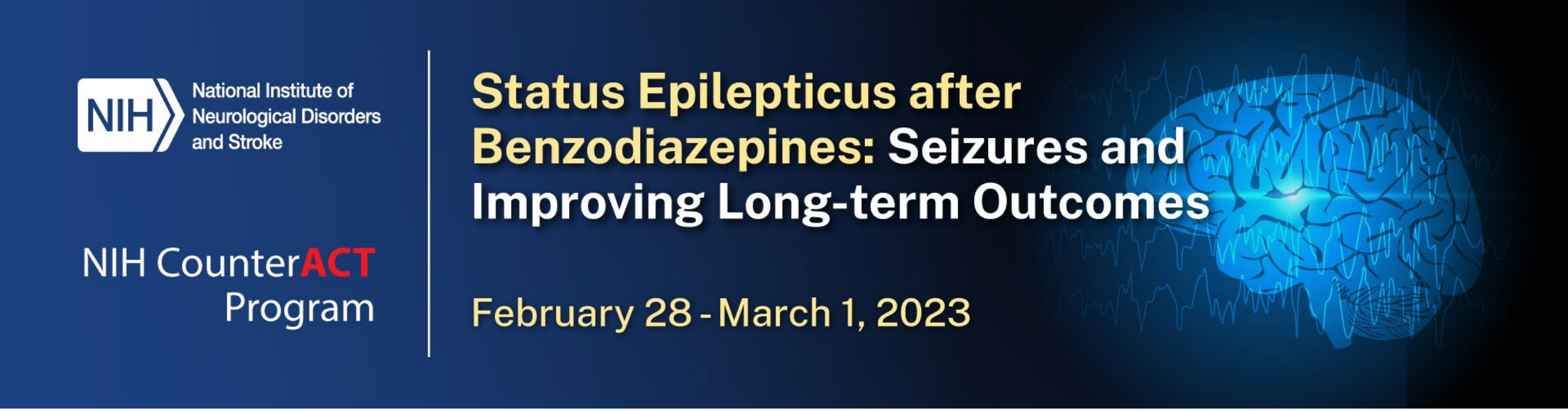

Real world implementation of status epilepticus care: seizing an opportunity for improvement

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Assistant Professor of Neurology, UCSF
Affiliate Faculty, Philip R. Lee Institute for Health Policy Studies, UCSF

Status Epilepticus after Benzodiazepines: Seizures and Improving Long-term Outcomes

