

Safety of video telemetry units

Patient surveillance during seizures and other safety factors

Ros Kandler, Athi Ponnusamy, Catherine Pang, Jeremy Bland, Ming Lai, Gail Charlton

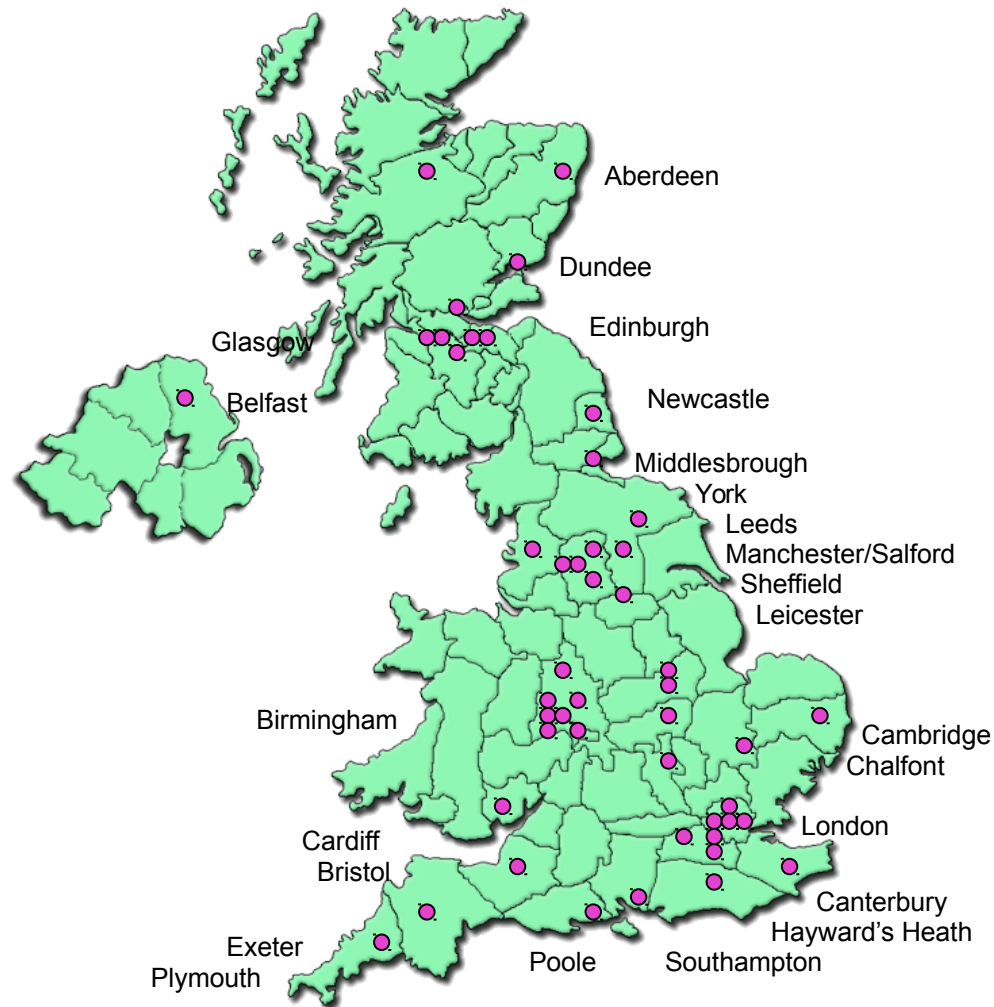
Aims

- Survey UK VT units on safety issues:
 - Guidelines and protocols
 - Types of unit and nursing intensity
- Measure
 - Incidence of adverse events during seizures
 - Level of nursing attendance to patients' seizures
- Make recommendations for appropriate patient surveillance in VT units

Methodology

- 63 forms were sent out
 - not all centres have a Video-telemetry (VT) unit
- 30 completed & returned from all areas of the United Kingdom
- 27 used for audit – 3 excluded for incomplete data
- 2 proformas
- Form A
 - I Guidelines
 - II Unit Infrastructure
- Form B
 - Seizures: first 5 from 5 patients
1/11/11 – 31/12/11
- Access database

