2019 ACMEGS Annual Conference
ACMEGS
Current Issues and Enduring Questions in Clinical MEG
Clinical Pandemonium:
MEG Use Notwithstanding Evidence And MEG Practice Despite Clinical Practice Guidelines
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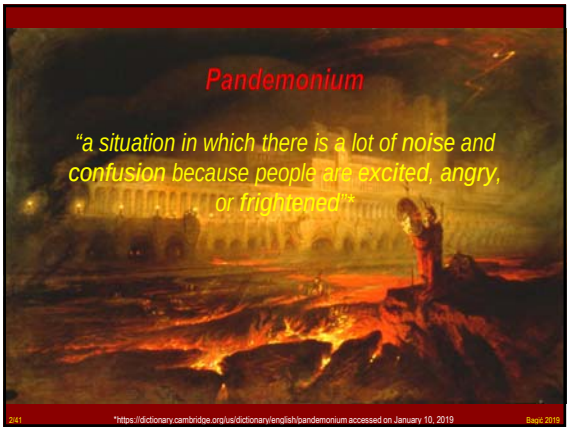
Past President, American Clinical MEG Society (ACMEGS)
10:00 – 10:25; Thursday, February 7, 2019; Caesar's Palace • Las Vegas, Nevada, USA


Pandemonium
"a situation in which there is a lot of noise and confusion because people are excited, angry, or frightened"*
2/41
*https://dictionary.cambridge.org/us/dictionary/english/pandemonium accessed on January 10, 2019
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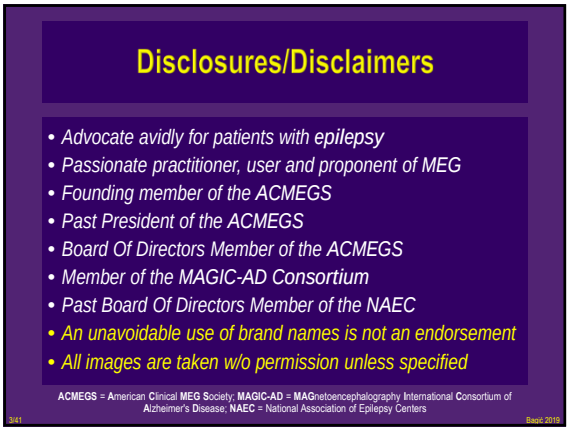
Disclosures/Disclaimers
• Advocate avidly for patients with epilepsy
• Passionate practitioner, user and proponent of MEG
• Founding member of the ACMEGS
• Past President of the ACMEGS
• Board Of Directors Member of the ACMEGS
• Member of the MAGIC-AD Consortium
• Past Board Of Directors Member of the NAEC
• An unavoidable use of brand names is not an endorsement
• All images are taken w/o permission unless specified
ACMEGS = American Clinical MEG Society; MAGIC-AD = MAGnetoencephalography International Consortium of Alzheimer's Disease; NAEC = National Association of Epilepsy Centers
3/41
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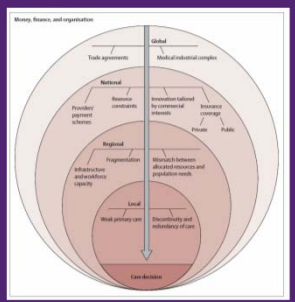
Outline

- 1. What drives a (poor) clinical care?
- 2. MEG's double conundrum
- 3. Current patterns of MEG *use*
- 4. Does evidence matter?
- 5. Current MEG *practice*
- 6. Do CPGs make a difference?
- 7. Accountable *use* and competent *practice*
- 8. Can we save MEG while rescuing epileptology?
- 9. Creating a better future

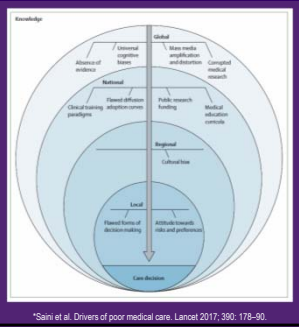
1. What drives a (poor) clinical care?

1. What drives a (poor) clinical care? "Money, finance, and organization"*



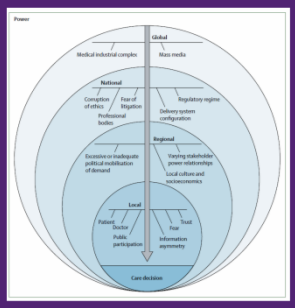
*Saini et al. Drivers of poor medical care. Lancet 2017; 390: 178–90.

1. What drives a (poor) clinical care? "Knowledge, bias, and uncertainty"*



*Saini et al. Drivers of poor medical care. Lancet 2017; 390: 178–90.