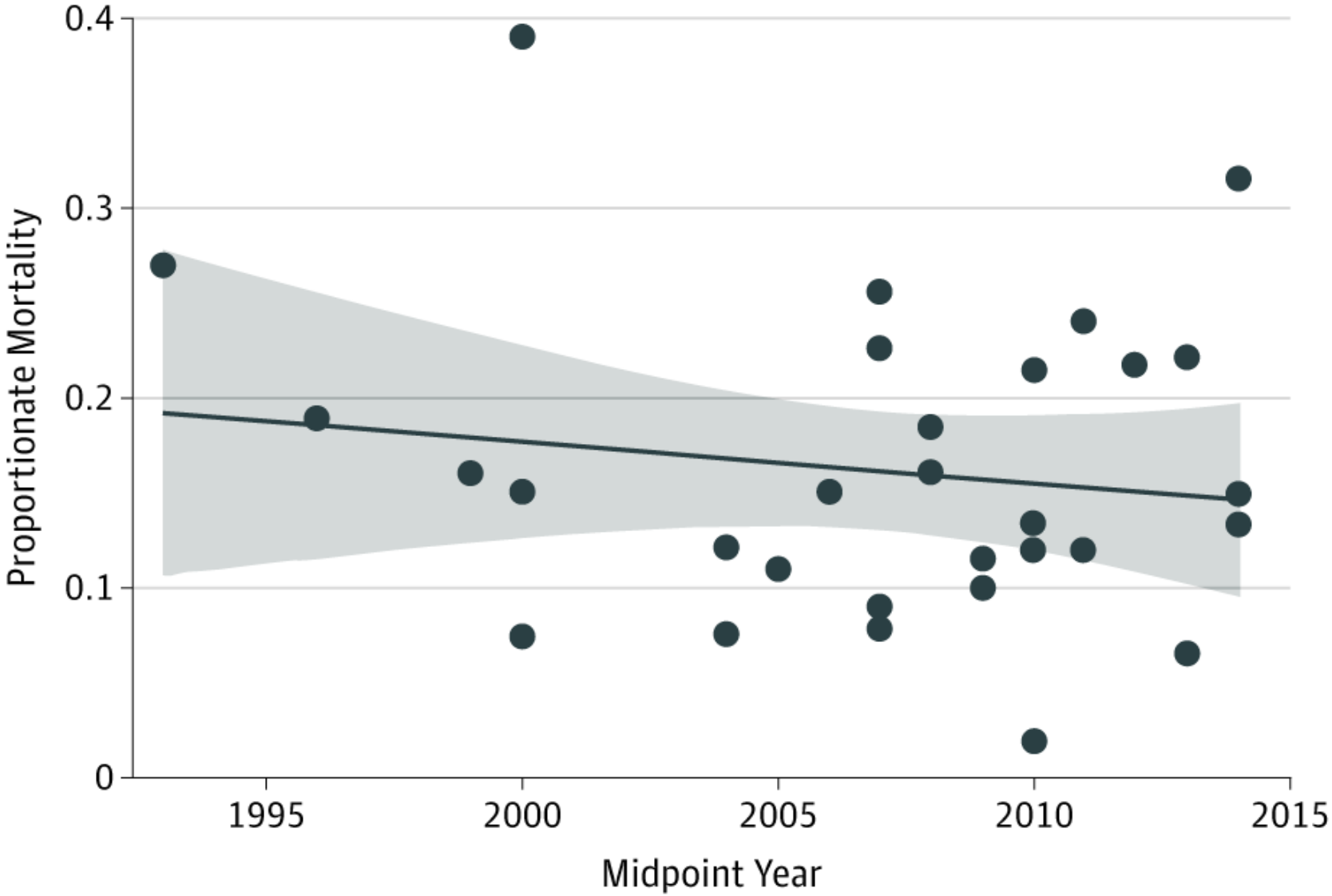
Disclaimer

This certifies that the views expressed in this presentation are those of the author and do not reflect the official policy of NIH.

Disclosure

This certifies that I, Elan Guterman, have no financial relationship that is relevant to the subject matter of the presentation. I have previously received fees from Marinus Pharmaceuticals, Inc and currently receive fees from JAMA Neurology and stock from REMO Health, Inc which are unrelated to the current presentation.

Status epilepticus-related-mortality is high and unchanged over time

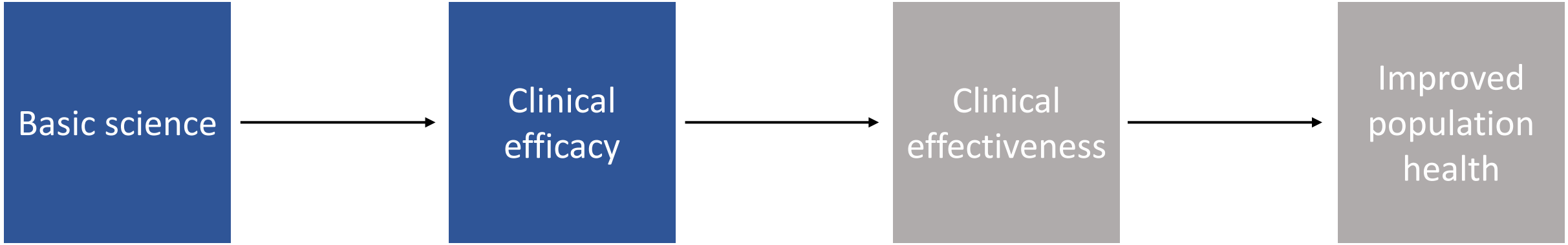


Neligan et al, JAMA Neurology 2019

Translation 1
Developing new therapies for status epilepticus

Translation 2
Evaluating therapies in the real world

Translation 3
Delivering therapies in the real world



Adaptation of the 3T's Road Map

Dougherty & Conway, JAMA 2008

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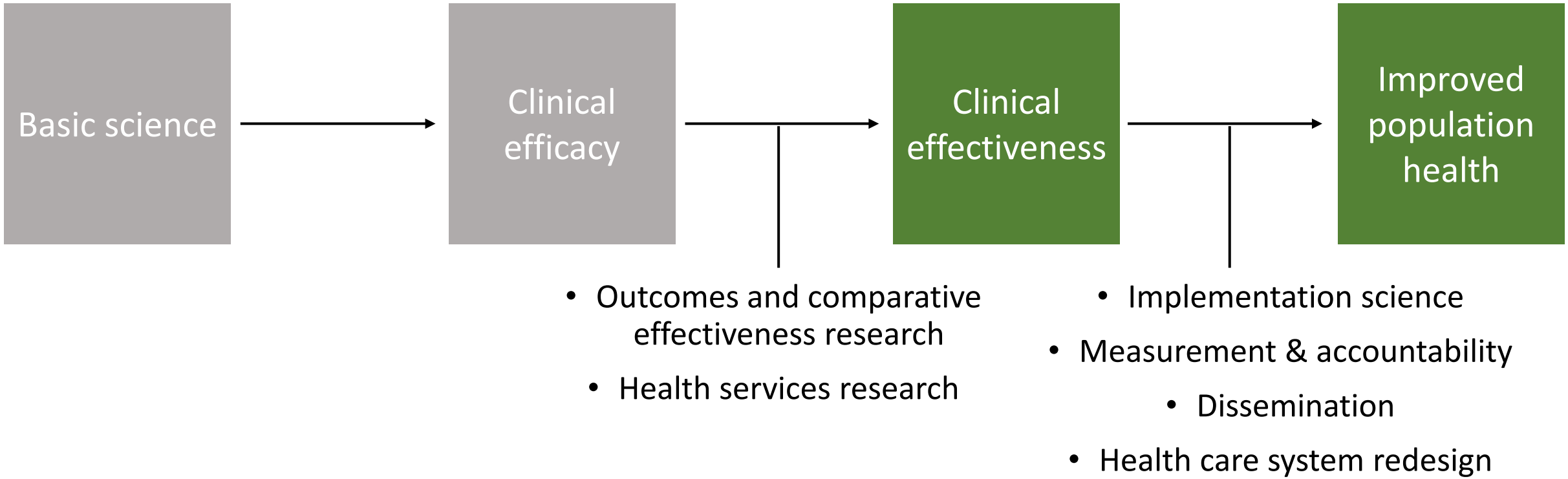


