

## FULL-LENGTH ORIGINAL RESEARCH

# Profiles of psychosocial outcome after epilepsy surgery: The role of personality

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### SUMMARY

**Purpose:** We have previously found that the developmental time frame of epilepsy onset influences adult personality traits and subsequent adjustment to intractable seizures. In the same cohort of patients we now investigate the influence of these factors on psychosocial outcome after surgical treatment.

**Methods:** Fifty-seven adult patients with focal epilepsy were prospectively assessed before and after surgery. Measures of psychosocial outcome included mood, health-related quality of life (HRQOL), and psychosocial adjustment, collected longitudinally at 1-, 3-, and 12-months after surgery.

**Results:** Patients with high neuroticism and low extraversion were predisposed to greater depression after surgery. More than 70% of patients with high neuroticism

also reported disrupted family dynamics and difficulties adjusting to seizure freedom. The latter was associated with changes in self-identity that increased over time. Patients with epilepsy onset before or during the self-defining period of adolescence reported the greatest perceived self-change after surgery that had positive effects for HRQOL.

**Discussion:** Psychosocial outcome after epilepsy surgery appears intrinsically linked to a change in self and a transition from chronically sick to well. The development of personality traits and self-identity in the context of habitual seizures can impact psychosocial outcome and the extent of self-change reported after surgery, and paradoxically, can concur more beneficial effects.

**KEY WORDS:** Epilepsy, Surgical outcome, Prospective, Psychosocial adjustment, Mood, Quality of life.

The outcome of surgery for medically intractable seizures has been the focus of considerable research attention. Although many researchers have defined outcome according to postoperative seizure control and HRQOL (Spencer & Huh, 2008), others have investigated psychiatric function and mood (Devinsky et al., 2005; Kanner et al., 2009), patient satisfaction with outcome, and psychosocial adjustment (Jones et al., 2002; Reid et al., 2004; Wilson et al., 2004; Tanriverdi et al., 2008). This work has shown that the course of postoperative recovery can be complex, and that individual patient trajectories and perceived outcomes are often influenced by the interaction of multiple factors (Wilson et al., 2005; Jacoby & Baker, 2008). Clinically this means that it can be difficult to predict an individual's

postoperative trajectory, and to identify those patients at greatest risk of experiencing difficulties after surgery.

Difficulties anticipating individual patient outcomes may partly reflect the use of differing approaches to measuring outcome. These include the standard practice of averaging across groups of individuals to quantify outcomes on specified variables (a variable-oriented approach) and less commonly, identifying subgroups of individuals with similar outcome profiles (an individual-oriented approach) to capture variability in outcome trajectories (Wilson et al., 2005). Using a variable-oriented approach, significant associations have been found between seizure outcome, HRQOL, cognition, and mood (Langfitt et al., 2007; Baxendale, 2008; Jacoby & Baker, 2008; Spencer & Huh, 2008); however, we have comparatively less understanding of how average outcomes on these variables map onto an individual's day-to-day functioning and psychological experiences of adjusting to life after surgery. In addition, we have limited knowledge of the impact of individual differences on outcome and specifically, the extent to which differences in personality traits influence outcome profiles (Rose et al., 1996; Derry & Wiebe, 2000).

Accepted September 4, 2009; Early View publication November 3, 2009.

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Clinically, at an individual level it is often the case that poor adjustment to intractable seizures before surgery is an indicator of adjustment difficulties after surgery (Derry et al., 2000). We have previously characterized the types of adjustment difficulties faced by individual patients and their families after surgery (Wilson et al., 2001). These often reflect changes in self-perceptions accompanying the transition from chronically sick to well, which can promote significant “burden of normality” or difficulties learning to live without epilepsy. More recently, we found that before surgery a personality profile of high neuroticism accompanied by low extraversion is associated with poor mood and family functioning, and that patients with epilepsy onset in the self-defining period of adolescence have high neuroticism scores, placing them at greater risk of adjustment difficulties (Wilson et al., 2009). In other words, the presence of chronic neurologic illness during the formative years of life may impact development of the self and an individual’s subsequent response to treatment.