1. What drives a (poor) clinical care? "Power and human relationships"*



*Saini et al. Drivers of poor medical care. Lancet 2017; 390: 178–90.

2. MEG's double conundrum

2. MEG's double conundrum

Users	Practitioners
Why many *epileptologists* do not care about *using* MEG?	Why many *magnetoencephalographers* do not care about *practicing* MEG?

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3. Current patterns of MEG *use*

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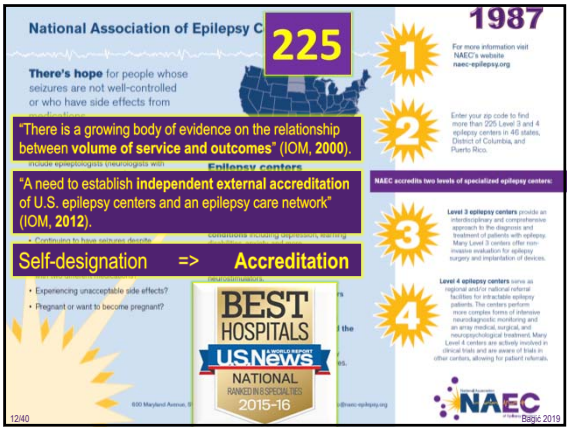

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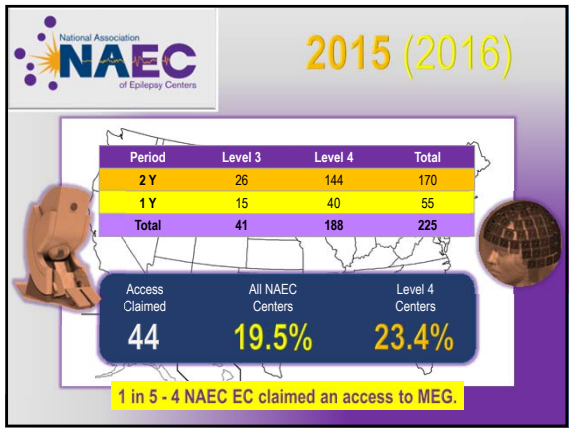
National Association
NAEC
of Epilepsy Centers
2015 (2016)
Period | Level 3 | Level 4 | Total
2 Y | 26 | 144 | 170
1 Y | 15 | 40 | 55
Total | 41 | 188 | 225
Access Claimed
All NAEC Centers
Level 4 Centers
44
19.5%
23.4%
1 in 5 - 4 NAEC EC claimed an access to MEG.