Adaptation of the 3T's Road Map

Dougherty & Conway, JAMA 2008

Continuum of status epilepticus care

Adapted from CDC
Paul Coverdell National Acute Stroke Program

Clinical case

4-year-old boy with no history of epilepsy is brought to the hospital by ambulance after having a generalized convulsion at home in the setting of a febrile viral illness. En route, he has a GCS of 8 and is given IV fluids and oxygen. In the ED, he has gaze deviation and dyskinetic movements of his face and you are paged to admit him to the ICU.

What is the likelihood of status epilepticus being detected in the prehospital setting?

Prehospital misdiagnosis of status epilepticus

150 adult patients brought in by EMS and diagnosed with SE in the ED
- 26 convulsive SE
- 124 NCSE

Calculated proportion of SE missed in prehospital setting
- SE missed 55.3% (83/150)
- SE missed more frequently in NCSE
  - NCSE missed in 63.7% (79/124)
  - CSE missed in 15.4% (4/26)

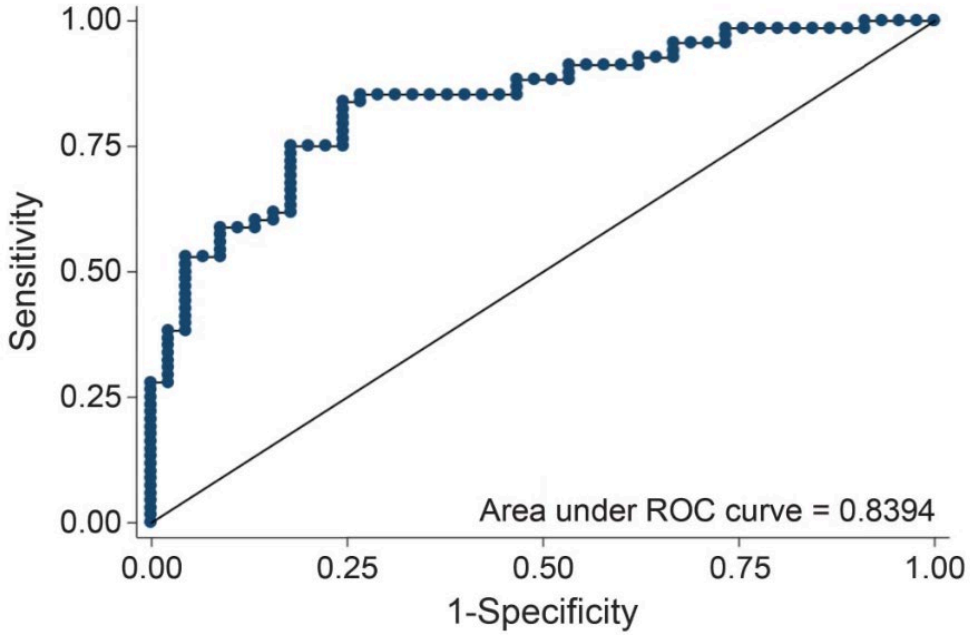
	Overall (n=150)	
Prehospital principal diagnosis	**Suspected by emergency medical service**	
	n	**%**
Suspected epileptic event	67	44.7
• Status epilepticus	32	21.3
• Seizures	35	23.3
Missed epileptic event (=Alternative suspected diagnosis without suspected SE)	83	55.3
• Unknown neurologic event	37	24.7
• Acute ischemic stroke	35	23.3
• Intracranial hemorrhage	4	2.7
• Cardiac emergency	4	2.7
• Traumatic brain injury	3	2.0

Semmlack et al, Neurology, 2017

Evidence that prehospital status epilepticus detection impacts outcomes

	Missed NCSE (n = 79)	Correctly suspected NCSE (n = 45)	P value
No recovery to baseline (among survivors)	38 (of 70 survivors; 54.3%)	10 (of 39 survivors; 25.6%)	0.004
In-hospital death	9 (11.4%)	6 (13.3%)	0.779
Death within 30 days	10 (12.7%)	7 (15.6%)	0.787

Prediction of missed out-of-hospital NCSE



Semmlack et al, Neurology, 2017

Clinical case

4-year-old boy with no history of epilepsy is brought to the hospital by ambulance after having a generalized convulsion at home in the setting of a febrile viral illness. En route, he has a GCS of 8 and is given IV fluids and oxygen. In the ED, he has gaze deviation and dyskinetic movements of his face and you are paged to admit him to the ICU.

