BSCN/ANS
Ambulatory EEG Audit 2019

Results of UK service evaluation:
Form B

Form B

BSCN Founded as the EEG Society in 1942 — Joint National Audit Project — ANS Association of Neurophysiological Scientists

A service evaluation of EEG Long Term Monitoring for the diagnosis of epilepsy, including the usefulness of co-recorded video, in the Outpatient setting across the UK

FORM B : Please complete for each patient attending for EEG LTM In the Outpatient Setting.

Postcode of Centre (Please complete)		**Local EEG number (Please complete)**		**Project Code** (Do not complete. For office use only)	

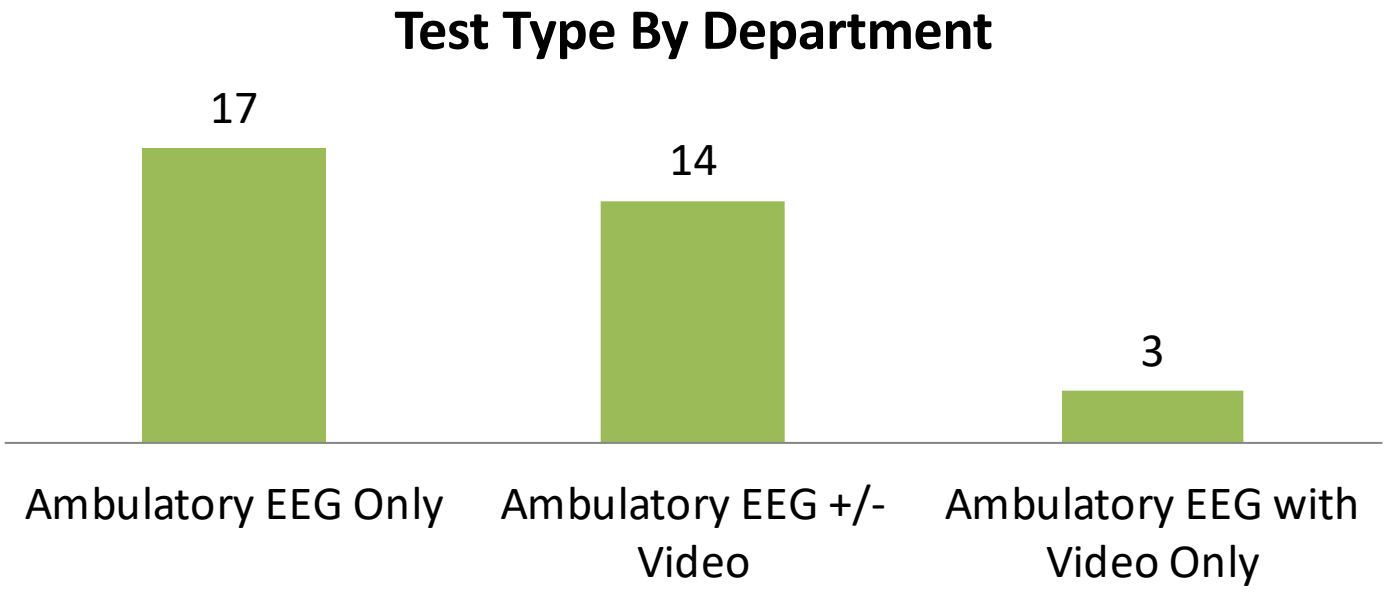
1.What was the age of the patient (years)	
2.What is the patient's gender	M F
3. Which procedure was performed? (Please circle)	Ambulatory EEG Ambulatory EEG with time locked video
4. What was the referral diagnosis?	Epilepsy NEAD Epilepsy/ NEAD Sleep related events
5. What was the duration of monitoring (hrs)	
6. Is the purpose of the recording primarily to capture ictal events or interictal EEG abnormalities?	Ictal Interictal Not specified/unclear
7. Was the frequency of seizures verified prior to the appointment being made e.g. by phone call to patient/carers etc?	Yes No
8. Was a standard configuration of 10:20 electrode placement (19+ground and reference) used?	Yes /No If yes – go to Q10 **If No – go to Q9**
9. If No - What electrode placement system was used?	
10. Please give details of any additional **cortical** electrodes applied? (or write NA)	
11. Were any of the following **polygraphy** channels applied? (please circle)	ECG EMG None
12. If applied, what sites were EMG electrodes placed at?	
13. Was a previous routine EEG or Sleep EEG performed?	Y N
14. Was a full clinical history recorded by the physiologist, including the patient's seizure types?	Y N
15. Were there any neuro-behavioural problems or other medical conditions that affected compliance with the recording procedure (e.g learning difficulty)	Y N
16. Did the seizure frequency relayed to the physiologist by the patient correlate well with the referral? (use most up to date information - so if department contacted patient then use this as the given seizure frequency)	Yes No – events more frequent No - events less frequent Frequency of events not stated on referral
17. Was there any adverse event during the recording? (Include events such as injury/skin reactions and/or data acquisition failure)	Y N
18 If yes – please state:	
19. Were any interictal epileptiform abnormalities detected during the recording?	Yes No If Yes continue to Q 20 **If No go to Q 23**
20. Were interictal epileptiform changes detected that were not present in previous EEGs (routine or sleep deprived)?	Yes No No previous
21. How far into the recording are the first interictal epileptiform abnormalities seen? (hours / minutes)	
22. When were interictal abnormalities seen?	Awake Sleep Awake and Asleep
23. Were any clinical events captured during the recording?	Yes No If yes – please continue to q24 **If No – the form is complete**
24. Were the events captured the patient's habitual events?	Yes No Yes (+ other)
25. What type of clinical event was captured? (circle all that apply)	Focal seizure Focal to bilateral tonic-clonic seizure Generalised seizure Non-epileptic event Unable to classify
26. How far into the recording was the first clinical episode captured? (Hours/Minutes)	
27. On the whole, were the times of clinical events documented by the patient/carer?	Y N
28. On the whole, were the clinical events well described by the patient/carer?	Y N
29. On the whole, was the event marker pressed at the time of the events during the recording?	Y N No event marker
30. On the whole, were the seizures adequately captured on the video recording?	Yes – clear recording of event, please go to q 32 No – please go to q31 No - ambulatory EEG only, please go to q 33
31. If No please state problems encountered with the video recording?	
32. Did the video on this patient aid interpretation/classification of the EEG?	Yes / No
33. If video was not performed, do you think video would have aided diagnosis/seizure classification for this patient?	Yes / No
34. If Yes: Please indicate your reason for your answer	

Results

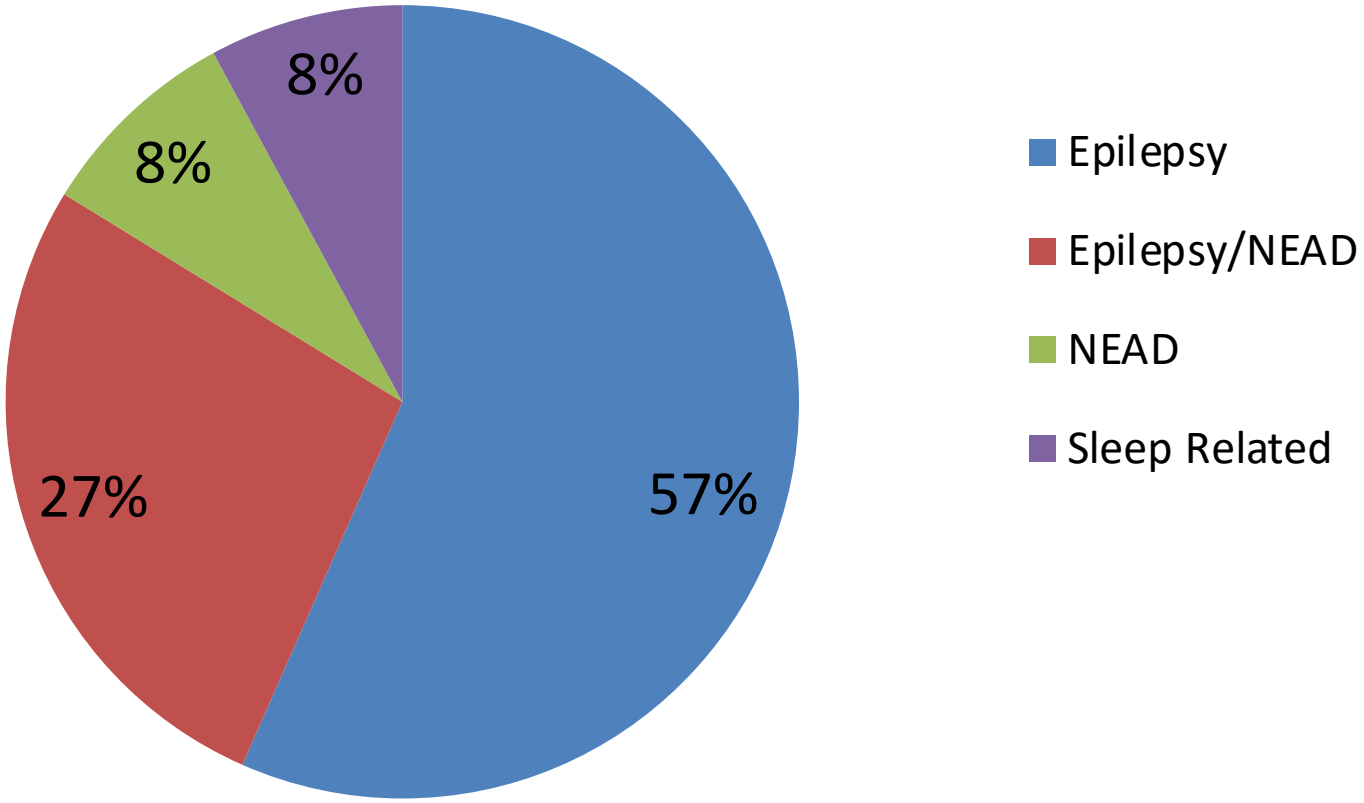
- Total Number of patients = 709
- Number of participating departments = 34
- 56% Female – 44% Male
- Age range - 6 months – 87 years
- Median 18 years
- 310 (44%) <16 Years (mean – 8 years)
- 388 (56%) 16+ Years (mean – 37 years)

Ambulatory Modality

- Total number aEEG only – 547
- Total number video-aEEG – 161
- Total not stated – 1

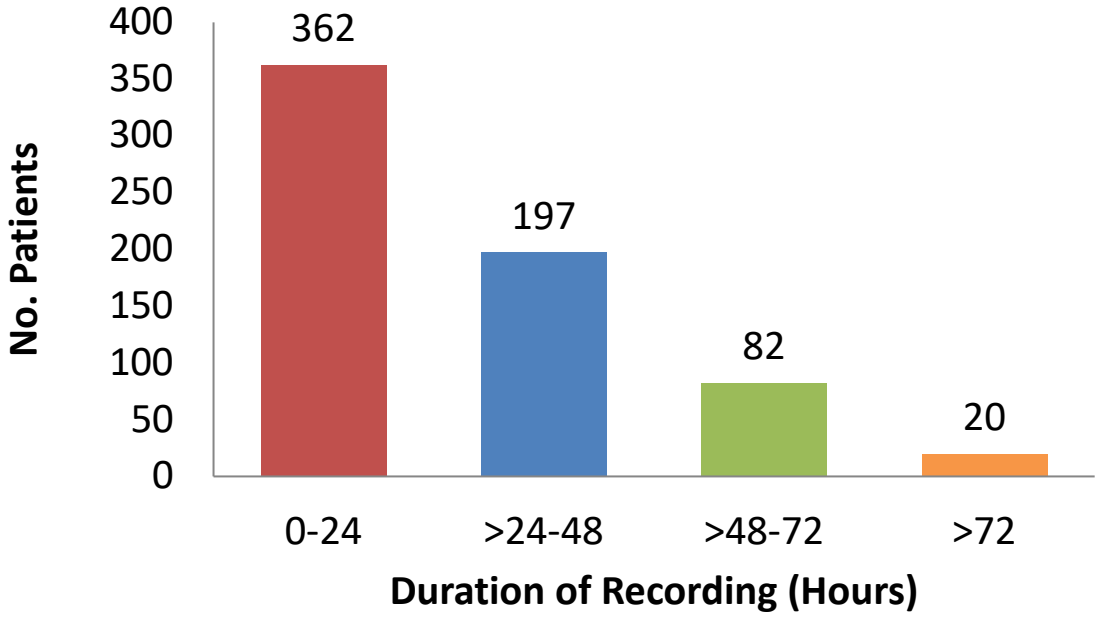


What was the Referral Diagnosis?



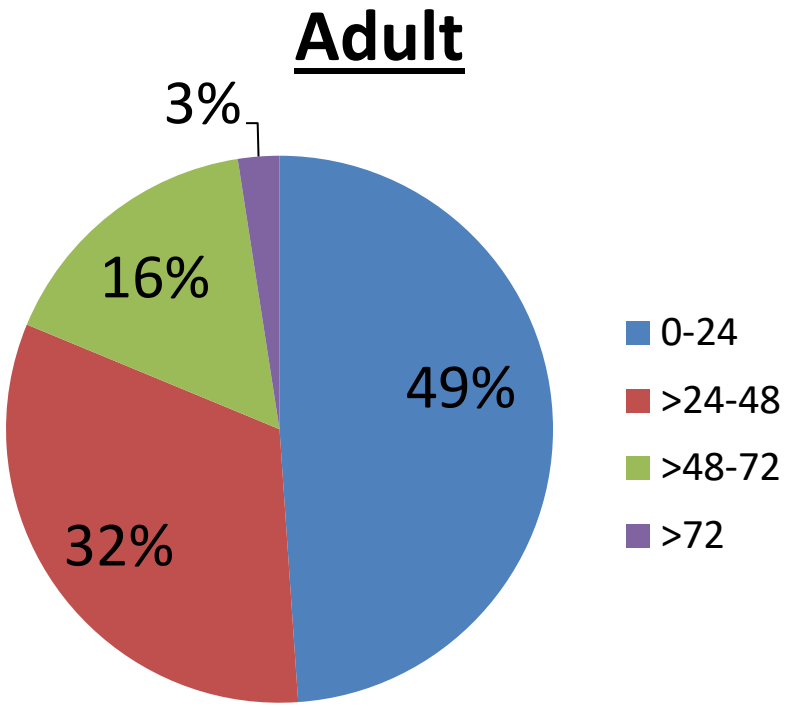
What was the Duration of Monitoring?