ACMEGS
Facts?
Dear Epilepsy Center Director,
In spite of our awareness about surgical success for intractable epilepsy, the number of surgeries is stagnant or even decreasing in some centers. In its attempt to contribute to the optimal care for patients with intractable epilepsy, the American Clinical MEG Society (ACMEGS) is interested in understanding how MEG/MSI is used currently and how its use can be improved in Epilepsy Centers (ECs) nationwide.
Your invaluable contribution would be acknowledged on our website (www.acmegs.org/) and in any ensuing publications.
The survey is anonymous and we ask that you share with us your true numbers or best estimates (if necessary).
Although it is possible to answer the survey by giving us your best estimates, we suggest that you fill it out using the following data points from your center's NAEC submission for 2016 that you recently completed:
1. Total number of PATIENTS who underwent "phase 1" evaluation in your center.
2. Total number of PATIENTS evaluated invasively irrespective of the method (i.e. strips, depths, grids, stereoEEG or combined).
3. Total number of PATIENTS who underwent a resection w/o invasive monitoring (i.e. "direct resection")
4. Total number of PATIENTS who underwent a resection AFTER invasive monitoring
5. Number of epilepsy patients seen in your center who were evaluated by MEG for the purpose of epilepsy LOCALIZATION.
6. Number of epilepsy patients seen in your center who were evaluated by MEG for the purpose of PRESURICAL MAPPING (of any kind).
14/92
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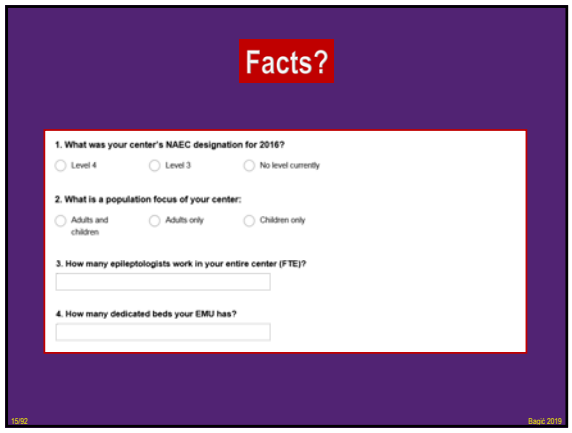
Facts?
1. What was your center's NAEC designation for 2016?
Level 4
Level 3
No level currently
2. What is a population focus of your center:
Adults and children
Adults only
Children only
3. How many epileptologists work in your entire center (FTE)?
4. How many dedicated beds your EMU has?
15/92
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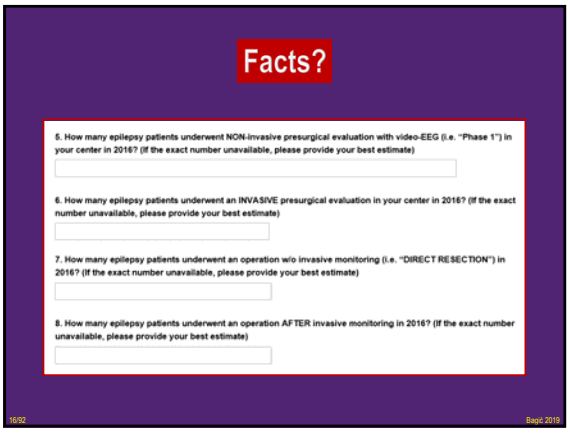
Facts?
5. How many epilepsy patients underwent NON-invasive presurgical evaluation with video-EEG (i.e. "Phase 1") in your center in 2016? (If the exact number unavailable, please provide your best estimate)
6. How many epilepsy patients underwent an INVASIVE presurgical evaluation in your center in 2016? (If the exact number unavailable, please provide your best estimate)
7. How many epilepsy patients underwent an operation w/o invasive monitoring (i.e. "DIRECT RESECTION") in 2016? (If the exact number unavailable, please provide your best estimate)
8. How many epilepsy patients underwent an operation AFTER invasive monitoring in 2016? (If the exact number unavailable, please provide your best estimate)
16/92
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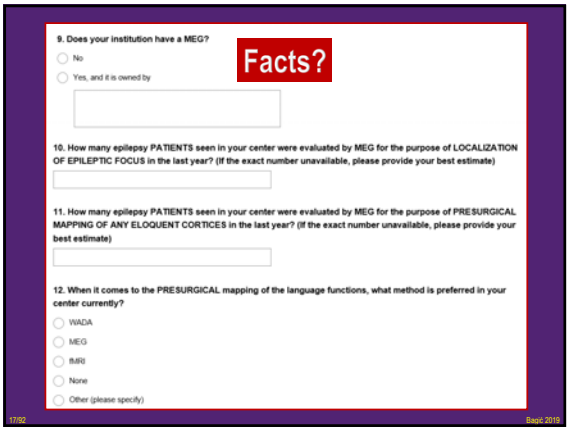
9. Does your institution have a MEG?
No
Yes, and it is owned by
Facts?
10. How many epilepsy PATIENTS seen in your center were evaluated by MEG for the purpose of LOCALIZATION OF EPILEPTIC FOCUS in the last year? (If the exact number unavailable, please provide your best estimate)
11. How many epilepsy PATIENTS seen in your center were evaluated by MEG for the purpose of PRESURGICAL MAPPING OF ANY ELOQUENT CORTICES in the last year? (If the exact number unavailable, please provide your best estimate)
12. When it comes to the PRESURGICAL mapping of the language functions, what method is preferred in your center currently?
WADA
MEG
fMRI
None
Other (please specify)
17/92
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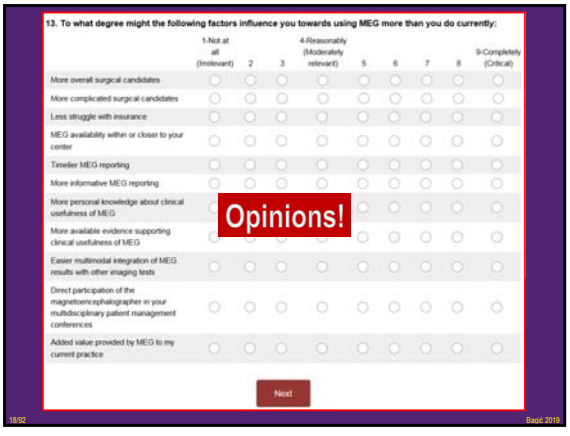
13. To what degree might the following factors influence you towards using MEG more than you do currently:
1-Not at all (Irrelevant)
4-Reasonably (Moderately relevant)
9-Completely (Critical)
More overall surgical candidates
More complicated surgical candidates
Less struggle with insurance
MEG availability within or closer to your center
Timelier MEG reporting
More informative MEG reporting
More personal knowledge about clinical usefulness of MEG
More available evidence supporting clinical usefulness of MEG
Easier multimodal integration of MEG results with other imaging tests
Direct participation of the magnetoencephalographer in your multidisciplinary patient management conferences
Added value provided by MEG to my current practice
Opinions!
Next
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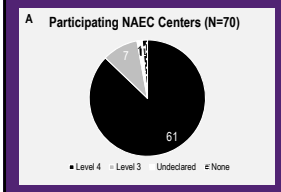
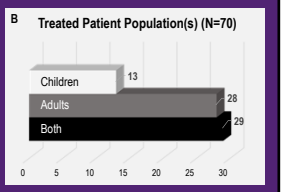
Accreditation level (A; Q1) and populations treated (B; Q2) by participating centers