What is the likelihood of status epilepticus being detected in the prehospital setting? Less than 40% among those with NCSE

Clinical case

4-year-old boy with no history of epilepsy is brought to the hospital by ambulance after having a generalized convulsion at home in the setting of a febrile viral illness. En route, he has a GCS of 8 and is given IV fluids and oxygen. In the ED, he has gaze deviation and dyskinetic movements of his face and you are paged to admit him to the ICU.

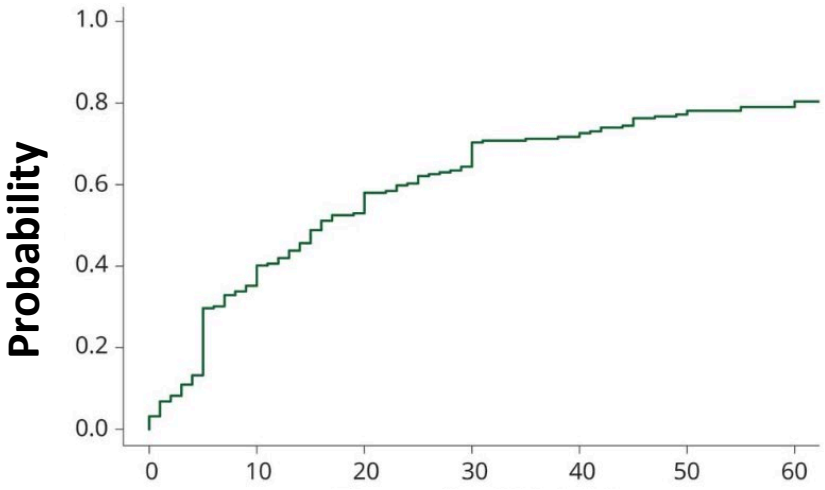
How and when was he treated with first-line treatment?

Minutes matter for status epilepticus control

	IV Lorazepam	IM Midazolam
Status epilepticus treated	**63.4%**	**73.4%**
Time outcomes		
Time to medication administration	4.8 minutes	1.2 minutes
Time from medication administration to seizure termination	1.6 minutes	3.3 minutes
Total time to seizure termination	6.4 minutes	4.5 minutes

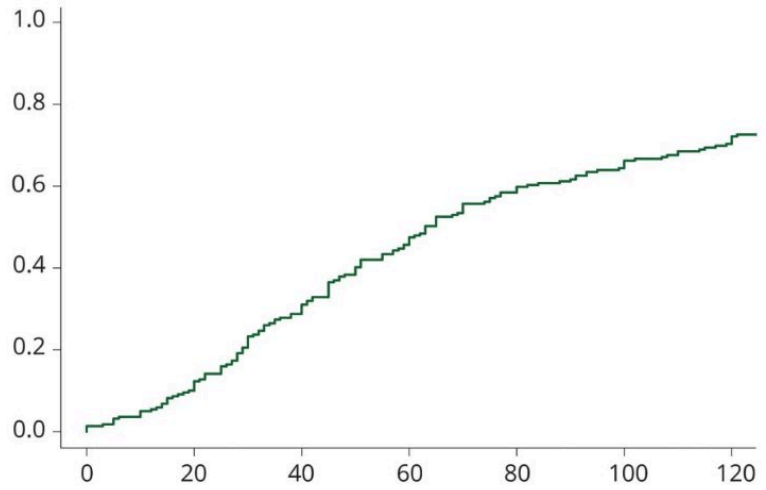
Silbergleit et al, RAMPART, NEJM 2012

Delays in treatment for out-of-hospital RSE



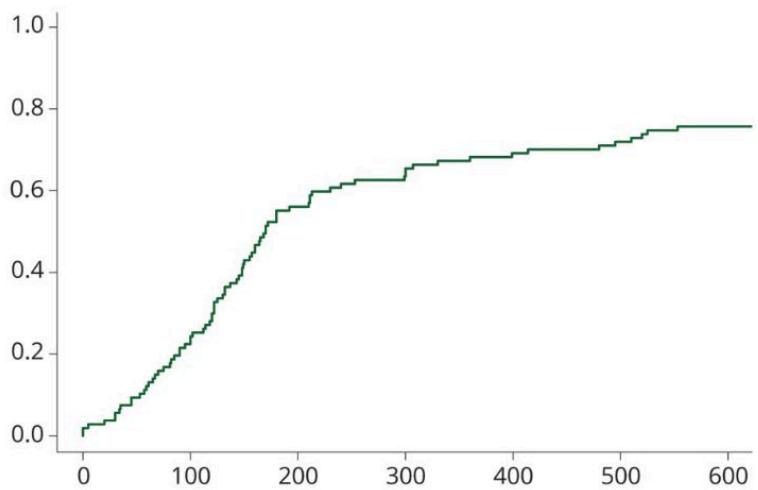
Time to first benzodiazepine

20 minutes
(IQR 8–55)



Time to first non-benzodiazepine ASM

80 minutes
(IQR 45–165)



Time to first infusion

164 minutes
(IQR 97.5–641)