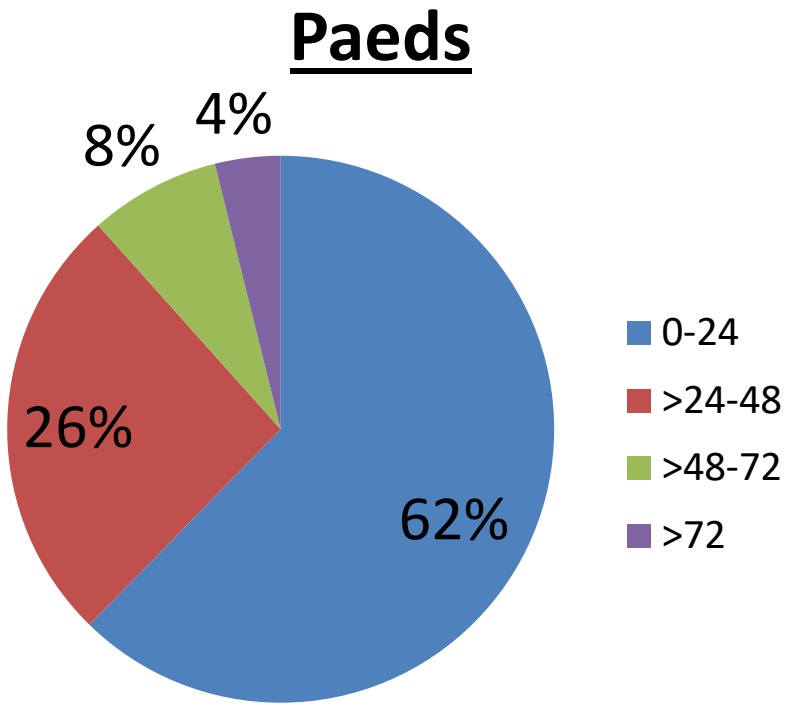
- Study duration - 2 hours* – 168 hours



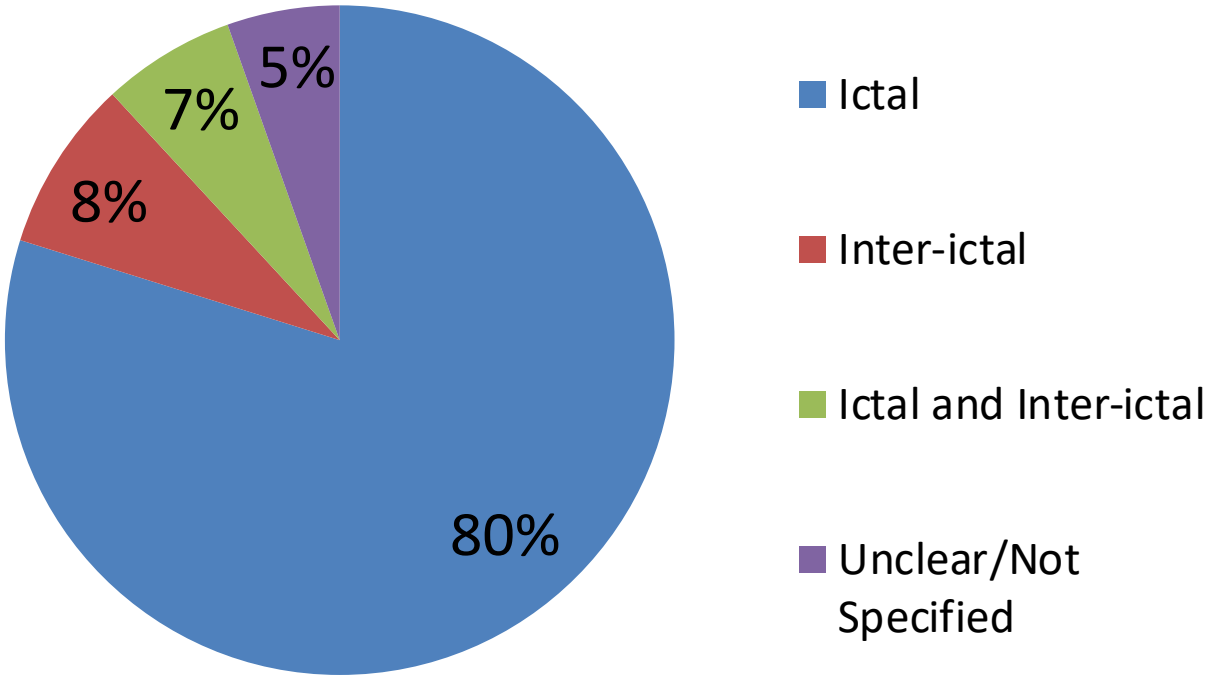
- Mixture of recording durations within departments.
- ?Criteria for longer recordings.
- Who makes the decisions regarding duration of recording required?

Adult and Paediatric Recording Durations

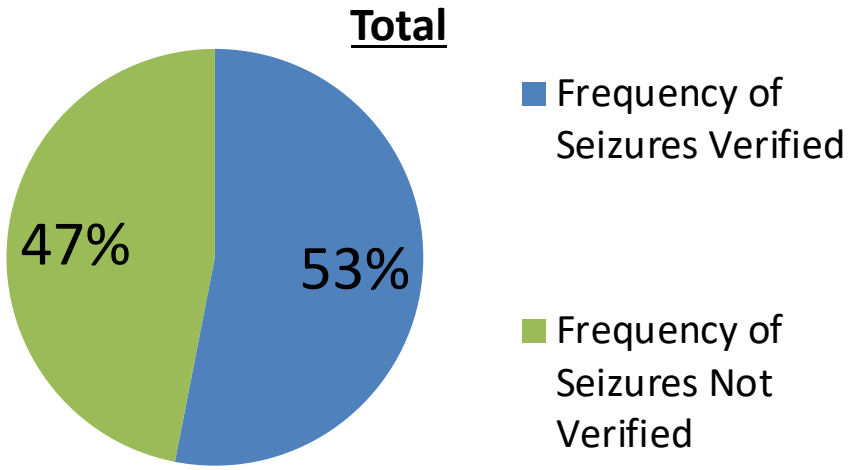


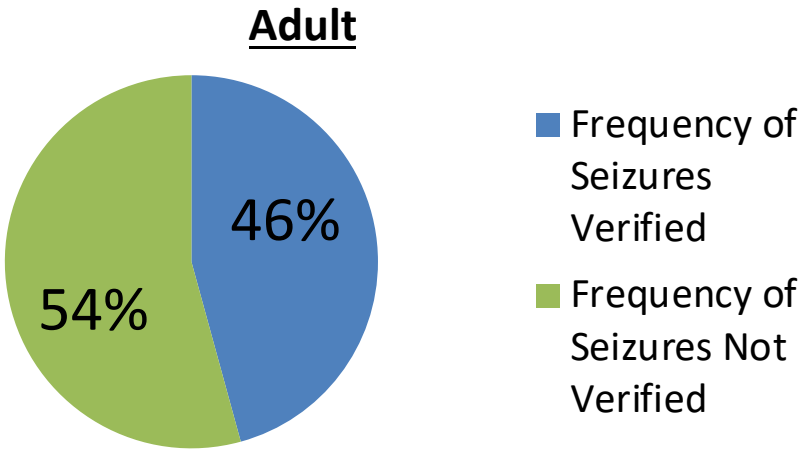


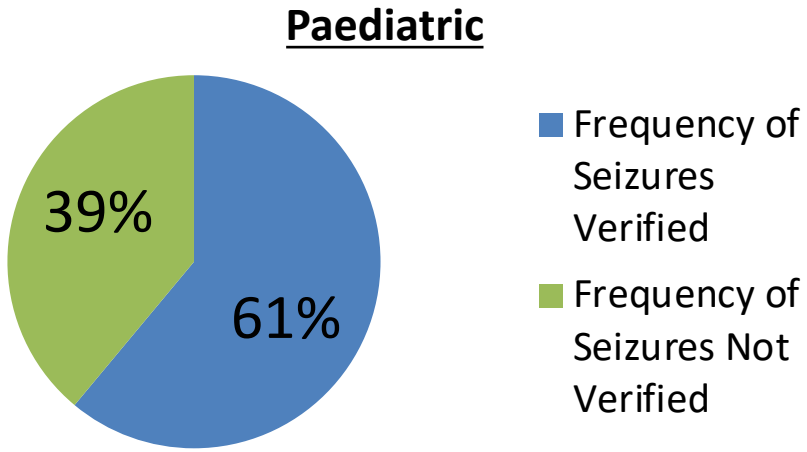
Is the Purpose of the Recording Primarily to Capture Ictal Events or Inter-ictal EEG abnormalities?



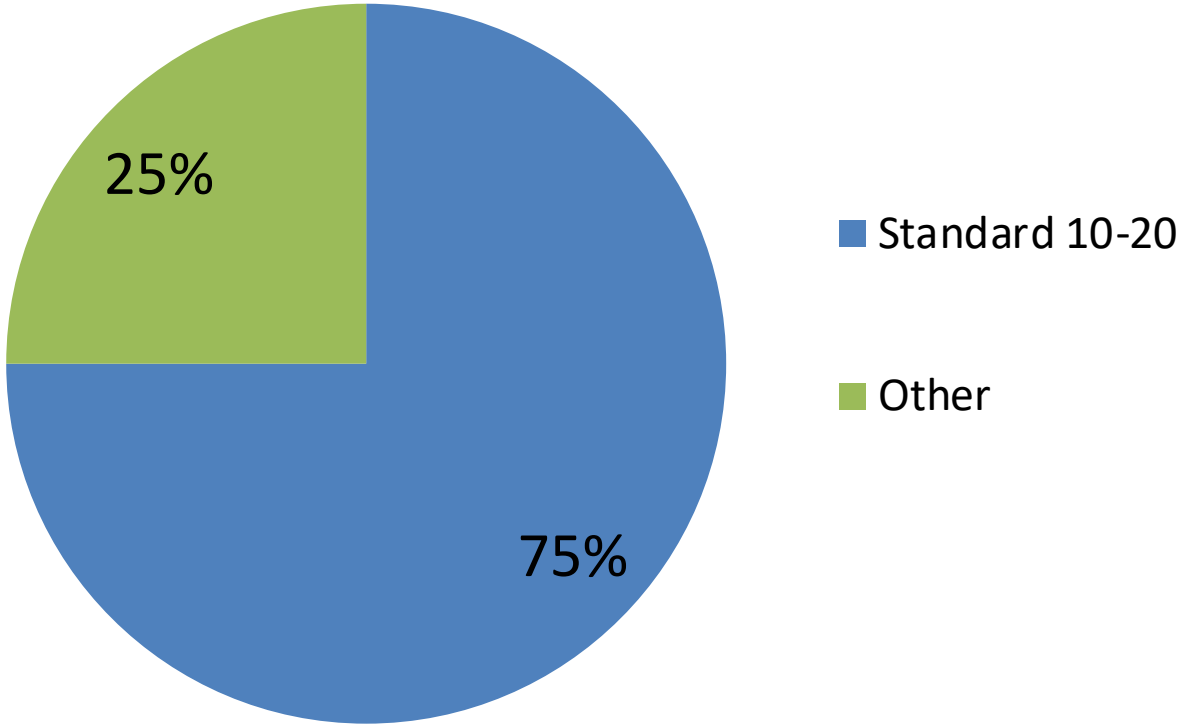
Was the Frequency of Seizures Verified Prior to the Appointment Being Made?







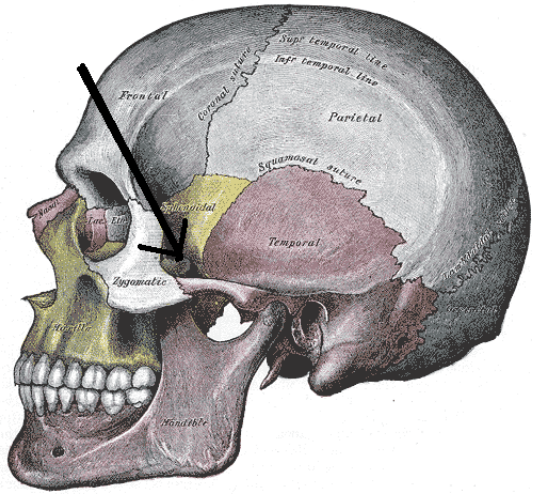
Was a Standard Configuration of 10-20 Electrode Placement Used?



- Modified Maudsley
- Omission of Fp1/2
- Limited Head
- 10-10 paediatric head?

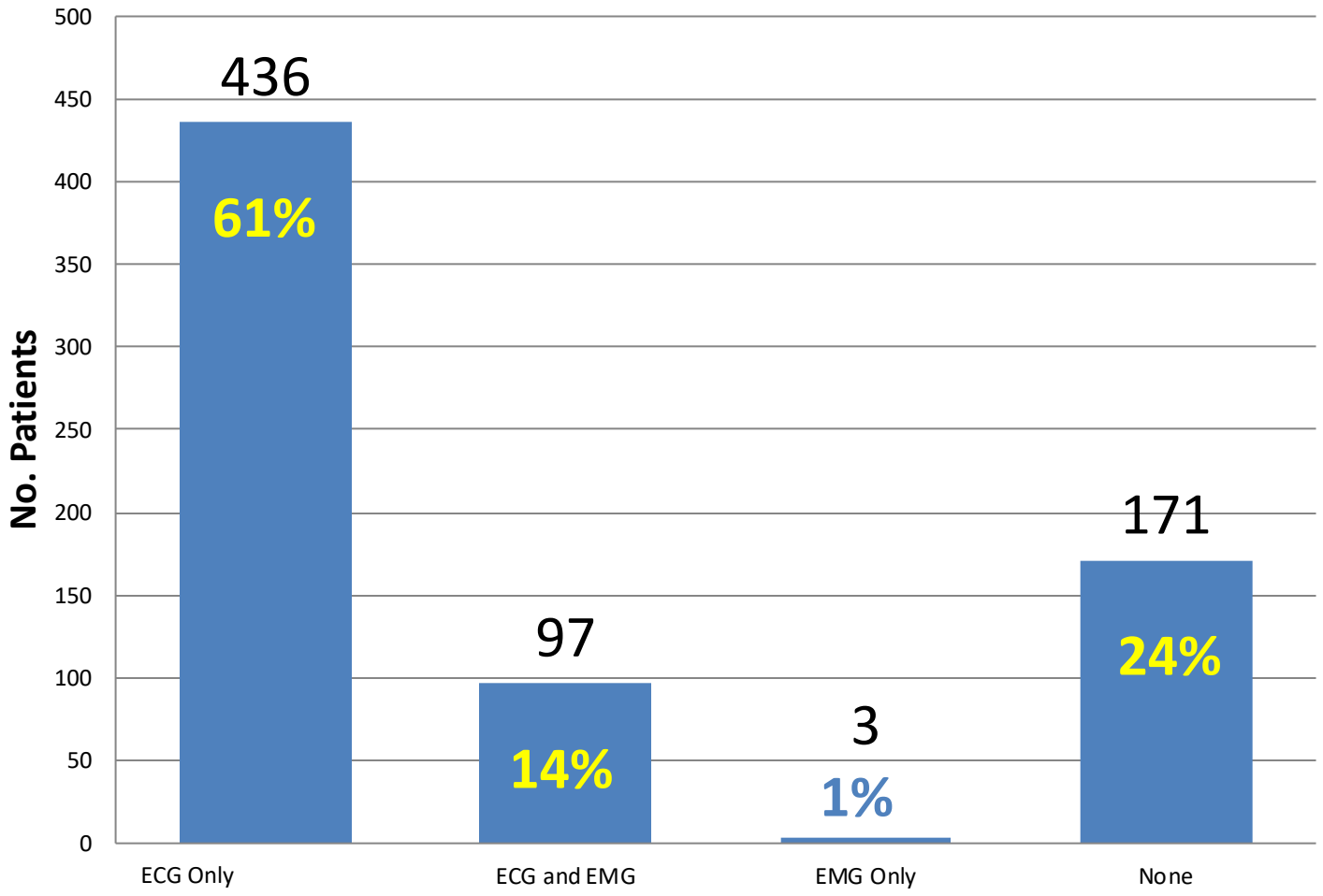
Additional Cortical Electrodes Applied

- A1 and A2 - x7 Departments
- Bilateral Surface Sphenoidals - x2 Departments on x4 occasions
- Zygomatic - x1 Department
- T1 and T2 - x1 Department



Abou-Khalil, 2013, Vanderbilt University Medical Centre

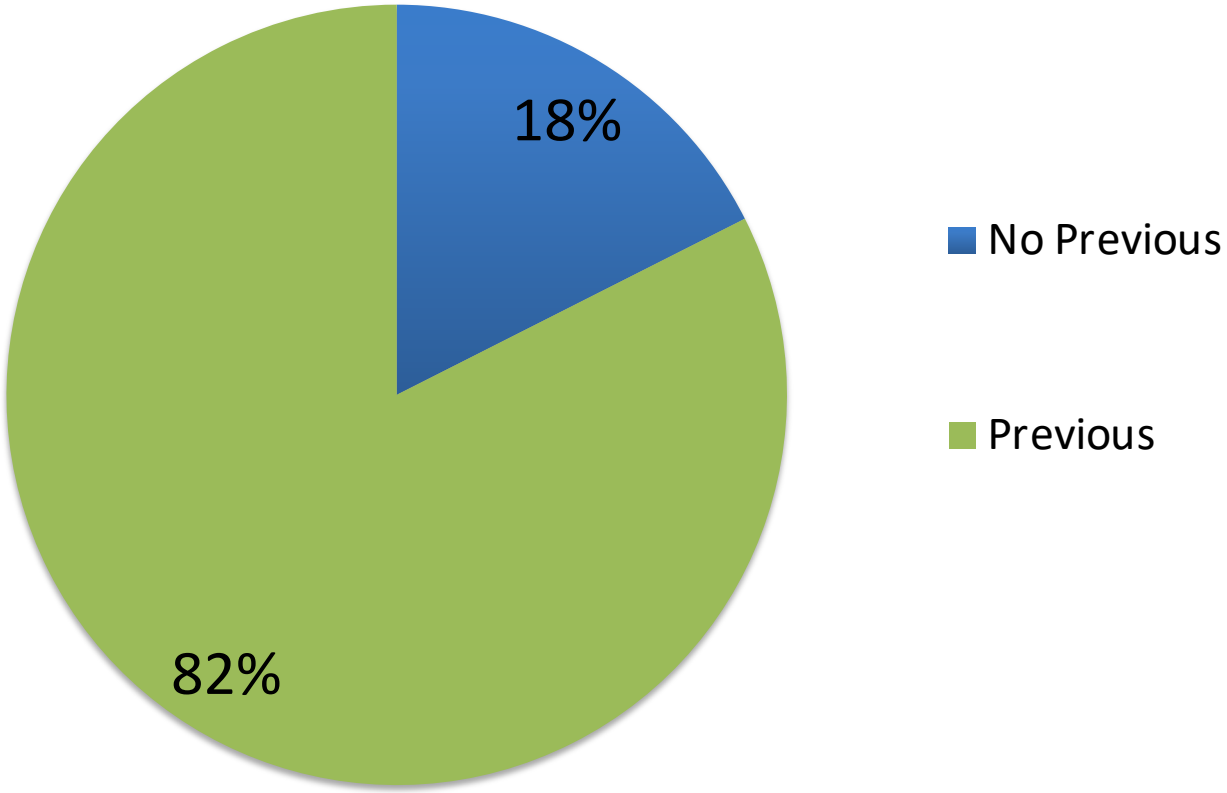
Were any Polygraphy Channels Applied?



