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Do Centers of Excellence excel in patient outcomes?: Evidence from U.S. Veterans Health Administration Centers for Epilepsy

Pamela Kelly[1], Ravi Chinta[2]*
[1]Regional Director, Southeast Epilepsy Centers of Excellence
Pamela.Kelly2@va.gov
[2]University Research Chair, School of Advanced Studies, University of Phoenix
ravichinta@hotmail.com

*Corresponding Author

Abstract- *The Veterans Health Administration created in 2009 several Epilepsy Centers of Excellence (ECoE) for epilepsy treatment to improve health outcomes of veterans suffering undergoing treatment for epilepsy. Our outcomes study assesses the health quality at these ECoEs in comparison to non-ECoEs over a three year time period (2009 to 2011). Data from both ECoEs and Non-ECoEs were collected on a number of health outcome measures to empirically test if ECoEs led to better health outcomes than non-ECoEs. Findings show that ECoEs, compared to non-ECoEs, led to higher emergency room visits, higher hospitalizations, but lower drug prescriptions. However, ECoEs and non-ECoEs did not have statistically significant differences in adverse effects of medications. The study concludes with the findings, implications and limitations in ways that impact the prevailing perspectives on the concept of Centers of Excellence.*

General Terms- VHA (Veterans Health Administration; ECoE (Epilepsy Centers of Excellence).

Keywords- *Centers of Excellence; Outcomes Research; Healthcare Management; Focus in Action.*

1. INTRODUCTION

Centers of excellence (CoEs) exist across the United States in a variety of disciplines, including business, technology, government, and medicine (Gunderman, 2006; Sugerman, 2013). While there is no universally acceptable definition of CoEs, there is wide agreement that CoEs lead to better outcomes relative to those that are not CoEs. That is, one can expect significant differences in some performance metric/s between CoEs and non-CoEs to merit the denomination of CoEs.

CoEs particularly in healthcare attempt to develop methods to increase the efficacy of clinical procedures, decrease their risks, and improve patient outcomes. Thus, one expected positive output of CoEs in healthcare is the emergence of more efficacious clinical protocols for the rest of the healthcare industry (Hyer et al., 2009; McDermott et al., 2011). A CoE model, where hundreds of similar procedures are performed each year further, would provide economies of scale leading to experience-based learning and effectiveness. For example, several studies (Birkmeyer et al., 2003; Livingston, 2009; Latts & Singer, 2010) found that, for most procedures, the mortality rate was higher among patients of low-volume surgeons than among those of high-volume surgeons, regardless of the surgical volume of the hospital in which they practiced.

However, there are several arguments against CoEs. First, it is argued that the experience gained in CoEs is specific to their contexts and is not easily transferable to other contexts making the best practices developed in CoEs difficult to emulate. Second, the correlation between volume and patient outcomes may be clear but the extension requires crowding out other needed procedures at the healthcare institutions. Third, unless the criteria used to establish the CoEs are robust and validated, the benefits of a CoE program may not be realized. Fourth, CoEs are often demonized as competition-reducing entities that tend to force smaller and non-designated entities (let us call them non-CoEs) out of business (Wonderling et al., 2011; McClellan, 2011). Such market power by CoEs is often described as CoE-phobia in the healthcare marketplace (Levy, 2014). Finally, the expected benefits (for example, benefits of improved outcomes and cost-effectiveness) from CoEs must first be empirically validated rather than assumed. The rationale for our study stems from this last point about CoEs. Our study compares CoEs and Non-CoEs in one particular setting to assess if CoEs excel their counterparts in health outcomes.

The paper is structured in four sections. First, literature review is done on CoE concept leading to the research hypotheses and variables of the study. Second, the sample and data collection methods are described. Third, the results of data analysis are discussed. Fourth, the findings and limitations of the study are delineated. The paper concludes with several suggestions arising from

implications for future research, clinical practice and policy making.

2. LITERATURE REVIEW

Centers of excellence (CoE) are found in multiple areas, including IT, education, and health care. The three major justifying factors for CoEs include decreasing the costs, improving the quality, and improving customer satisfaction (America's SAP Users' Group [ASUG/SAP], 2006). Centers of excellence (CoE) are a form of integrative health care involving the collaboration of multiple disciplines. In many respects, the theory of CoE is aligned with the expectation of lean process thinking theory. The overarching concepts of lean process thinking are standardization, eliminating excess, and process improvement (Lehman & Suozzi, 2008; Young & McClean, 2008; Joosten et al., 2009).

