2-52	
Monthly average seizure frequency, mean ± SD	22.840 ± 51.795	
Range	1 - >100	
Seizure localization, n (%)		
Temporal lobe	71 (76%)	
Frontal lobe	9 (10%)	
Parietal lobe	5 (5%)	
Other[a]	8 (9%)	

[a]Locations comprised the paramedian sensory cortex (n = 1), posterior quadrant (n = 5), anterior quadrant (n = 1), and cerebellum (n = 1).

[b]Abbreviation: IQ, intelligence quotient.

*$P < .05$.

***$P < .001$.

2.2 | Materials

2.2.1 | Interactive computer software: "Living With Epilepsy"

We purpose-built an online interactive computer program, "Living With Epilepsy," to capture people's beliefs about their epilepsy, their experience of living with epilepsy and its treatment, and its impact on family functioning.[23] The program uses a mix of qualitative and quantitative measures, including psychological rating scales, textboxes for patients to directly record their feelings and views, and graphical representations such as a "family map" to assess family cohesion. The program takes approximately 30 minutes to complete and contains three main sections that explore the impact of epilepsy on (1) current and desired psychosocial roles and activities; (2) self-identity, family functioning, and perceived support; and (3) feelings and views about epilepsy surgery. A modified version of the program was developed to assess the perspectives of family members, focusing on the dynamics of family functioning and their views about epilepsy surgery. Questions relating specifically to the patient's perceptions of living with epilepsy and its treatment were not included in the family version.

Of particular relevance to this study, part 2 of the program ("Describing My Epilepsy") requires patients to choose a binary response for each of 15 statements that capture the extent to which they have maintained positive illusions about their epilepsy (eg, "To me my epilepsy is something I can control" [high positive illusion] versus "something I can't control" [low positive illusion]). These 15 statements were designed to tap into the implicit biases that patients have about their sense of self and abilities, personal control over life events, and optimism for the future in relation to their epilepsy. These biases were canvassed from different angles, because the largely automatic nature of positive illusions means that they can influence a diverse range of psychological constructs.[2]

2.2.2 | Mood and quality of life

Symptoms of depression and anxiety, and HRQOL were evaluated with well-validated measures used extensively in epilepsy research, including the Neurological Disorders Depression Inventory for Epilepsy,[24] the Patient Health Questionnaire for Generalized Anxiety Disorder–7 items (PHQ-GAD-7),[25,26] and the Epilepsy Surgery Inventory–55 items (ESI-55), which was subsequently expanded into the Quality of Life in Epilepsy Inventory–89 items for applicability to settings outside of epilepsy surgery.[27,28]

2.3 | Statistical analyses

Analyses were run using IBM SPSS Statistics (v22.0) with significance set at $P \leq .05$ (two-tailed). Where assumptions of parametric tests were not upheld, more conservative nonparametric alternatives were employed.[29]

To identify patients with high or low positive illusions, we ran a two-step cluster analysis on the statements canvassing positive illusions about epilepsy in the 93 patients. The two-step technique was employed because it is most appropriate for ordinal binary data where categories are asymmetric (ie, present vs absent), with a likelihood-based measure used to model distances between binary variables to address any arbitrary effects associated with the order of case entry. To identify clinical and sociodemographic factors associated with cluster membership, we ran bivariate descriptive analyses comparing the two clusters, including chi-square analyses with continuity corrections using Phi (ϕ) as the measure of effect size, and independent samples *t* tests with Cohen *d* as the measure of effect size.

To test the hypothesis that patients in the "High Positive Illusions" cluster would show better adjustment to epilepsy than those in the "Low Positive Illusions" cluster, we then used univariate analysis of variance with a priori planned repeated contrasts to compare the mean scores of the two patient groups and the healthy controls on current depression and anxiety symptoms. In particular, we compared the Low Positive Illusions group to the High Positive Illusions group, and the High Positive Illusions group to healthy controls. Because controls did not complete the epilepsy-specific measure of HRQOL, we used independent samples *t* tests and Cohen *d* to compare the patient groups on the scales of the ESI-55. Similarly, to explore the impact of positive illusions on adjustment after epilepsy surgery, we used independent samples *t* tests with Cohen *d* to compare patients in the High Positive Illusions and Low Positive Illusions groups before surgery on mood, HRQOL, and seizure variables at 3 and 12 months postsurgery.