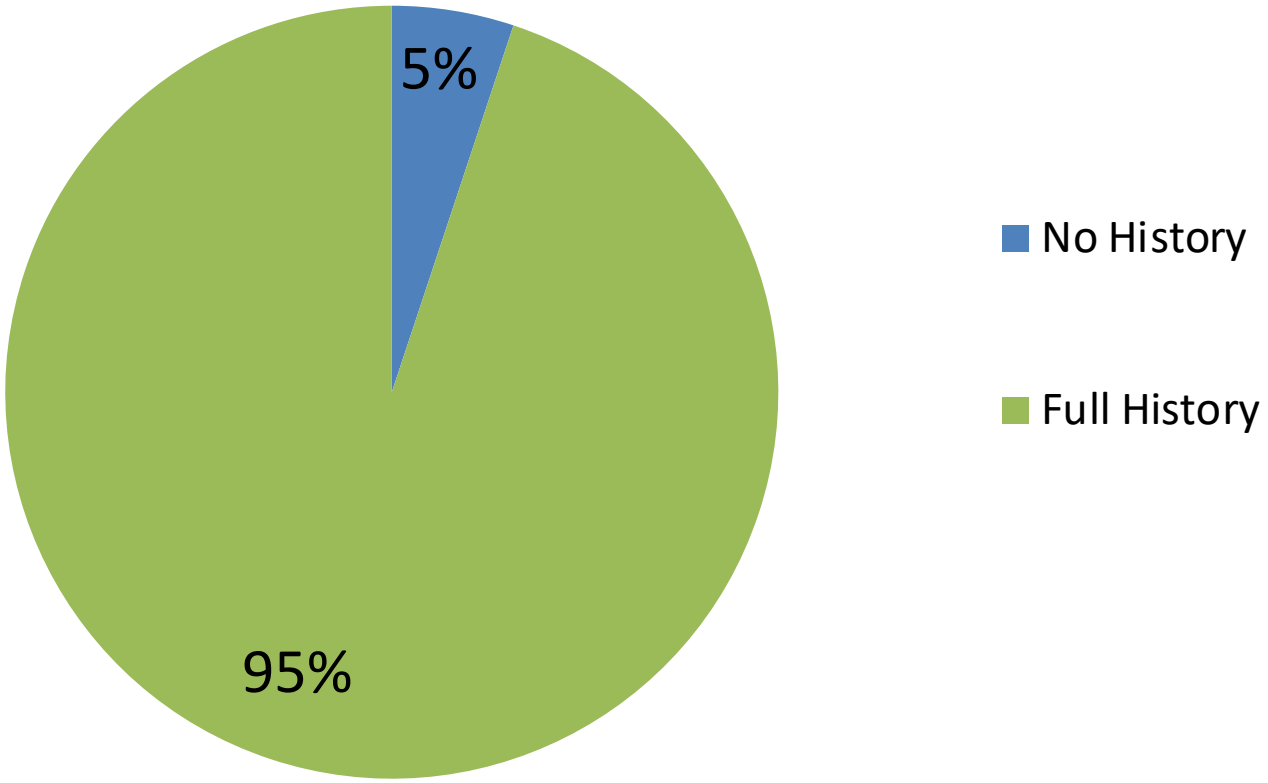
What Sites Were EMG Electrodes Placed?

- Bilateral Deltoid
- Bilateral Deltoid and Submental
- Bilateral Deltoid and TA
- Right Deltoid x1
- Right Bicep x1
- Bilateral Vastus Lateralis

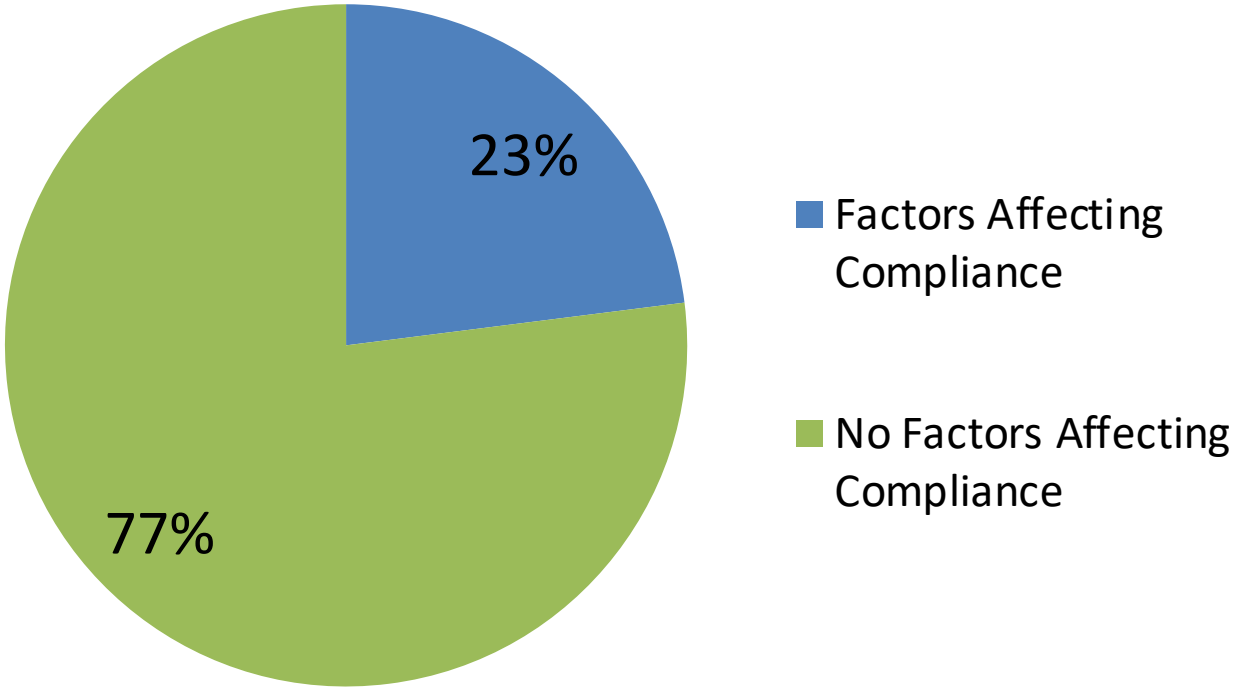
Was a Previous Routine or Sleep EEG Performed?



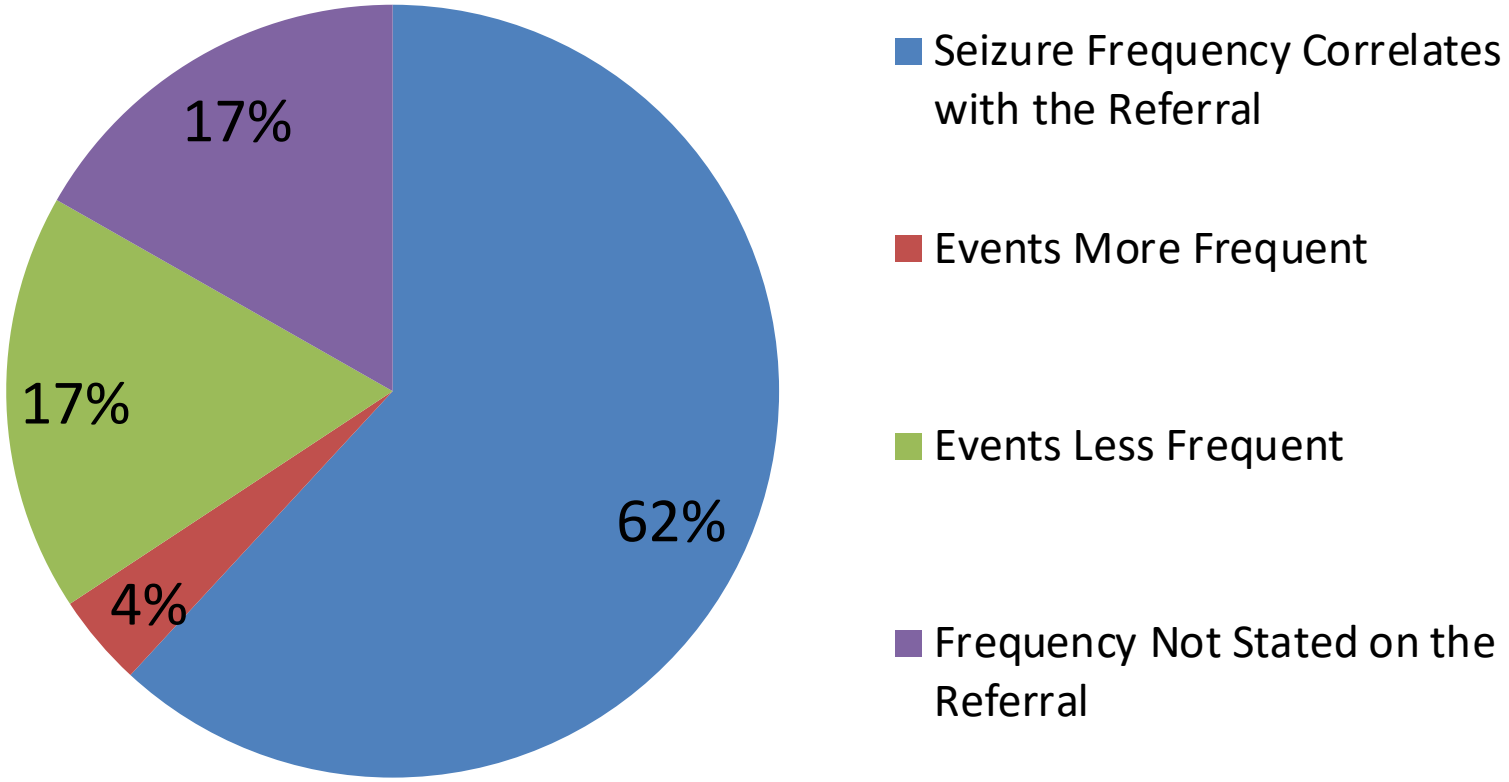
Was a Full Clinical History Recorded by the Physiologist, Including the Patient's Seizure Types?



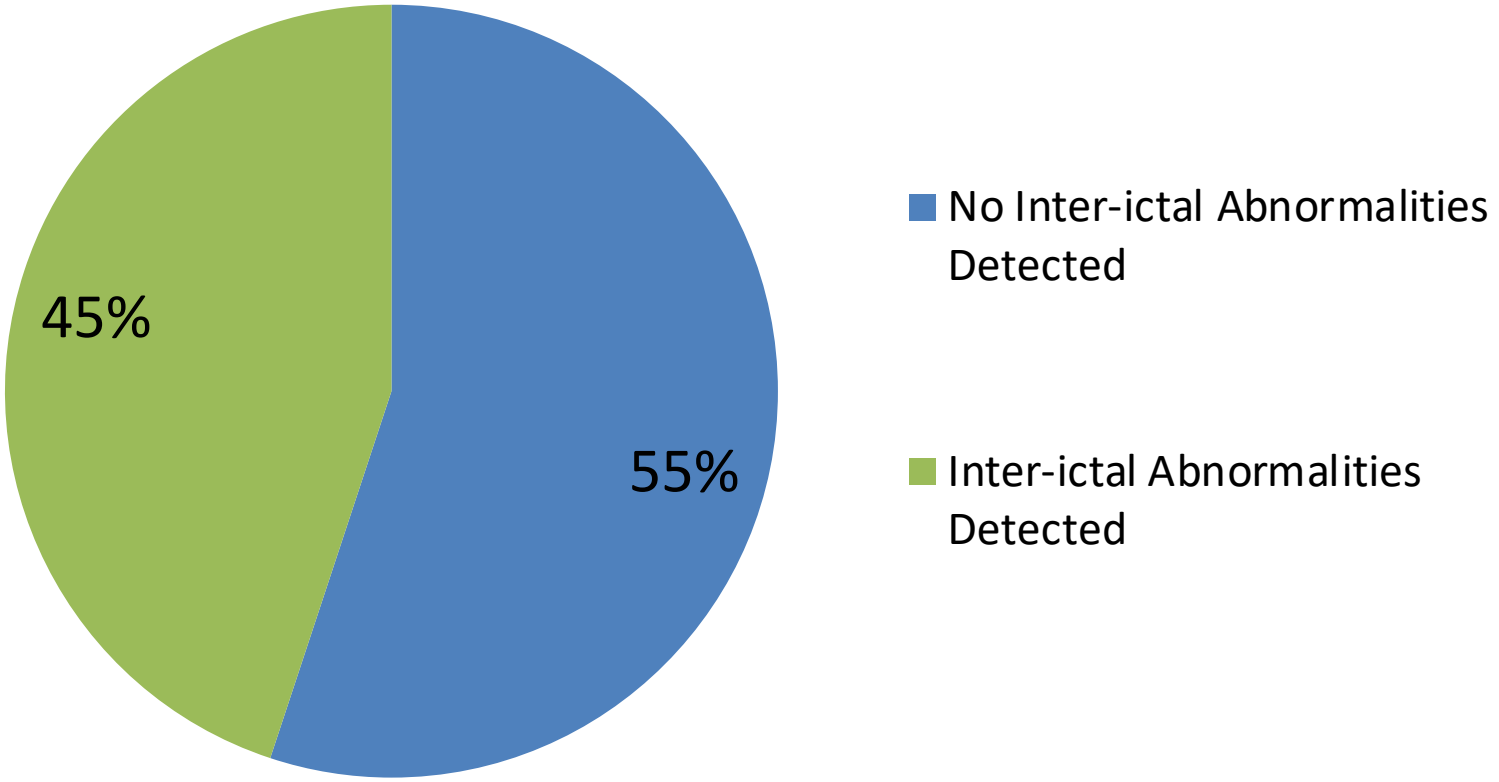
Were There any Neuro-behavioural Problems or Other medical Conditions that Affected Compliance with the Recording Procedure?



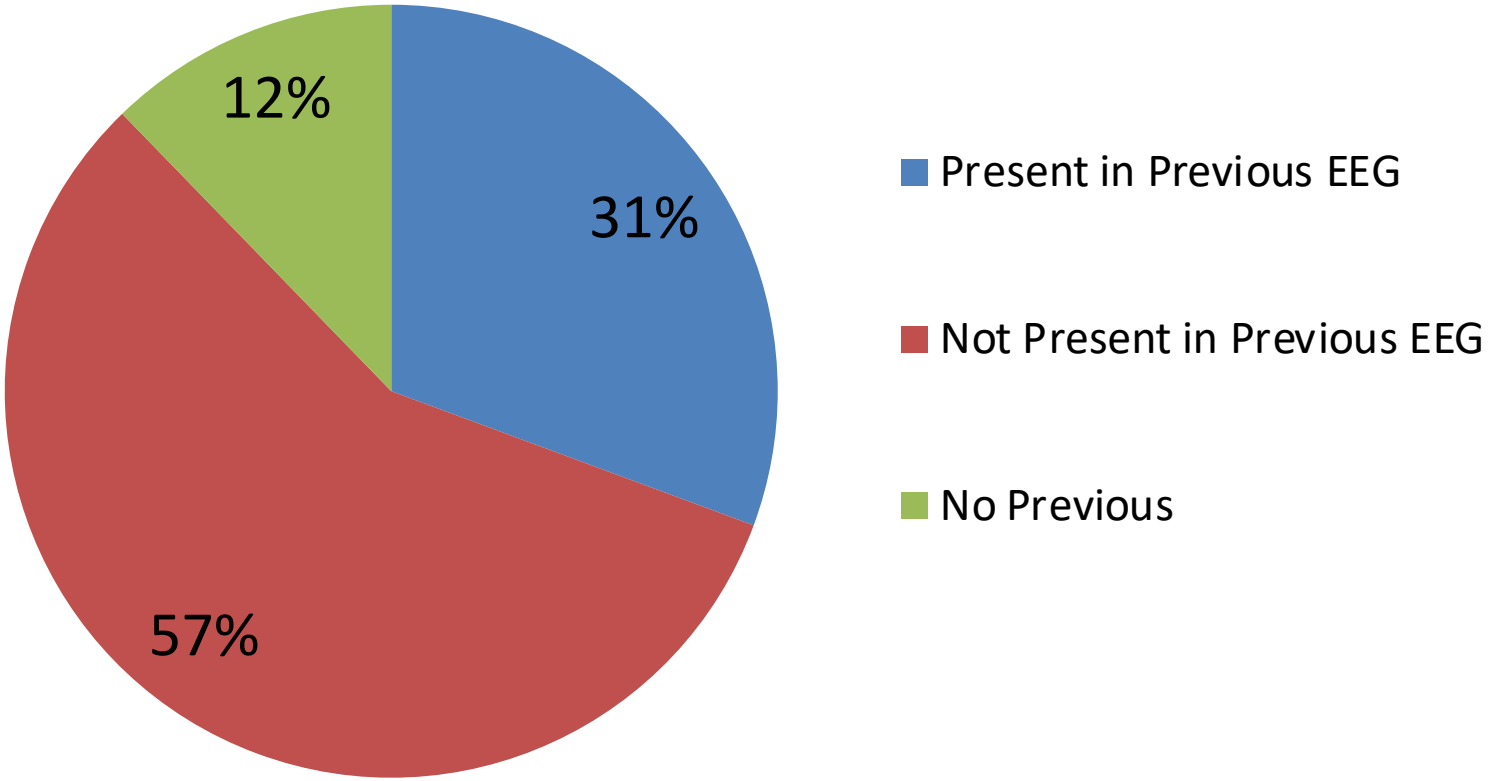
Did the Seizure Frequency Relayed by the Patient Correlate Well with the Referral?