Sanchez Fernandez et al, Neurology, 2018

Prehospital status epilepticus treatment is not consistent with national guidelines

	All	Intramuscular	Intranasal	Intravenous	Other[a]
Midazolam					
<5mg	3289 (42.9%)	648 (8.5%)	559 (7.3%)	2061 (26.9%)	21 (0.3%)
5mg	3809 (49.7%)	1677 (21.9%)	788 (10.3%)	1331 (17.4%)	13 (0.2%)
>5 and <10mg	22 (0.3%)	6 (0.1%)	3 (0.0%)	13 (0.2%)	0 (0.0%)
10mg	541 (7.1%)	310 (4.0%)	154 (2.0%)	72 (1.0%)	5 (0.1%)
Total	**7,665**	**2,641**	**1,504**	**3,481**	**39**
Lorazepam					
<2mg	331 (26.2%)	40 (3.2%)	18 (1.4%)	268 (21.2%)	5 (0.4%)
2mg	890 (70.4%)	188 (14.9%)	47 (3.7%)	640 (50.6%)	15 (1.2%)
>2 and <4mg	2 (0.2%)	1 (0.1%)	0 (0.0%)	1 (0.1%)	0 (0.0%)
4mg	35 (2.8%)	13 (1.0%)	2 (0.2%)	18 (1.4%)	2 (0.2%)
Total	**1,264**	**245**	**69**	**928**	**22**
Diazepam					
<6mg	207 (84.5%)	18 (7.4%)	25 (10.2%)	162 (66.1%)	2 (0.8%)
≥6mg and ≤10mg	38 (15.5%)	2 (0.8%)	2 (0.8%)	29 (11.8%)	5 (2.0%)
Total	**245**	**20**	**27**	**191**	**7**