Map Plot VT



FORM A : Please complete Parts I and II once only for each department

Postcode of Centre (Please complete)	
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I. GUIDELINES	
1. Do you use published guidelines for safety of video telemetry?	Yes/No
2. If so please give reference	
3. Do you use a local protocol for safety of video telemetry?	Yes/No
4. If so please attach copy	Attached/not applicable
5. Have you performed a local or regional audit on this topic?	Yes/No
6. If so please provide a summary and main recommendations.	
7. Can you remember any adverse events that occurred during video-telemetry regardless of how long ago they may have occurred?	Yes/No
8. If so, please give details and has there been a change in clinical practice as a result?	

- Subject matter of Form A I
- **A Retrospective** review of:-
- Procedure
 - Published guidelines
 - Local unpublished guidelines
- Adverse events

II. UNIT INFRASTRUCTURE

9. How many video-telemetry beds do you have?	
10. How many video-telemetry beds are in single occupancy cubicles?	
11. How many video-telemetry beds are in multiple occupancy bays?	
12. Do you have a dedicated unit for videotelemetry distinct from the general neurology or neurosurgery ward? If "Yes" please go to question 17 If "No" please go to question 13	Yes/No
13. How many beds are there on the ward in total?	
14. What is the minimum number of nurses*on the ward during the day?	
15. What is the minimum number of nurses on the ward during the night?	
16. Do your telemetry beds have nurses: (Please tick one option) If '2' please go to question 19	1. Dedicated to the VT beds or 2. Looking after the patients on VT as part of general nursing duties
17. If nurses are dedicated to telemetry or if it is a dedicated VT unit, how many nurses at any one time monitor the patient(s) during the day?	
18. If nurses are dedicated to telemetry or if it is a dedicated VT unit, how many nurses at any one time monitor the patient(s) during the night?	
19. Is the VT bed in direct view from the nurses' station?	Yes/No
20. How do the nurses monitor the patients? Please tick all that apply	TV or computer monitor at a nurses station Nurses sitting outside the patient's room Nurses sitting within the patient's room Alarms Other eg via relatives, carers
21. Is ECG monitored for all patients undergoing VT?	Yes/No
22. Can the nurses monitoring the patient easily see the ECG?	Yes/No
23. Is there a cot-side policy?	Yes/No
24. If so what is it?	
25. Overall do you find the intensity of nursing care appropriate?	Yes/No

*For the purposes of the questionnaire, the term 'nurses' includes unqualified healthcare assistants, support workers etc

Form A II VT Unit Infrastructure

- Bed number: Bay vs Cubicles
- Dedicated Units/Nursing vs General nursing
- Nurse* to patient ratios day and night
- Health Care Professional = nurse or nursing assistant
- Seizure monitoring methods
- Other: ECG, cot sides
- Perception of appropriateness of intensity of nursing care

Results

Form A part I and II
Guidelines

Reviewed by Gail Charlton & Dr Ming Lai
RVI
Newcastle upon Tyne

Do you use published guidelines for safety of video-telemetry?

- NO 21/27 centres 77.8%
- YES 6/27 centres 22.2%

Of these 6 centres using published guidelines 4/11 relate to safety (36.3%)

Published Guidelines Used

- **BPNA Spring 2001 – VT Safety Audit**
- **Labiner DM, Bagic AI et al. - Essential Services, personnel, facilities in specialised epilepsy centres-Revised 2010 guidelines. *Epilepsia*, 51(11): 2322-2333, 2010**
- **Noe, K.H. and Drazkowski, J.F (2009), *Mayo Clinical Proc* 84 (6):495-500**
- **Association of Advancement of Medical Instrumentation 1993 (Equipment safety)**
- **NICE Guidelines 2004 - *Guidelines on diagnosis and management of epilepsy in adults and children (guideline G20)***
- **Guideline 12 - *Guidelines for Long Term Monitoring for Epilepsy (2008), Journal of Clinical Neurophysiology Vol 25, Number 3 pg 170-180***
- **Tatum, W.O,(2001) - Long Term EEG Monitoring, *Journal of Clinical Neurophysiology* 18 (5):442-455**
- **ILAE commission report: recommendations regarding the requirements and applications for long term monitoring in epilepsy. *Epilepsia* 2007; 48: 379-384**
- **E1467-94 standard for transfer of digital neurophysiological data between independent computer systems (*American Soc. For Testing & Materials*)**
- **US DNP Guidelines 1985**
- **American Academy of Neurology 1989**

Do you use a local protocol for safety of video-telemetry?