Were any Inter-ictal Epileptiform Abnormalities Detected During the Recording?

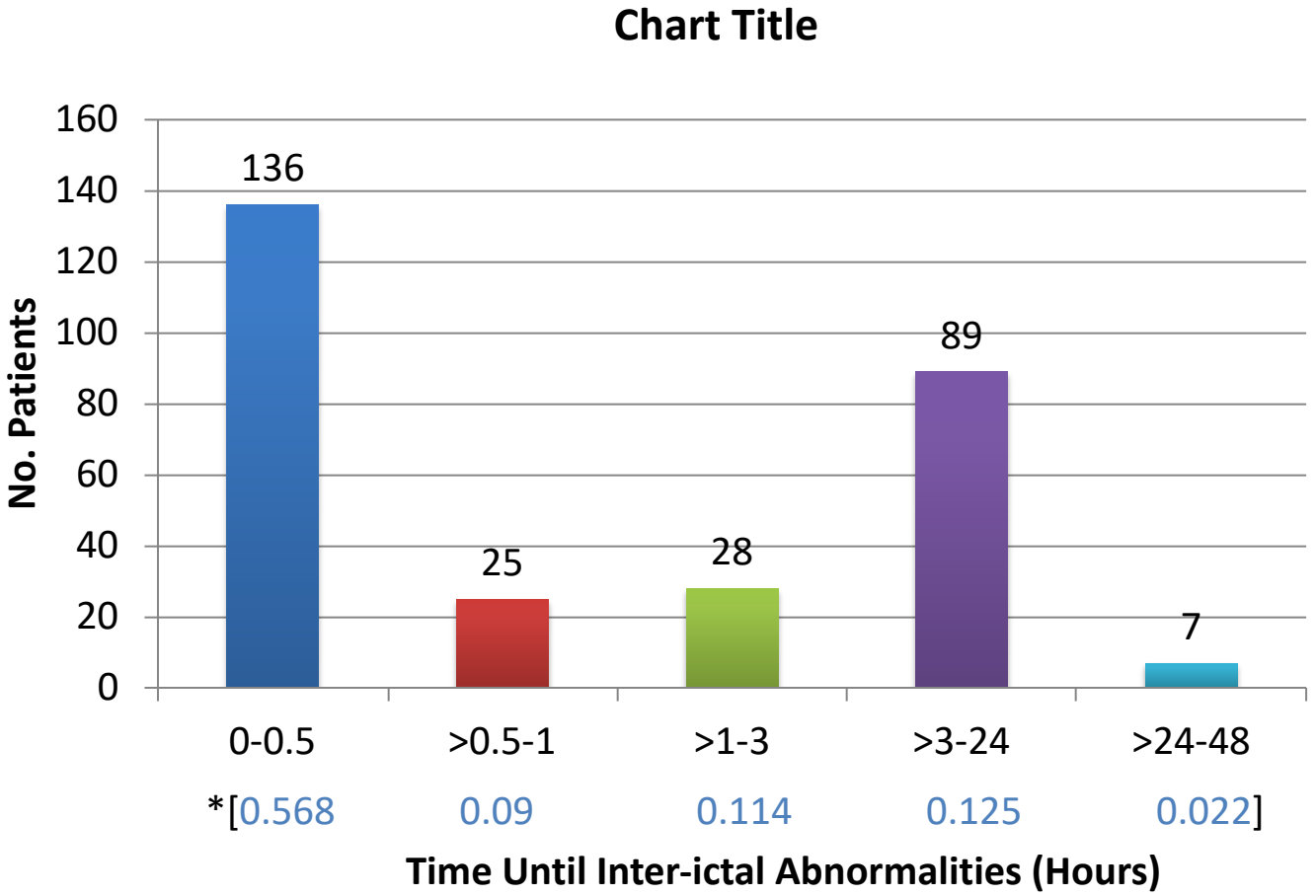


Of Those with Inter-ictal Abnormalities…



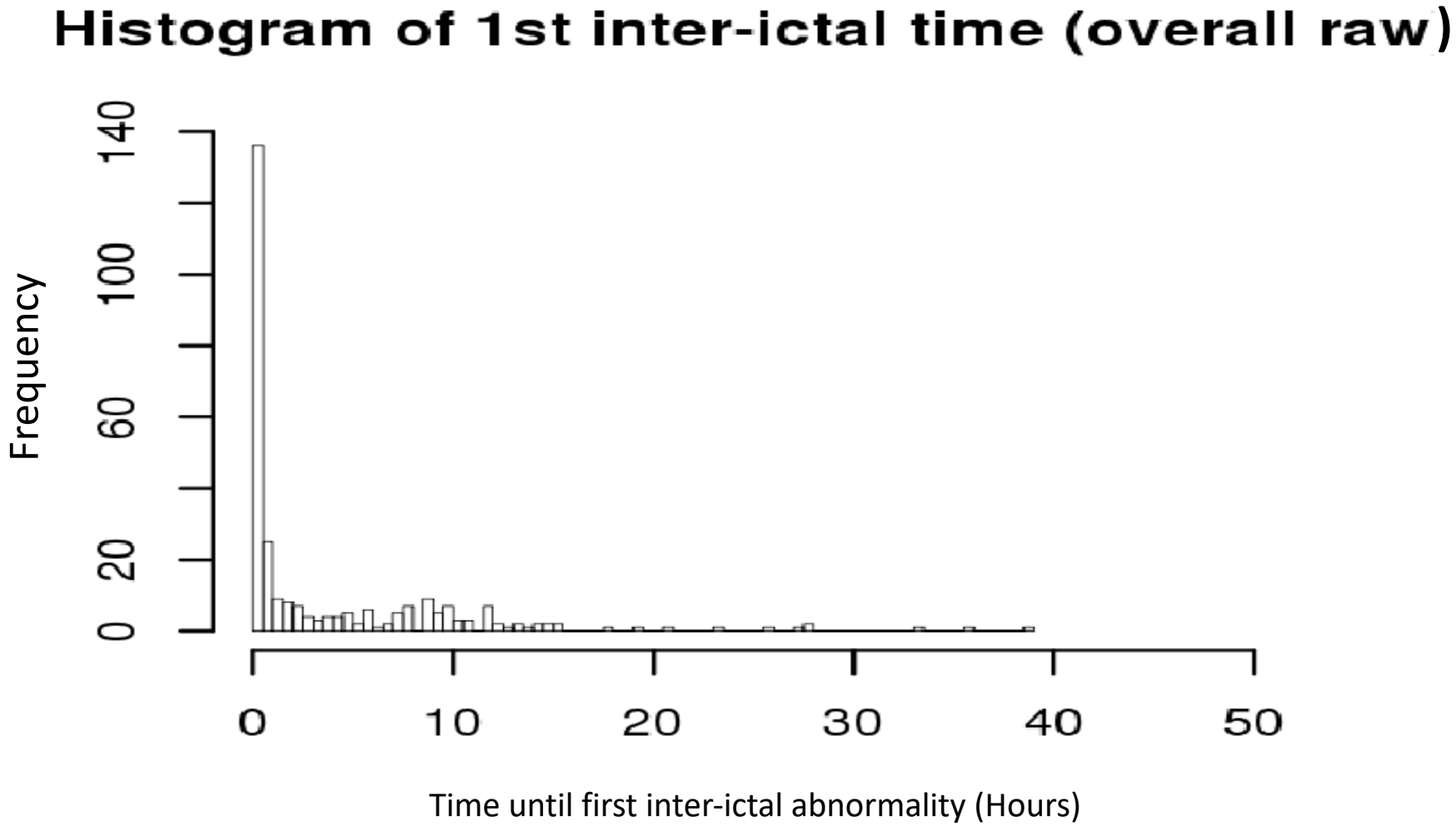
How Far into the Recording are the First Inter-ictal Epileptiform Abnormalities Seen?

- <1 minute up to 39 hours

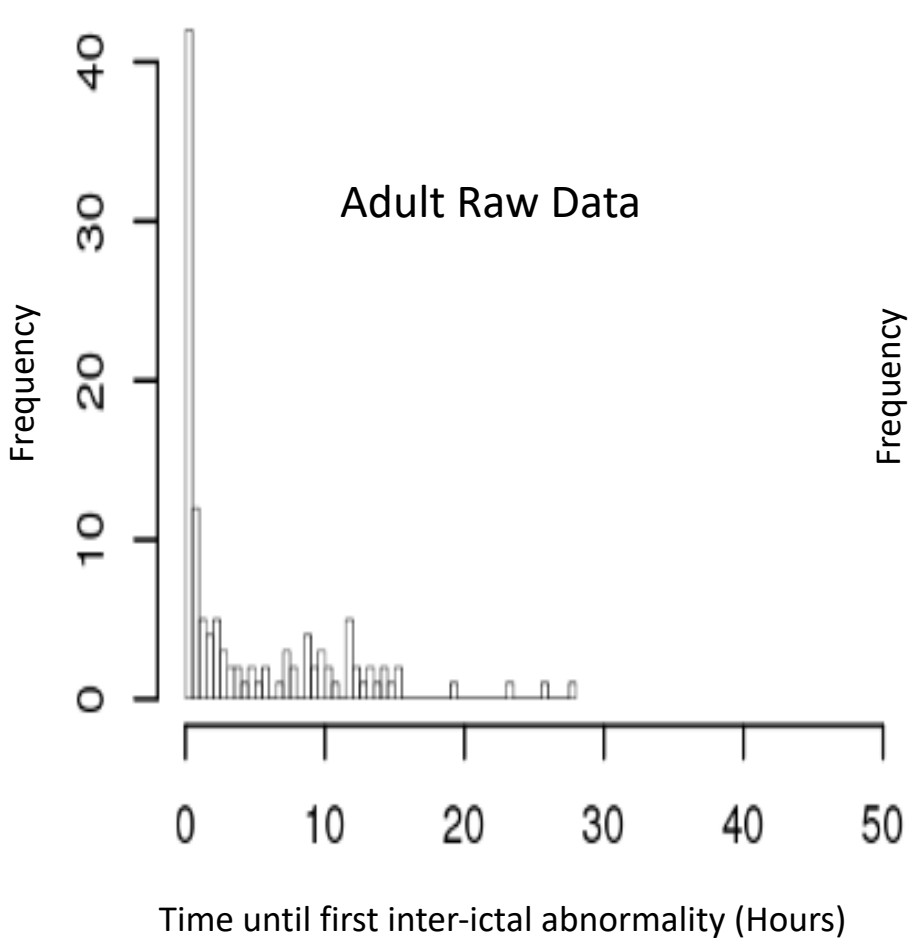


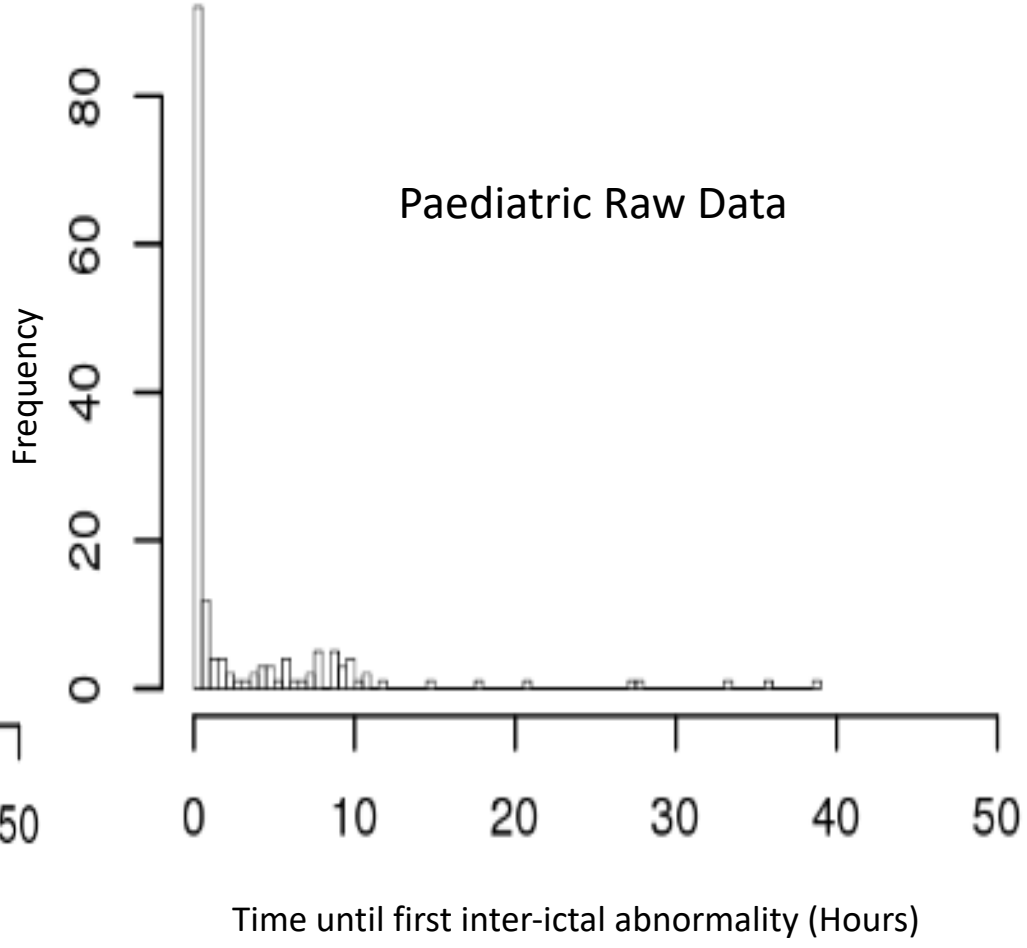
*mcmc method: based on generalized pareto distribution also 10000 times, the "likelihood"

