

NAEC Update – 2021 Center Annual Report Data

Stephan Schuele, MD, PhD
NAEC Secretary-Treasurer

May 23, 2022



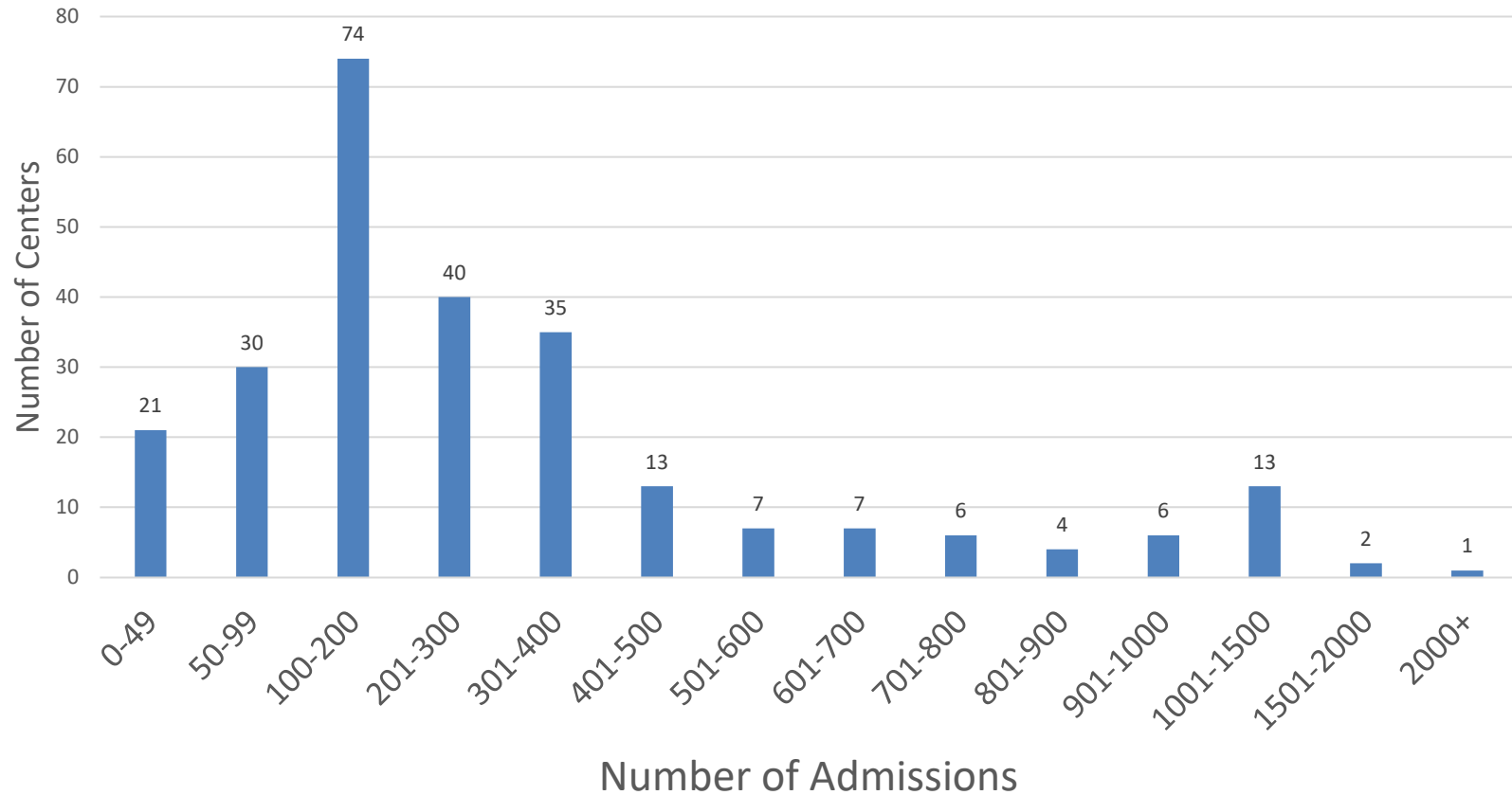
Center Demographics – 2022 vs 2021

| 2022 Center Demographics | | | | |
|--------------------------|-------------|-----------------|--------------|---------------|
| | Adult | Adult/Pediatric | Pediatric | Total |
| Level 4 | 74 (+1) | 77 (-2) | 47 (+1) | 198 (Same) |
| Level 3 | 44 (+2) | 13 (-2) | 4 (-1) | 61 (-2) |
| Total | 118 (+3) | 90 (-5) | 51 (Same) | 259 (-2) |

Note: (changes) are compared to 2021



EMU Admissions - 2021



2021 EMU Admissions – Total Patients

2021 Total EMU Admissions: 84,532

2020 Total EMU Admissions: 68,992

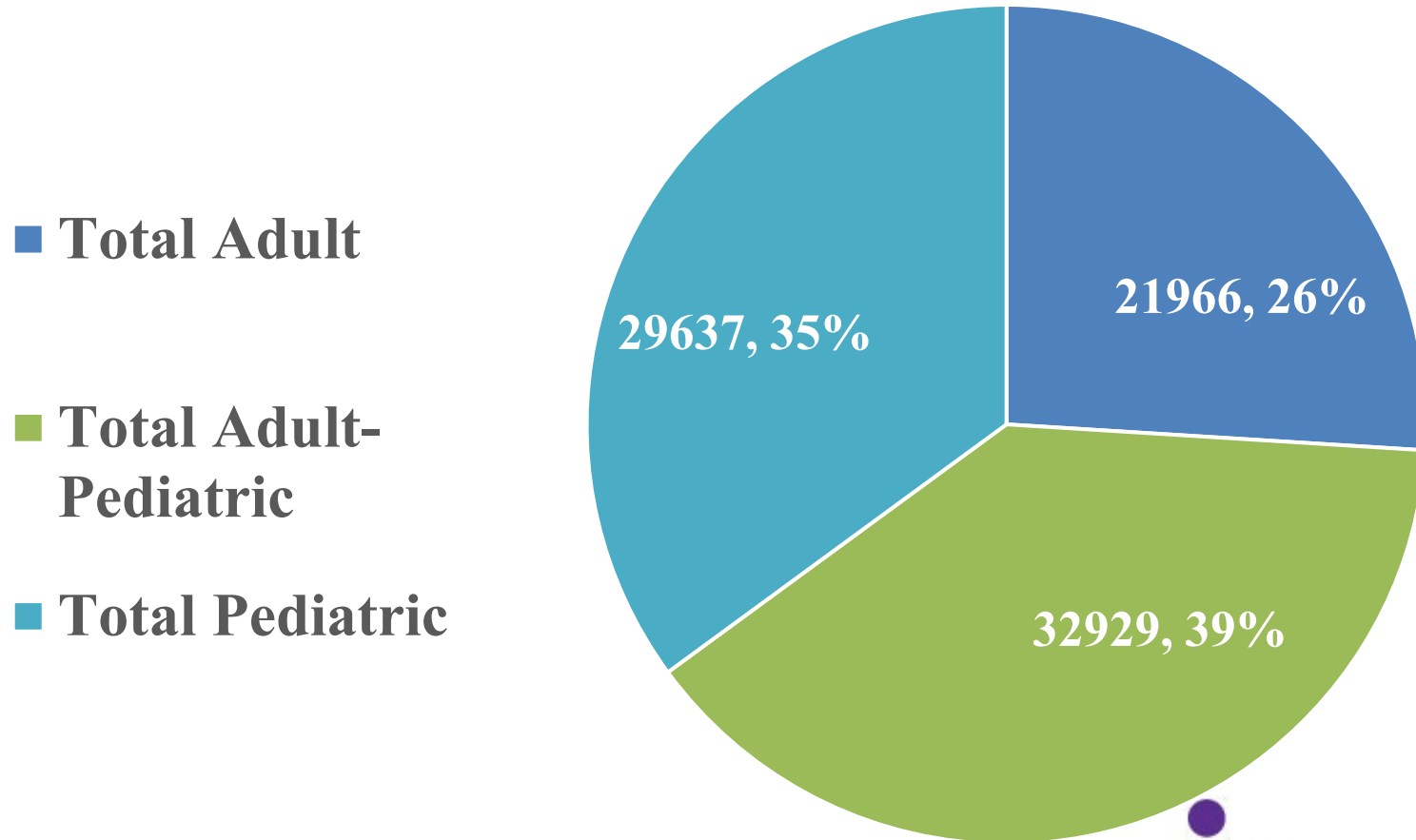
2019 Total EMU Admissions: 95,565

2018 Total EMU Admissions: 99,173

| Total Patients <18 | Total Patients 19+ |
|-----------------------|-----------------------|
| 45,173 | 39,359 |