3 | RESULTS

3.1 | Positive illusions in people with drug-resistant focal epilepsy

Inspection of the frequency of patient responses revealed considerable variability in the extent to which they held positive illusions about their life with epilepsy, in terms of its effects on their sense of self and personal control, and their view of the future. Approximately half of the patients accepted their epilepsy and felt proud of it, and approximately two-thirds felt able to disclose it and talk about it with others. Approximately one-third felt that they could control it, and only a minority felt that it was helping them forward, toward their future life. Three of the 15 illusion statements showed low discriminability with <10% patient endorsement (Figure 1) and thus were removed from subsequent analyses.

Two-step cluster analysis of the 12 remaining illusion statements revealed two distinct clusters, for which 10 of the 12 items differed significantly between the clusters. As shown in Table 2, 49 patients (53%) were assigned to the first cluster and tended to hold high positive illusions about their epilepsy (High Positive Illusions group), whereas the second cluster comprised 44 patients (47%) who were less positive (Low Positive Illusions group). Those in the High Positive Illusions group were significantly more likely to accept their epilepsy (76%) as part of themselves (96%) and felt it was something they could be proud of (92%). This meant they could reveal their epilepsy (90%) and talk about it with others (92%). In contrast, the majority of patients in the Low Positive Illusions group felt ashamed (93%) and bad about their epilepsy (100%), considering it an enemy (100%) that was out of their control (80%) and a barrier to life (98%). They felt it was something inside themselves (84%) that they needed to focus on (75%) and get rid of (82%).

We examined the clinical and sociodemographic variables shown in Table 1 to compare the profiles of the High Positive Illusions and Low Positive Illusions groups. Striking was how similar the two groups were for the range of variables assessed, with no significant differences between the groups ($P > .05$ for all comparisons; see Table S1).

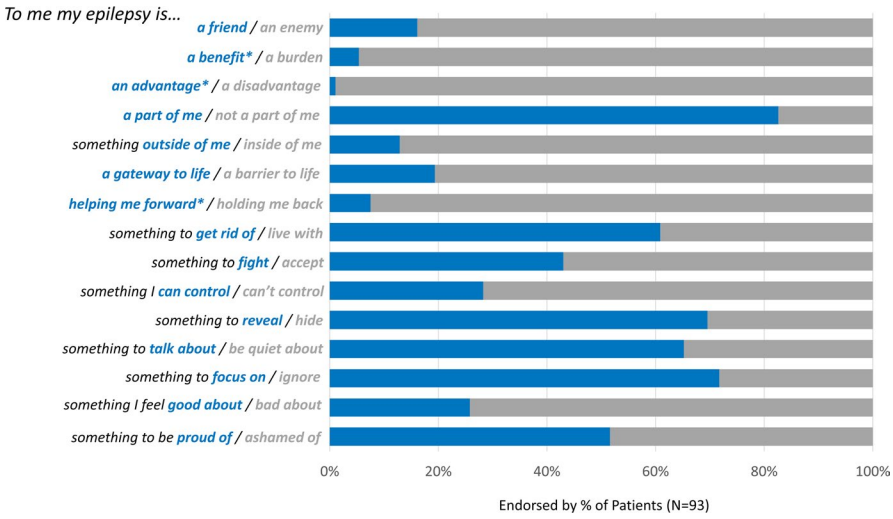

FIGURE 1 Percentage frequency distribution of patient responses to the 15 statements in the Living With Epilepsy program designed to capture the extent to which patients held positive illusions about their epilepsy. Three statements showing low discriminability (<10% frequency) were removed from subsequent analyses (marked with an asterisk)