First Inter-ictal abnormalities - Overall

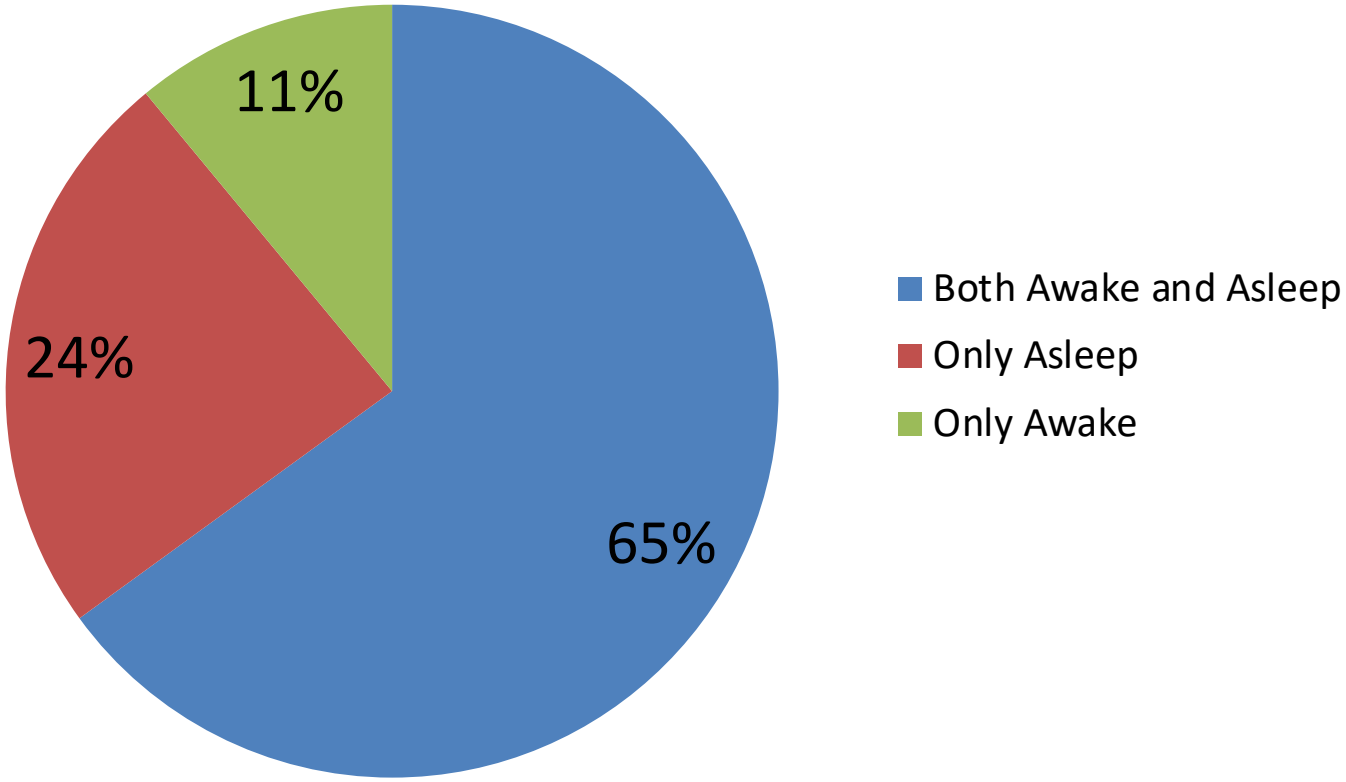


First Inter-ictal Abnormalities – Adult vs Paediatric

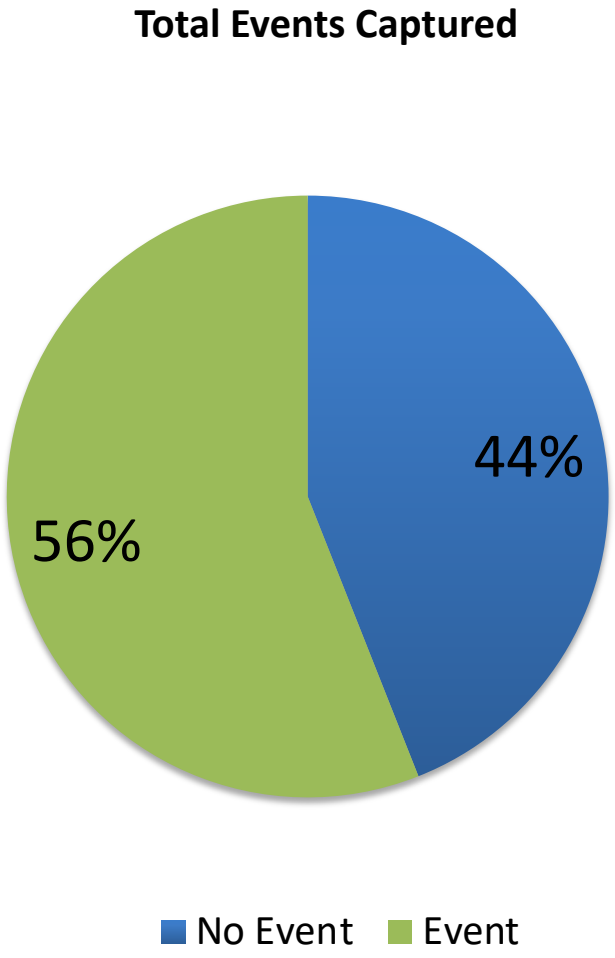


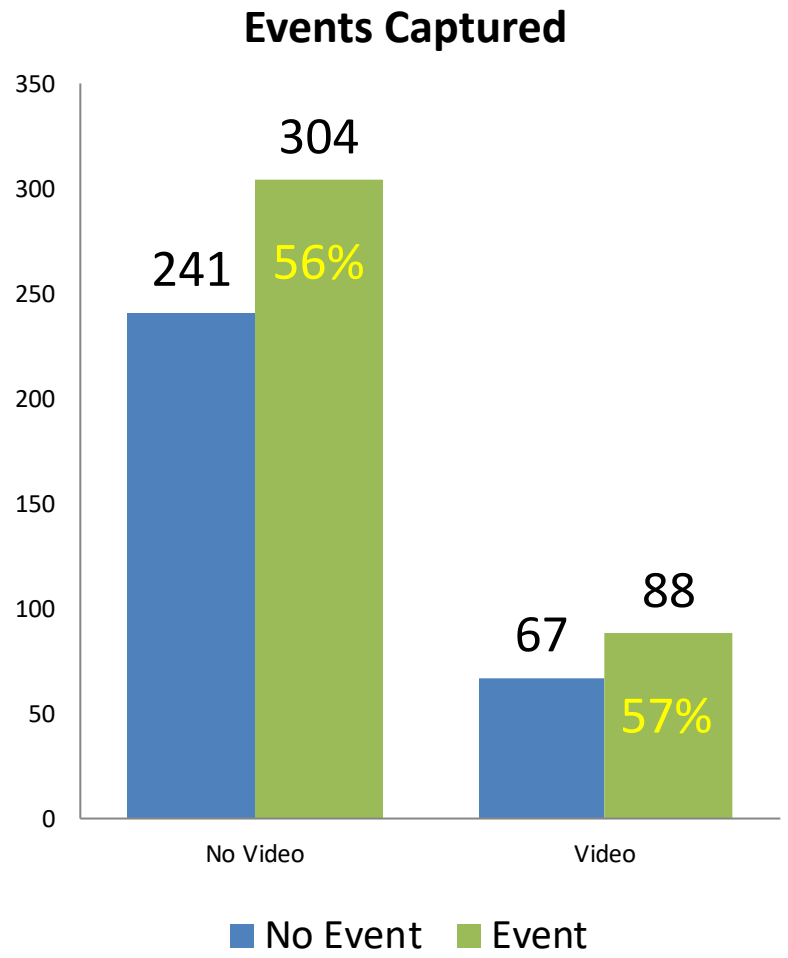


When Were Inter-ictal Abnormalities Seen?

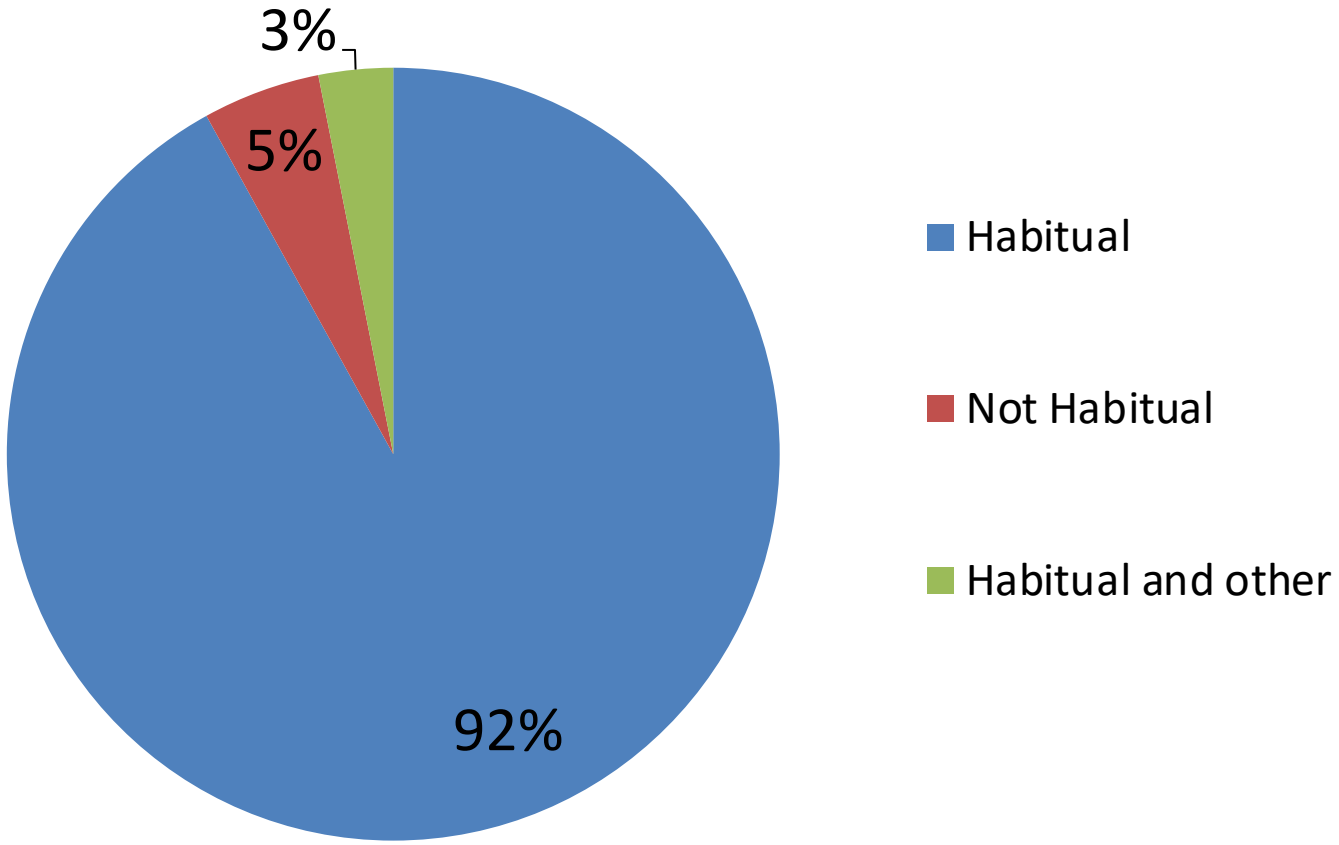


Were any Clinical Events Captured During the Recording?

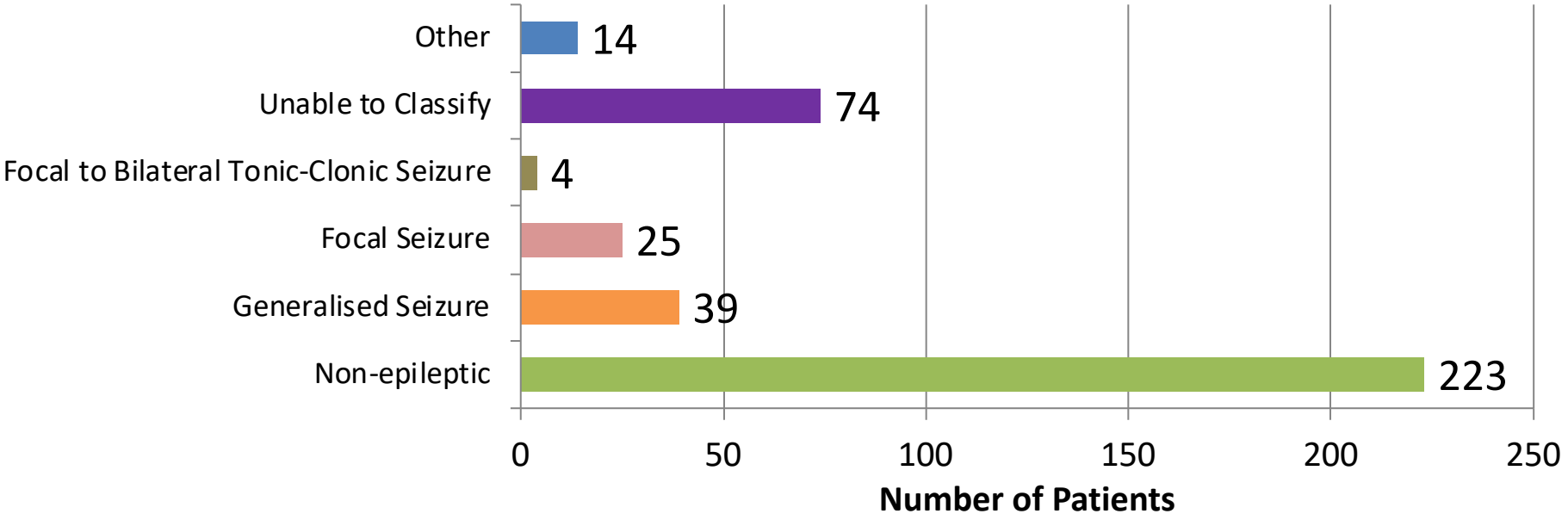


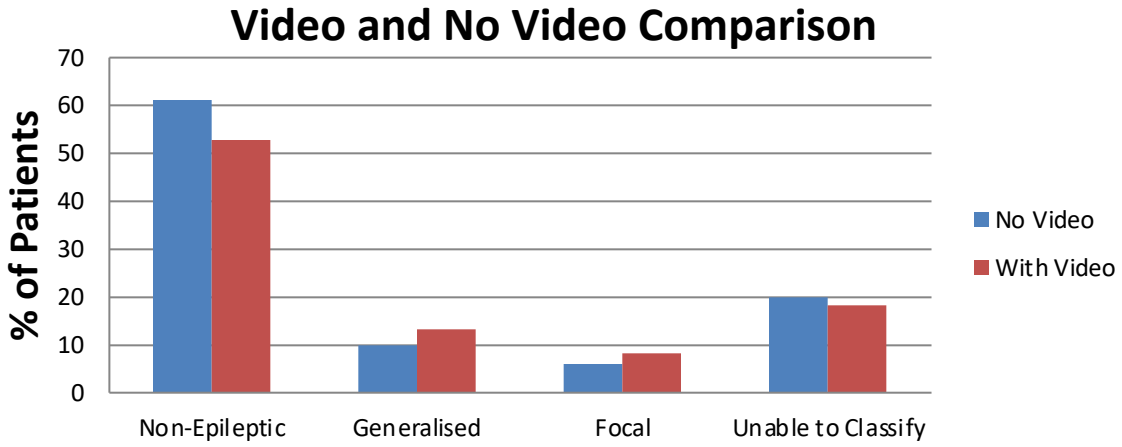


Were the Events Captured the Patient's Habitual Events?

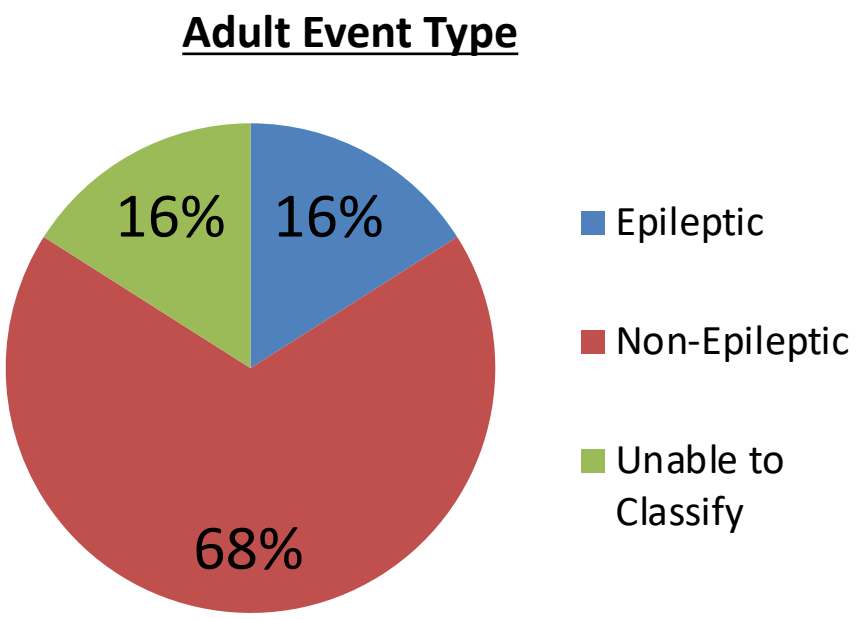


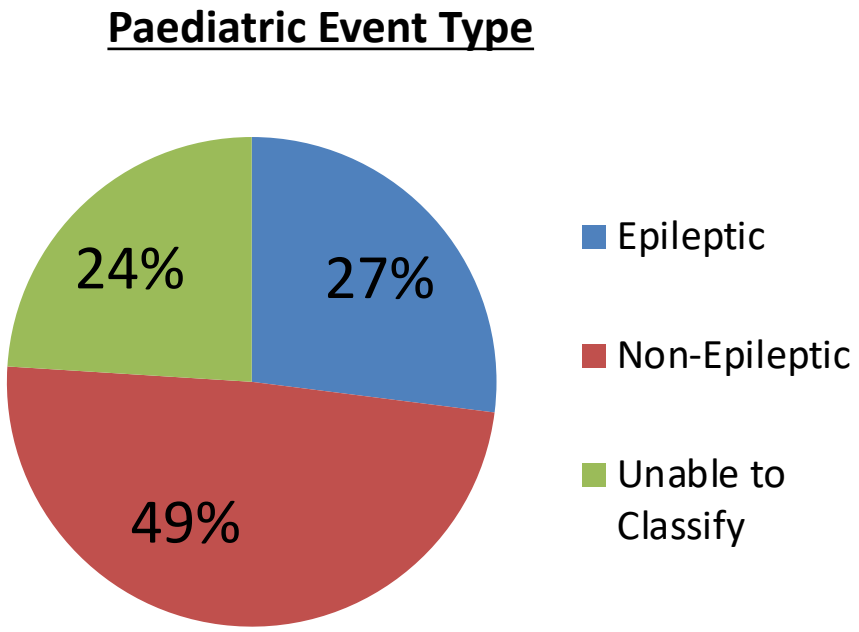
What Type of Clinical Event was Captured?