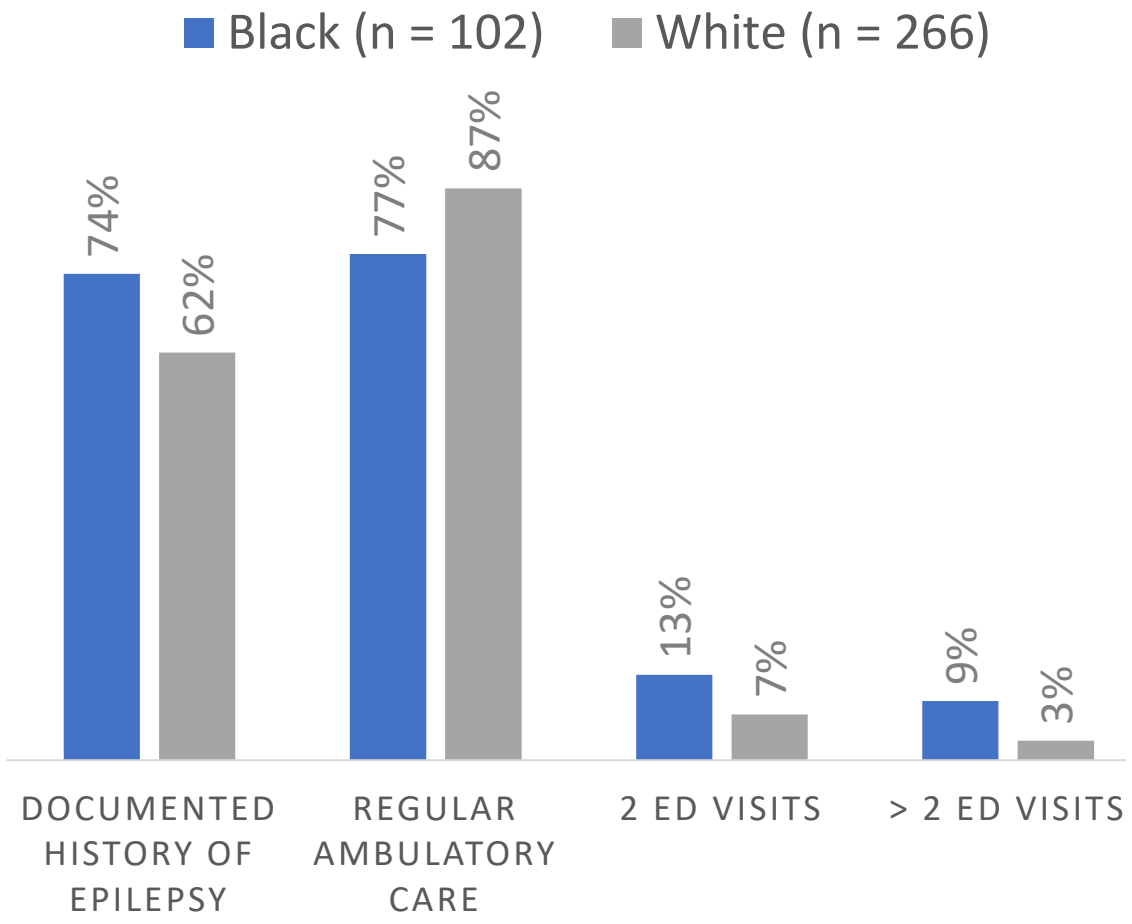
Guterman, Burke, Sporer, JAMA 2021

Clinical case

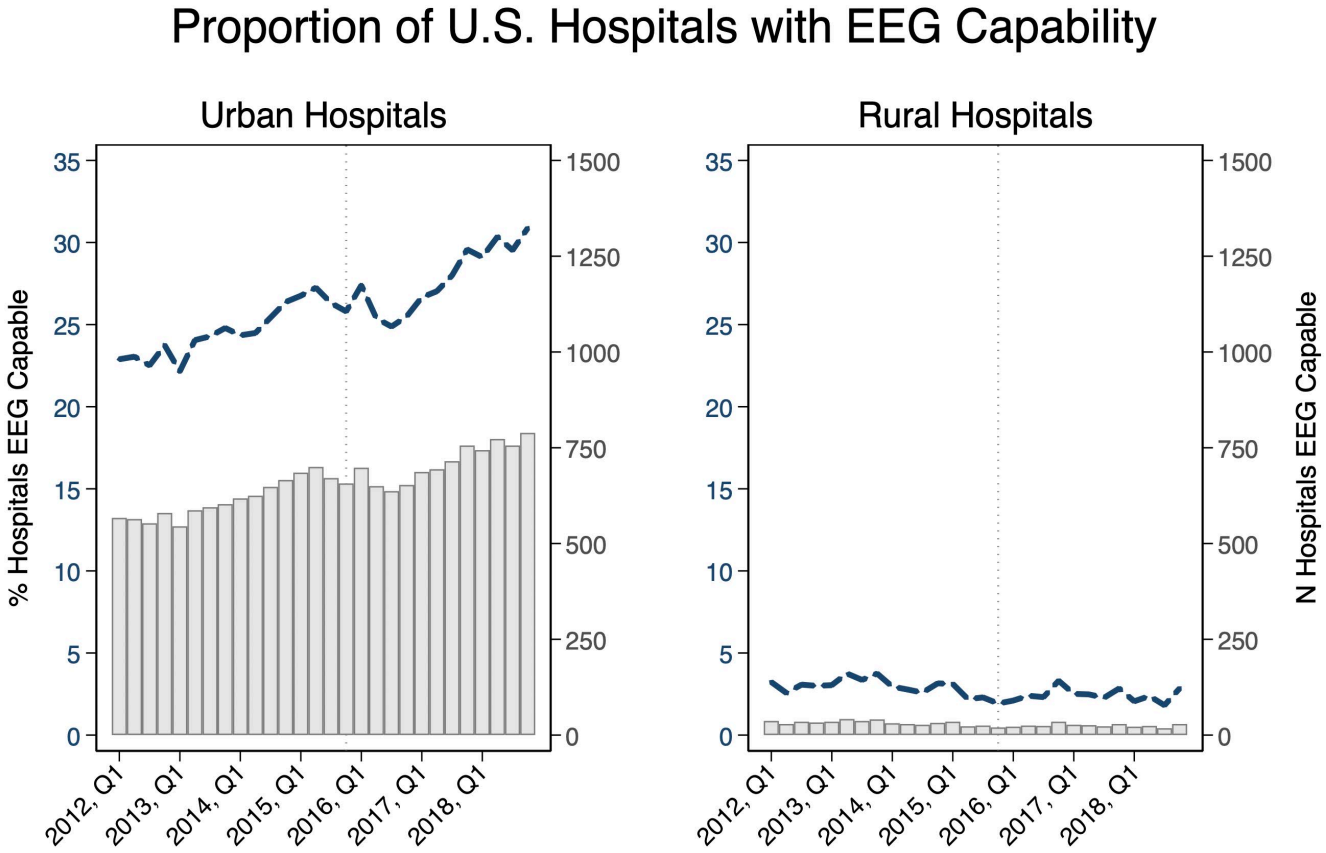
4-year-old boy with no history of epilepsy is brought to the hospital by ambulance after having a generalized convulsion at home in the setting of a febrile viral illness. En route, he has a GCS of 8 and is given IV fluids and oxygen. In the ED, he has gaze deviation and dyskinetic movements of his face and you are paged to admit him to the ICU.