TABLE 2 Patient clusters with high and low positive illusions (N = 93)

High positive illusions, n = 49		Low positive illusions, n = 44		χ^2 statistic[a]	ϕ[b]
To me my epilepsy is…					
Something to be proud of	92%	Something to be ashamed of	93%	63.736***	0.849
Something I feel good about	49%	Something I feel bad about	100%	26.545***	0.559
Something to talk about	92%	Something to be quiet about	64%	29.199***	0.583
Something to reveal	90%	Something to hide	52%	17.549***	0.458
A friend	31%	An enemy	100%	13.876***	0.416
A gateway to life	35%	A barrier to life	98%	13.604***	0.410
Something to live with	57%	Something to get rid of	82%	13.236***	0.399
Something to accept	76%	Something to fight	64%	12.941***	0.395
A part of me	96%	Not a part of me	32%	10.649***	0.367
Something I can control	37%	Something I can't control	80%	2.244*	0.179
Something outside me	10%	Something inside me	84%	0.260	0.085
Something to ignore	30%	Something to focus on	75%	0.137	0.062

[a]Continuity corrected, $df = 1$.

[b]Variables are listed in order of effect size, where 0.1 is considered a small effect, 0.3 a medium effect, and 0.5 a large effect.

*$P < .05$.

***$P < .001$.

3.2 | Positive illusions are associated with better adjustment to drug-resistant epilepsy

The first hypothesis, that patients with high positive illusions would show better adjustment to epilepsy, was supported. Results for the measures of mood showed significant main effects, for current symptoms of both depression ($F_{2, 134} = 11.329$, $P < .001$, $\eta^2 = 0.147$, large effect size) and anxiety ($F_{2, 125} = 6.504$, $P = .002$, $\eta^2 = 0.100$, large effect size). Specifically, a priori contrasts revealed that patients with low positive illusions had significantly higher levels of depression (mean = 13.950 ± 3.790) and anxiety symptoms (mean = 7.240 ± 5.780) than patients in the High Positive Illusions group (depression mean = 11.420 ± 3.180; anxiety mean = 4.35 ± 3.477), who in turn reported similar levels of depression (mean = 10.630 ± 3.168) and anxiety symptoms (mean = 3.830 ± 3.937) to controls ($P > .05$ for all comparisons, see Figure 2A). These effects were not attributable to the differences in the mean age and marital status of the healthy control and patient groups (cf Table 1, $P > .05$ for all comparisons).

For HRQOL, group means for patients with high positive illusions were larger than those with low positive illusions for

all 11 scales of the ESI-55. This difference was statistically significant for six of 11 scales, with a trend toward significance for a further two (Figure 2B). Specifically, compared to patients in the Low Positive Illusions group, those with high positive illusions reported significantly better overall quality of life ($t_{89} = 2.376$, $P = .020$, 95% CI = −14.757 to −1.315; $d = -0.500$, medium effect size), emotional well-being ($t_{89} = 3.025$, $P = .003$, 95% CI = −18.653 to −3.864; $d = -0.640$, medium-large effect size), and better cognitive ($t_{88} = 2.216$, $P = .029$, 95% CI = −19.809 to −1.077; $d = -0.470$, medium effect size) and social functioning ($t_{76.135} = 3.231$, $P = .002$, 95% CI = −29.318 to −6.957; $d = -0.69$, medium-large effect size). They also had a more positive perception of their health ($t_{89} = 2.649$, $P = .010$, 95% CI = −16.929 to −2.418; $d = -0.560$, medium effect size,) and reported less pain ($t_{87} = 2.024$, $P = .046$, 95% CI = −19.320 to −0.175; $d = -0.430$, small-medium effect size).

3.3 | High positive illusions before surgery foster better postsurgical adjustment

Of the participants who underwent surgery, a similar proportion fell in the preoperative High Positive Illusions (n = 19, 48%) and Low Positive Illusions groups (n = 21, 52%; $P > .05$). Participants were significantly more likely to have undergone surgery if they were MRI lesion positive (88%; $\chi^2_1 = 17.059$, $P < .001$; $\phi = 0.451$, medium-large effect size). There were no other significant differences for the clinical and sociodemographic variables listed in Table 1 ($P > .05$ for all comparisons).