The present study extends our recent work in the same cohort of patients by examining the influence of the personality traits of neuroticism and extraversion on surgical outcome. We examined a range of outcome variables, including seizure outcome, mood, and HRQOL, and considered their relationships to the patient’s psychological experience of learning to live without epilepsy and day-to-day psychosocial functioning. Finally, we examined the role of the developmental time frame of epilepsy onset on perceived self-change after surgery, given that such change can be central to the process of postoperative adjustment.

## METHODS

### Participants

The methods of the study have been described in detail previously (Wilson et al., 2009). In brief, 57 patients (30 males; mean age 35 years, range 18–60 years) participated in a 2-year prospective, longitudinal study examining the psychological and psychosocial effects of chronic epilepsy and its surgical treatment. Outcome after surgery included thorough medical, psychological, and psychosocial assessment (Wilson et al., 2004) that was examined at three time points reflecting initial (1-, 3-month) and longer-term (12-month) outcomes. The study was approved by the human research ethics committees of the relevant institutions and all participants gave written informed consent.

### Procedure

Before surgery, participants completed the Eysenck Personality Questionnaire Revised-Short Form (Barrett & Eysenck, 1992). Patients were classified as having high neuroticism or high extraversion if their scores fell above the mean of normative data (Neuroticism, 5.43; Extraversion, 6.98), and low neuroticism or low extraversion if their scores fell at or below these values (Eysenck & Eysenck,

**Table 1. Markers of adjustment at 1, 3, and 12 months after surgery**

Marker	Score
<b>Mood</b>	
Beck Depression Inventory–II	0–63
State Trait Anxiety Inventory (Form Y)	20–80
<b>Health-related quality of life (HRQOL)</b>	
Epilepsy Surgery Inventory-55	1–100
<b>The “burden of normality”<sup>a</sup></b>	
<b>Psychological features<sup>b</sup></b>	
Present	1
Absent	2
<b>Family dynamics</b>	
Impaired	1
Unimpaired	2
<b>Social functioning</b>	
Impaired	1
Unimpaired	2
<b>Perceived changes in self-identity<sup>c</sup></b>	
I think differently about myself since having the operation	1–5
I feel like a new person	1–5
I believe that my personality has improved	1–5
I have more self-confidence	1–5

<sup>a</sup>The Austin CEP Interview was used to explore all aspects of a patient’s psychosocial functioning and adjustment to surgery through extensive interview of the patient and relevant family members. For the purposes of this study, postoperative variables that capture the psychological experiences of the patient and are generally indicative of psychosocial functioning were coded.

<sup>b</sup>Psychological features of the burden of normality include a sense of having been “cured” by surgery, of needing to “prove normality” to oneself or others, a sense of increased expectations (from self or others), lack of the “excuse” of chronic illness, grieving the loss of epilepsy, a sense of missed opportunities, and/or the need to make up for “lost time.”

<sup>c</sup>Patients rated each statement on a 5-point Likert-type scale with 1 = “strongly disagree” to 5 = “strongly agree.” Generally, Spearman rho correlations between the four questions were significant at each follow-up review and thus the aggregate score was used.

1990). Measures of mood, HRQOL, and psychological and psychosocial functioning were used as indicators of patient adjustment after surgery, as detailed in Table 1.

Medical evaluation was performed in accordance with our previously described methods (Wilson et al., 2009). Participants were grouped according to their age of habitual seizure onset that mapped onto four distinct phases of development, including infancy (0–3 years), childhood (5–12 years), adolescence (13–21 years), and adulthood (>21 years). The medical characteristics of these four groups are shown in Table 2.