- No 7 / 27 centres 25.9%
- Yes 20 / 27 centres 74.1%
- 15 centres included their protocols for review
- All centres mention some safety measures

Safety Measures Used by Centres

• Cot sides policy (either to use or not)	20 / 27	(74.1%)
• Record ECG (part of All)	27 / 27	(100%)
– ECG visible to ward staff	16 / 27	(59.3%)
• Leads tied together/attached to pt	4 / 27	(14.8%)
• Drug reduction policy	10 / 27	(37.0%)
– No reduction of drugs with long half life (phenytoin, phenobarbitone)		
– No drug reduction for pregnancy		
– Not reduced if >1 tonic clonic sz / month		
– Drugs to be reinstated for 24 hours prior to discharge		
– Venflon in situ for rapid drug administration if required for sz or status		
• Importance of being in camera view	6 / 27	(22.2%)
• Close supervision of patient	4 / 27	(14.8%)
• Measure O2 saturation	2 / 27	(7.4%)

Safety Measures Used cont.....

- Bathing /showering forbidden policy 4 / 27 (14.8%)
- Electronic tagging of patients 1 / 27 (3.7%)
(if pt is at risk of post ictal confusion & wandering)
- Falls / trips risk assessment policy 3 / 27 (11.1%)
- Patient alarms 2 / 27 (7.4%)
- Alteration to environment 2 / 27 (7.4%)
- Patient safety notices provided 2 / 27 (7.4%)

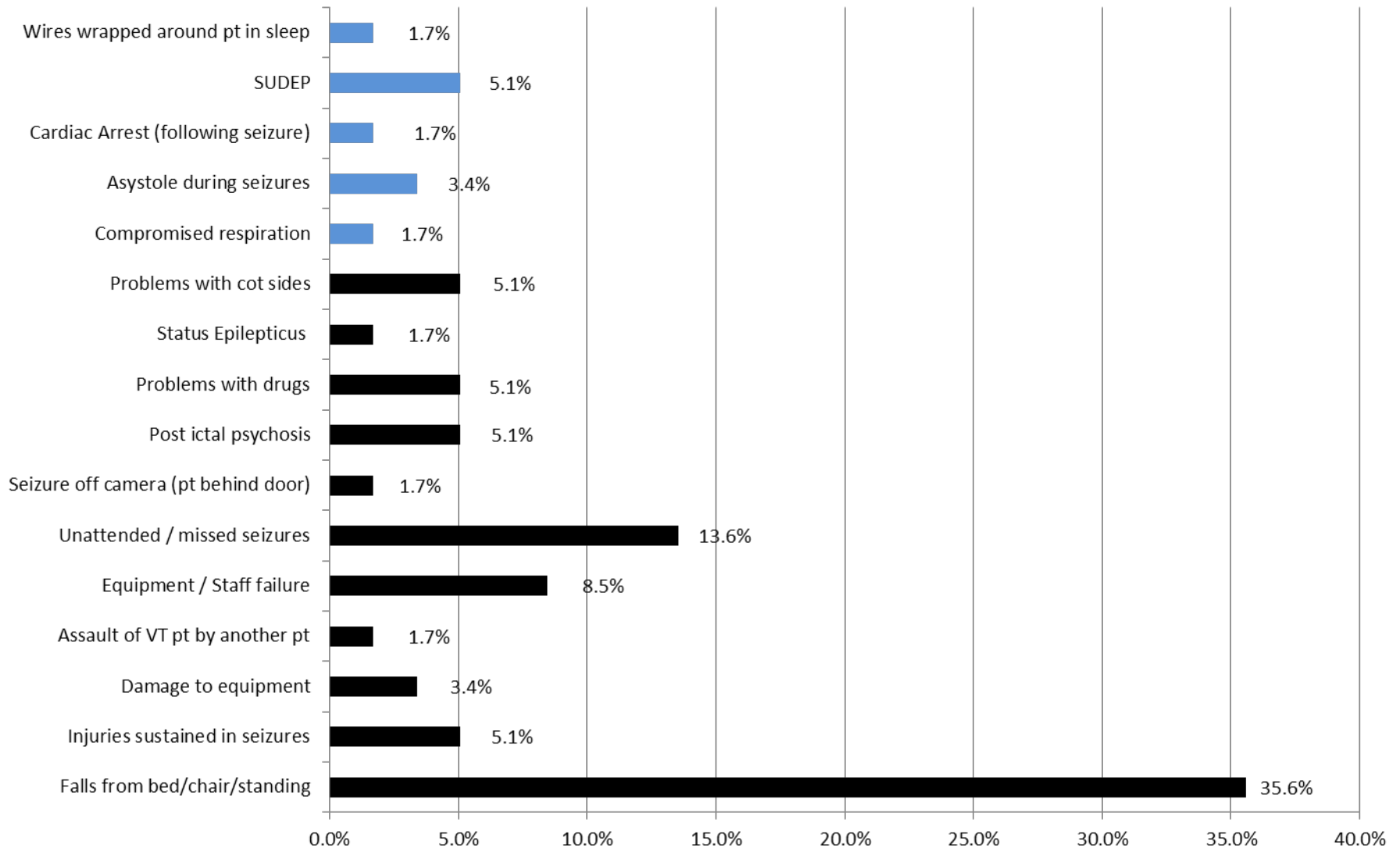
Have you performed a local or regional audit on this topic?