At 3 months postsurgery, patients who had high positive illusions before surgery were not significantly different from patients with low positive illusions in terms of their views about surgery and its success (Table 3, $P > .05$ for all comparisons). This may reflect gains in mood and HRQOL shown by the Low Positive Illusions group (Figure 3). At 12 months, however, the High Positive Illusions group showed significantly better adjustment after surgery than the Low Positive Illusions group, reporting fewer symptoms of depression (High Positive Illusions mean = 8.540 ± 2.727, Low Positive Illusions mean = 12.310 ± 3.637; $t_{24} = 2.299$, $P = .006$; $d = 1.220$, very large effect size) and lower levels of physical restriction on their quality of life (High Positive Illusions mean = 92.308 ± 17.394, Low Positive Illusions mean = 67.308 ± 35.743; $t_{17.382} = -2.268$, $P = .036$; $d = 0.926$, large effect size). Effect sizes also indicated lower levels of anxiety in the High Positive Illusions group; however, this failed to reach significance (High Positive Illusions mean = 2.230 ± 2.127, Low Positive Illusions mean = 4.770 ± 4.065; $t_{24} = 1.995$, $P = .058$; $d = 0.815$, large effect size). Of note, patients with high or low positive illusions before surgery did not differ significantly in their postoperative seizure outcome at 3 or 12 months, although the proportion of patients who were seizure-free was greater in the High Positive Illusions group at both time points (Table 3, $P > .05$ for all comparisons).