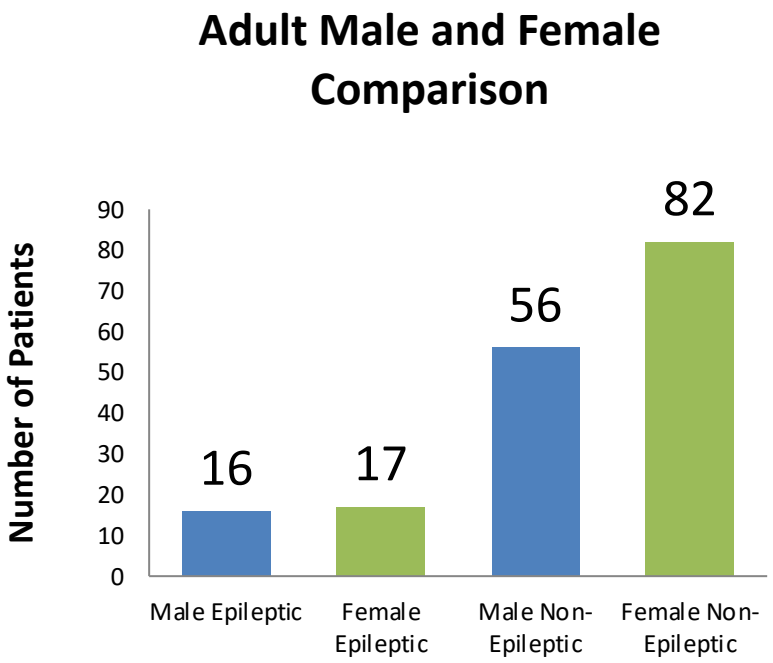
Adults vs Paediatrics Event Type

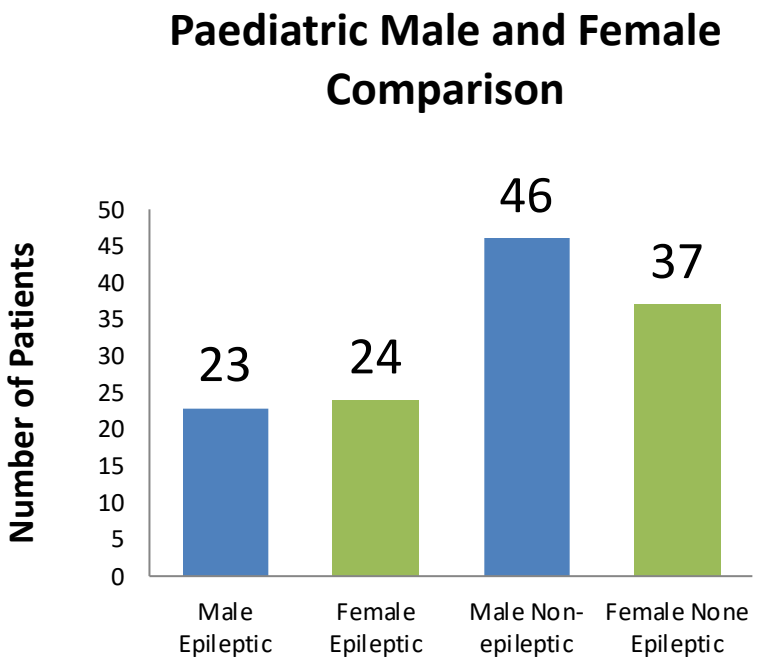




P<0.01

Male/Female Event Type

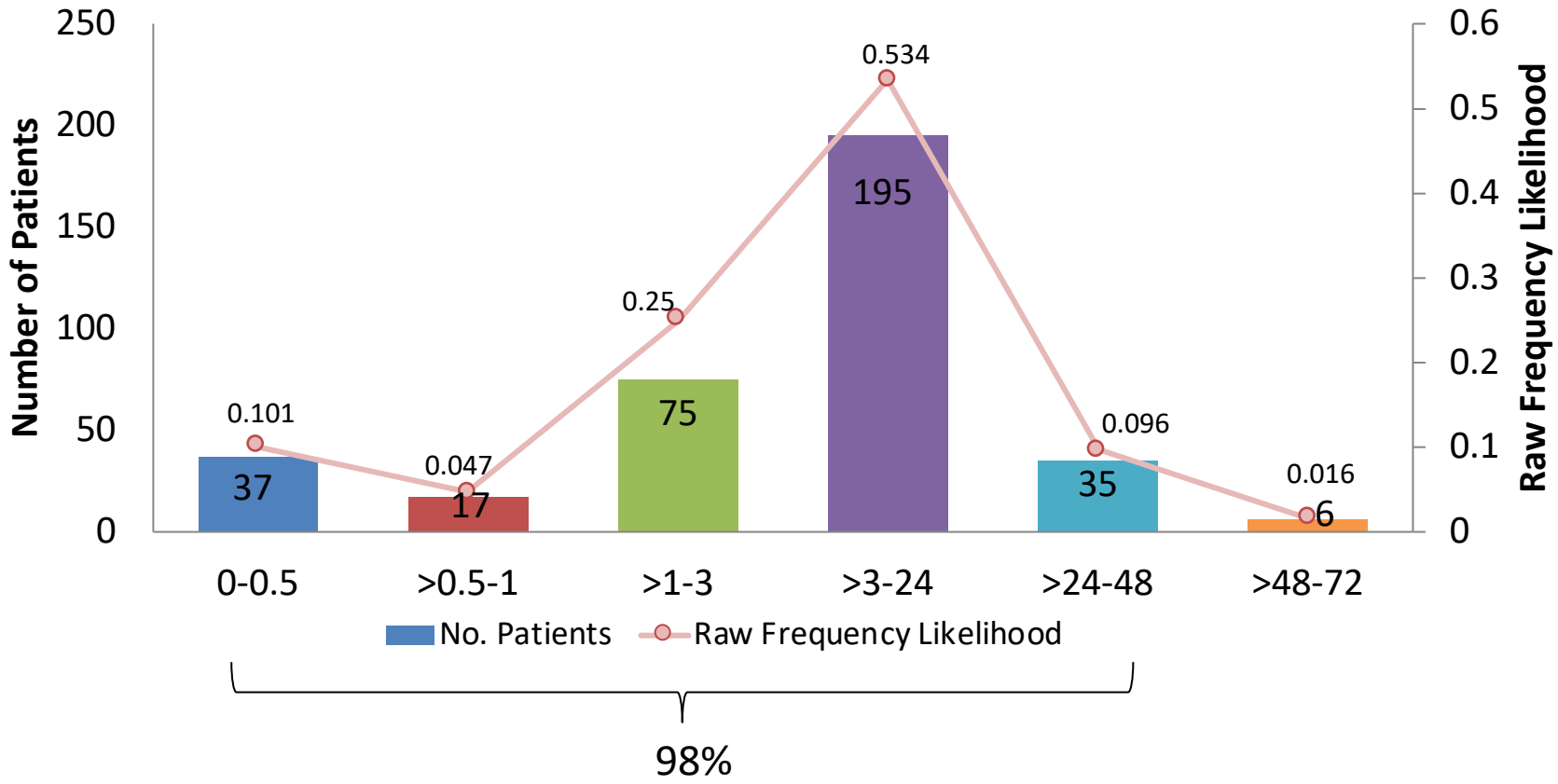




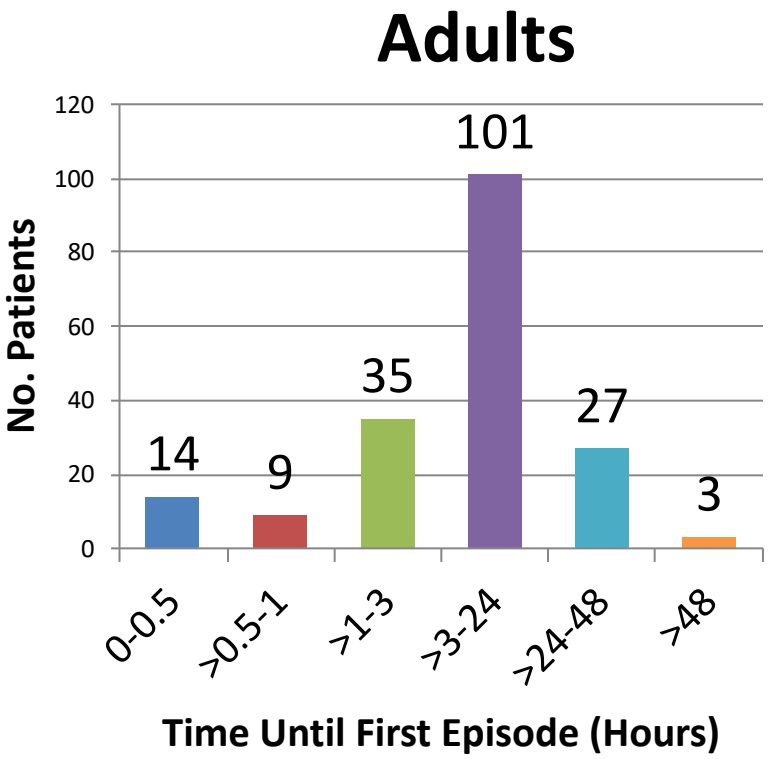
- P = 0.21

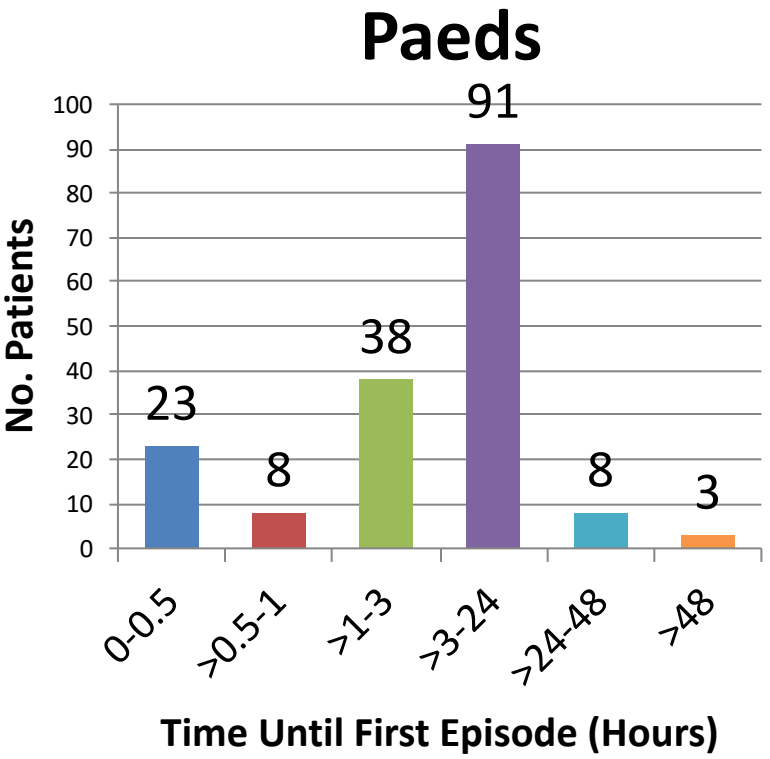
How Far into the Recording was the First Clinical Episode Captured?

- <1 minute - 62 hours
- ~ 10 hours - Average



Adult vs Paediatric

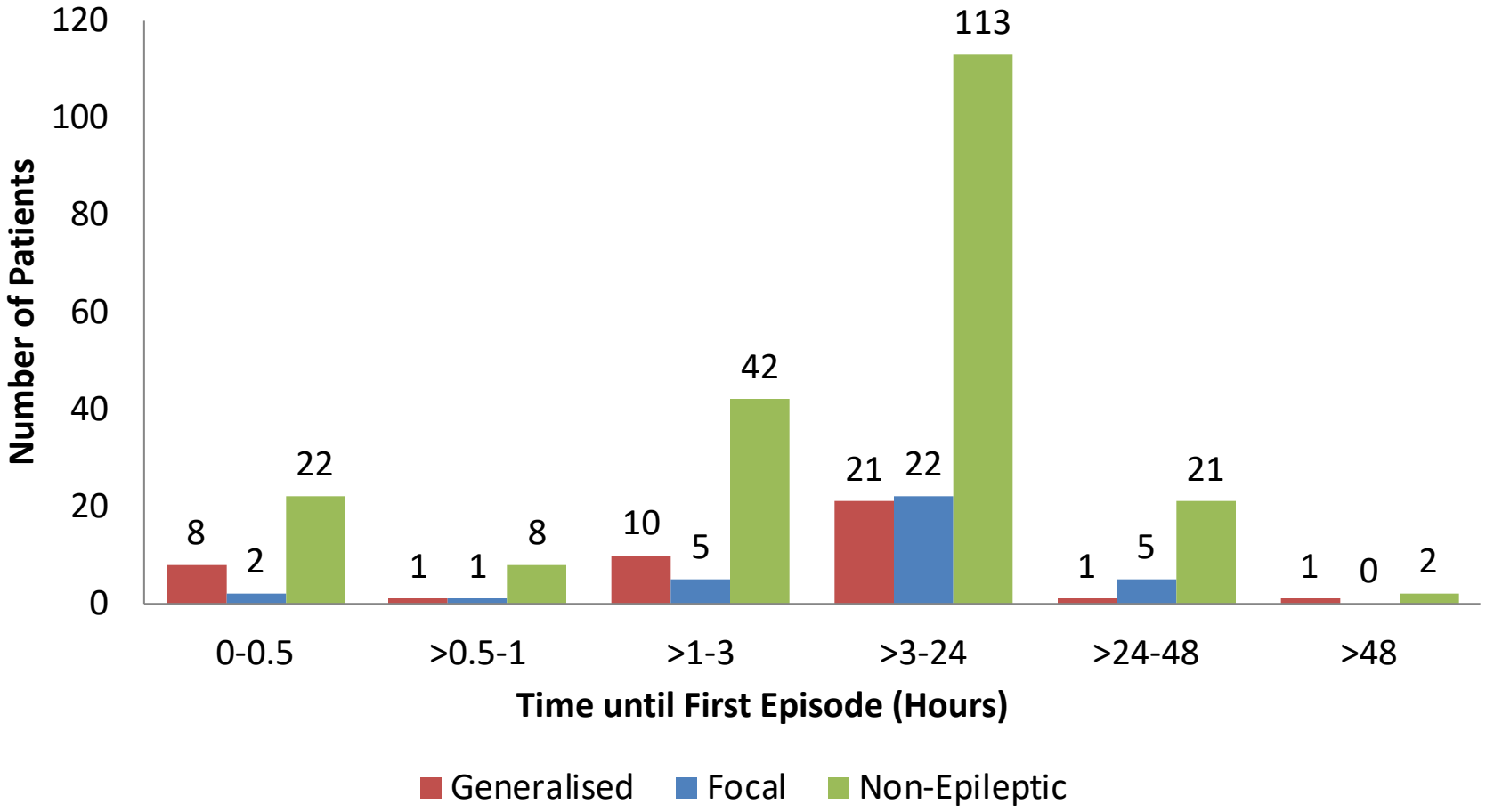




Raw Frequency Likelihood	0.065	0.049	0.179	0.543	0.147	0.016
MCMC Likelihood	0.04	0.04	0.142	0.632	0.121	0.025