### Statistical analyses

Parametric analyses were performed using SPSS 13 for Mac OS X (SPSS Inc., Chicago, IL, U.S.A.) with  $p \leq 0.05$  (two-tailed) set as the criterion of statistical significance. We examined the influence of personality traits on outcome profiles using univariate analyses of variance (ANOVAs), comparing patients high or low on neuroticism and extraversion as a function of mood, HRQOL, and self-change at each review after surgery. The relationships between

**Table 2. Medical characteristics of the four developmental seizure-onset groups**

Characteristic	No. (%)			
	Infancy (n = 12)	Childhood (n = 14)	Adolescent (n = 17)	Adult (n = 14)
Site of surgical resection				
Within mesial temporal lobe	8 (66.7)	8 (57.1)	11 (64.7)	9 (64.3)
Outside mesial temporal lobe	4 (33.3)	6 (42.9)	6 (35.3)	5 (35.7)
Postoperative pathology				
Mesial temporal sclerosis	7 (58.3)	4 (28.6)	6 (35.3)	6 (42.9)
Cortical dysplasia	5 (41.7)	7 (50)	9 (52.9)	5 (35.7)
Other <sup>a</sup>	0	3 (21.4)	2 (11.8)	3 (21.4)
1-Month seizure outcome <sup>b</sup>				
Seizure free	10 (83.3)	12 (85.7)	14 (82.4)	11 (78.6)
Not seizure free	2 (16.7)	2 (14.3)	3 (17.6)	3 (21.4)
3-Month seizure outcome <sup>b</sup>				
Seizure free	9 (75)	9 (64.3)	13 (76.5)	10 (71.4)
Not seizure free	3 (25)	5 (35.7)	4 (23.5)	4 (28.6)
12-Month seizure outcome <sup>b</sup>				
Seizure free	8 (66.7)	8 (57.1)	13 (76.5)	7 (53.8) <sup>c</sup>
Not seizure free	4 (33.3)	6 (42.9)	4 (23.5)	6 (46.2)

<sup>a</sup>Included two vascular malformations, two acquired lesions (trauma), three mild astrocytosis, and one with no abnormality detected.

<sup>b</sup>Patients classified as seizure free had experienced no seizures, or auras only. Patients classified as not seizure free had experienced one or more complex partial and/or generalized tonic-clonic seizures from discharge to the time of the review, excluding seizures with an identifiable precipitant.

<sup>c</sup>One case of missing data.

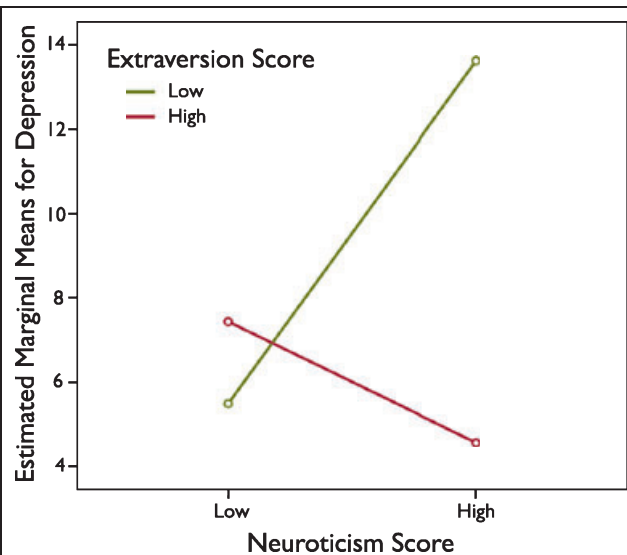
personality traits, the psychological experience of learning to live without epilepsy, and psychosocial functioning were examined using chi-square analyses. We also examined the influence of the developmental time frame of habitual seizure onset on patient outcome profiles using repeated measures ANOVA and chi-square analyses.

