



## Association of adherence to epilepsy quality standards with seizure control



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### ABSTRACT

**Objective:** We assessed the relationship between adherence to epilepsy quality measures (EQM) and seizure control over 2–3 years in a retrospective cohort study.

**Methods:** 6150 patients were identified at two large academic medical centers with a primary or secondary diagnosis of epilepsy, were 18–85 years old and seen in outpatient general neurology or epilepsy units between June 2011 and May 2014. Patients were included if: their initial visit was between June 2011 and June 2012, treatment was with  $\geq 1$  anti-seizure drug, there was  $\geq 1$  visit per year during the timeframe, and seizure frequency was documented at initial and final visits, yielding 162 patients/1055 visits from which socio-demographic, clinical and care quality data were abstracted. Quality care was assessed as (1) percent adherence to up to 8 eligible EQM, and (2) defect-free care (DFC: adherence to all eligible EQM). Seizure control (SC) was defined as  $\geq 50\%$  reduction in average seizures/month between initial and final visits. Chi-square and *t*-test compared care quality with seizure control. Logistic regression was used to assess the relationships between SC, quality of care and subspecialist involvement.

**Results:** Care quality, reflected by documentation of seizure frequency, addressing therapeutic interventions, and referral to a comprehensive epilepsy center, all exceeded 80% adherence. Care quality as reflected by documentation of seizure type, etiology or syndrome; assessment of side effects, counseling about epilepsy safety and women's issues, and screening for psychiatric disorders ranged from 40 to 57%. Mean EQM adherence across all applicable measures was associated with greater seizure control ( $p=0.0098$ ). DFC was low ( $\approx 8\%$ ) and did not covary with seizure control ( $p=0.55$ ). The SC and non-SC groups only differed on epilepsy etiology ( $p=0.04$ ). Exploratory analysis showed that mean quality scores are associated with seizure control (OR = 4.9 [1.3–18.5],  $p=0.017$ ) while controlling for the effect of subspecialty involvement as a possible confounding variable.

**Conclusions:** Average quality of care but not defect-free care was associated with seizure control in this retrospective cohort.

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**Abbreviations:** AAN, American Academy of Neurology; EQM, epilepsy quality measures; SC, seizure control; DRE, drug resistant epilepsy; DFC, Defect Free Care; PHS, Partners Healthcare System; RPDR, Research Patient Data Registry; ASD, anti seizure drug; PI, Principal Investigator; IOM, Institute of Medicine.

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### 1. Introduction

There has been substantial interest in the impact of health policy reform on quality of care and patient outcomes (Kaplan and Porter, 2011; McWilliams et al., 2013; Hesdorffer and Begley, 2013). Policy and research alike have aimed to develop evidence-based methods of consistently high quality care for all patients with a given medical condition (Fitzsimons et al., 2012; Kaplan and Porter, 2011; Harden et al., 2009).

In an effort to further these goals in the field of epilepsy, the American Academy of Neurology (AAN) partnered with the American Epilepsy Society to publish the epilepsy quality measures

(EQM) in 2011, and a revised version of these in 2015. EQM are intended to assist clinicians in providing high quality care (Fountain et al., 2015). The current EQM span the spectrum of epilepsy care, including measures of clinical documentation of seizure frequency, type, etiology and syndrome; screening for psychiatric or behavioral health disorders, asking about and intervening in side effects of anti-seizure therapy, personalized safety counseling, and discussion about pregnancy and referral for surgery where appropriate. If proven effective, these measures may be used in pay-for-performance programs and to develop educational programs for care-improvement (Fountain et al., 2015).

Past studies have attempted to address physician's adherence to quality indicators in epilepsy (Cisneros-Franco et al., 2013; Fitzsimons et al., 2013; Hesdorffer and Begley, 2013; Moura et al., 2015; Pourdeyhimi et al., 2014; Pugh et al., 2011, 2007; Veeravigrom et al., 2013; Wasade et al., 2012; Wicks and Fountain, 2012). It remains unclear whether adherence to the EQM leads to improved clinical outcomes for people living with epilepsy.

Our group started to address this question with a retrospective cohort that explored the association of adherence to epilepsy quality measures with one outcome, recommending or prescribing folate to women with epilepsy. The analysis showed that even with strict adherence to a single item in the EQM (annual documentation of women's counseling), the "action" of prescribing or recommending folic acid was frequently omitted (Moura et al., 2015). However, the relationship between adherence to either the original or the revised EQM (Fountain et al., 2011, 2015) and clinical outcomes such as seizure control have yet to be demonstrated empirically.

To quantify these associations, we assessed adherence to EQM in two academic settings where people with epilepsy are seen in general neurology or epilepsy outpatient units. We tested whether quality of care as measured by EQM adherence was associated with seizure control over 2–3 years. We also explored whether the involvement of an epilepsy specialist might account for any association of epilepsy process-of-care quality measures and reduction in seizure frequency.