- **Delayed diagnosis**
- **Delayed treatment**
- **Underdosed medication**

Inequitable access to high quality care

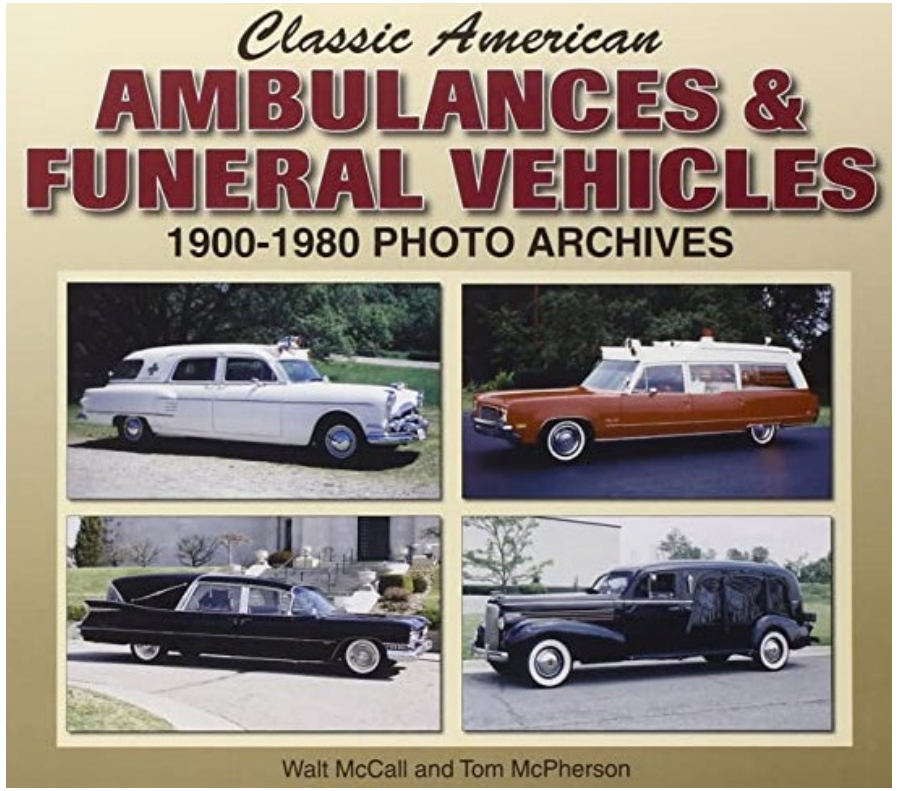


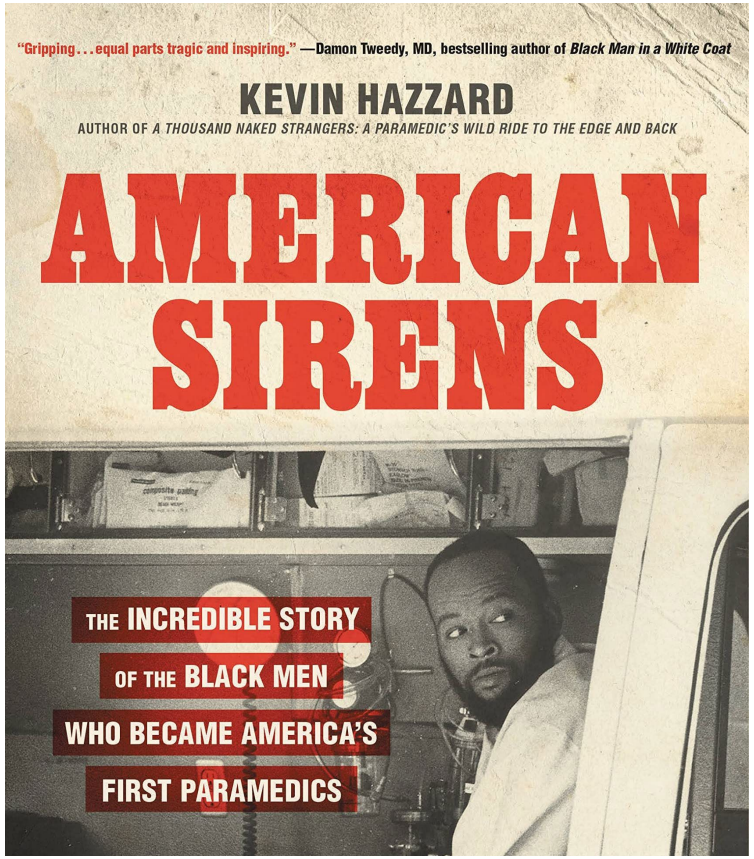
Fantaneanu et al, Seizure, 2016

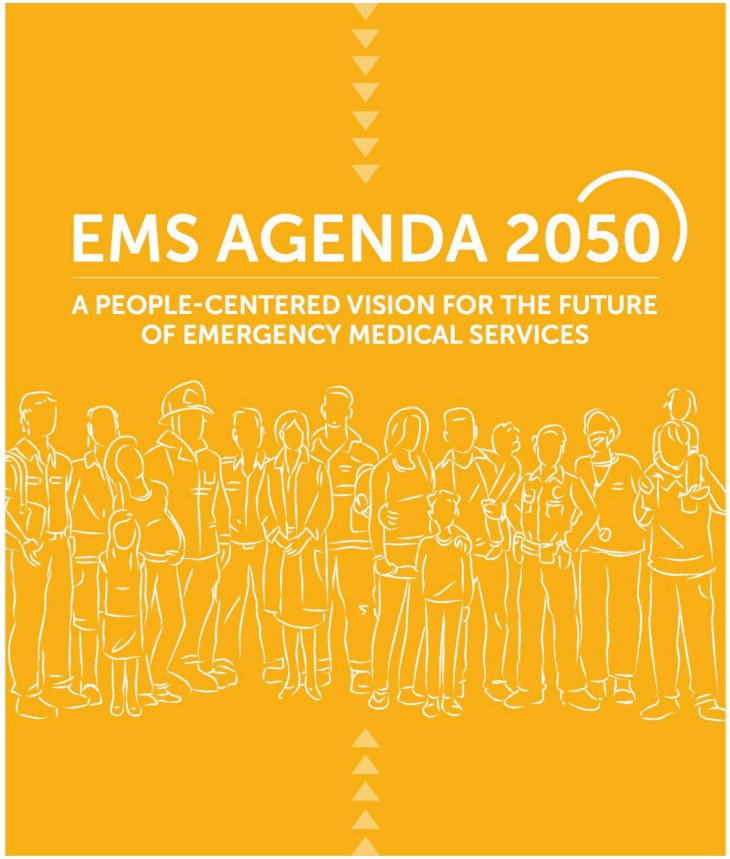


Suen et al, accepted awaiting publication

Where are we going?







New era in early interventions for status epilepticus and other neurologic emergencies

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 FEBRUARY 16, 2012 VOL. 366 NO. 7

Intramuscular versus Intravenous Therapy for Prehospital Status Epilepticus

Robert Silbergleit, M.D., Valerie Durkalski, Ph.D., Daniel Lowenstein, M.D., Robin Conwit, M.D., Arthur Pancioli, M.D., Yuko Palesch, Ph.D., and William Barsan, M.D., for the NETT Investigators*

The New England Journal of Medicine

VOLUME 345 AUGUST 30, 2001 NUMBER 9

A COMPARISON OF LORAZEPAM, DIAZEPAM, AND PLACEBO FOR THE TREATMENT OF OUT-OF-HOSPITAL STATUS EPILEPTICUS

BRIAN K. ALLDREDGE, PHARM.D., ALAN M. GELB, M.D., S. MARSHAL ISAACS, M.D., MEGAN D. CORRY, E.M.T.-P., M.A., FAITH ALLEN, M.D., SUEKAY ULRICH, R.N., M.S., MILDRED D. GOTTWALD, PHARM.D., NELDA O'NEIL, R.N., M.S.N., JOHN M. NEUHAUS, PH.D., MARK R. SEGAL, PH.D., AND DANIEL H. LOWENSTEIN, M.D.

JAMA Surgery | Original Investigation

Association of Statewide Implementation of the Prehospital Traumatic Brain Injury Treatment Guidelines With Patient Survival Following Traumatic Brain Injury

The Excellence in Prehospital Injury Care (EPIC) Study