Raw Frequency Likelihood	0.142	0.045	0.227	0.523	0.045	0.017
MCMC Likelihood	0.084	0.073	0.227	0.546	0.052	0.019

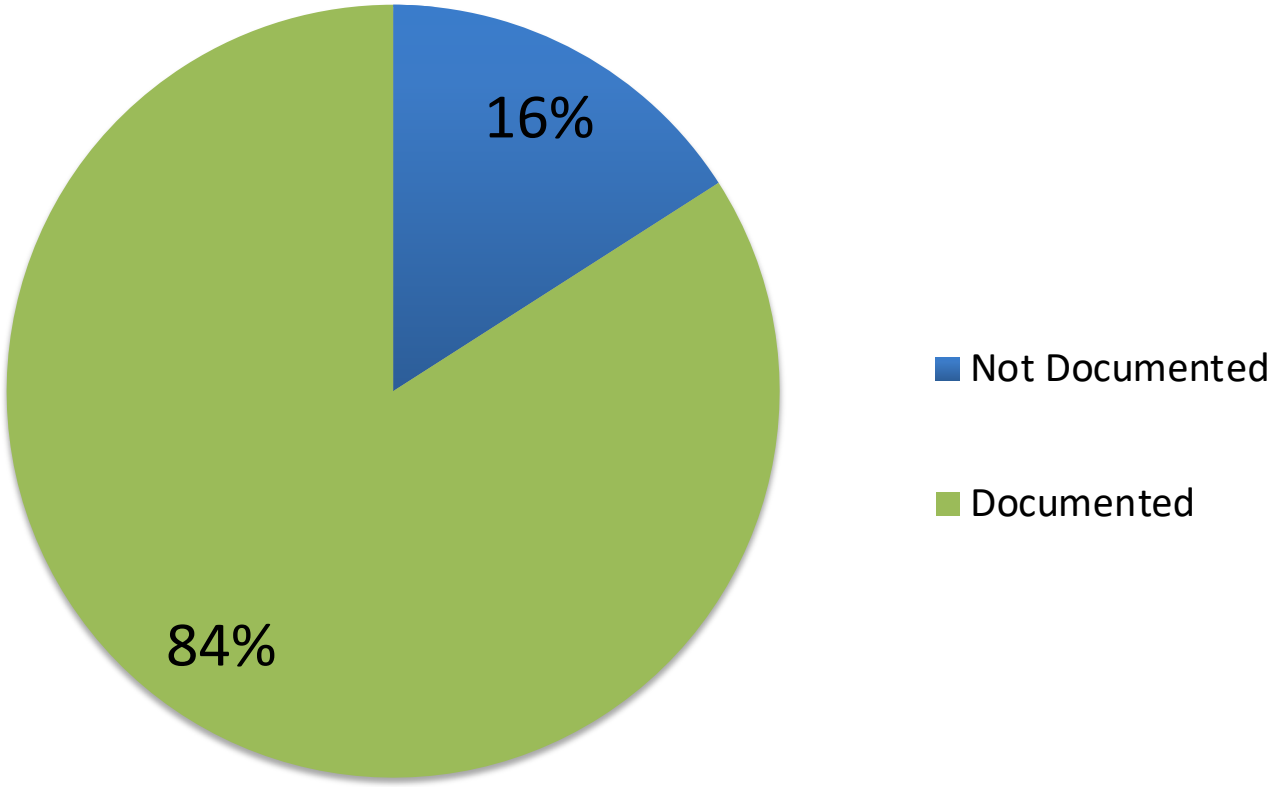
First Episodes By Type



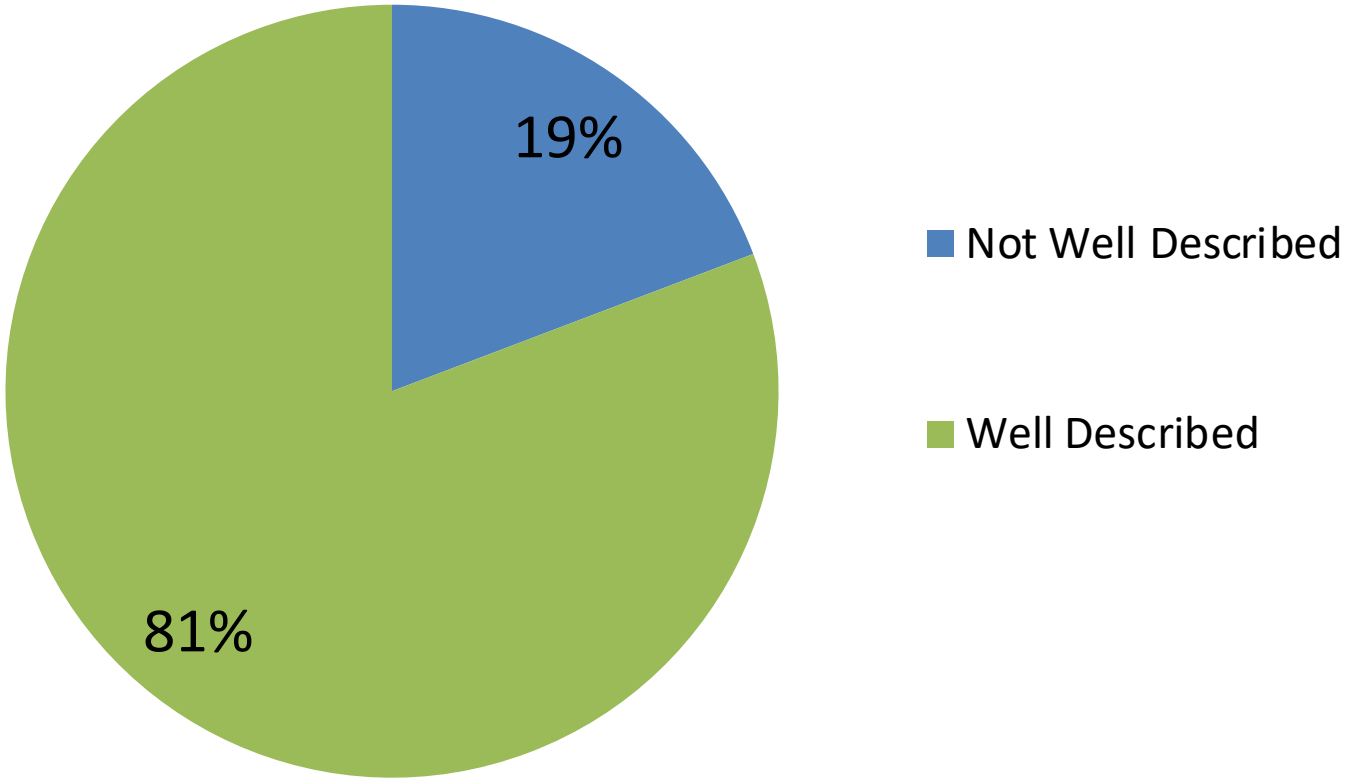
Frequency Verified/Not Verified

- Of those who had an episode during the recording:
  - 58% had their seizure frequency verified prior to the test.
- Of those who did not have an episode during the recording:
  - 48% had their seizure frequency verified prior to the test.
- P = 0.013

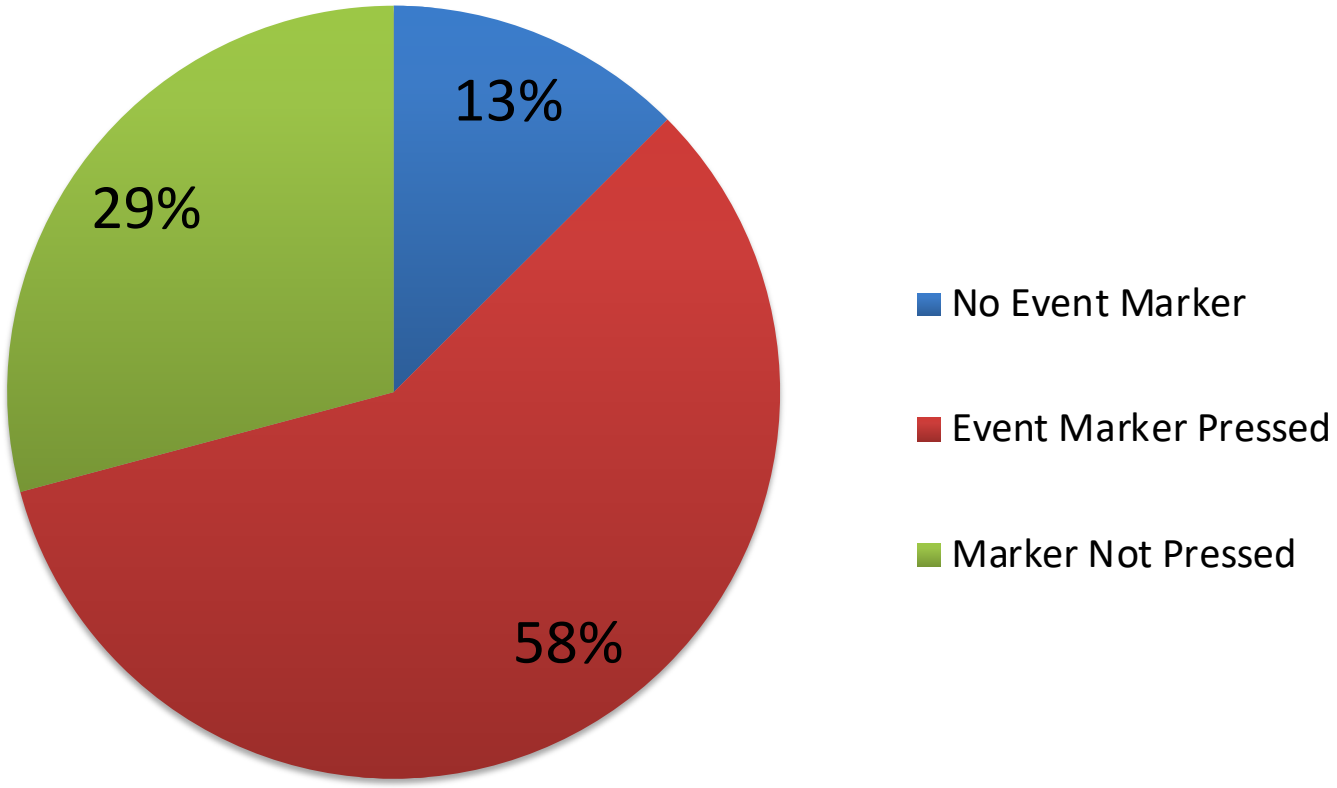
Were Clinical Events Documented by Patient/Carer?



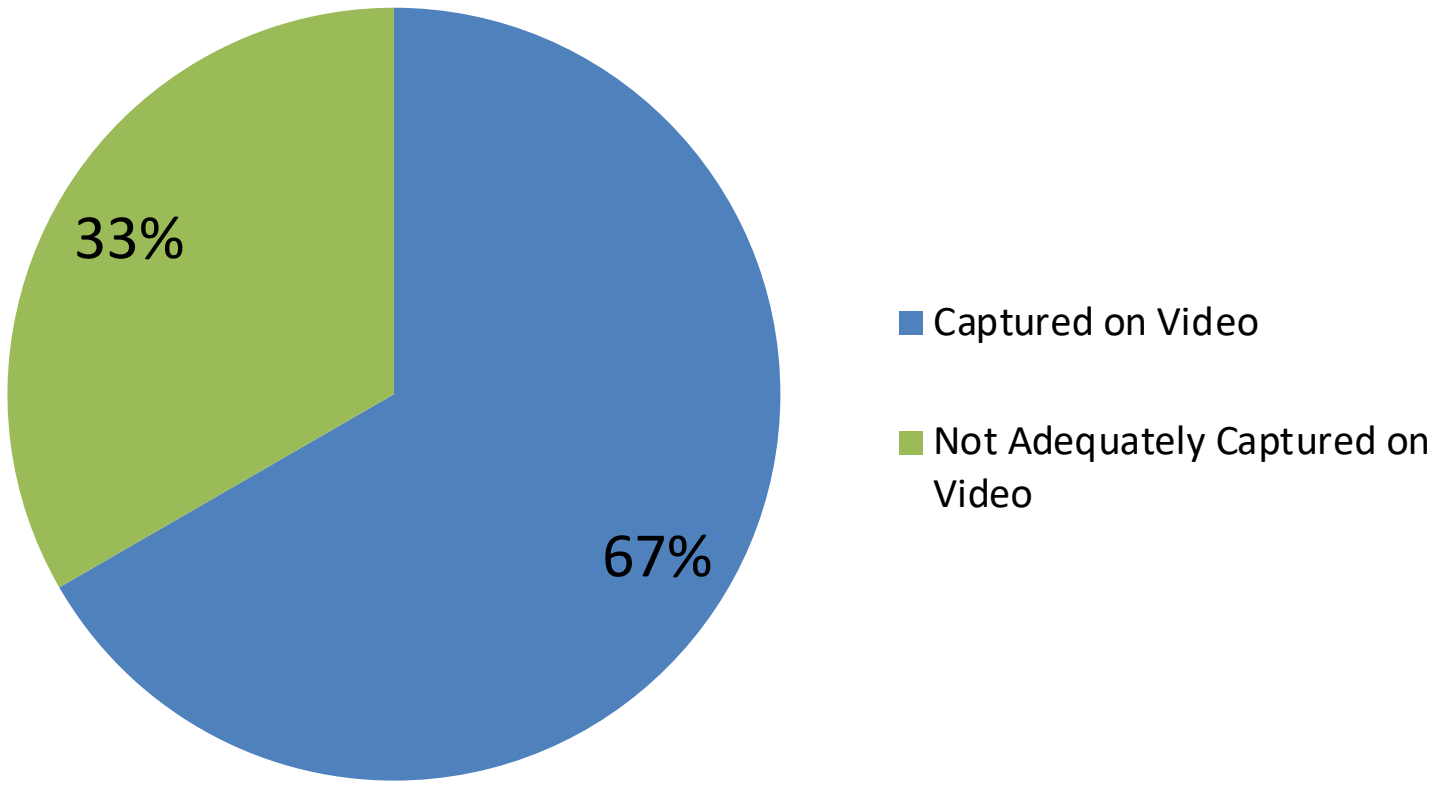
Were the Clinical Events Well Described by the Patient/Carer?



Was the Event Marker Pressed at the Time of the Events?



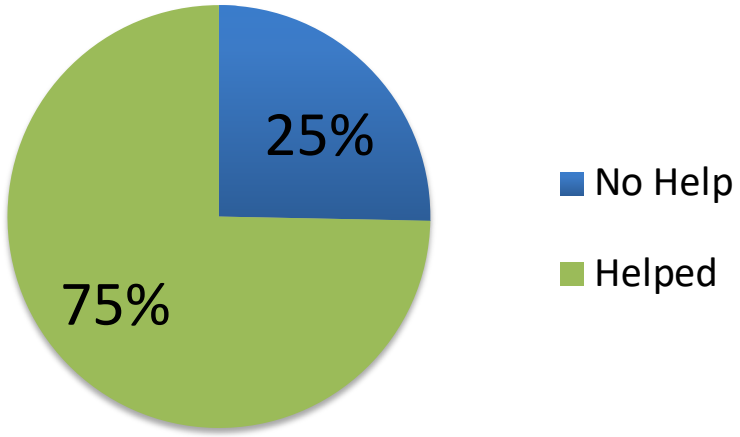
Were the Events Adequately Captured on the Video Recording?