Bagić AI, Burgess RC. Utilization of Magnetoencephalography (MEG) among the USA Epilepsy Centers: A Survey-Based Appraisal. **J Clin Neurophysiol 2019**, *in press*.

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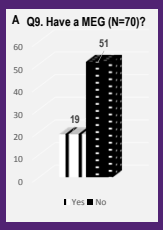
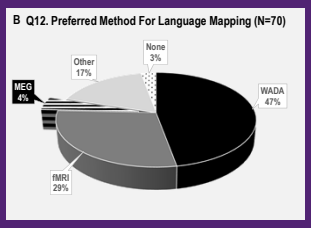
Ownership of a MEG (A; Q9) and preferred method of language mapping (B; Q12) in participating centers





Bagić AI, Burgess RC. Utilization of Magnetoencephalography (MEG) among the USA Epilepsy Centers: A Survey-Based Appraisal. **J Clin Neurophysiol 2019**, *in press*.

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Distribution of answers to the Q3-8, 10 and 11.

Qs (Surveyed Variables)	Valid N	Mean	Median	Minimum	Maximum	Total
Q3 (Epileptologists, FTEs)	70	5.6	4	1	16	389
Q4 (Dedicated EMU beds)	70	7.3	6	1	22	510
Q5 (Phase 1)	69	205.7	150	10	1,200	14,196
Q6 (Phase 2)	70	14.9	9	0	130	1,044
Q7 ("Direct" resections)	68	9.6	6	0	41	652
Q8 ("Indirect" resections)	66	8.6	6	0	46	566
Q10 (MEGs for Epilepsy)	64*	11.2	2	0	100	752
Q11 (MEGs for any PSM modalities)	66	7.6	0	0	100	501

Legend: Some centers provided estimates; some centers provided a range in which case the mean was included; some comments – excluded from calculations. P1 = Phase 1 admissions; P2 = Phase 2 admissions; DR = direct resections; IR = indirect resections; MEG-Epi = MEG studies ordered for the purpose of localization of epileptic focus; MEG-PSM = MEG studies ordered for the purpose of localization of eloquent cortices.

Bagić AI, Burgess RC. Utilization of Magnetoencephalography (MEG) among the USA Epilepsy Centers: A Survey-Based Appraisal. **J Clin Neurophysiol 2019**, *in press*.

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Distribution of answer to the Q13
(*"To what degree might the following factors influence you towards using MEG more than you do currently"*) as collapsed from nine to three categories (Low: 1-3; Moderate: 4-6; High: 7-9).

	Low (1-3)	Moderate (4-6)	High (7-9)	Total
More overall surgical candidates	[redacted]	34.78%	34.78%	[redacted]
More complicated surgical candidates	10.71%	[redacted]	50.00%	[redacted]
Less struggle with insurance	[redacted]	[redacted]	42.86%	[redacted]
MEG availability within or closer to your center	[redacted]	50.00%	47.14%	[redacted]
Timelier MEG reporting	47.16%	[redacted]	12.86%	[redacted]
More informative MEG reporting	44.93%	[redacted]	[redacted]	[redacted]
More personal knowledge about clinical usefulness of MEG	50.72%	[redacted]	[redacted]	[redacted]
More available evidence supporting clinical usefulness of MEG	[redacted]	38.57%	[redacted]	[redacted]
Easier multimodal integration of MEG results with other imaging tests	[redacted]	44.78%	[redacted]	[redacted]
Direct participation of the MEGer in your MPMC	41.43%	[redacted]	[redacted]	[redacted]
Added value provided by MPG in my current practice	[redacted]	45.77%	[redacted]	[redacted]

Bagić AI, Burgess RC. Utilization of Magnetoencephalography (MEG) among the USA Epilepsy Centers: A Survey-Based Appraisal. **J Clin Neurophysiol 2019**, *in press*.

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4. Does evidence matter?