Daniel W. Spaite, MD; Bentley J. Bobrow, MD; Samuel M. Keim, MD, MS; Bruce Barnhart, RN, CEP; Vatsal Chikani, MPH; Joshua B. Gaither, MD; Duane Sherrill, PhD; Kurt R. Denninghoff, MD; Terry Mullins, MPH, MBA; P. David Adelson, MD; Amber D. Rice, MD, MS; Chad Viscusi, MD; Chengcheng Hu, PhD

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 SEPTEMBER 9, 2021 VOL. 385 NO. 11

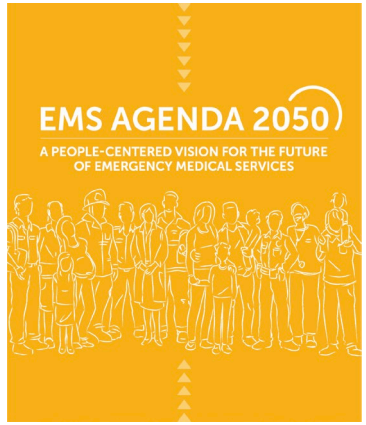
Prospective, Multicenter, Controlled Trial of Mobile Stroke Units

J.C. Grotta, J.-M. Yamal, S.A. Parker, S.S. Rajan, N.R. Gonzales, W.J. Jones, A.W. Alexandrov, B.B. Navi, M. Nour, I. Spokoyny, J. Mackey, D. Persse, A.P. Jacob, M. Wang, N. Singh, A.V. Alexandrov, M.E. Fink, J.L. Saver, J. English, N. Barazangi, P.L. Bratina, M. Gonzalez, B.D. Schimpf, K. Ackerson, C. Sherman, M. Lerario, S. Mir, J. Im, J.Z. Willey, D. Chiu, M. Eisshofer, J. Miller, D. Ornelas, J.P. Rhudy, K.M. Brown, B.M. Villareal, M. Gausche-Hill, N. Bosson, G. Gilbert, S.Q. Collins, K. Silnes, J. Volpi, V. Misra, J. McCarthy, T. Flanagan, C.P.V. Rao, J.S. Kass, L. Griffin, N. Rangel-Gutierrez, E. Lechuga, J. Stephenson, K. Phan, Y. Sanders, E.A. Noser, and R. Bowry

Conclusions

EMS is a critical partner in delivering high-quality status epilepticus care

Vast majority of patients do not receive evidence-based care with clear gaps in diagnosis and treatment



We need improved systems to ensure equitable access to high quality care for status epilepticus and other neurologic emergencies

Thanks.

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