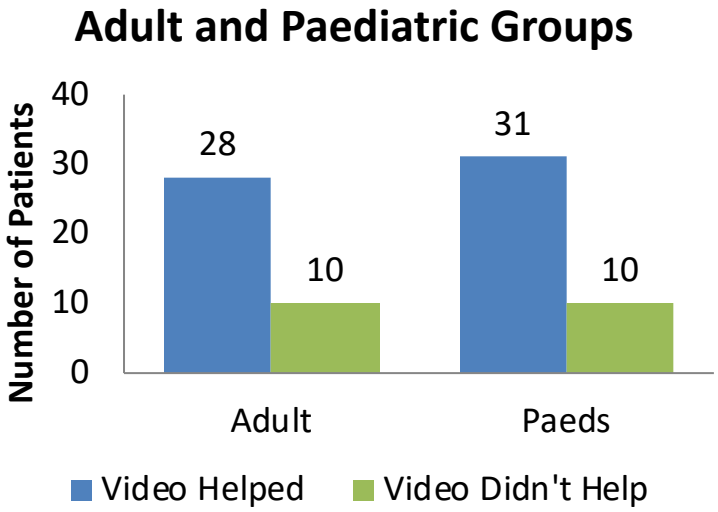


Problems Encountered with the Video

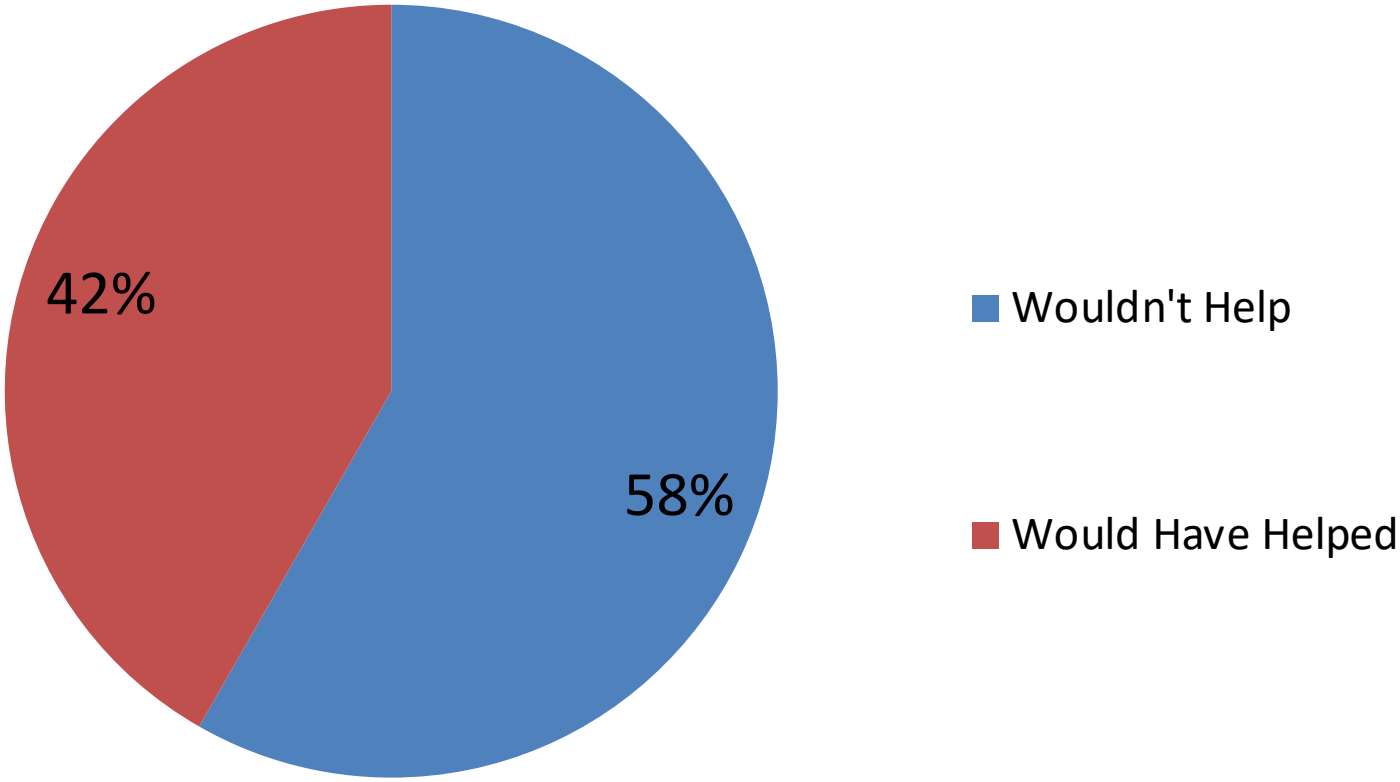
- Patient compliance
- Poor illumination
- Patient off camera/camera obscured
- Technical fault
- Unable to use video in public/at the toilet

Did the Video Aid in the Interpretation/Classification of the EEG?

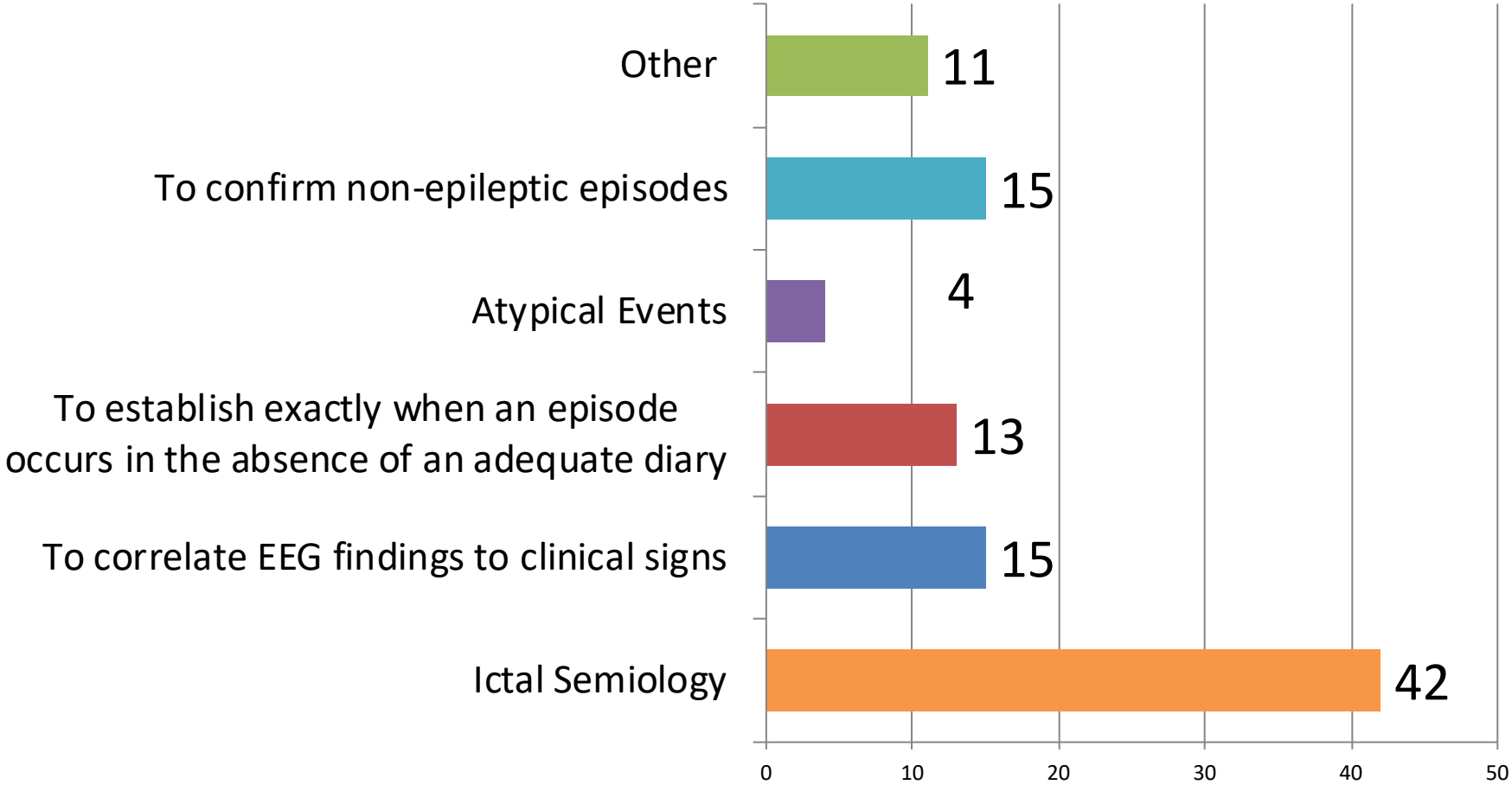




Would Video Have Aided Diagnosis/Seizure Classification?

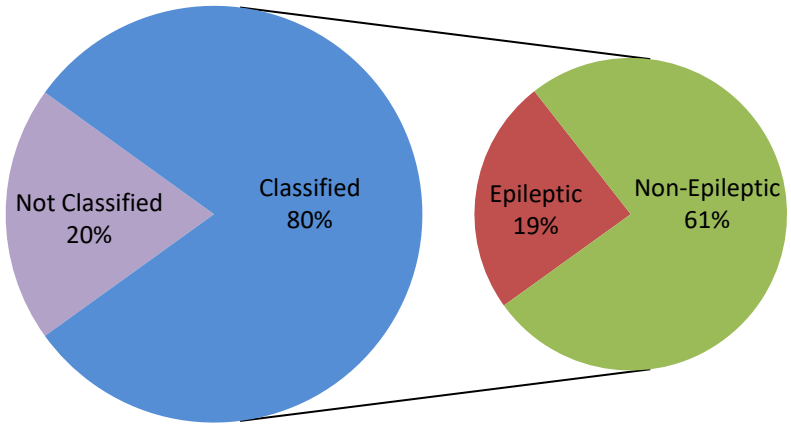


Reason Why Video Would Have Helped

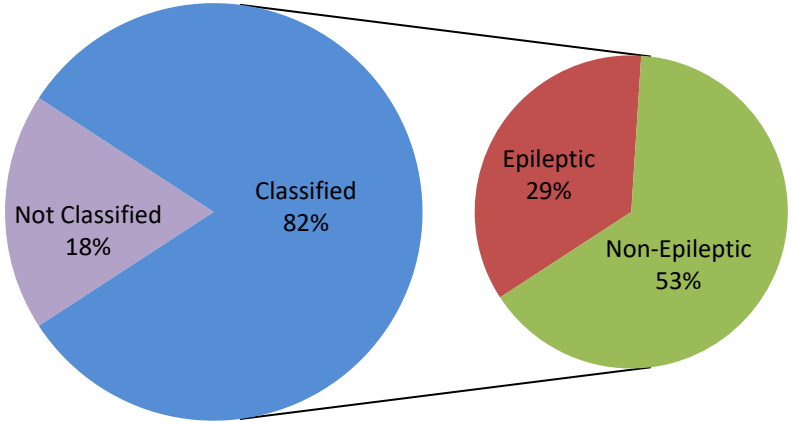


Diagnostic Yield

Ambulatory EEG – No Video



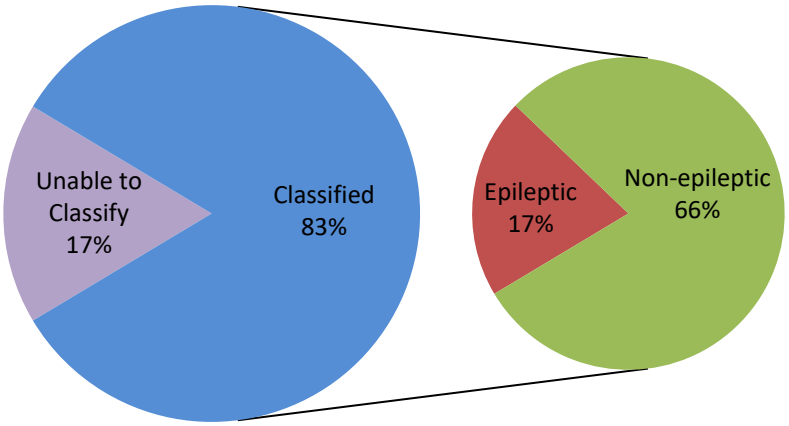
Ambulatory EEG - With Video



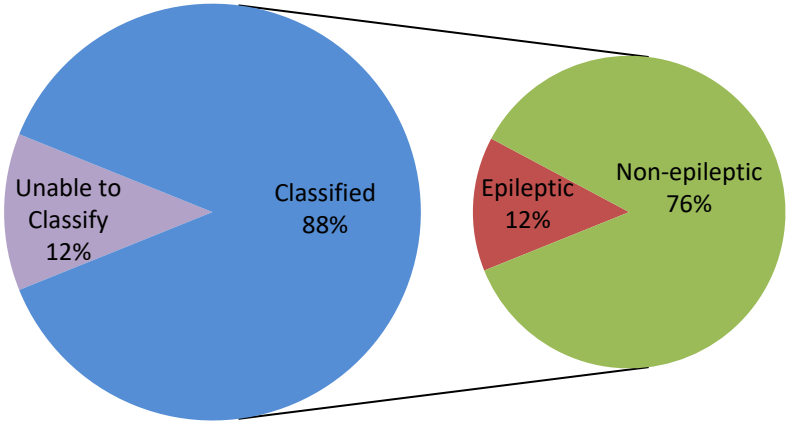
- Overall classification was seen to be comparable.
- VaEEG displayed a significantly higher incidence of Epileptic classification (p=0.046).

Diagnostic Yield - Adults

Ambulatory EEG - No Video

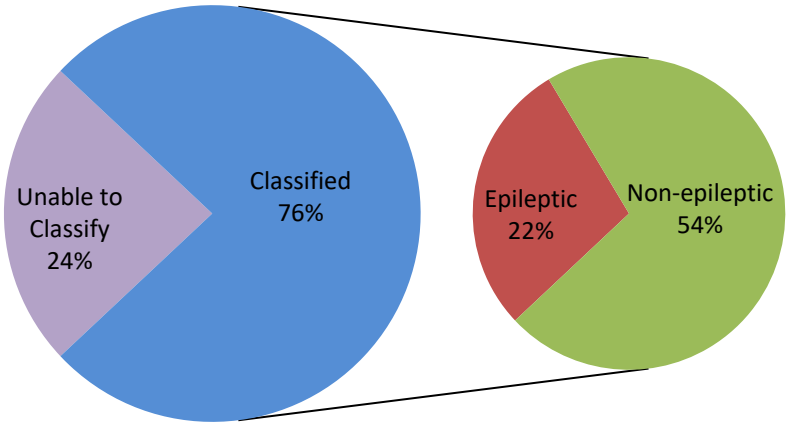


Ambulatory EEG - With Video

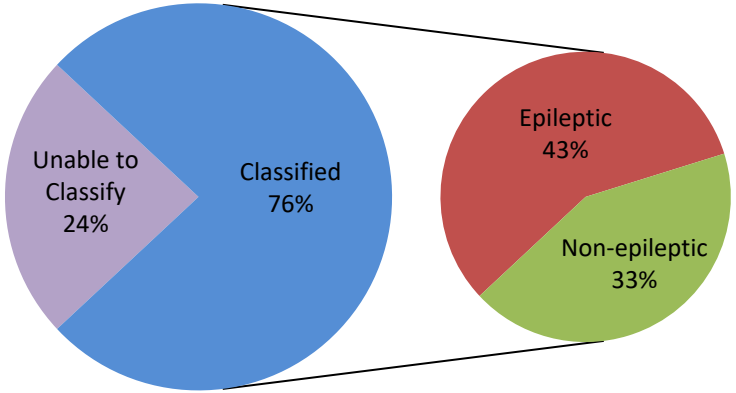


Diagnostic Yield - Paediatric

Ambulatory EEG - No Video



Ambulatory EEG - With Video



Were There any Adverse Events During the Recording?

- x6 skin reactions
- x3 issues relating to patient state
- x15 premature removal of electrodes
- x22 data acquisition failure
- x12 video fault or compliance issue

Skin Reactions

- x6 out of 709 patients (0.8%)

- x5 paediatric (3-11years)
  - x2 relating to shoulder ECG - red and raised on one occasion – no broken skin.(glued) (53.5 hours and 45.5 hours continuous)
  - x1 “mild” skin irritation at Fp1/2 (24 hours)
  - x1 “mild” skin reaction at Fz, A1/2 (26 hours)
  - x1 mild skin reaction at Fz and Cz – small abrasion (pt had cradle cap) (22 hours)

- x1 adult (50 years) (48 hours)
  - On removal of frontal polar and inferior frontal electrodes skin was red and raised with numerous pin prick white/pus spots.

Summary

- Time-locked VaEEG is being utilised by at least 50% of our sample departments, still only a small number appear to be using video exclusively for their recordings.

- The data showed that recording up to 24 hours is adequate for capturing first inter-ictal discharges .

- Where event capture is the main aim this could be extended to 48 hours if required.

Summary

- The diagnostic yield of both aEEG and VaEEG was found to be high at ~ 80%.
- Non-epileptic events account for the majority of diagnoses.
- VaEEG provided a significantly higher classification of epileptic episodes in paediatric patients.
- Although the audit showed that often aEEG without video was deemed adequate to achieve diagnosis, a significant proportion of reviewers felt that video would have helped.

Summary

- On the whole technical faults do not contribute greatly to unsuccessful studies.
- Serious adverse events were not seen in the prospective data capture.
- Adverse skin reactions in patients are uncommon (0.8%) but this is perhaps an underestimate of mild reactions.