- No 18 /27 centres 66.7%
 - Yes 9 ^{*}/ 27 centres 33.3%
- ^{*} Only 5 of the audits related to safety (18.5%)- the other 4 related to evaluation of the service

Can you remember any adverse events occurring during VT?

- No 2 /27 centres 7.4%
- Yes 25 /27 centres
92.6%

Adverse Events.



Changes in practice as a result of audit and adverse events- 27 centres

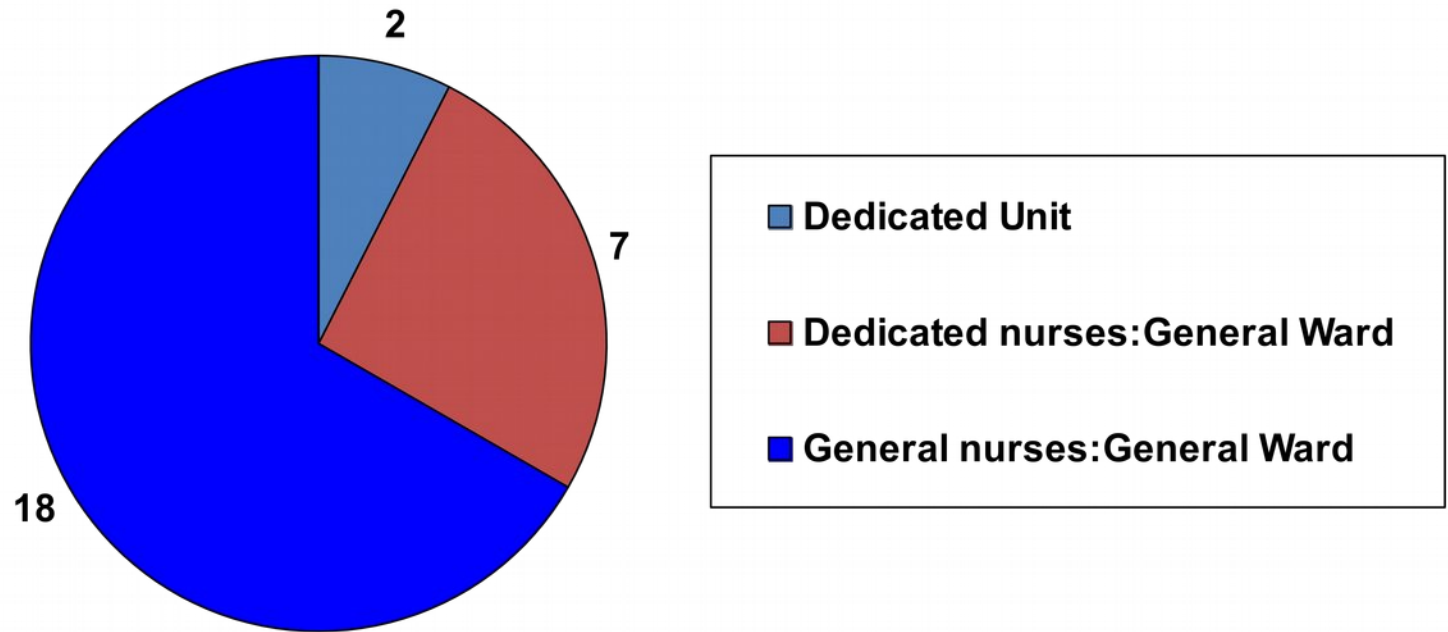
- Record O2 sats 1 (3.7%)
- Staff training in place 3 (11.1%)
 - Patient alarm
 - Seizure recognition
 - Interaction with patient during seizure
- Cot sides to be raised 7 (25.9%)
- Cannulation of all pts for drug reduction 1 (3.7%)
- Increase in staffing levels 2 (7.4%)
- 24hr hosp stay following drug re-introduction 2 (7.4%)
- Cardiac monitoring of all pts 1 (3.7%)