Other health care theories emphasize the idea of multifactor determinants for changes in provision of health care. Weisbrod (1991) coined the phrase "health care quadrilemma" to describe the integration of technology change, insurance, quality of care, and cost factors for the success of health care services (p. 523). CoEs are intended to provide focus in the complex healthcare environment (Grol et al., 2007).

Using lean process thinking tools such as process reengineering, flow charting, Ohno's waste identification and reduction, lay-out planning, value stream mapping and other visuals that depict processes for delivering services (Bush, 2007; Shortell et al., 2007; Jooston et.al., 2009; Pronovost, 2011; O'Malley, 2014) in the ECoE program will be important in identifying the strengths and gaps. Comparing costs prior to the implementation of the ECoE and over the course of the initial three to four years of the program should also provide significant insight in the elimination of waste. In health care, lean process thinking success involves both operational and sociotechnical components (Joosten et al., 2009; Pronovost, 2011).

In health care, many centers of excellence have been established by medical specialties (e.g., Shouldice Hospital in hernias) or a government entity such as the National Cancer Institute or the Veterans Health Administration or even a consumer products company such as Walmart who partnered with 6 nationally well-known health care organizations, including the Mayo Clinic and the Cleveland Clinic. Increasingly government is mandating the formation of CoEs to drive better outcomes. For example, in 2006, the Centers for Medicare & Medicaid Services ruled that Medicare would pay only for bariatric surgery that was performed at an ASMBS center of excellence or an ACS level 1 bariatric surgery center. In 2012, the ACS and ASMBS decided to combine their certifications to create 1 set of national standards (CMS, 2012).

The National Association of Epilepsy Centers (1990) identified gaps in epilepsy care, such as access to care and substantial cost concerns. The National Institute of Medicine (NIH) initially funded ECoEs for the civilian health care sector. The VHA established similar centers as mandated by Veterans' Mental Health and other Improvements Act, P.L. 110-387 (2008). Physicians in multiple health care organizations struggle to improve access to care and maintain the quality of health care services within budget constraints and increased health care legislation reform leading significant differences in patient outcomes (Halpern et al., 2000; Fried & Gaydos, 2002; World Health Organization [WHO], 2002; Nosek, 2004; The Kaiser Foundation, 2008; Kasun, 2010; IOM, 2012). The drive for CoE is aligned with the challenges faced by the national and global health care systems.

The Centers for Disease Control (CDC) led multiple studies to develop quality care indicators for epilepsy care (Kobau et al., 2008). Effective quality metrics involve multipronged criteria that include measures of function and composition to produce objective data for evaluation (Koop et al., 2002). The Joint Commission (TJC), College of American Pathologists, and the International Organization of Standardization developed indicators and metrics for quality. At a minimum, patient outcomes can be measured by what happens to the patient during and after medical interventions such as hospitalizations, # of medications or diagnostic assessments (Colvello & Merkhofer, 1993; Sperling et al., 1999; Palin et al., 2008).

The Veterans Health Administration (VHA)

The VHA, being one of the largest health care delivery systems, has evolved from predominately inpatient hospitalization and residential support from 1930 until the early 1960s into a program of balance for both inpatients and outpatients, as a result of congressional activity such as P.L. 106-117 and the Veterans Millennium Healthcare and Benefits Act (1999); Shay & Yoshikawa, 2010). Currently, the VHA consists of approximately 150 medical centers, 130 nursing homes, 950 community-based clinics, and 230 counseling centers distributed throughout 21 regional or Veterans Integrated Service Networks (VISN) (GAO 11-205, 2010); 5.6 million Veterans receive services from the VHA annually (Darkins et al., 2008).

CoEs offer equity of superior-quality services, fiscal responsibility, support, guidance, sharing resources, and coordinated, collaborative governance toward a pursuit of excellence (DeMaria et al., 2010; George Mason University 2010; Khalil et al., 2001). Although the definition of COE varies in application, a common theme for COE is collaboration that offers synergistic performance. The VHA mandated ECoE to meet the demands of the projected increase of epilepsy in the Veteran population. The Veteran Mental Health and Other Care Improvements Act (Public Law [P.L.] 110-387, Title IV, Sec 404, 2008) mandated the establishment of the Epilepsy Center of Excellence (ECoE).

3. RESEARCH QUESTIONS AND HYPOTHESES

The primary research question is: Do ECoEs excel in health outcomes for patients relative to non-ECoEs? The ECoE provides a corralling of resources for epilepsy-specific health care; therefore, Veterans receiving care within the ECoE system should show significantly better results in quality, access, and cost factors than the Veterans receiving care at VA non-ECoE sites.