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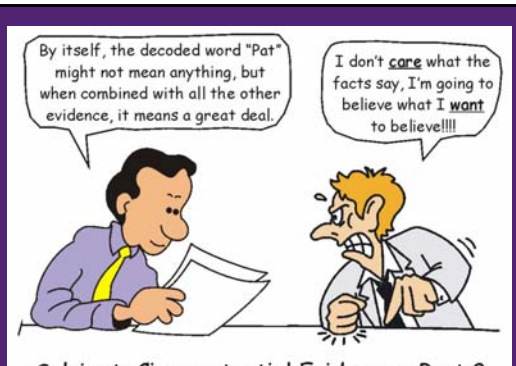

https://larrycuban.wordpress.com/2015/02/23/cartoons-on-evidenced-based-practice-and-data-driven-decisions/

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5. Current MEG *practice*

Various MEG Installations In the USA (2016)

ACMEGS Survey Of Practice 1/3

- Q1. In what kind of setting is your MEG center located? (Select One)
- Q2. Who owns your MEG? (Select One)
- Q3. What year was your MEG center established?
- Q4. Is your MEG center associated with a Level IV National Association of Epilepsy Centers (NAEC) Epilepsy Center?
- Q5. As the MEG director, what category below describes your personal training best? (Select One)
- Q6. Excluding those personnel who carry out research only, how many staff members (full or part time) do you have working in your MEG center directly? (Select One)
- Q7, 8, 9: Person #1 Background [1]; Total percent of this person's effort [3]; Role(s): [IL: up to 8 characters]

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- Q10. Q10 Annual number of CLINICAL (i.e. billed 95965) epilepsy localization studies in 2016?
- Q11. Annual number of CLINICAL (i.e. billed 95966 and 95967) pre-surgical MEG mappings counting each modality individually in 2016?
- Q12 Annual number of RESEARCH MEG studies in 2016?
- Q13 Does your center conduct MEG studies on children (<18 y.o.)?
- Q14 What percentage of your MEG patients are children?
- Q15 Do you sedate/anesthetize some children for epilepsy localization studies?
- Q16 While ANALYZING a clinical epilepsy MEG study, how does your center use an EEG? (Select One)
- Q17 What source modeling methods do you use routinely in CLINICAL PRACTICE (Select All that Apply)?

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- Q18 What software do you use IN CLINICAL PRACTICE (Select All that Apply)?
- Q19 On average, within how many days after recording do you report CLINICAL studies?
- Q20 When mapping language function(s), what paradigms do you use (Select All that Apply)?
- Q21 When mapping motor function(s), what paradigms do you use (Select All that Apply)?
- Q22 How long do you usually run a MEG recording for epilepsy localization (Select One)?
- Q23 How would you define your implementation of "clinical practice guidelines (CPGs)" (Select One)?
- Q24 Please rank the statements below in the order that best reflects your attitude towards formalized certification for analyzing and reporting clinical MEG studies. You may omit ranks for those statements about which you have no opinion.

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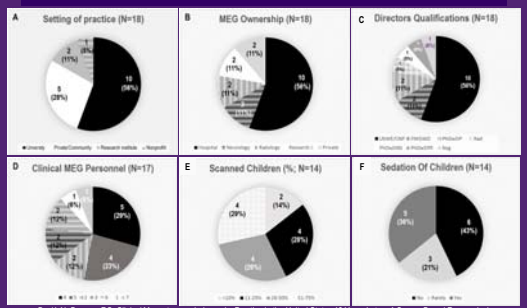

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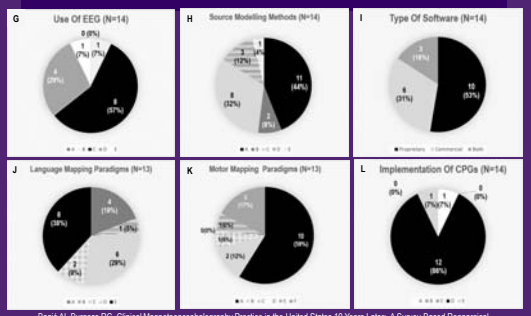

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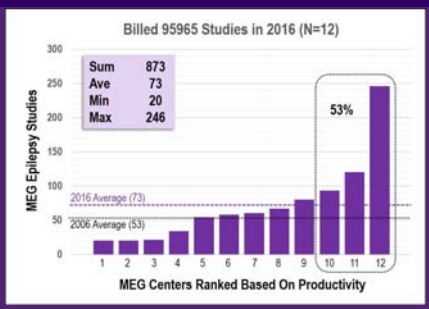

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ACMEGS Survey Of Practice Results 4/5