Changes in practice cont.....

- Dedicated staff/carer 4 (14.8%)
- Using sliding doors for en-suite 1 (3.7%)
- Risk assess each pt for falls 1 (3.7%)
- Attach leads to pt 1 (3.7%)
- No changes 4 (14.8%)
- Cot sides not used-lower bed 1 (3.7%)
- Low impact flooring 1 (3.7%)
- No sharp edges on furniture 1 (3.7%)

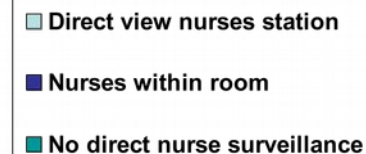
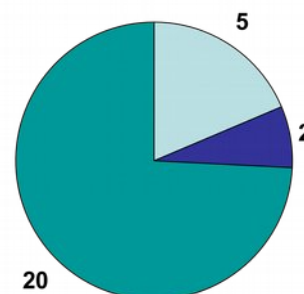
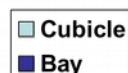
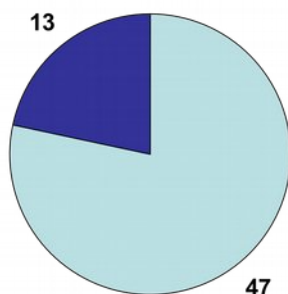
Findings from Form A II: Infrastructure