Patient Outcomes

Frequency of emergency room visits and hospitalizations, number and distribution of prescribed medications, and adverse side effects are expected to be significantly different between ECoE and non-ECoE sites. Research indicates that quality can be defined by correct diagnosis, the availability of testing as needed, medication control, minimum urgent medical visits or hospitalization, and appropriate patient education (Campbell et al., 2000; Lingsma, 2010; Manjunath et al., 2012).

$H_0 1_a$: There is no significant difference in frequency of emergency room visits between types of unit (non-ECoE, ECoE).

$H_0 1_b$: There is no significant difference in frequency of hospitalizations between types of unit (non-ECoE, ECoE).

Specific to epilepsy, quality of care is demonstrated in the number of medications prescribed and the control of side effects associated with AEDs (Begley et al., 2011; Pugh et al., 2011). Correct diagnosis is important for prescribing the right number medications and for providing appropriate individualized treatment plans (Stephen et al., 1999; Kwan & Brodie, 2001). Therefore, it was expected that the non-ECoE unit patients would have significantly more prescribed drugs, less orders, and more abnormal lab results for calcium and Vitamin D testing (reflecting bone health) than the patients in an ECoE unit.

$H_0 2$: There is no significant difference in the number of prescribed medications between types of unit (non-ECoE, ECoE).

$H_0 3$: There is no significant difference in adverse side effects related to long term use of AEDs, between types of unit (non-ECoE, ECoE).

$H_0 3a$: the measure is adverse effects per Vitamin D deficiencies

$H_0 3b$: the measure is adverse effects per Calcium deficiencies

Population, Sample And Variables

Population. The population for the study was the patients suffering from epilepsy in the VHA. Approximately 2 million people are diagnosed with epilepsy in the United States (Centers for Disease Control, 2011). A national ECoE study estimated that the VHA had 87,377 patients with an epilepsy diagnosis, and 15,830 (18.1%) were enrolled in 16 ECoE facilities nationally.

Sample. In this study, four ECoEs in South East were compared with ten VA non-ECoE centers. The 10 VHA medical centers not designated as ECoE sites were randomly selected from the population of all non-ECoEs. Randomization provides a better chance of capturing variety and increases the potential for a well-represented cohort of patients (Campbell & Swinscow, 2009). Data were collected from 4 ECoEs and 10 non-ECoEs designated as such by VHA.

The historical data of seizure patients for the two cohorts of non-ECoE and ECoE units for consecutive VHA fiscal years from 2009 through 2011 (FY09, FY10, and FY11) were collected from the VHA VSSC databases, the main VHA database warehouse where all data for administration and operation is maintained. Using the Holden algorithm (Holden et al.,2005; Pugh et al., 2008), patients with at least one inpatient or outpatient seizure encounter (ICD-09-CM 345.xx or 780.3x) and at least 30 days or more AED prescriptions in the same fiscal year were considered VA epileptic patients.

Variables. Six variables were identified in this study, one independent variable and five dependent variables. The independent variable was a type of unit, and the dependent variables were frequency of emergency room visits and hospitalization episodes, number of prescribed medications, adverse side effects related to long-term use of AEDs,.

Frequency of emergency room visits and hospitalizations. These were determined by the number of encounters for hospitalizations and emergency room visits in the VSSC databases.

Number of prescribed medications. These were identified by the number of prescriptions for 30 epilepsy drugs in the pharmacy benefits package that is a part of the VSSC database (Pack & Morrell, 2004).

Adverse side effects related to long-term use of AEDs. Evaluation looked specifically at the calcium and vitamin D lab results. From the laboratory section of the VSSC database, the number of orders for referenced tests and the number of abnormal calcium and vitamin D results were compared between the ECoE and non-ECoE units.

4. DATA ANALYSIS AND RESULTS

The study used Chi-squared and independent 't' test to determine significant differences between the ECoE and non-ECoE units. Comparative analyses drives the method and design selection of our research (Whittermore & Meikus, 2008; Creswell, 2009). The normality assumptions of 't' tests did not matter due to large sample size (Lumley et.al, 2002; Weaver, 2004; Campbell & Swinscow, 2009; Fay & Proschan, 2010).