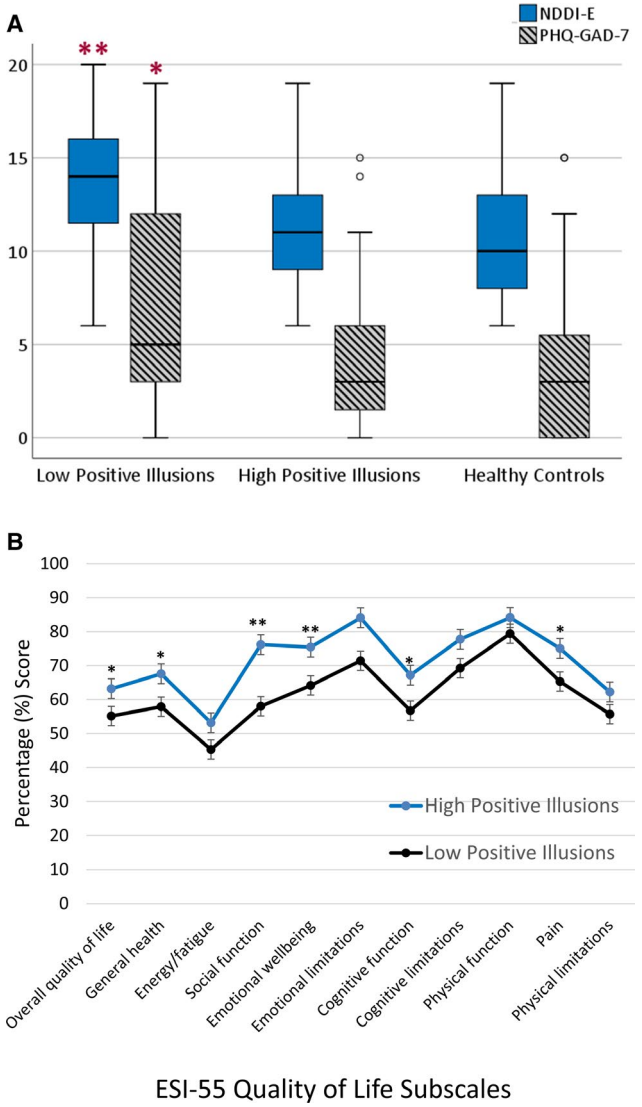

FIGURE 2 A, Box-and-whisker plots of current symptoms of depression and anxiety in patients with high positive illusions, patients with low positive illusions, and healthy controls. The band inside the box depicts the median, whereas the bottom and top of the box represent the first and third quartiles, respectively. The ends of the whiskers (lines extending vertically from the box) represent the minimum and maximum, whereas the small circles depict outliers. Current depression symptoms were measured with the Neurological Disorders Depression Inventory for Epilepsy (NDDI-E; maximum score = 24) and current anxiety symptoms with the Patient Health Questionnaire for Generalized Anxiety Disorder–7 items (PHQ-GAD-7; maximum score = 21). B, Line chart showing the mean percentage scores for patients with high positive illusions (blue line) and low positive illusions (black line) for each of the 11 quality of life scales of the Epilepsy Surgery Inventory–55 items (ESI-55). The error bars represent the standard error of the mean. *$P < .05$, **$P < .01$.

TABLE 3 Impact of presurgery positive illusions on postoperative medical and psychological outcomes

	3 mo postsurgery, n = 34		12 mo postsurgery, n = 26	
	High positive illusions, n = 16	Low positive illusions, n = 18	High positive illusions, n = 13	Low positive illusions, n = 13
Seizure outcome, %				
Seizure-free	89	69	85	64
Aura-free	75	83	85	64
Antiepileptic drug monotherapy	14[a]	20[b]	25	36
Views on surgery, %				
Considers surgery a success	93	100[c]	92	89
Satisfied with life after surgery	93	83[c]	92	78
Regrets having the operation	0	9[c]	0	0
Considers self to still have epilepsy	60	54	50	66

[a]Two cases of missing data.
[b]Three cases of missing data.
[c]Six cases of missing data.

4 | DISCUSSION

This study examined the role of positive illusions in patient adjustment to drug-resistant focal epilepsy and its surgical treatment, giving rise to new findings. First, approximately one in two patients with chronic focal epilepsy had low positive illusions about themselves and their life with epilepsy. This had significant mental health and psychosocial impacts, associated with higher levels of depression and anxiety symptoms, and lower levels of subjective quality of life. Coupled with the lack of significant effects for clinical and sociodemographic variables, this points to the core role played by positive illusions in maintaining patient perceptions of their health and well-being. Second, patients who had high positive illusions about their epilepsy prior to surgery had a significantly better psychosocial outcome 12-months after surgery in terms of their mood and quality of life. This reinforces the protective role played by positive illusions over the longer term for adjusting to major life events and health challenges such as epilepsy surgery.

4.1 | Positive illusions impact patient adjustment

Despite variability in the extent to which different positive illusions about epilepsy were held, patients clustered into two equally sized but distinct groups. Those with high positive illusions (53% of patients) had accepted epilepsy into their sense of self and felt proud about it, conferring positive effects on their self-identity that they could talk about with others. They were also more likely to experience a sense of control over their epilepsy and to view it, and the future, more optimistically. In contrast, patients with low positive illusions were more likely to feel ashamed about their epilepsy and to hide it from others, perceiving it as out of their control and a barrier to their future life. This latter group (47% of patients) clearly demonstrates that it is common for positive illusions to be disrupted in drug-resistant focal epilepsy.

Our findings converge with a broader literature suggesting that positive illusions are by-and-large polar psychological biases that occur rapidly and automatically, acting as simple heuristics that guide an individual's decision-making below conscious awareness, maintaining adaptive coping behaviors and mental well-being.[30] These biases relate to traits that reliably shape an individual's behavior over time and in the case of pessimism, pose risks for health and behavioral outcomes. Although these traits can be measured using dimensional scales, in our study, any reduction in statistical power associated with the use of binary responses to tap into these biases did not preclude the discovery of significant effects. The cluster analysis clearly showed two equal but distinct patient groups that subsequently had different psychological trajectories in terms of their mood and subjective quality of life by 12 months postsurgery. This is commensurate with a large body of evidence indicating that membership in either group leads to distinct psychological outcomes.[31] This points to the potential benefit of developing new and more personalized psychological treatments that directly target the construction and maintenance of high positive illusions, such as benefit-finding, mindfulness-based approaches that foster acceptance, cognitive reframing, and behavioral modeling to improve patient adjustment and quality of life outcomes.