Results : 27 Units

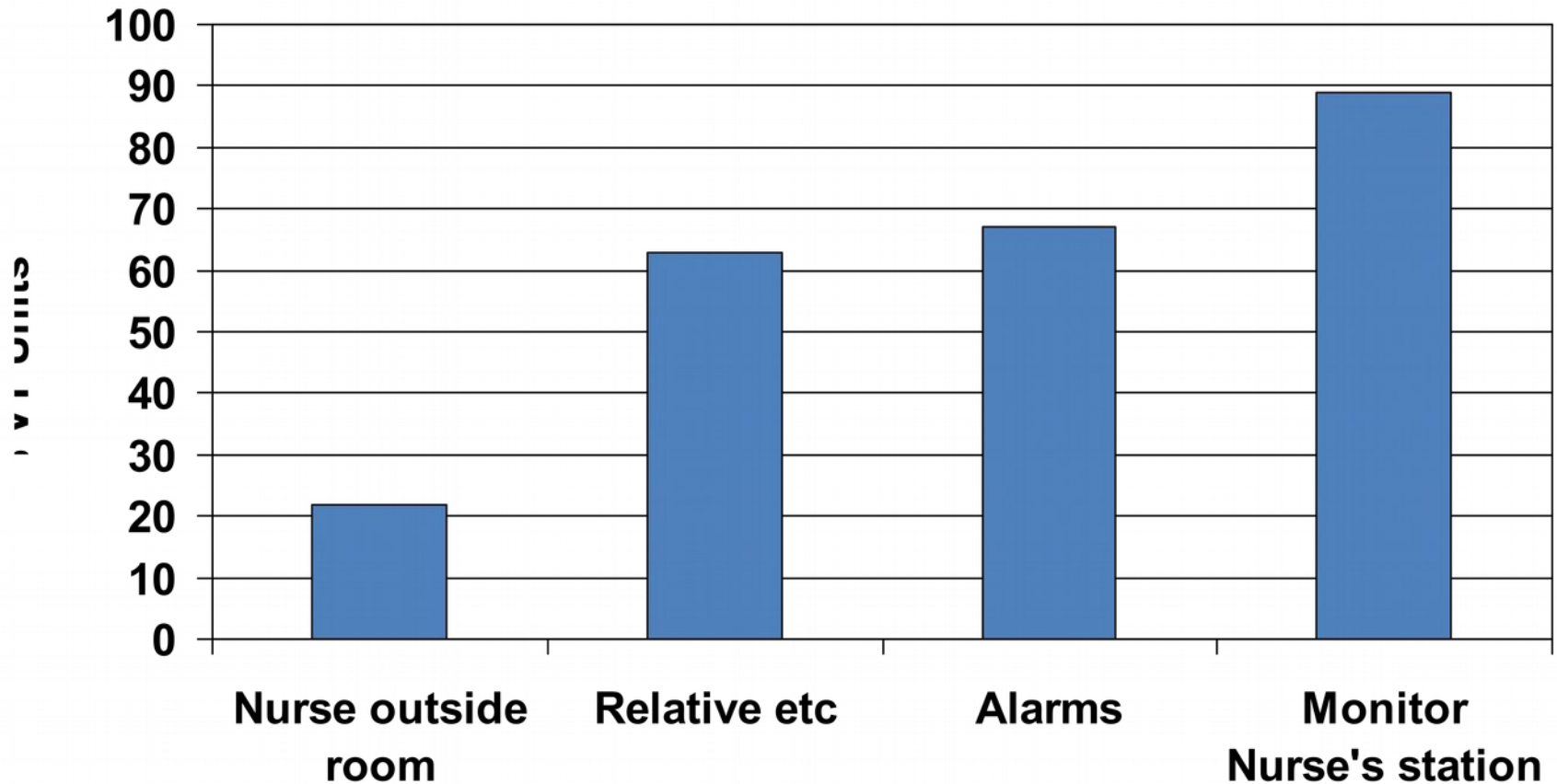


Nurse to patient ratios: Median 1:5 Range 1:1 to 1:15

60 beds: median 2/unit range 1 - 7



Other patient surveillance methods



Other safety issues

- All 27 units monitored ECG but only visible to nurses in 17
- 21 units had a cot side policy:
 - Up in 18
 - Down in 2
 - Not stated in 1
- Only 12/27 units thought intensity of nursing was appropriate

Regarding : “All 27 units monitored ECG but only visible to nurses in 17”

- In the part A1 audit (Mrs Gail Charlton)
- Cardiac based adverse events are common
- Of the 27 centres retrospective survey of adverse events 6 cardiac based events have occurred at 5/27 centres
- SUDEP 3 events in two centres.
 - Both centres ECG recorded and visible
- Asystole during sz (1 centre)
 - ECG recorded, not visible
- Cardiac arrest following multiple sz (1 centre)
 - ECG recorded and visible
- “Bradycardia/potential asystole” (1 centre)
 - ECG monitored, not visible
- (5 centres in total)

A1 and All Conclusions 1

- Very few centres use published guidelines for safety of VT – very few published guidelines
- The majority of centres use a local protocol
- However, implicit practice exists –not all steps are written down-no uniform standard
e.g. ECG- only 22% centres state recording ECG in protocol but 100% actually do.
- 33% of centres have done a VT audit