For first hypothesis (a, and b), 't' tests for significance of the difference between two independent means were conducted. The independent variable is the type of unit (non-ECoE, ECoE) and the dependent variables are frequency of emergency room visits and hospitalizations. The resulting two-tailed significance value is reported; if $p < \alpha = .05$, the difference in the independent means is considered as a significant difference.

For second and third hypotheses, chi-squared analyses were conducted. The independent variable was the same as stated above and the dependent variables were the number

of prescribed medications, adverse side effects related to long- term use of AEDs, and proportion of fee basis patients. Since chi-square tests are nonparametric, only two assumptions exist for their use, according to Field (2009): observations must be independent from each other, and the expected cell frequencies must be greater than five. The data analysis includes a table representing the cell frequencies as well as statistics representing the significance. For this analysis, alpha was set at $p < .05$.

Findings

Frequencies of ER visits.

The average visits to the ER showed a downward trend across the three years of data collected. Therefore, the average visits were higher in FY09 baseline year than in FY11. FY09 showed a statistically significant higher average number of visits for the ECoE unit. This significant difference between the units was also noted in the intervention year FY11and thus, $H_0$1a is rejected.

Table 1: ***Frequency of Emergency Room (ER) Visits***

Statistics	FY09		FY10		FY11	
	ECoE	Non-ECoE	ECoE	Non-ECoE	ECoE	Non-ECoE
Total patients	3571	5199	3515	5363	3183	4801
Total # of visits	4642	5558	4479	6279	3915	4947
Avg # of Visits	1.29	1.06	1.27	1.17	1.23	1.03
t test	4.46		2.0		3.7	
df	8768		8876		7982	
p	<.0001		0.0459		.0002	

Hospitalization frequencies.

The average hospitalizations for the ECoE unit were higher in FY09, FY10, and FY11. A statistically significant difference between the two units was noted in all the three years of data and is presented in Table 2. Significant difference in average hospitalizations between the units was noted in FY11 and thus, $H_0$1b is rejected.

Table 2: ***Frequency of Hospitalizations***

Statistics	FY09		FY10		FY11	
	ECoE	Non-ECoE	ECoE	Non-ECoE	ECoE	Non-ECoE
Total patients	3571	5199	3515	5363	3183	4801
Total # of visits	1986	2220	1798	2284	1558	1823
Avg # of Visits	.55	.43	.51	.43	.49	.38
t test	5.14		3.56		4.31	
df	8768		8876		7982	
p	<.0001		0.0004		<.0001	

Medications prescribed

Chi-squared statistical testing was used to evaluate the proportion of patients for three categories for the number of prescribed AEDs (1 AED prescription, 2 AED prescriptions, and 3 or more AED prescriptions). Results of $\chi 2$ test for distribution of prescribed medications are shown in Table 3. In the baseline year FY09 statistical significance was noted for the prescribed medications. However, no statistical significance was noted in FY10 or FY11 and thus the results accept $H_0$2 hypothesis

Table 3: ***Counts of Patients Prescribed AED Medications***

Number of medications	FY09		FY10		FY11	
	ECoE	Non-ECoE	ECoE	Non-ECoE	ECoE	Non-ECoE
Total patients	3571	5199	3515	5363	3183	4801
1	2264, *63.4*	3406, *65.5*	2225, *63.3*	3430, *64.0*	1996, *62.7*	3026, *63.0*
2	971, *27.2*	1373, *26.4*	944, *26.9*	1481, *27.6*	873, *27.4*	1354, *28.2*
3 or more	336, *9.1*	420, *8.1*	346, *9.8*	452, *8.4*	314, *9.9*	421, *8.8*
$\chi^2(1)$ [a]	6.2950		5.3239		2.9409	
P	.0430		.0698		.2298	

Percentages may not equal 100 due to rounding.
[a]Degrees of freedom for χ^2 test. FY: fiscal year

Adverse side effects due to long term uses of AEDs.
Statistical significance was found in FY09 and FY10, the non-ECoE unit reported a higher proportion of abnormal Vitamin D results than the ECoE unit. No statistical difference found in the reporting of abnormal vitamin D results in the two units (non-ECoE, ECoE) for FY11 (see Table 4), thus evidence supports the rejection of the hypothesis ($H_0$3a) for Vitamin D results.