## 2. Material and methods

### 2.1. Participants

The retrospective cohort study used abstraction of medical records. Eligible medical records were identified using the Partners Healthcare Research Patient Data Registry (RPDR), a clinical data registry that aggregates records from sources throughout the Partners Healthcare System (PHS), including the narrative, reporting, laboratory, and administrative systems (Partners Healthcare, 2011). The PHS covers a four-state area and consists of primary care and specialty physicians, community hospitals, managed care organizations, specialty facilities, community health centers, and other health-related entities. Inpatient and outpatient records are collected on every patient in the PHS. Patient's medical records from two PHS academic medical centers, the Brigham and Women's Hospital and the Massachusetts General Hospital, were screened for this study.

Using the RPDR, patients seen in either of the two academic medical centers between June 1st, 2011 and May 31st, 2014 were identified. Each center included both a general neurology clinic and a comprehensive epilepsy center. We used the following inclusion criteria: age 18–85 years, one or more outpatient visits at each medical center, epilepsy as the principal or secondary diagnosis assigned to the visits: ICD-10 code G40 (epilepsy and recurrent seizures) or ICD-9 codes 345.0–345.9 (epilepsy) (Reid et al., 2012; St Germaine-Smith et al., 2012). Partners Healthcare employees were automatically excluded from this query.

### 2.2. Procedures

The Principal Investigator (PI) trained two research assistants to abstract relevant medical records to code information related to patient demographics, provider, and EQM documentation. When conflicting or incomplete information was encountered, the medical record was discussed and reviewed by the PI. In addition, data reliability was assessed using a random sample of 10% of charts reviewed by each research assistant. Inter-rater reliability revealed a good level of agreement between both research assistants and the PI (kappa above 0.8 for EQM measures 1A, 1B, 2, 3, 6 and 7, and kappa ranging from 0.6 to 0.8 for EQM measures 4 and 5).

### 2.3. Measurements

Socio-demographic data were abstracted including age at first visit, gender, primary language, race, education level, type of insurance (private vs. public), number of visits for epilepsy care, academic medical center and epilepsy specialist involvement. Neurologists with formal subspecialized training in epilepsy or those working as attending physicians in an epilepsy specialized clinic were considered epilepsy specialists; the academic background information of each neurologist were obtained from the Partners website (Partners Healthcare, n.d.). All other neurologists were classified as general neurologists. Epilepsy specialist involvement was considered present when a neurologist with formal subspecialized training in epilepsy cared for the patient at least once within the study evaluation period (Cheng et al., 2007; Reid et al., 2012).

The medical record abstraction was operationalized for each quality measure based on the 2015 AAN's EQM performance guidelines (8 measures) (Fountain et al., 2015). Quality of care was assessed at the first outpatient visit where epilepsy-related issues were addressed and at all subsequent follow-up visits within a two to three-year follow-up window. These criteria assured that the patient had established care with the provider (Bakaki et al., 2013).

Four epilepsy quality measures were only applicable to patients with a diagnosis of epilepsy with a seizure frequency >0 (EQM 1B), to patients without diagnosis of intellectual disability (EQM 5), to women of childbearing potential (EQM 6) and to patients with intractable epilepsy (EQM 7) and were only included in calculations of adherence in these cases. Other considerations included the required frequency of each measure within the treatment period (i.e. annually vs. every visit). Table 1 details the specifications for each measure (Nolan and Berwick, 2006).

Quality of care was assessed as the mean EQM scores, obtained as the percent adherence to up to 8 EQM that were applicable for an individual patient. In addition, because the Institute of Medicine (IOM) recommends consideration of whether all "critical aspects of care" are achieved (Choi et al., 2014), we derived a binary measure of defect free care (DFC), defined as the adherence to all applicable quality measures within the study timeframe (DFC = 100% adherence to all applicable EQMs, non-DFC = failure to adhere to at least one applicable EQM). This approach has been widely used in the literature (e.g. stroke care) and has excellent sensitivity to inter-provider performance variability (Nolan and Berwick, 2006).

Seizure frequency control was the clinical outcome for our analyses, chosen because epilepsy care aims to achieve reduction in seizure frequency and – ideally – seizure freedom (Choi et al., 2014). Seizure frequency was abstracted at all visits and defined as seizure frequency during the six months preceding the visit.

Seizure frequency control (Seizure Control = SC vs. non-SC) was defined as the proportion of patients who showed a  $\geq 50\%$  reduction in seizure frequency between the initial and final visits. This metric has been commonly used to reflect a significant clinical improvement in seizure frequency (Bae et al., 2011; Paquette et al., 2015).

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