Question	N	Total	Mean*	Min	Max	None
Q3	18	221	12	2	29	NA
Q10	12	873	73	20	246	0
Q11a (AEFs)	13	79	6	0	30	6
Q11b (LEFs)	13	330	25	0	90	2
Q11c (MEFs)	13	170	13	0	58	4
Q11d (SEFs)	13	526	40	0	80	1
Q11e (VEFs)	13	74	6	0	50	3
Q12	13	1607	124	0	600	1
Q14	14	521.5	37	5	75	NA
Q19a	14	166	12	2.5	24.5	NA
Q19b	13	104.5	9	2.5	24.5	NA

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33/92 Bagić 2019

ACMEGS Survey Of Practice Results 5/5

Q24. Please rank the statements below in the order that best reflects your attitude towards formalized certification for analyzing and reporting clinical MEG studies. You may omit ranks for those statements about which you have no opinion.

Rank	Score	Statement
1	2.00	*d. Certification would improve quality of patient care and help propelling clinical MEG, but should not be mandatory*
2	2.36	*c. I would welcome appropriate form of standardized training WITH certification*
3	2.40	*a. I would welcome appropriate form of standardized training WITHOUT certification*
4	3.78	*b. I would welcome appropriate form of certification WITHOUT required standardized training*
5	4.55	*e. I oppose certification since it is just unnecessary intricacy of medical profession*
6	4.75	*f. Certification is a formality that would have no practical effect on the MEG field*

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6. Do CPGs make a difference?

Referral pattern for epilepsy surgery after evidence-based recommendations

A retrospective study

Table Age at onset of regular habitual seizures, years of seizure, and age at evaluation for temporal lobe epilepsy compared between groups 1 and 2

	1995-1998 (Group 1, n = 83), mean ± SD	2005-2008 (Group 2, n = 102), mean ± SD	*t* Test, *p* Value	Levene test, *p* Value
Age at therapeutic intervention, y	17.0 ± 12.2	18.4 ± 11.6	0.41	0.59
Duration of pharmacotherapy, y	17.1 ± 10.0	18.6 ± 12.6	0.39	0.03

THERE WAS NO DIFFERENCE in the overall age of diagnosis, duration of pharmacotherapy, or age at evaluation between 1995 and 1998 and 2005 to 2008.

direction. *Neurology*® 2010;75:699-704

ORIGINAL ARTICLE

J Clin Neurophysiol 2011;28(4):341-7.

Disparities in Clinical Magnetoencephalography Practice in the United States: A Survey-Based Appraisal

Anto I. Bagić

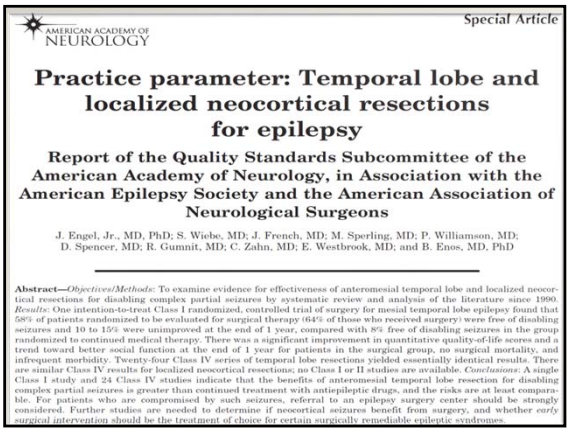
TABLE 4. Answers to Question 5 in Appendix 2

	MD*	Phys†	Neu	Rad	FMG	PhD‡	All
N	23	19					
a	1	0					
b	13	11					
c	6	5					
d	0	0					
e	2	2					
Total	22	18					

TABLE 5. Answers to Question 6 in Appendix 2

	MD*	Phys†	Neu‡	Rad	FMG	PhD§	All
N	23	19	14	4	4	9	32
a‖	2	2	2	0	0	2	4
b	0	0	0	0	0	0	0
c¶	6	3	3	0	3	6	12
d‖¶	12	11	6	4	1	2	14
e#	3	3	3	0	0	0	3
f	0	0	0	0	0	0	0
g#	1	1	1	0	0	0	1
Total	24	20	15	4	4	10	34