## RESULTS

### The role of personality in outcome profiles

The influence of preoperative personality traits was most evident early after surgery for mood outcome. Patients with high levels of neuroticism and low levels of extraversion had significantly higher postoperative depression scores at 3-months ( $F = 4.45$ ,  $d.f. = 1.40$ ,  $p < 0.05$ , partial  $\eta^2 = 0.1$ ; Fig. 1). There were no significant effects for anxiety, overall HRQOL scores, or perceived self-change after surgery.

Preoperative neuroticism also influenced the experiences and ability of patients to adjust to life after surgery. Those with high neuroticism, as compared to low, were significantly more likely to report disrupted family dynamics at 1 month (72%,  $\chi^2 = 4.07$ ,  $d.f. = 1$ ,  $p < 0.05$ ) and 3 months (77%,  $\chi^2 = 6.85$ ,  $d.f. = 1$ ,  $p = 0.009$ ). They were also more likely to report psychological features of the burden of normality at 12 months (76%,  $\chi^2 = 3.81$ ,  $d.f. = 1$ ,  $p = 0.05$ ). There were no other significant effects, with the exception



**Figure 1.**

Estimated marginal means showing the interaction between neuroticism, extraversion, and depression. Patients with high levels of neuroticism (above the population norm) and low levels of extraversion (at or below the population norm) had the highest mean depression scores at 3-months after surgery.

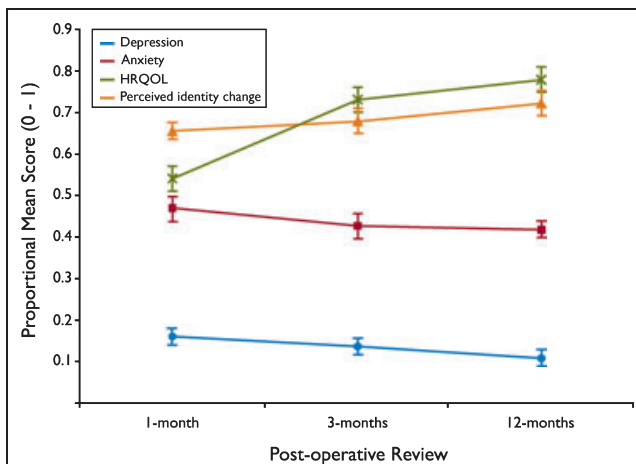
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that high extraversion, as compared to low, was associated with disrupted family dynamics at 1 month (56%,  $\chi^2 = 6.6$ ,  $d.f. = 1$ ,  $p = 0.01$ ).

### Profiling the course of self-change and adjustment after surgery

On average, patients generally endorsed self-change after surgery; at each review five or fewer patients perceived no change, with the extent of perceived identity change increasing over time. HRQOL scores also increased over time, whereas depression and anxiety scores decreased (Fig. 2). Accompanying this process of change, at each review more than one-third of patients described psychological features of the burden of normality (1 month 39%, 3 months 40%, 12 months 37%) and approximately half or more patients reported disrupted family dynamics (1 month 44%, 3 months 53%, 12 months 44%) and difficulties with social functioning (1 month 91%, 3 months 70%, 12 months 53%). By 12 months, patients with psychological features of the burden of normality had a significantly higher mean self-change score ( $F = 4.17$ ,  $d.f. = 1.38$ ,  $p < 0.05$ , partial  $\eta^2 = 0.1$ ) and were more likely to be seizure free ( $\chi^2 = 5.32$ ,  $d.f. = 1$ ,  $p = 0.02$ ) despite a decrease in the percentage of patients classified as seizure free (1 month 83%, 3 months 72%, 12 months 64%).