Admissions by Center Type

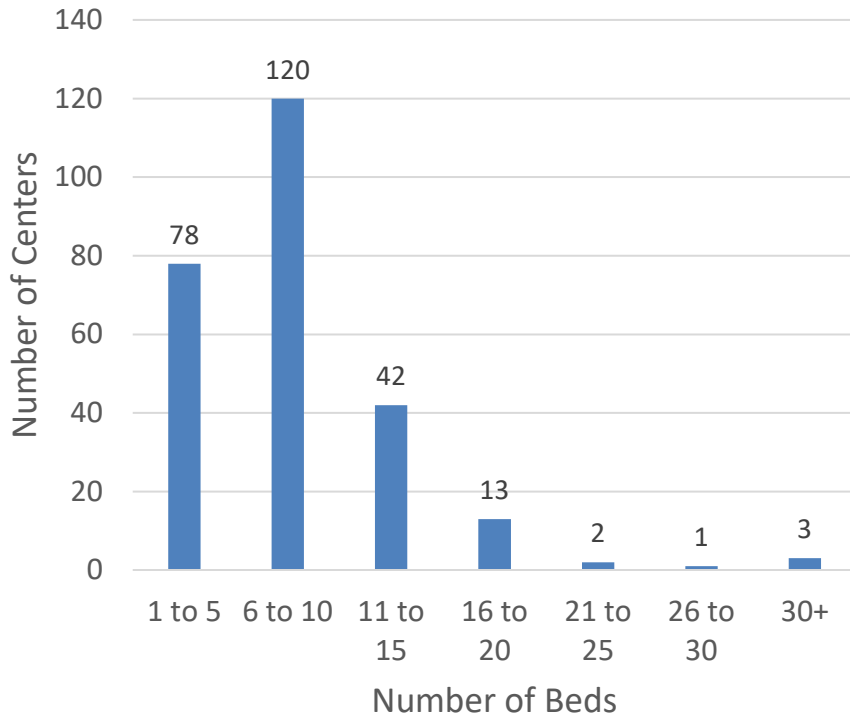


- Total Adult
- Total Adult-Pediatric
- Total Pediatric

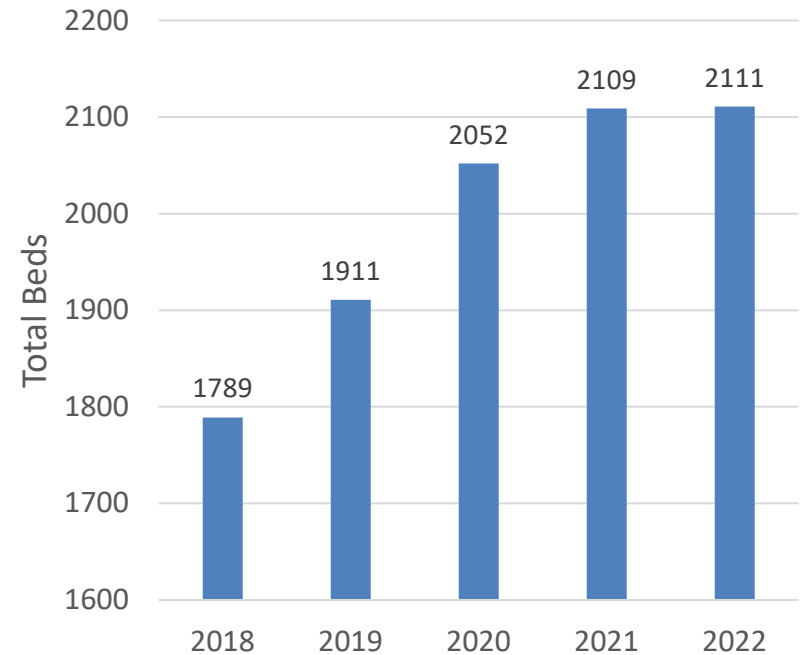


Number of EMU Beds – 2018-2022

Number of Beds - 2022



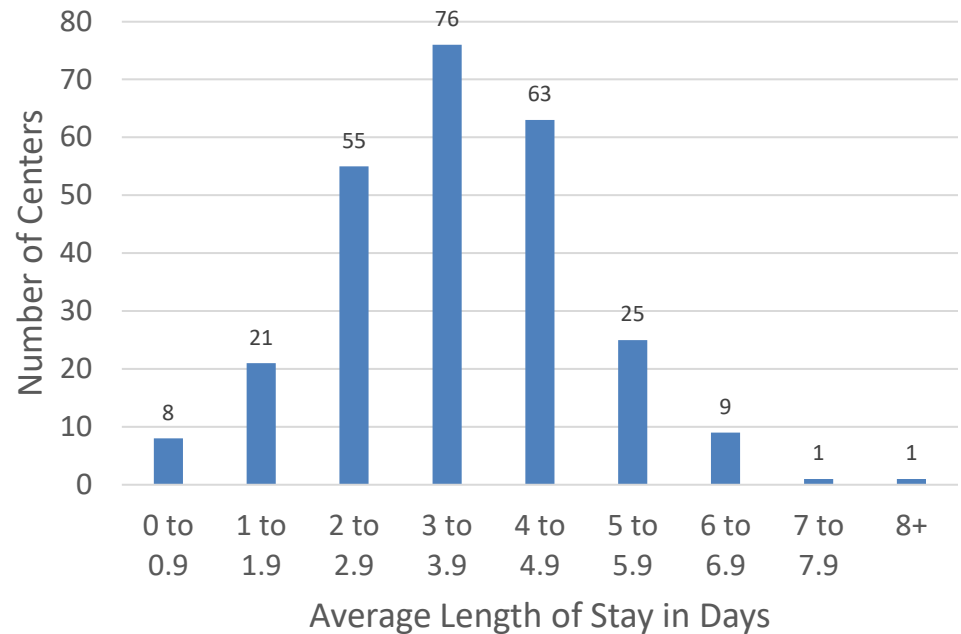
Total Number of Beds Reported by NAEC Centers



Average LOS 2021

Average Length of Stay in Days by Center Type

| | |
|---------------------------------|-----|
| Adult Epilepsy Center | 3.9 |
| Adult/Pediatric Epilepsy Center | 3.8 |
| Pediatric Epilepsy Center | 2.1 |



Average Length of Stay Reported by NAEC Centers

| 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|------|------|------|------|------|------|------|
| 3.5 | 3.5 | 3.4 | 3.4 | 3.5 | 3.4 | 3.4 |



Distribution of Procedures – Totals Reported by NAEAC Centers for 2021

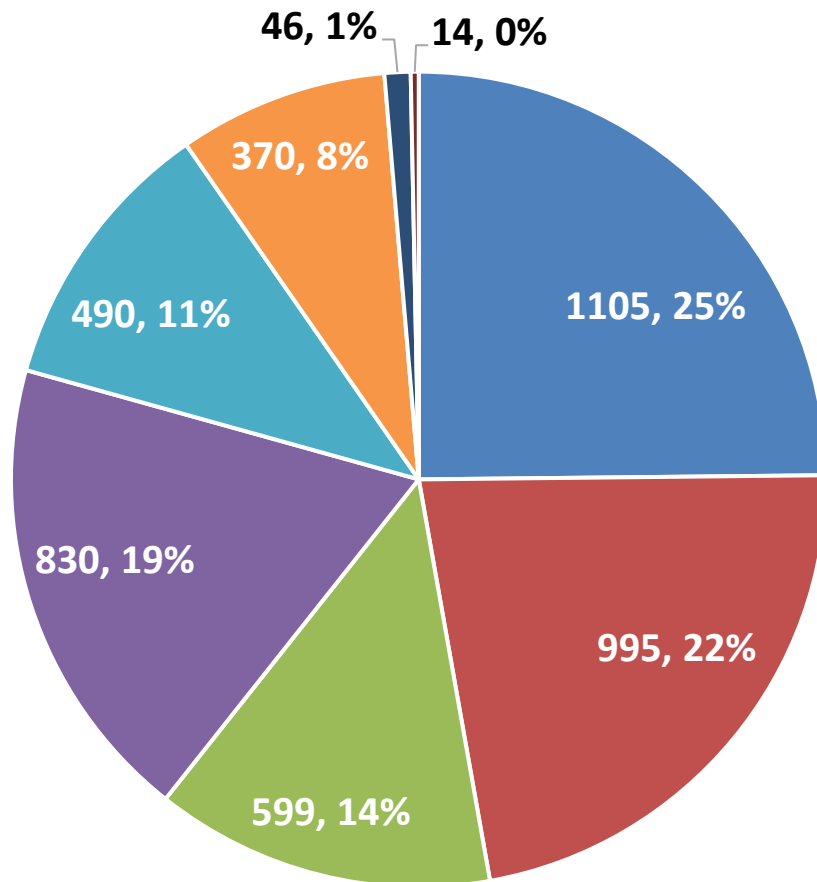
| Procedure | Ped Pts | Adult Pts | All Pts |
|---|---------|-----------|---------|
| Temporal Lobectomy | 432 | 995 | 1427 |
| Temporal Lobectomy with Intracranial Electrodes | 150 | 363 | 513 |
| Extra-Temporal Resection | 404 | 490 | 894 |
| Extra-Temporal Resection with Intracranial Electrodes | 226 | 203 | 429 |
| Intracranial Monitoring without Resection | 218 | 599 | 817 |
| Hemispherotomy | 126 | 14 | 140 |
| Laser Ablation | 248 | 370 | 618 |

Distribution of Procedures – Totals Reported by NAEAC Centers for 2021

| Procedure | Ped Pts | Adult Pts | All Pts |
|-----------------------------------|---------|-----------|---------|
| Corpus Callosotomy | 122 | 46 | 168 |
| DBS Implantation | 27 | 296 | 323 |
| DBS Replacement or Battery Change | 2 | 236 | 238 |
| VNS Implantation | 837 | 1105 | 1942 |
| VNS Replacement or Battery Change | 543 | 2177 | 2720 |
| RNS Implantation | 121 | 534 | 655 |
| RNS Replacement or Battery Change | 16 | 207 | 223 |

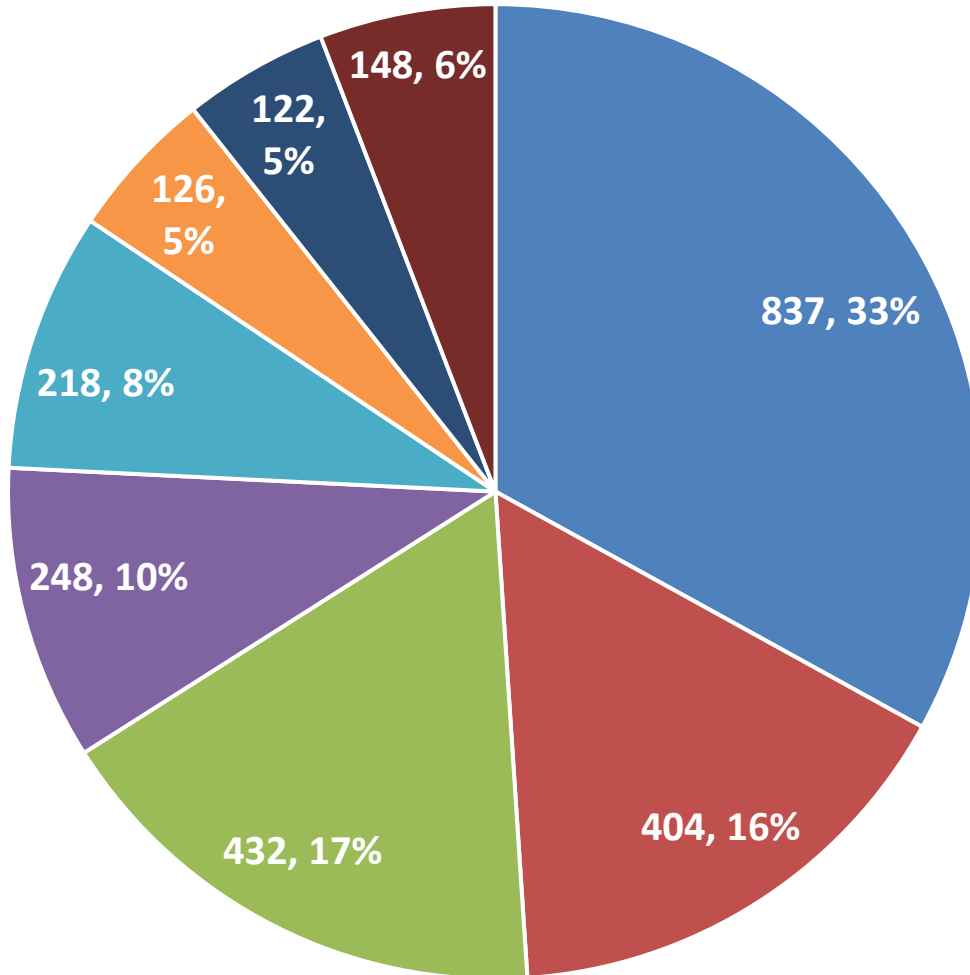
| Procedure | % Change for All Patients | |
|--|----------------------------------|---------------------|
| | 2021 vs 2019 | 2020 vs 2019 |
| Temporal Lobectomy | 3% | -3% |
| Temporal Lobectomy with Intracranial Electrodes | -25% | -19% |
| Extra-Temporal Resection | -4% | 28% |
| Extra-Temporal Resection w/ Intracranial Electrodes | -14% | 7% |
| Intracranial Monitoring w/o Resection | -15% | 14% |
| Hemispherotomy | -24% | 11% |
| Laser Ablation | -2% | 25% |
| Corpus Callosotomy | 22% | 51% |
| DBS Implantation | -11% | -2% |
| DBS Replacement or Battery Change | -34% | -37% |
| VNS Implantation | -16% | -5% |
| VNS Replacement or Battery Change | -13% | -10% |
| RNS Implantation | 24% | 19% |
| RNS Replacement or Battery Change | -12% | 39% |
| Total Procedures by Age | -10% | -8% |