7. Accountable *use* and competent *practice*



AMERICAN ACADEMY OF NEUROLOGY

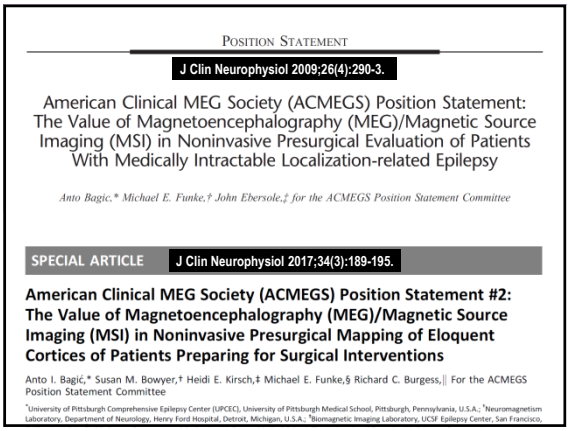
Special Article

Practice parameter: Temporal lobe and localized neocortical resections for epilepsy

Report of the Quality Standards Subcommittee of the American Academy of Neurology, in Association with the American Epilepsy Society and the American Association of Neurological Surgeons

J. Engel, Jr., MD, PhD; S. Wiebe, MD; J. French, MD; M. Sperling, MD; P. Williamson, MD; D. Spencer, MD; R. Gumnit, MD; C. Zahn, MD; E. Westbrook, MD; and B. Enos, MD, PhD

Abstract—*Objectives/Methods:* To examine evidence for effectiveness of anteromesial temporal lobe and localized neocortical resections for disabling complex partial seizures by systematic review and analysis of the literature since 1990. *Results:* One intention-to-treat Class I randomized, controlled trial of surgery for mesial temporal lobe epilepsy found that 58% of patients randomized to be evaluated for surgical therapy (64% of those who received surgery) were free of disabling seizures and 10 to 15% were unimproved at the end of 1 year, compared with 8% free of disabling seizures in the group randomized to continued medical therapy. There was a significant improvement in quantitative quality-of-life scores and a trend toward better social function at the end of 1 year for patients in the surgical group, no surgical mortality, and infrequent morbidity. Twenty-four Class IV series of temporal lobe resections yielded essentially identical results. There are similar Class IV results for localized neocortical resections; no Class I or II studies are available. *Conclusions:* A single Class I study and 24 Class IV studies indicate that the benefits of anteromesial temporal lobe resection for disabling complex partial seizures is greater than continued treatment with antiepileptic drugs, and the risks are at least comparable. For patients who are compromised by such seizures, referral to an epilepsy surgery center should be strongly considered. Further studies are needed to determine if neocortical seizures benefit from surgery, and whether *early surgical intervention* should be the treatment of choice for certain surgically remediable epileptic syndromes.



POSITION STATEMENT

J Clin Neurophysiol 2009;26(4):290-3.

American Clinical MEG Society (ACMEGS) Position Statement: The Value of Magnetoencephalography (MEG)/Magnetic Source Imaging (MSI) in Noninvasive Presurgical Evaluation of Patients With Medically Intractable Localization-related Epilepsy

Anto Bagic, Michael E. Funke,† John Ebersole,‡ for the ACMEGS Position Statement Committee*

SPECIAL ARTICLE J Clin Neurophysiol 2017;34(3):189-195.

American Clinical MEG Society (ACMEGS) Position Statement #2: The Value of Magnetoencephalography (MEG)/Magnetic Source Imaging (MSI) in Noninvasive Presurgical Mapping of Eloquent Cortices of Patients Preparing for Surgical Interventions

Anto I. Bagić,* Susan M. Bowyer,† Heidi E. Kirsch,‡ Michael E. Funke,§ Richard C. Burgess,‖ For the ACMEGS Position Statement Committee