The developmental period of habitual seizure onset played a significant role in perceived identity change after surgery. There was a significant interaction between habitual seizure onset and the extent of self-change from 3 to 12



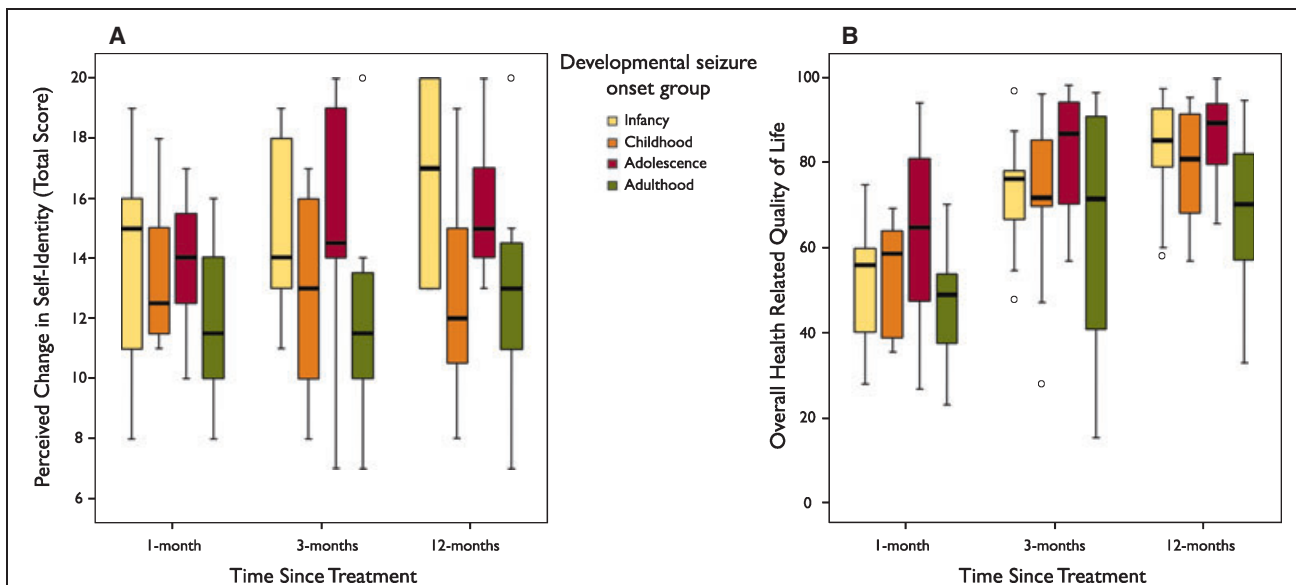
**Figure 2.** Line graphs showing the average patient trajectory for depression (blue), anxiety (red), health-related quality of life (HRQOL) (green), and perceived identity change (orange) across time after surgery. Scores are shown as mean proportional values (0–1) to account for differences in total scale scores. *Epilepsia* © ILAE

months ( $F = 3.11$ ,  $d.f. = 3.27$ ,  $p < 0.05$ ,  $\eta^2 = 0.26$ ). To explore this interaction, univariate analyses of variance with planned simple contrasts were conducted for each post-operative review. These targeted the adolescent seizure-onset group, given that identity development is a key task of adolescence (Wilson et al., 2009). The results showed that patients with adolescent onset were significantly more

likely to report self-change compared to the adult-onset group at 1 month (contrast estimate =  $-2.16$ ,  $p = 0.04$ ), 3 months (contrast estimate =  $-3.47$ ,  $p = 0.02$ ), and 12 months (contrast estimate =  $-2.49$ ,  $p = 0.05$ ; Fig. 3A). They also reported greater self-change than the childhood-onset group at 12 months (contrast estimate =  $-2.66$ ,  $p < 0.05$ ). There was no significant difference between the adolescent and infant-onset groups at any review, and as shown in Fig. 3A, the infant group had the highest mean identity change score at 12 months. The experience of self-change had benefits for perceived HRQOL, with the adolescent-onset group reporting higher mean HRQOL scores than the adult-onset group (contrast estimate =  $-16.3$ ,  $p < 0.02$ ) for the 12 months after surgery (Fig. 3B). There were no significant effects of the developmental time frame of habitual seizure onset on the other measures of seizure, psychological, or psychosocial outcome.