Distribution of Adult Procedures 2021



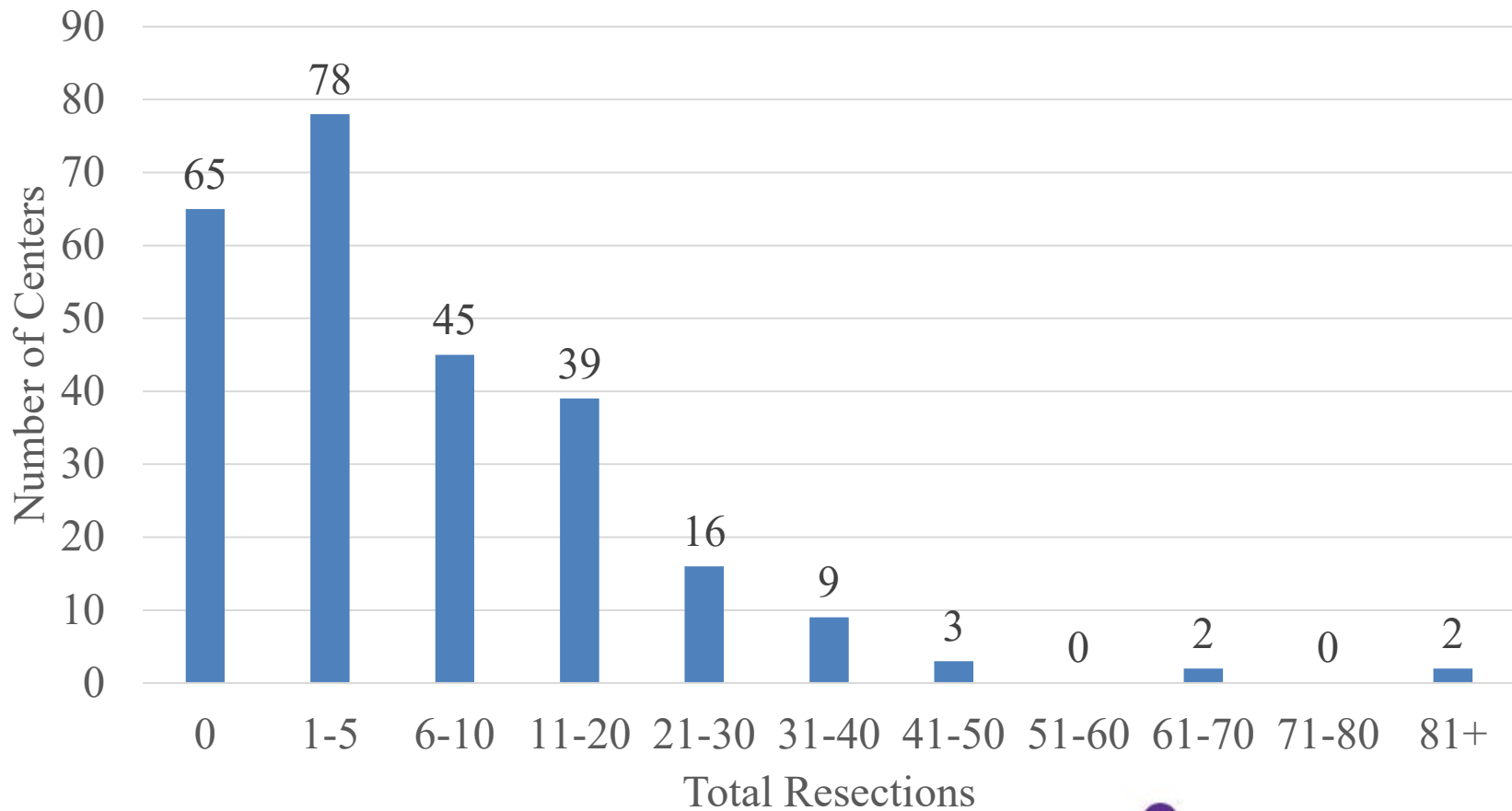
- VNS Implantation
- Temporal Lobectomy
- Intracranial Monitoring without Resection
- DBS and RNS Implantation
- Extra-Temporal Resection
- Laser Ablation
- Corpus Callosotomy
- Hemispherotomy

Distribution of Pediatric Procedures - 2021

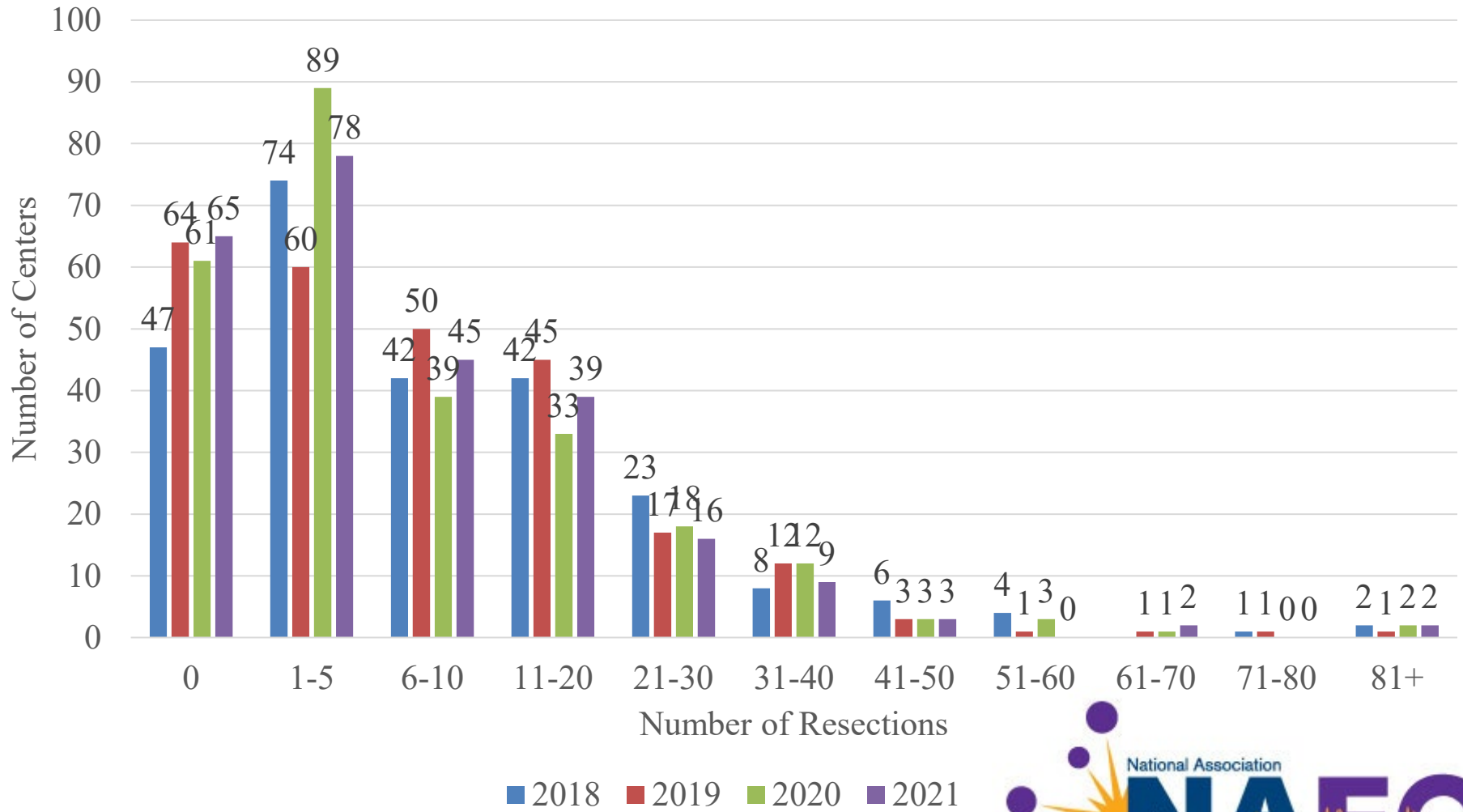


- VNS Implantation
- Extra-Temporal Resection
- Temporal Lobectomy
- Laser Ablation
- Intracranial Monitoring without Resection
- Hemispherotomy
- Corpus Callosotomy
- DBS and RNS Implantation