Table 4: ***Counts of Patients with Abnormal Vitamin D Lab Results***

	FY09		FY10		FY11	
Test results	ECoE	Non-ECoE	ECoE	Non-ECoE	ECoE	Non-ECoE
Total patients	3571	5199	3515	5363	3183	4801
Abnormal	47, *46.1%*	79, *63.7%*	65, *45.1%*	124, *59.3%*	94, *42.3%*	123, *51.0%*
Normal	55, *53.9%*	45, *36.3%*	79, *54.9%*	85, *40.67%*	128, *57.7%*	118, *48.9%*
$\chi^2(1)$ [a]	7.0522		6.9027		3.5083	
P	.0079		.0086		.0611	

Percentages may not equal 100 due to rounding.
[a].Degrees of freedom for χ^2 test. FY: fiscal year

Calcium. Calcium tests are often performed in routine blood workup because irregular levels (rarely present as visibly problematic) can be an indication of many medical issues (Pack, 2005; Wysolmerski & Insogna, 2011). For calcium testing, the proportions of abnormal results were not found to be statistically different between the two units (Table 5) in FY 09 or FY11. Therefore the $H_0$3b hypothesis is accepted for Calcium results.

Table 5: ***Counts of Patients with Abnormal Calcium Lab Results***

	FY09		FY10		FY11	
Test results	ECoE	Non-ECoE	ECoE	Non-ECoE	ECoE	Non-ECoE
Total patients	3571	5199	3515	5363	3183	4801
Abnormal, %	162, *19.5*	297, *20.2*	137, *16.37*	305, *19.99*	136, *17.7*	222, *17.0*
Normal, %	668, *80.5*	1174, *79.8*	700, *83.6*	1221, *80.01*	631, *82.3*	1082, *82.9*
$\chi^2(1)$ [a]	.1502		4.6553		.1688	
P	.6984		.031		.6812	

Percentages may not equal 100 due to rounding.
[a]Degrees of freedom for χ^2 test. FY: fiscal year

5. DISCUSSION

The general theoretical concept of the CoE is to improve quality of outcomes, increased access, decreased costs, and sustainability of improvements (Nilsson et al., 1999; Lehman & Suozzi, 2008; So et al., 2009).

Comparison of hospitalization in ECoE and non ECoE units. The results for hospitalization frequencies were also found to be statistically significant in both years with the ECoE unit demonstrating a higher incidence of hospitalization than the non- ECoE (Table 2). Given the amount of required hospitalizations for Long Term Monitoring (LTM) of EEG testing, an increased number of hospitalizations in the ECoE unit when compared to a non-ECoE would be a reasonable finding.

The availability of LTM only in the ECoE unit, and the assertion that the ECoE unit cohort includes sicker patients are extraneous variables that may influence the frequency of hospitalizations and ER visits and affect the comparative evaluation of the units. The discovery of the extraneous variables also justified the decision to evaluate frequency of ER visits and hospitalizations separately.

Medication prescription patterns. The number of epilepsy medications prescribed for patients were compared using categorical data. Prior research indicates that approximately 60% of epileptic patients are controlled with one prescribed drug (Brodie, 2001). However, the comparative data results between the ECoE and non-ECoE units were not statistically different (Table 3).

Interventions take time to implement, and determination of impact via evaluation can be time sensitive in accordance with complete implementation. There is evidence that the ECoEs intervention was not fully completed implemented in FY11; therefore, the lack of difference in the two types of units may be attributed to a premature evaluation of this variable.

Quality maintenance in laboratory tests

For the last quality variable, our study examined lab results. Research has confirmed the correlation of AEDs and bone health; therefore, management of Vitamin D and calcium results is important (Pack, 2005). The Vitamin D blood test is more specific for bone health, while calcium blood testing is done frequently for general health care evaluations.

The adverse side effects of AEDs were measured through abnormal lab results for calcium and Vitamin D levels. No significant differences were found in the baseline year or in FY11 among units for calcium results. However, FY09 had shown a significant difference where the non-ECoE unit data contained a larger percentage of abnormal vitamin D results than the ECoE unit. In FY11, the percentage of abnormal results decreased in both units and no significant difference was found.

Policy Implications

This project has the potential to result in policy implications for higher utilization of ECoEs and implementation of CoEs for other health care subspecialties in the VHA and more wide-spread use of CoEs by other health care entities (Wechsler, 2007). Prior to the establishment of ECoE, specialized epilepsy healthcare was diverted to external (non-VA) providers when resources were unavailable. PL 110-387 made provisions for funding to enhance resources within the VA. Without CoEs, the specialized care can be fractured (Strzelczyk et al., 2008).