### DISCUSSION

In this study we found that individual differences in personality profiles predict early mood outcomes following epilepsy surgery. Patients high in neuroticism and low in extraversion reported more symptoms of depression 3 months after surgery. High neuroticism was also associated with disrupted family dynamics early after surgery, and psychological difficulties adjusting to being well (the burden of normality) by 12 months. Approximately half of the patients reported psychosocial adjustment difficulties over the first 12 months, contrasting with declining symptoms of



**Figure 3.** Box-and-whisker plots of perceived change in (A) self-identity, and (B) health-related quality of life (HRQOL) at 1, 3, and 12 months after surgery, shown for the four developmental seizure-onset groups. *Epilepsia* © ILAE



depression and anxiety and increasing HRQOL scores. Adjustment difficulties at 12 months were greater in patients who perceived their identity to have changed post-surgery which, in turn, was more common in patients with habitual seizure onset before or during the identity-defining period of adolescence.

Our previous study with this cohort showed that high neuroticism was linked to the developmental time frame of regular seizure onset, and pointed to adolescence as the period where greatest disruption to self-development can occur (Wilson et al., 2009). We now show that although undergoing efficacious epilepsy surgery can bring a dramatic life change as the patient transitions from chronically sick to well, the extent of this change appears linked to earlier development. The onset of habitual seizures during or before adolescence promoted the greatest change, whereas onset in adulthood effected less change, presumably reflecting an already established sense of self. Paradoxically, although seizure onset before adulthood may pose a greater risk to self-development, it brings the opportunity of perceiving greater benefits after surgery as evident from higher postoperative HRQOL scores in the adolescent seizure-onset group.

The notion that more-pervasive change may promote greater psychological growth has been reported in a range of populations, including first-seizure patients (Velissaris et al., 2007). The process of change following treatment of chronic disease is typically pervasive (Wilson et al., 2007; Genardini et al., 2008; Schüpbach & Agid, 2008) and is best considered from the perspective of longitudinal outcome profiles that link medical, psychological, and social variables. In this study the endorsement of self-change increased over time and was not directly related to mood, but was related to the psychological experience of becoming seizure free and better seizure outcome. Mood disturbance was greatest early postsurgery and generally improved over time. It has been noted as a risk factor for poor longer-term psychosocial outcomes if not effectively treated (Wilson et al., 2005). It can now also be linked to the personality profile of patients before surgery, promoting improved preventive treatment strategies. Importantly, the findings concur with the relationships between personality profile, mood, and family functioning that we reported in this cohort before surgery (Wilson et al., 2009).

Finally, recent research has reported mixed results about the relationship of HRQOL to other outcome variables, and has noted a plateau in HRQOL scores around 2 years after surgery (Jacoby & Baker, 2008). In this study, HRQOL showed an inverse relationship with mood over time. It was also associated with perceived self-change, indicating a link with processes of adjustment after surgery. Because adjustment issues typically span the first 2 years of surgery (Wilson et al., 2001), HRQOL scores may be better understood in the context of the patient's adjustment process. Further research of this issue is warranted.

## CONCLUSION

Patient outcome trajectories following treatment of chronic neurologic illness represent interactions between biomedical, psychological, and social factors. In the case of epilepsy, we have shown that individual differences in personality traits reflect self-development in the context of habitual seizures and this, in turn, influences treatment outcomes. Critical to the provision of psychologically informed care is the understanding that the developmental time frame of regular seizure onset can affect the extent of change experienced by patients after surgery and the perceived benefits of being rendered seizure free.

## ACKNOWLEDGMENTS

This project was supported by an Australian Research Council Linkage Project Award (LP0453690). We would like to thank the staff and patients of the Comprehensive Epilepsy Program at Austin Health for their involvement in this study.

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.

Disclosure: None of the authors has any conflict of interest to disclose.

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