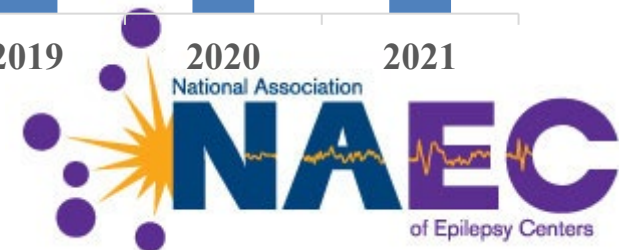
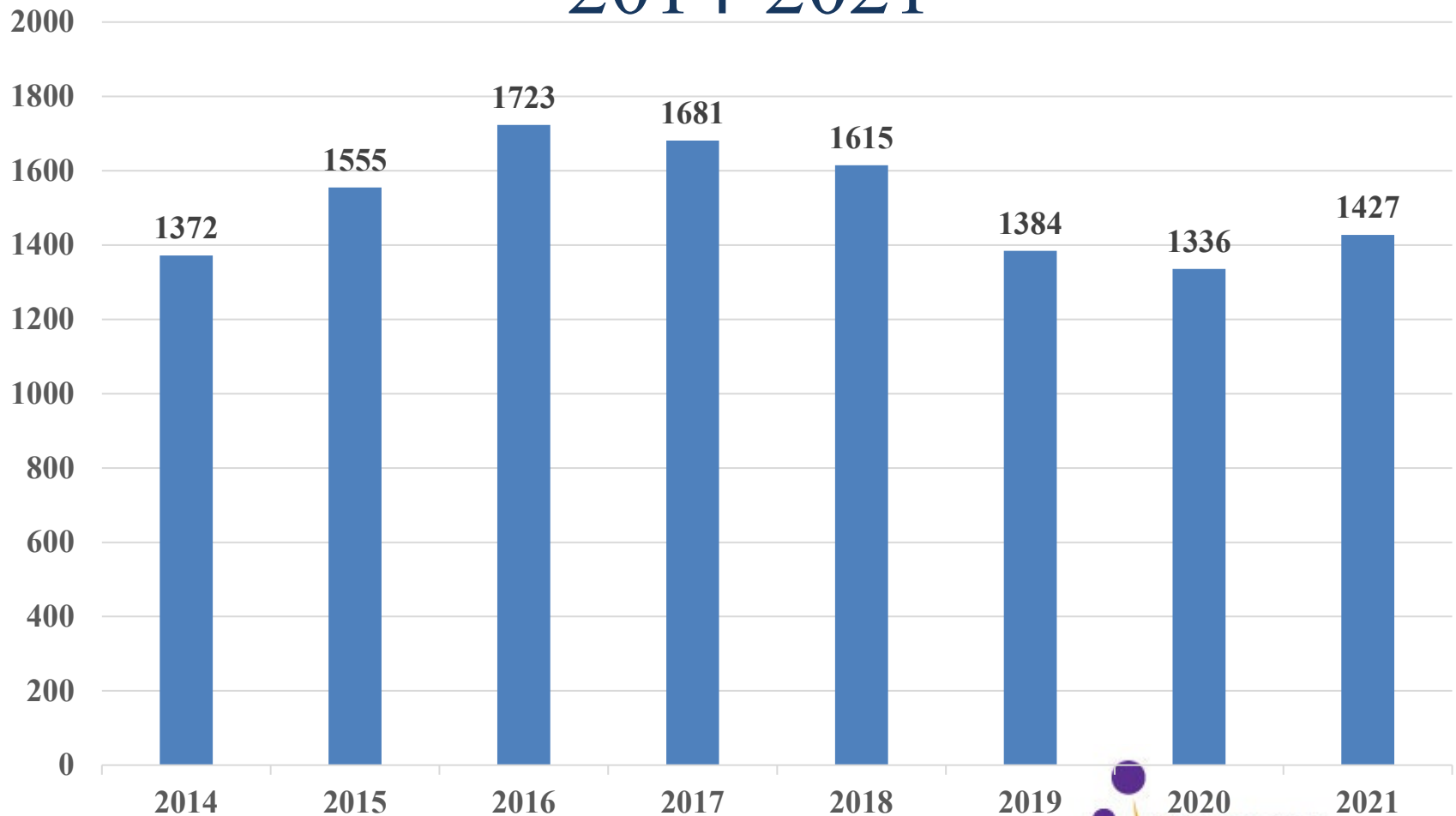
Total Resections 2021



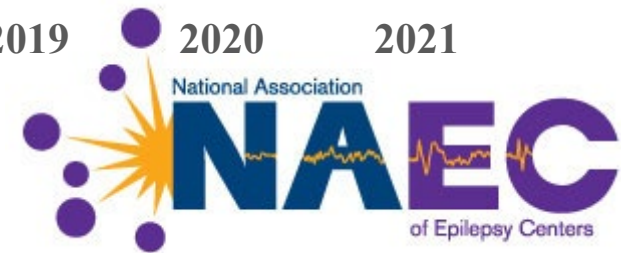
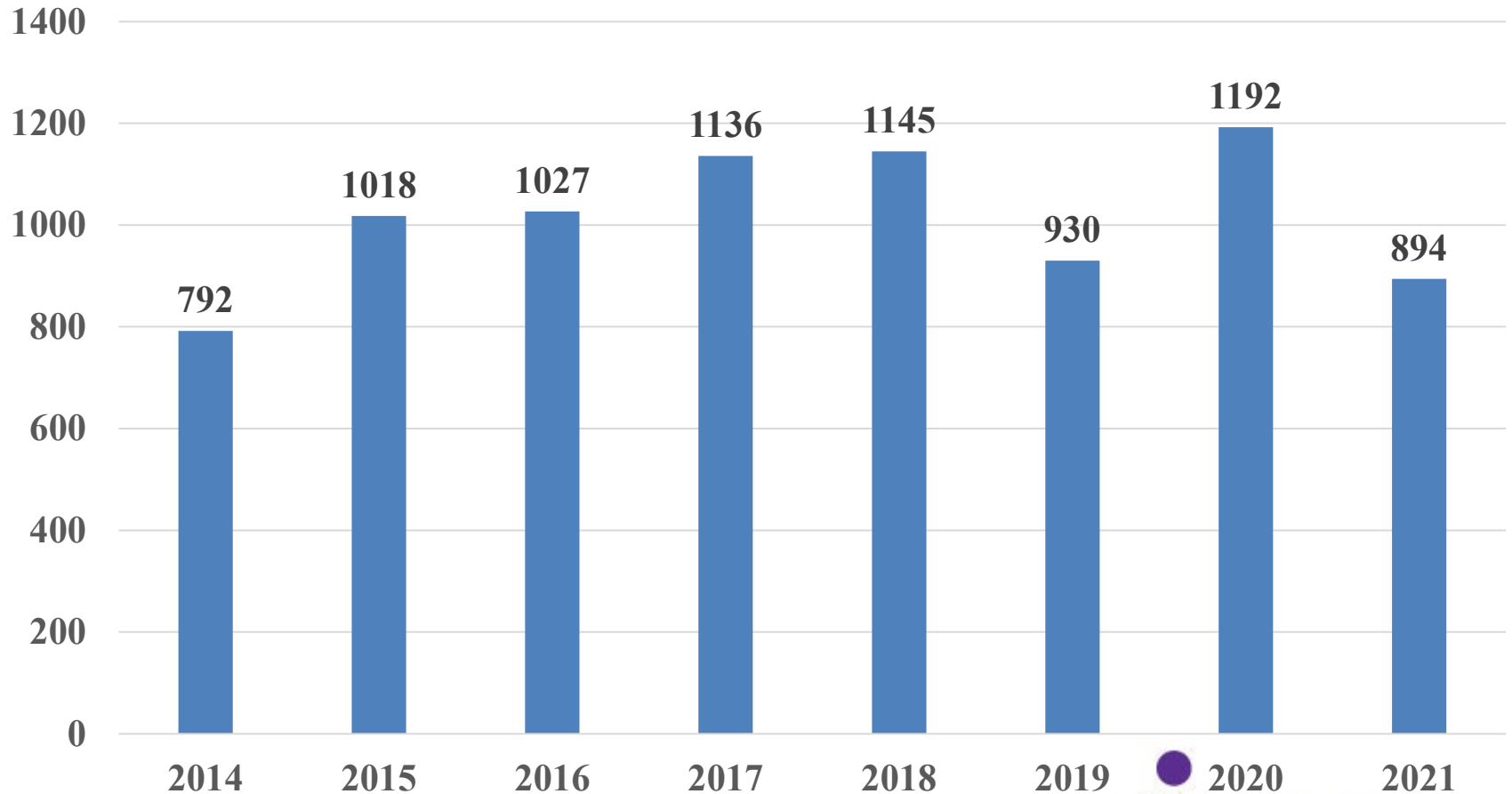
Total Resections 2018-2021