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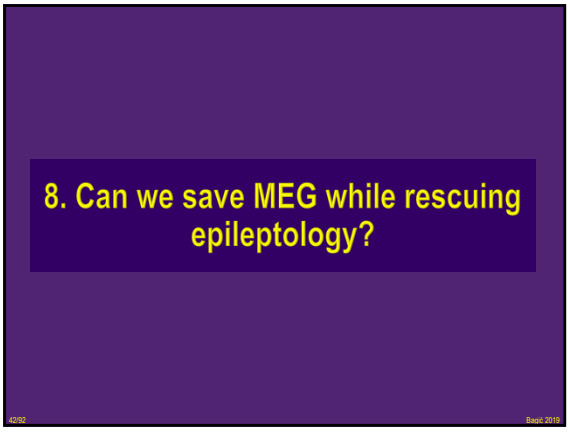
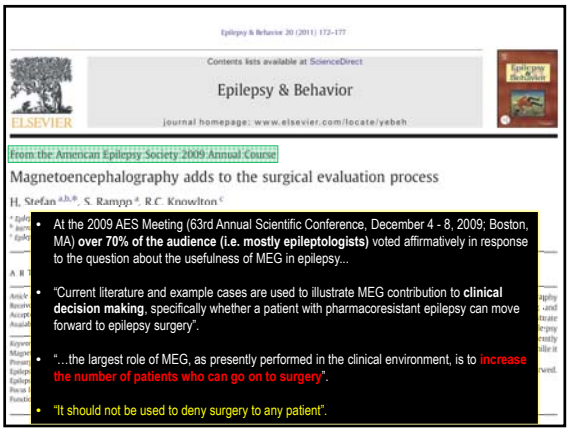
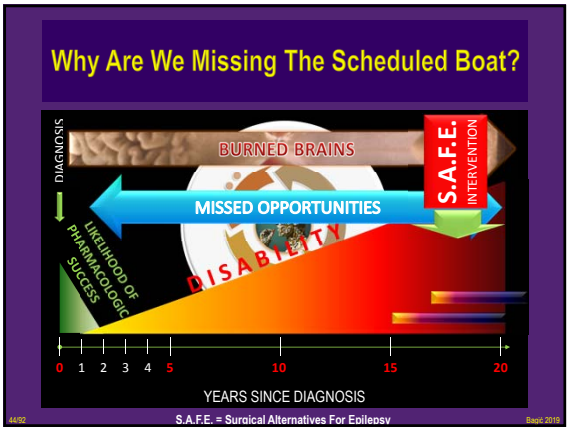
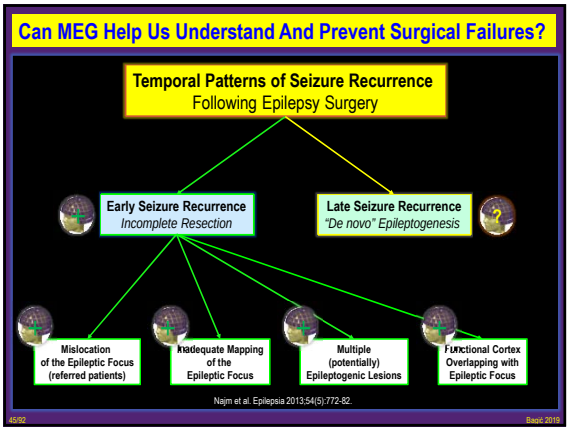



Epilepsy & Behavior 20 (2011) 172–177
Contents lists available at ScienceDirect
Epilepsy & Behavior
journal homepage: www.elsevier.com/locate/yebeh
From the American Epilepsy Society 2009 Annual Course
Magnetoencephalography adds to the surgical evaluation process
H. Stefan
S. Rampp
R.C. Knowlton
At the 2009 AES Meeting (63rd Annual Scientific Conference, December 4 - 8, 2009; Boston, MA) over 70% of the audience (i.e. mostly epileptologists) voted affirmatively in response to the question about the usefulness of MEG in epilepsy...
"Current literature and example cases are used to illustrate MEG contribution to clinical decision making, specifically whether a patient with pharmacoresistant epilepsy can move forward to epilepsy surgery".
"…the largest role of MEG, as presently performed in the clinical environment, is to increase the number of patients who can go on to surgery".
"It should not be used to deny surgery to any patient".


Why Are We Missing The Scheduled Boat?
DIAGNOSIS
BURNED BRAINS
S.A.F.E.
INTERVENTION
MISSED OPPORTUNITIES
LIKELIHOOD OF PHARMACOLOGIC SUCCESS
DISABILITY
0 1 2 3 4 5 10 15 20
YEARS SINCE DIAGNOSIS
S.A.F.E. = Surgical Alternatives For Epilepsy
44/92
Bagić 2019


Can MEG Help Us Understand And Prevent Surgical Failures?
Temporal Patterns of Seizure Recurrence
Following Epilepsy Surgery
Early Seizure Recurrence
Incomplete Resection
Late Seizure Recurrence
"De novo" Epileptogenesis
Mislocation of the Epileptic Focus (referred patients)
Inadequate Mapping of the Epileptic Focus
Multiple (potentially) Epileptogenic Lesions
Functional Cortex Overlapping with Epileptic Focus
Najm et al. Epilepsia 2013;54(5):772-82.
45/92
Bagić 2019

9. Creating a better future

Conclusions

- 1. According to the Survey of MEG USE, it remains insufficiently utilized among the NAEC members despite more favorable claims.
- 2. The number and complexity of surgical candidates are claimed as the key drivers of the future increased MEG use.
- 3. According to the Survey of MEG PRACTICE, it remains relatively unchanged in terms of overall volumes.
- 4. The claimed ATTITUDE towards MEG CPGs has IMPROVED.
- 5. The displayed attitude towards formalized certification for analyzing and reporting clinical MEG studies was FAVORABLE.
- 6. *"MEG has to improve to survive":* we urgently need new CPGs and effective improvements in practice and use.