This study is the first to demonstrate the relevance of positive illusions in a neurological population, extending research with other clinical populations that has shown the significant

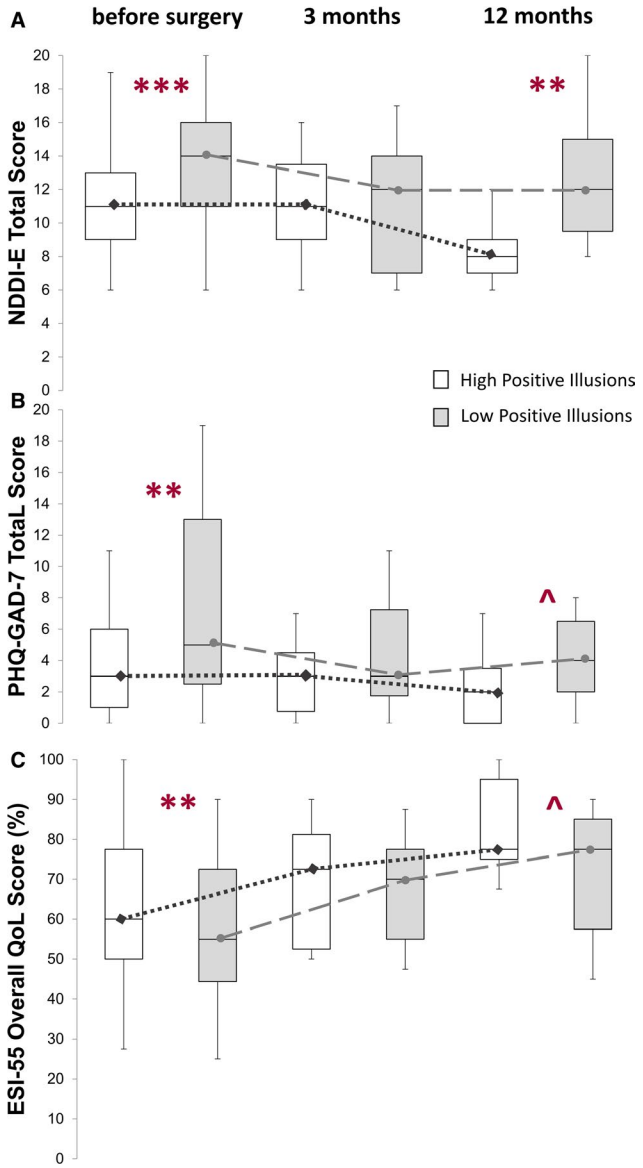

FIGURE 3 Box plots showing the mood and health-related quality of life (QoL) outcomes of patients with high positive illusions versus low positive illusions at three time points: before surgery, 3 months postsurgery, and 12 months postsurgery. A, Current depression symptoms measured with the Neurological Disorders Depression Inventory for Epilepsy (NDDI-E; maximum score = 24). B, Current anxiety symptoms measured by the Patient Health Questionnaire for Generalized Anxiety Disorder–7 items (PHQ-GAD-7; maximum score = 21). C, Current overall QoL scores taken from the Epilepsy Surgery Inventory–55 items (ESI-55; maximum score = 100). $^{**}P < .01$, $^{***}P < .001$, ^trend.

health benefits of being able to maintain positive illusions in the face of a serious medical condition.[4,5,7] This is significant because neurological conditions are often associated with changes in cognition and psychological functioning, yet it would appear that positive illusions continue to exert their effects on patient health and well-being as in other, nonneurological populations. Patients who were able to maintain high positive illusions about themselves and their life with epilepsy reported minimal levels of depression and anxiety, commensurate with healthy controls, and generally had higher levels of HRQOL than patients with low positive illusions. This is in accordance with previous reports that people with depression typically report lower levels of self-esteem and self-worth, do not overestimate their control over life events, and fail to show an optimism bias.[5,32,33]