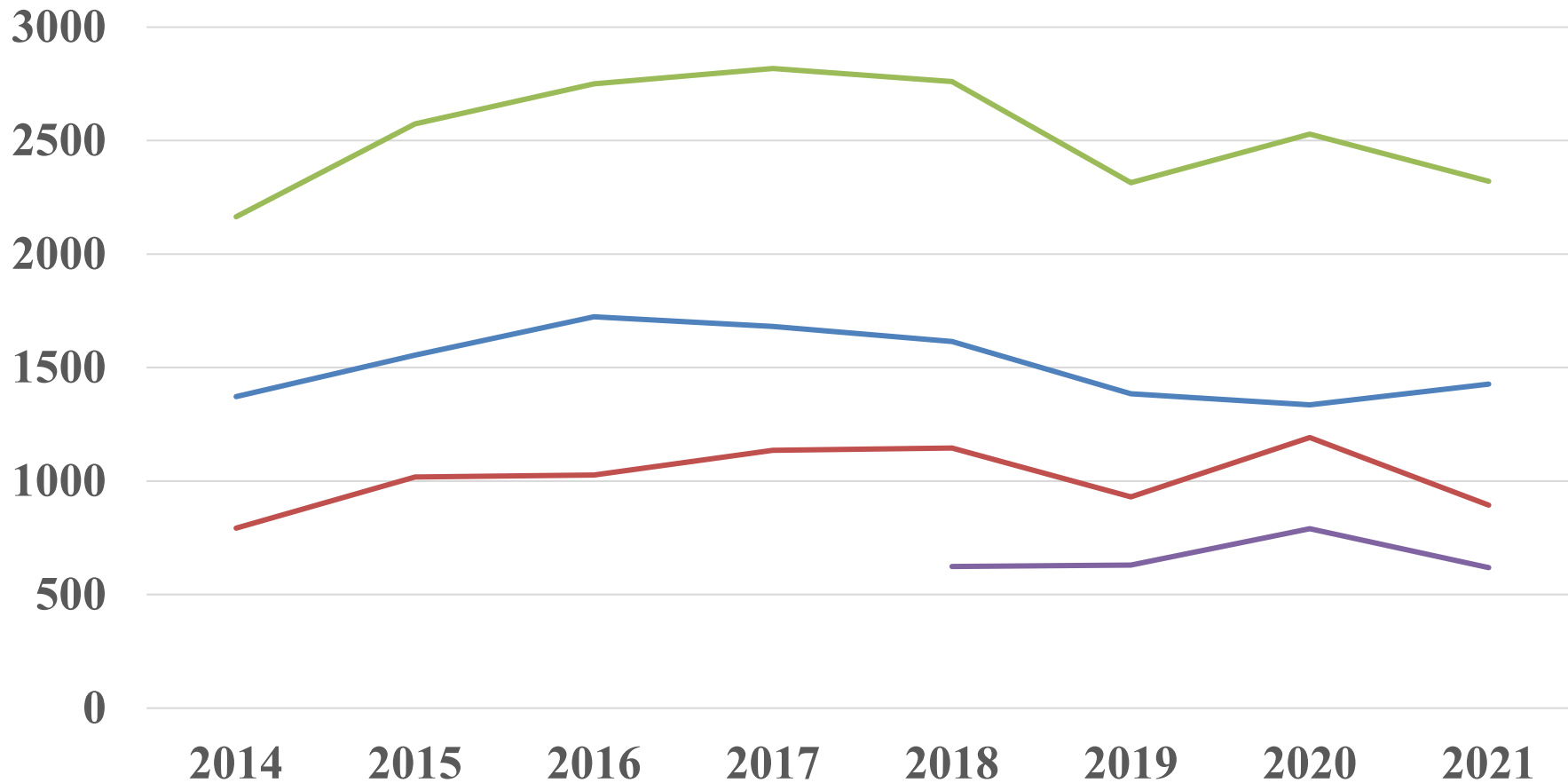
Total Temporal Lobectomies – 2014-2021



Total Extra Temporal Resections 2014-2021



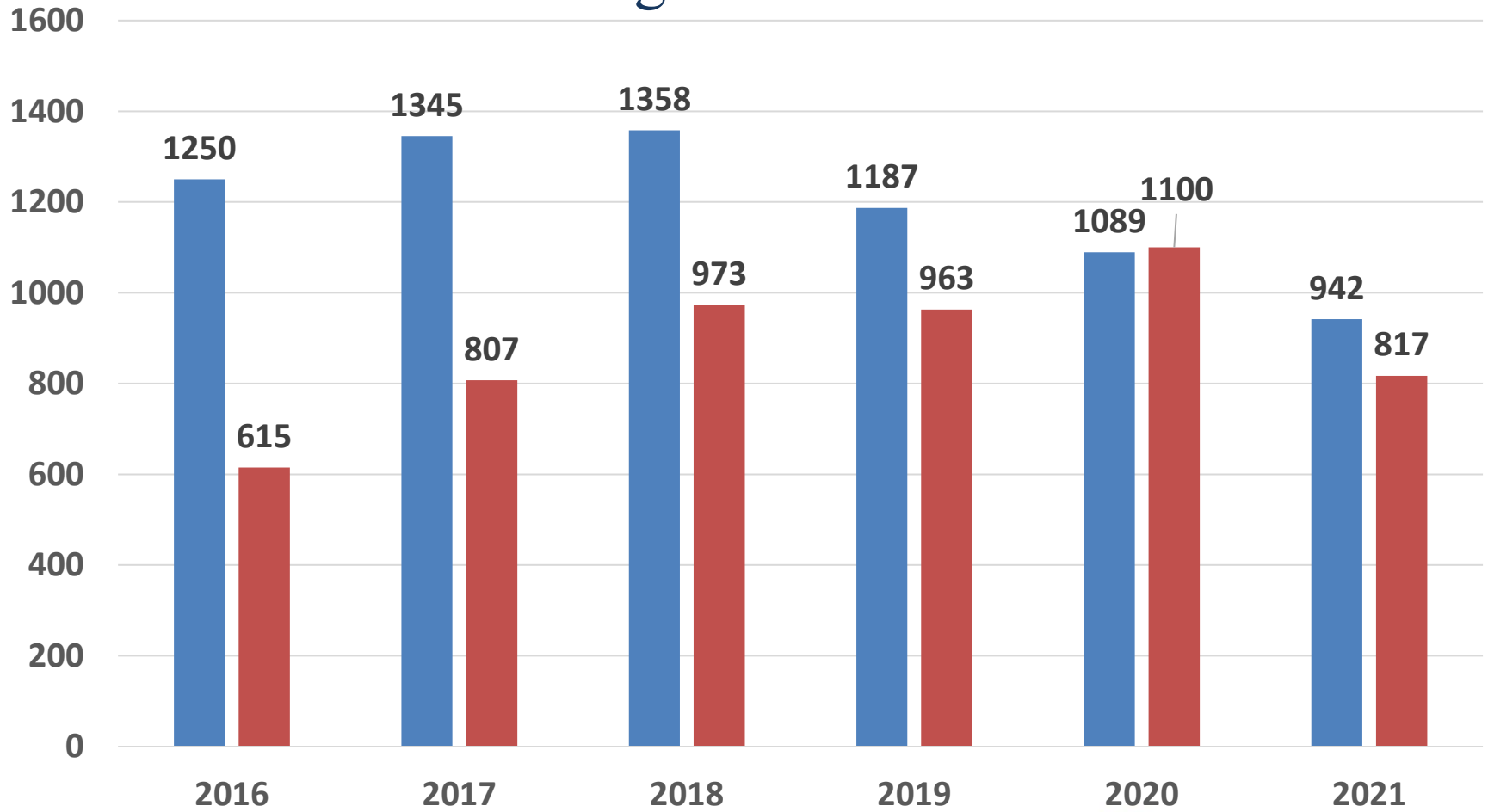
Resections Over Time



- Total Temporal Lobectomies
- Total Extratemporal Lobectomies
- Total Resections
- Total Resections via Laser ablation



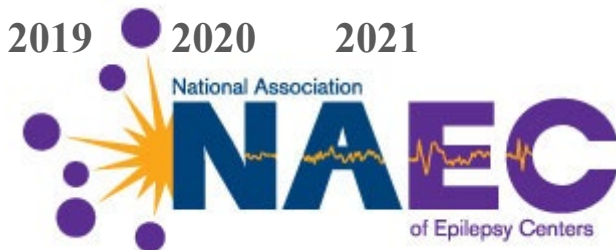
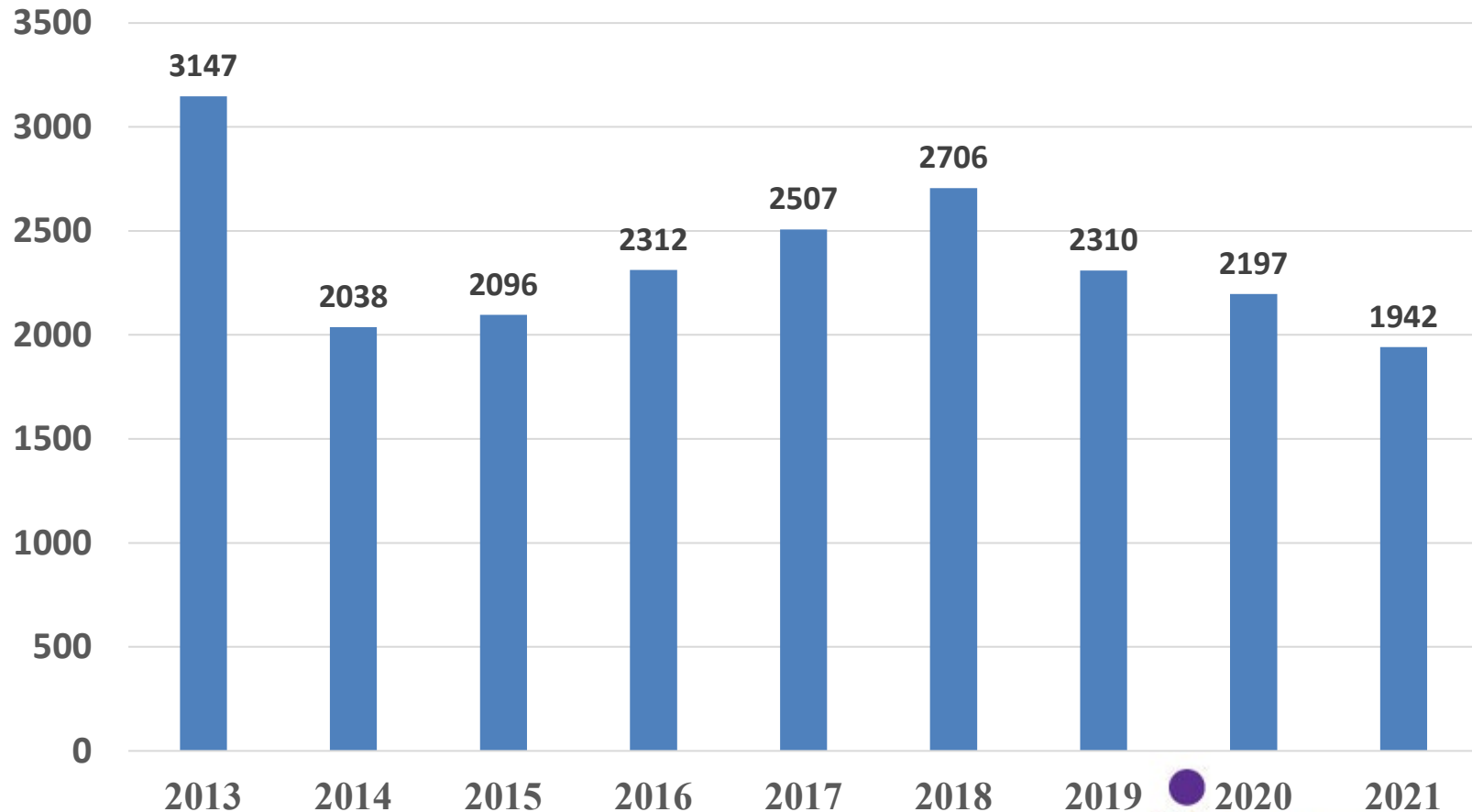
Total Resections with Intracranial Monitoring vs. Intracranial Monitoring without Resection 2016-2021