If future evaluations of the ECoE program reaffirm the findings from this study, the VHA ECoE leadership should consider policies that increase the number of ECoEs, distribute the ECoEs more evenly across the nation, and approve nontraditional operations to address an expected increase in ER visits and higher mean cost when fee-based service becomes necessary.

Recommendations for Future Research

Our study focused on five specific direct variables for the factors of quality. Future research should consider other co-variants such as access and cost and others that may affect quality of care (Salinksy et al., 2011). Future research should also evaluate referral patterns between ECoE units and non-ECoE units; examine or track consultations and formal communication modes between ECoE providers and non-ECoE providers. Additionally, time lapse between the implementation of intervention and between evaluations should be carefully considered for future studies of medical CoEs, as this may vary and be dependent on the specifics of the diagnosis or condition being assessed.

Given our empirical findings, future studies should also examine whether the concept of Centers of Excellence is more applicable to surgical COEs (e.g., hernia operations at Shouldice Hospital in Toronto) rather than medical CoEs (e.g., Epilepsy CoEs as in our study). Future research should also adjust for the effects of patient characteristics that may vary across CoEs and non-CoEs. It is quite possible that sicker patients may be going to CoEs which will effect patient outcomes. Risk adjustment is particularly important for outcome measures because patient outcomes are driven not just by quality of care but also by age, gender, medical history, comorbidities, behavioral and social factors, and physiological factors.

Limitations and Strengths of the Study

One limitation of our study is that we have not adjusted for confounding variables such as patient age, sex, education, comorbidities and complications in examining differences in patient outcomes. At a minimum; ideally one must also consider whether patients have drug resistant epilepsy or not, etc.) before definitive conclusions can be reached regarding whether Centers of Excellence excel in patient outcomes. Our defense of our study lies in the large sample size of our study (*n=8770*), and that we are making overall inferential assessments at institutinal levels for CoEs vs. non-CoEs. However, we agree that future studies should examine the confounding variables when studying patient outcomes.

To the best of our knowledge, this is the first quantitative analysis project of its kind in ECoEs. The strength of the study lies in the use of a previously

validated algorithm for data extractions from one of the most extensive databases in the country. The VHA is world renowned for its databases, and with proper clearance, readily accessible national information.

The algorithm used to identify epilepsy patients was previously validated for the geriatric veteran population (Pugh et al., 2008). However, for general VHA patients the validation research is still underway and the validity of the algorithm for other populations is not fully established. Use of new AED medications for conditions other than epilepsy may have led to false positives. Covariates, such as homeless patterns and family support systems, were not included in this study, and these could influence quality results. Additionally, referral patterns and movement between parent stations due to resident relocations were not considered in this study. Although the P.L. mandated the program in 2008, and implementation was expected in 2009, new information acquired during the course of the study confirmed that gaps in workload captured existed through 2011, or that some portions of the intervention were not completed implemented at that time. Since implementation is not fully complete, an evaluation of this caliber at this time may be perceived as premature. With full implementation of the ECoE, results could change. Complete workload capture is necessary for a more reliable and comprehensive evaluation.

6. CONCLUSION

This study specifically evaluated the CoE intervention for specialized epilepsy care in the VHA. The potential that VHA ECoE practices are exportable for other CoE models is in alignment with Congress' support of the VHA mission to provide quality care to veterans; the ECoE was designed to meet the needs of veterans plagued with seizures. Thus, valid studies of the efficiency of CoE medical models can be expected to have strong implications for future medical business acumen and quality health care services.

In the short time the PL 110-387 (2008) has been in effect, the VHA has responded remarkably to maximize specialized resources by establishing ECoEs to provide quality epilepsy healthcare for Veterans. The VHA ECoE program is essential for veterans "who have borne the battle," and modern warfare increasingly exposes troops to dangers of TBI and PTSD (Nilsson et al., 1999; Raymont et al., 2010). CDC (2011) reports that10% of Americans will experience seizures and 3% will be diagnosed with epilepsy prior to age 80. These statistics further justify the need for appropriate specialized care for epilepsy and seizure symptoms.

The CoE concept suggests that the benefits from CoE are not limited to those realized at the CoE entity level but extend to the creation of better protocols (processes) for dissemination to other nonCoEs. Such additional benefits from CoEs are not considered in our study but must be reckoned with when assessing CoEs which must be viewed as investments for social good.

Lastly, CoE concept must be implemented more cautiously for its benefits to become manifest in the healthcare arena. In the complex healthcare environment, realization of economies of scale and quality improvements through CoE concept implementation may be easier said than achieved as our study findings demonstrate.

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