In the field of epilepsy, our findings extend the work of Pais-Ribeiro et al,[34] who showed that epilepsy-specific optimism rather than seizure variables predicted improved physical and mental health perceptions and overall quality of life. We found a striking lack of evidence for specific clinical or sociodemographic factors that differentiated between patients with high or low positive illusions. This supports the idea that positive illusions per se, rather than medical variables such as seizure control, constitute a potential psychological mechanism underpinning patient perceptions of quality of life. Although we have only established the relevance of positive illusions in epilepsy, we would expect them to be relevant to other neurological disorders, providing an important new angle on understanding heterogeneity in patient functioning and outcomes in neurological conditions and their treatment that is independent of medical treatment success.

4.2 | Positive illusions: the psychological mechanism underpinning quality of life

More broadly, our findings support a model of quality of life proposed by Cummins and colleagues,[10] wherein life satisfaction is not simply determined by our experiences but is managed by a psychological process. In this model, quality of life is maintained under homeostatic control by our positive illusions, which reframe our experiences to minimize the gap between perceptions of our current life and the life we expect or feel we deserve.[3] Individuals are considered to have a "set-point" for subjective well-being to which they generally return even after major life challenges, allowing life satisfaction to be regulated within a fairly restricted range. This is presumed to support our motivation to thrive even in adverse conditions, helping us avoid the debilitating consequences of depression.[3,10,35]

This homeostatic model is able to explain the small differences in subjective ratings of quality of life observed in the Western population (mean = 75, SD = 2.5 on a 100-point scale) compared with the global population (mean = 70, SD = 5.0), despite large differences in objective living conditions and resources. It has also been applied to individuals with chronic medical illness or injury, who may report similar levels of quality of life to healthy controls.[36] In other words, the relationship between life satisfaction and our objective health status is not considered to be linear, but rather to be determined by a carefully regulated psychological threshold,

below which an individual's subjective well-being can decline in the context of major life challenges.[3]

In this study, living with drug-resistant epilepsy was associated with this decline in approximately half our patients, who struggled to generate positive illusions about themselves and their life with epilepsy. This difficulty did not appear secondary to depression, because these same patients reported highly positive views of life and surgical success early after surgery (Table 3). Rather, the findings point to dysregulation of the psychological mechanism itself. Previous researchers have argued that this mechanism arose with the emergence of conscious foresight or prospection in humans, underpinned by a neurocognitive network supporting autonoetic consciousness and decision-making for future events.[5,37] Individuals with a high level of optimism show reduced activation in this network when tracking undesirable errors, which in turn predicts the extent to which they update their beliefs based on information that enforces optimism rather than counters it. This work provides a potential neurobiological mechanism for how positive illusions may be maintained and may become resistant to change, warranting further research both in epilepsy and in other neurological conditions.

5 | CONCLUSION

This study found that epilepsy can disrupt positive illusions in drug-resistant patients, impacting identity, self-control, and expectations for the future, thereby negating the protective role of illusions in psychological adjustment and well-being. The extent of this effect was not determined by sociodemographic or clinical variables, such as seizure frequency. Rather, it pointed to the importance of an active psychological process that maintains positive illusions in the face of adversity, allowing patients to maintain the balance between their perceptions of their current life and the life they feel they deserve. This process also influenced patient psychological adjustment and quality of life outcomes following epilepsy surgery, pointing to the potential benefits of targeting positive illusions before surgery through more personalized psychological treatments.

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CONFLICT OF INTEREST

None of the authors has any conflict of interest to disclose. We confirm that we have read the Journal's position on issues involved in ethical publication and affirm that this report adheres with those guidelines.

ORCID

Sarah J. Wilson https://orcid.org/0000-0002-2678-1576
Genevieve Rayner https://orcid.org/0000-0002-0747-3877

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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