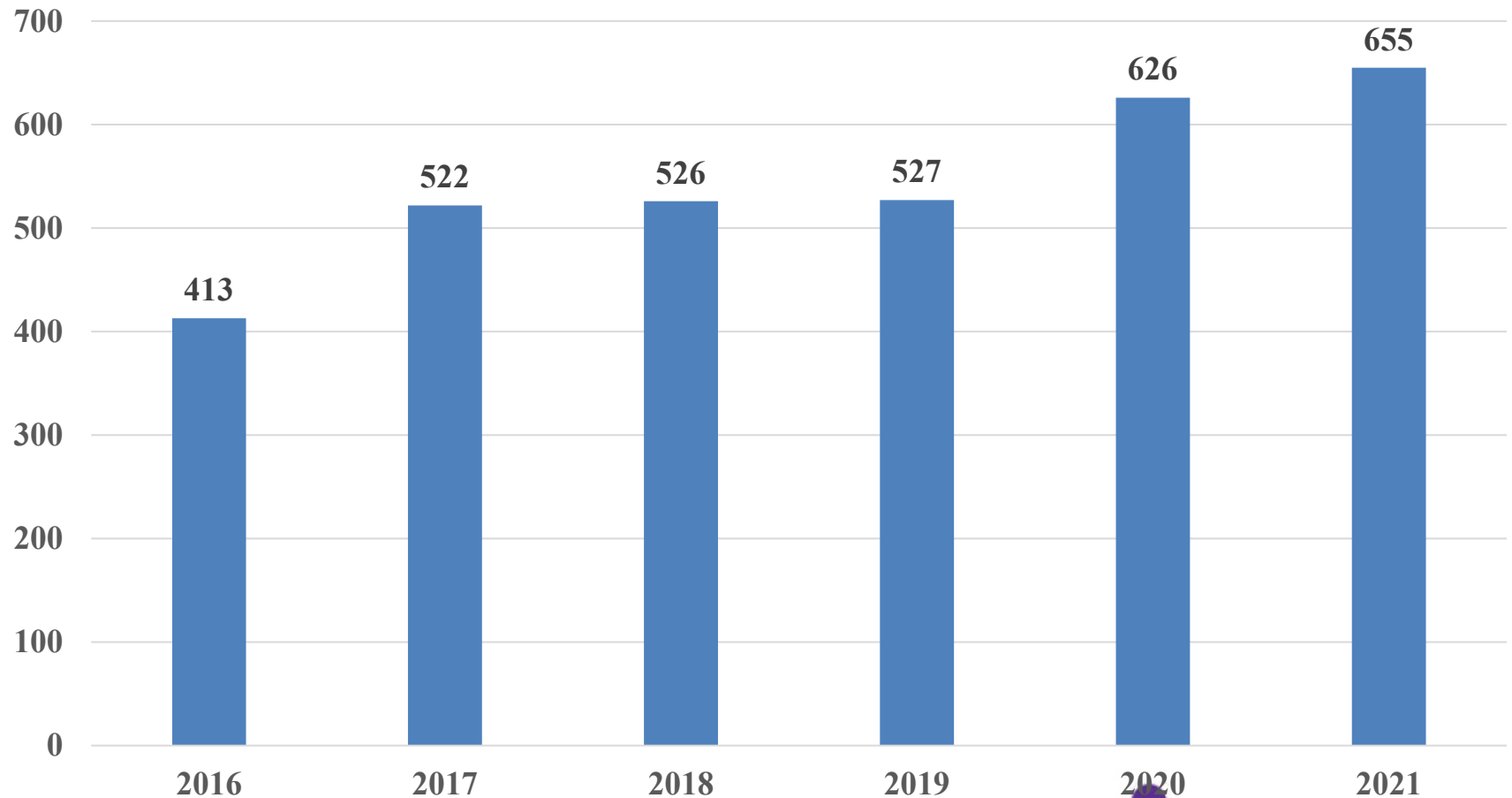
■ Total Resections with Intracranial Monitoring
■ Intracranial Monitoring without Resection



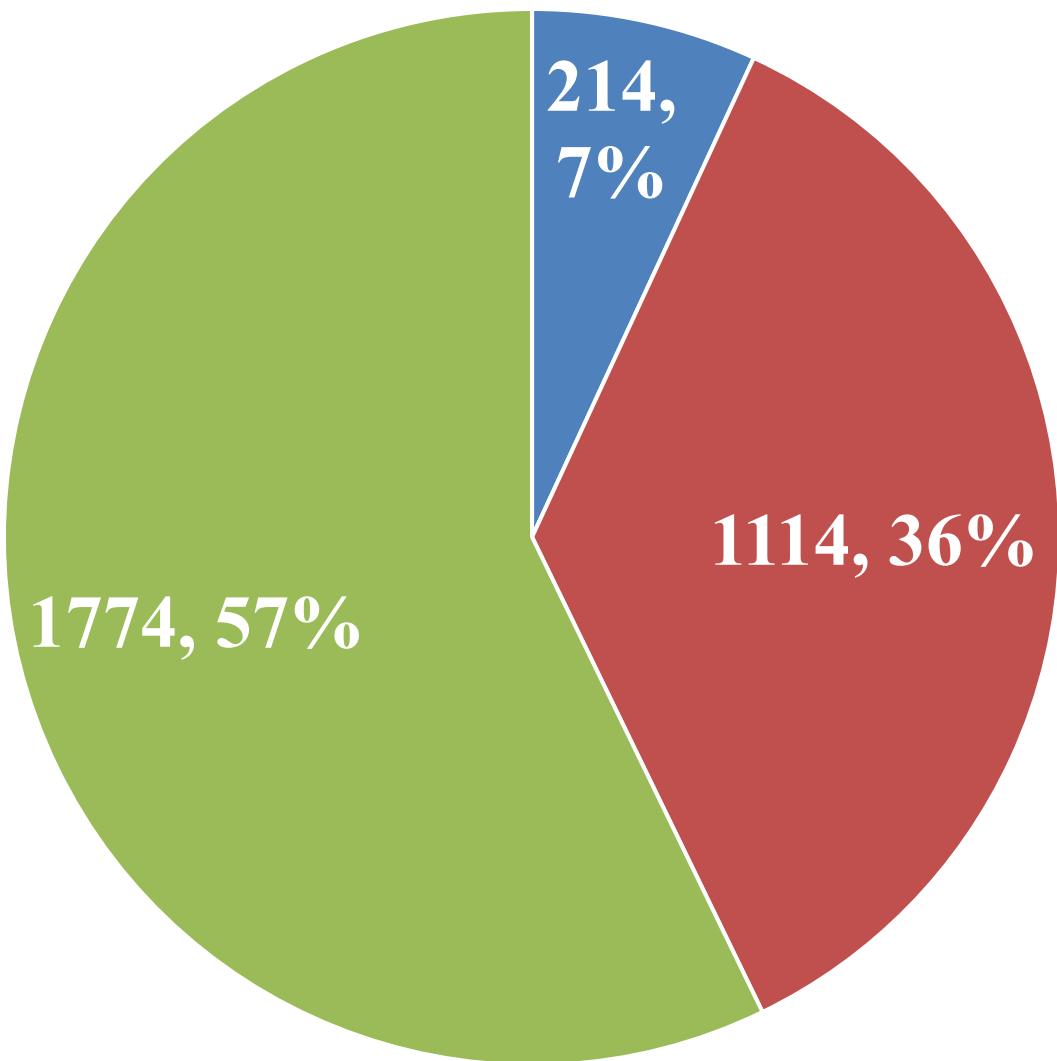
Total VNS Implantations 2014-2021



Total RNS Implantations 2016-2021



2021 Total Procedures in Pediatric Population by Age of Patient



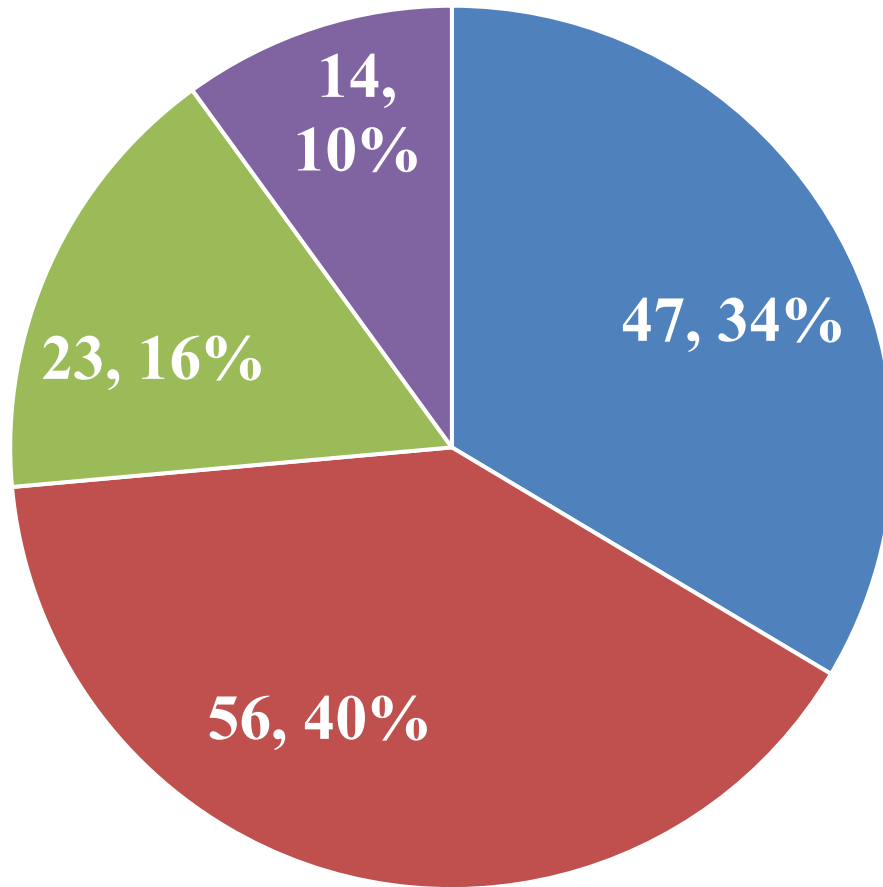
■ 0 to 2 years

■ 3 to 10 years

■ 11 to 18 years

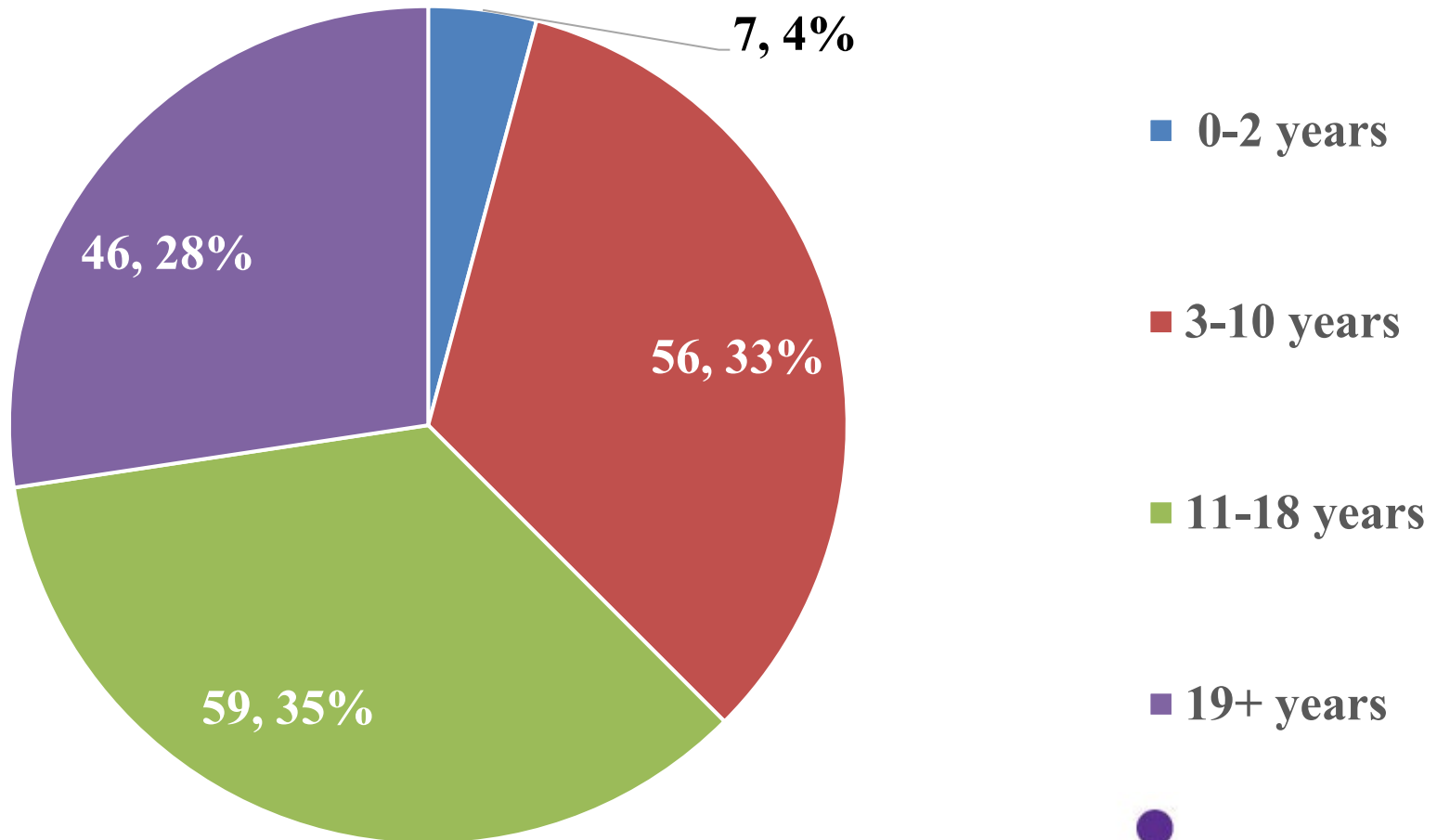


2021 Hemispherotomies by Age

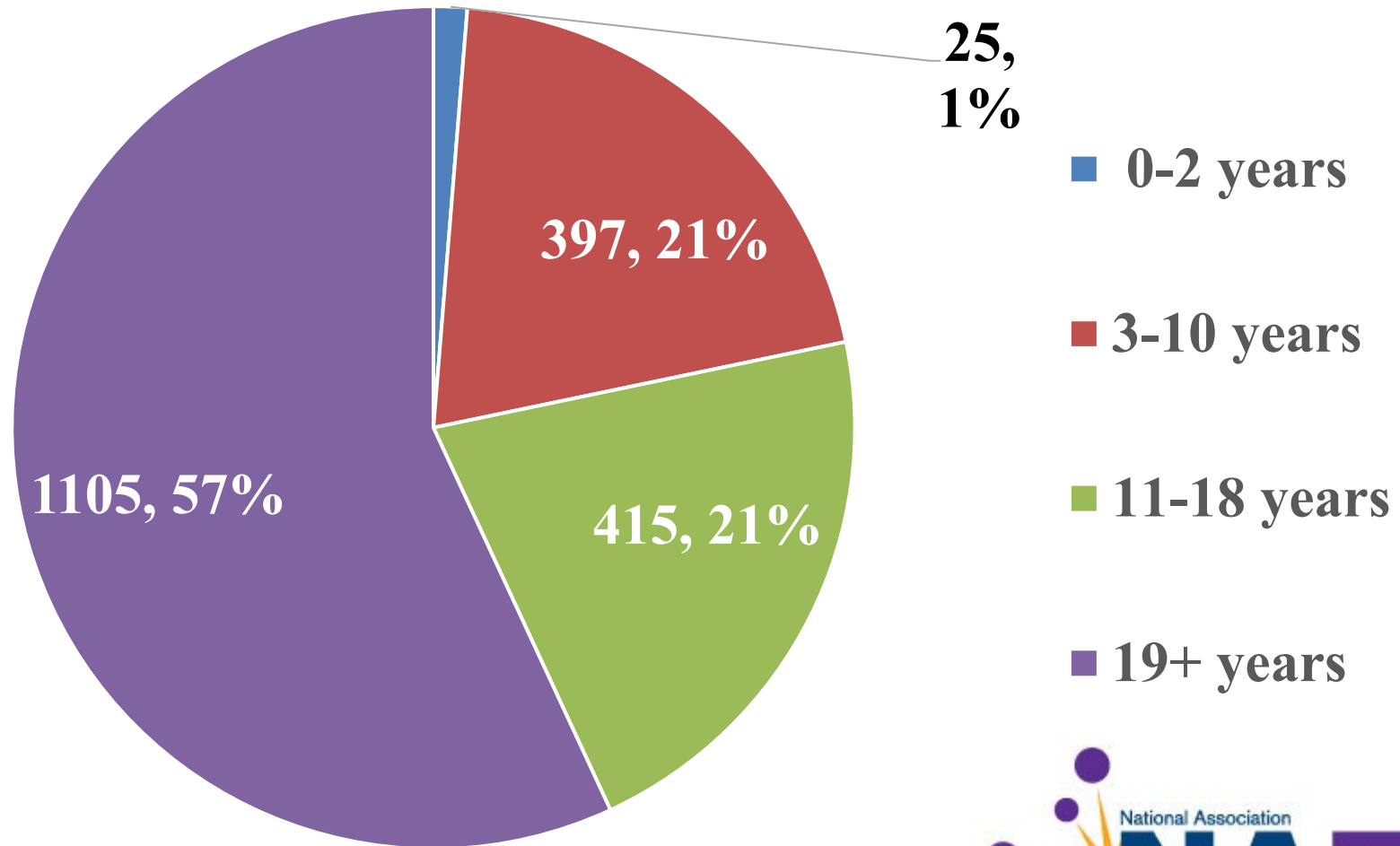


- 0-2 years
- 3-10 years
- 11-18 years
- 19+ years

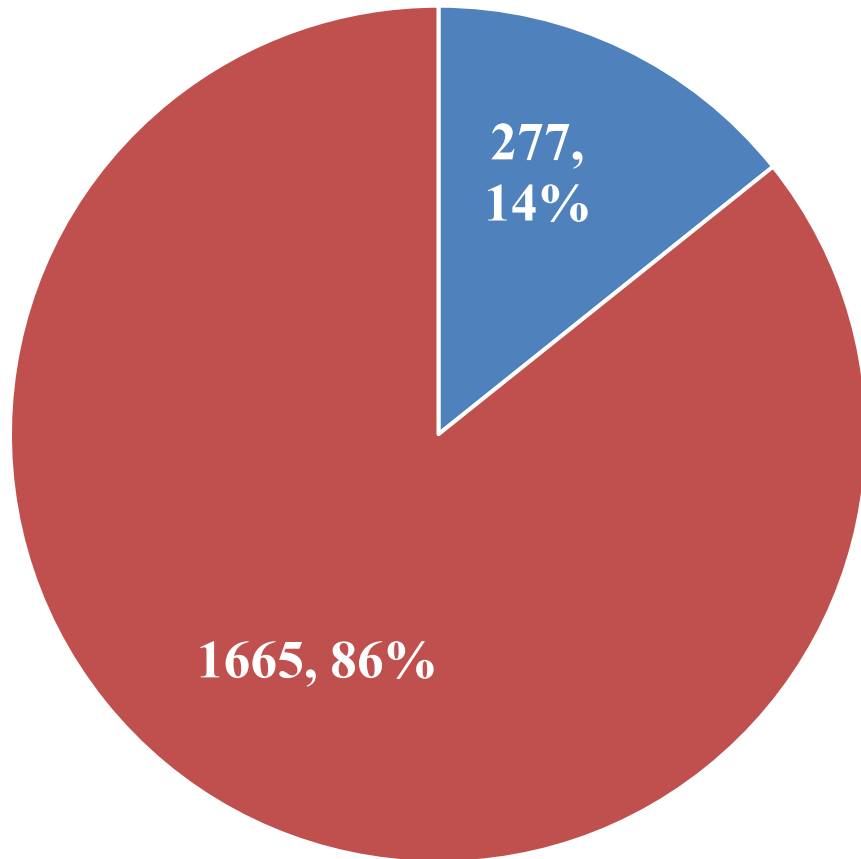
2021 Corpus Callosotomies by Age



2021 VNS Implantations by Age



VNS Implantations by Center Level



■ Level 3 ■ Level 4

| | Mean | Range |
|----------------------------------|------|---------|
| All Level 3 Centers | 4.5 | [0, 48] |
| Level 3 Centers that Perform VNS | 8.9 | [1, 48] |
| Level 4 Centers | 8.4 | [0, 60] |

Update on NAEAC 2020 Accreditation Data

Adam Ostendorf, MD
Stephanie Ahrens, DO



Background

- Partnership with NAEC to collect and analyze data from accreditation surveys
- Data in the 2021 Center Data presentation by Dr. Schuele and those described by Dr. Ostendorf from the publication examining the impact of the COVID-19 pandemic are slightly discrepant. These differences are secondary to data preparation for peer-review analysis, including removal of incomplete datasets or clear outliers.
- Goals:
 - Characterize current practice
 - Analyze trends over time, future directions
 - Advance NAEC mission
 - Set standards of care
 - Advocate for access to high level care
 - Provide knowledge and resources to members



2020 Annual Data

- 260 accredited centers, 100% annual report completion
- 2019-2020 data: Impact of COVID-19 epidemic

RESEARCH ARTICLE OPEN ACCESS

Impact of the COVID-19 Pandemic on Epilepsy Center Practice in the United States

Stephanie M. Ahrens, DO, Adam P. Ostendorf, MD, Fred Alexander Lado, MD, PhD, Susan T. Arnold, MD, Shasha Bai, PhD, Meriem K. Bensalem-Owen, MD, Kevin E. Chapman, MD, Dave F. Clarke, MD, Mariah Eisner, MS, Nathan B. Fountain, MD, Johanna M. Gray, MPA, Muhammed Talha Gunduz, MD, Jennifer L. Hopp, MD, Ellen Riker, MHA, Stephan U. Schuele, MD, MPH, Barbara Small, BA, and Susan T. Herman, MD

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2020 Annual Data

- EMU admissions declined (aggregate -23%)
 - level 3 centers (-44%)
 - adult centers (-39%)
 - no significant, sustained decrease in pediatric centers
 - median staffing, EMU beds and average LOS were unchanged

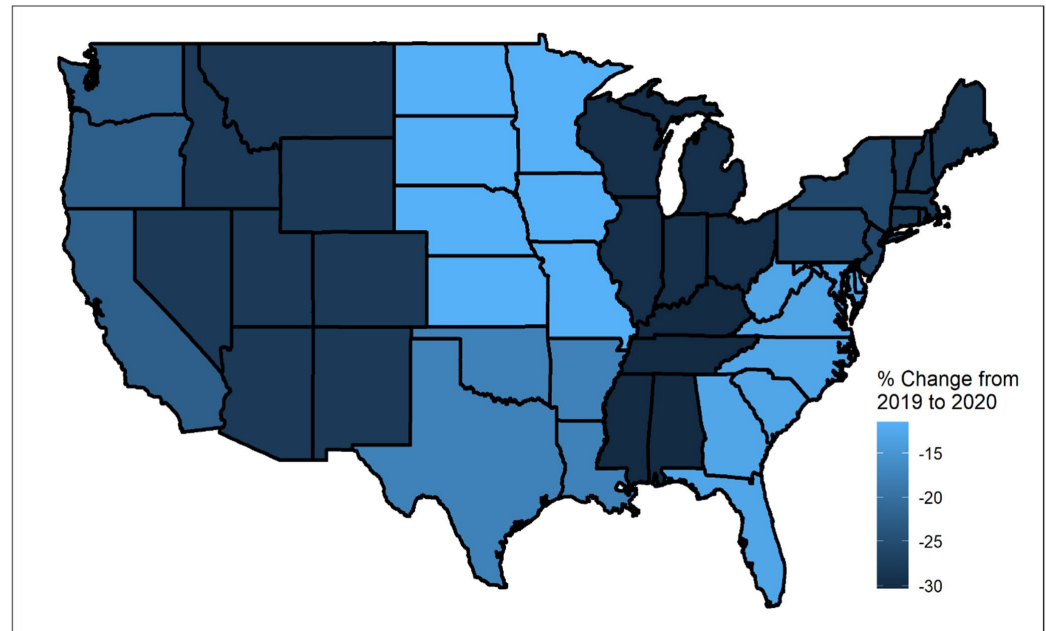


2020 Annual Data

Geographical differences:

- -30% in East South Central
- -12% in the West North Central

Changes in aggregate admissions by U.S. census division from 2019 to 2020:



2020 Annual Data

Change in aggregate procedures by type:

| Characteristic | Procedure Volume | | % Change |
|---------------------------------------|-------------------------------|-------------------------------|--------------|
| | 2019, N = 253 ¹ | 2020, N = 257 ¹ | 2019 to 2020 |
| Temporal lobectomy | 1,465 | 1,238 | -15.5 |
| Extratemporal resection | 867 | 972 | 12.1 |
| Corpus callosotomy | 155 | 209 | 34.8 |
| VNS implantation | 2,622 | 2,136 | -18.5 |
| Hemispherotomy | 190 | 205 | 7.9 |
| Laser ablation | 686 | 790 | 15.2 |
| RNS implantation | 561 | 625 | 11.4 |
| Intracranial electrodes, no resection | 1,010 | 1,098 | 8.7 |
| Total intracranial monitoring | 2,288 | 2,187 | -4.4 |
| Total treatment surgery | 6,546 | 6,175 | -5.7 |

¹Statistics presented: sum

Surgeries declined (-5.7%)

- VNS implantations (-19%)
- Temporal lobectomies (-16%)
- All other procedure volumes increased



2020 Annual Data

Median procedure volumes by center demographic:

| Characteristic | Adult | | | Adult/Pediatric | | | Pediatric | | |
|--|-------------------------------|-------------------------------|--------------------------|------------------------------|------------------------------|--------------------------|------------------------------|------------------------------|--------------------------|
| | 2019, N = 108 ¹ | 2020, N = 113 ¹ | p- value ² | 2019, N = 96 ¹ | 2020, N = 95 ¹ | p- value ² | 2019, N = 50 ¹ | 2020, N = 50 ¹ | p- value ² |
| Temporal lobectomy | 5 (2.8, 11) | 4 (2, 8) | 0.086 | 6.5 (3, 12) | 4.5 (2, 8) | 0.027 | 4.5 (2.2, 7.8) | 6 (2, 10) | 0.5 |
| Extratemporal resection | 3 (2, 5) | 2 (1, 4.2) | 0.2 | 4 (2, 8) | 3 (1, 7) | 0.5 | 7 (2, 11) | 7.5 (4, 16) | 0.3 |
| Corpus callosotomy | 2 (1, 2) | 1 (1, 2) | 0.5 | 1 (1, 3) | 2.5 (1, 5.2) | 0.093 | 2 (1, 4) | 3 (1.5, 4) | 0.2 |
| VNS implantation | 7 (4, 12) | 5 (2, 8.2) | 0.008 | 9.5 (5, 19.8) | 8.5 (4, 13.2) | 0.10 | 11 (5, 16.8) | 10 (5.2, 17.5) | 0.7 |
| Hemispherotomy | 1 (1, 2.5) | 1 (1, 1) | 0.4 | 2 (1, 2.8) | 1 (1, 2.2) | 0.6 | 2 (1.8, 5) | 3 (1, 5) | 0.8 |
| Laser ablation | 5.5 (4, 7) | 4 (2, 8) | 0.2 | 3 (2, 6) | 4 (2, 7.8) | 0.5 | 4 (3, 9) | 4 (2.2, 8.5) | 0.7 |
| RNS implantation | 4 (2, 7) | 4 (2, 6) | 0.8 | 3 (1, 6) | 4 (2, 5.2) | 0.2 | 2 (1, 3.8) | 3 (1, 5) | 0.2 |
| Intracranial electrodes, no resection | 5 (2, 8) | 4 (2.5, 7.5) | 0.6 | 4 (2, 8) | 5 (2, 9.8) | 0.3 | 4.5 (3, 6.8) | 5 (3, 7) | 0.7 |
| Total intracranial monitoring | 7 (3, 14.5) | 8 (5, 15.5) | 0.5 | 7.5 (4, 17.2) | 7 (3, 16.5) | 0.7 | 11 (4.5, 16) | 12 (6.5, 17) | 0.6 |
| Total treatment surgery | 17 (7.2, 30) | 12 (5, 24) | 0.044 | 22 (11, 40.8) | 21 (10, 37.5) | 0.5 | 32 (14.5, 49) | 35 (18, 52.5) | 0.8 |

¹Statistics presented: n (%); median (IQR), among non-zero procedures

²Statistical tests performed: chi-square test of independence; Wilcoxon rank-sum test; Fisher's exact test



Conclusions

- Access to epilepsy care declined
 - Most impact in level 3 centers, adult centers, East South Central region
- Ongoing pandemic, impact unknown
 - Hospital admission practices
 - Resource allocation
 - Patient willingness to seek care
- Important to continue to track data



2021 Accreditation Process Update

Meriem Bensalem-Owen, MD

NAEC Accreditation Committee Chair

May 23, 2022



Accreditation Changes for 2022: COVID-19 Flexibilities End

- NAEC will remove the COVID-19 flexibilities from 2021 (relaxed criteria related to EMU admissions, surgical procedures, and key personnel) and reinstitute prior criteria
- NAEC recognizes that in certain areas, the COVID-19 pandemic still impedes center activities, while most centers reported they returned to more normal operations.
- **Accordingly, the Accreditation Committee independently and anonymously reviewed all centers with deficiencies on case-by-case basis**



New Criteria Taking Effect in 2022

- **An EMU that meets certain criteria**
- **Medical Director who is board-certified in epilepsy or clinical neurophysiology (or equivalent); the 2nd epileptologist may be board-eligible rather than board-certified;**
- **Pediatric and adult/ped centers must:**
 - have a **pediatric epilepsy specialist** (board-certified in child neurology as well as epilepsy and/or clinical neurophysiology); provide a **video EEG report for a patient 2 years old or younger.**
- *Note: These criteria are implemented on a **prospective basis**: centers must meet them when they submit their Center Annual Report and moving forward.*



New EMU Criteria

1. Designated hospital beds where video and EEG data is captured and sent to a central location
2. Remote-control video cameras with 24/7 recording available (not a fixed camera)
3. Trained personnel dedicated 24/7 to monitoring video and EEG – someone trained in seizure recognition and recording integrity, not necessarily a traditional EEG technologist
4. EMU safety-trained inpatient nurses
5. Epilepsy-specific staff training and protocols for seizure safety
6. Clinical decision-making by an epileptologist



2021 Accreditation Decisions

| | # of Centers |
|---------------------|-----------------------|
| Level 4 | 171 (+1 from 2021) |
| Level 4 Conditional | 27 (+24 from 2021) |
| Level 3 | 45 |
| Level 3 Conditional | 16 (+15 from 2021) |
| No Accreditation | 7 |



Common Deficiencies

| Deficiency* | # of Centers |
|--|--------------|
| Did not meet EMU criteria | 21 |
| Low EMU admissions | 12 |
| Did not meet intracranial threshold | 9 |
| Did not meet board certification requirement | 9 |
| Did not perform required service | 7 |
| Withdrew membership | 4 |
| Dues have not been received | 3 |
| Did not complete process | 2 |

*Centers may have more than one issue

EMU Criteria Deficiencies

| # of centers | 1 | 4 | 19 | 2 |
|--------------|------------------------------|--|---|--|
| Issue | EMU not in a single location | Staff do not have sufficient epilepsy training | Center does not have 24/7/365 continuous monitoring | Center does not have multiple people with training for back up |

Note: Centers may have multiple issues