AI and All conclusions 2

- 92.6% can remember an adverse event occurring -only 18.5% have looked at safety issues
- The most common adverse events are falls
- Missed events and seizures
- 5/27 SUDEP or cardiac rhythm disturbance
 - Centres that have not experienced this have been fortunate
 - All centres record ECG for post acquisition analysis
 - But many centres the ECG is not available for review in real time

AI and All conclusions 3

- The development of VT units around much of the country has been done on a shoe string
- We have been learning as we have gone along
- The issue of safety and having appropriate infrastructure is high in the minds of physicians related to VT units
- The time is ripe to formalise our VT activities, working towards a conceptually uniform practice around the country

Patient Safety in Video Telemetry

Review of existing literature

Dr Athi Ponnusamy

*Consultant Clinical Neurophysiologist
Royal Hallamshire Hospital, Sheffield*

Introduction

- Long term video EEG monitoring is recommended:
 - differentiation epileptic from non epileptic seizures
 - classification seizure type
 - pre-surgical evaluation in intractable epilepsy
- Success depends on recording patient's habitual seizure.
- Patients at risk due to seizures and complications:
 - head injuries
 - soft tissue injuries
 - dental injuries
 - fractures
 - burns
 - SUDEP as a consequence of seizure related cardiac and respiratory complications

SUDEP in video telemetry units

	Dasheiff and Dickinson ⁵⁷ (SUDEP*)	Bird and co-workers ⁵⁸ (SUDEP)	Lee and co-workers ^{59†} (SUDEP)	So and co-workers ⁶² (near SUDEP)	McLean and Wimalaratna ⁶⁰ (SUDEP)	Thomas and co-workers ⁶¹ (near SUDEP)
Clinical data						
Sex, age (years)	Male, 48	Male, 47	Female, 41	Female, 20	Female, 50	Male, 18
Age at onset (years)	27	19	Infancy	1	4	14
Relevant history	Myocardial infarction at 38 years, angina	--	--	Recurrent post-ictal respiratory arrest	--	--
Seizure type	CPS	CPS + 2nd GTCS	Partial seizures	CPS + 2nd GTCS	SPS + 2nd GTCS	SPS + CPS
Nocturnal seizure	--	Yes	--	--	--	--
EEG focus	Left temporal	Right temporal	Left temporal	Bi-frontal	--	Right temporal
AEDs at admission	Phenytoin, carbamazepine, phenobarbital	Phenytoin, carbamazepine, gabapentin	Phenobarbital	Valproate, gabapentin, felbamate	Valproate, lamotrigine	--
Monitoring data						
Type of monitoring	Intracranial EEG	Intracranial EEG	Video and scalp EEG	Video and scalp EEG	Ambulatory EEG	Video and scalp EEG
Video	--	Yes	--	Yes	--	Yes
EEG	--	Yes	--	Yes	Yes	Yes
ECG	Yes†	-- §	-- §	Yes	--	Yes
Respiration	Visual inspection	Visual inspection	--	Visual inspection	--	Visual inspection
Description of event						
Time of event	Day time	Night time	Night time	Day time	Day time	Day time
Cluster of seizures	2 seizures in 1 h	5 seizures in <24 h	No	4 seizures in 6 h	No	7 seizures in 2 h
Type of last seizure	CPS	2nd GTCS	2nd GTCS	2nd GTCS	Unclear	CPS
Primary observation	Ictal or post-ictal cyanosis, cardiorespiratory arrest, immediate resuscitation, ventricular fibrillation on ECG, then terminal asystole	Post-ictal permanent flattening of EEG, right then left, followed by bradycardia for 2 mins, then terminal asystole	Post-ictal EEG slowing followed by marked suppression of EEG, then bradycardia and terminal asystole after 18 mins	Post-ictal central apnoea followed by bradycardia, asystole and EEG flattening after 10 s, 67 s, and 87 s, respectively	Polyspike ictal discharges for 52 s followed by abrupt and terminal flattening of EEG traces	Ictal obstructive apnoea (laryngeal spasm?) followed by bradycardia and asystole after 15 s and 27 s, respectively
Supervision	Yes	No	No	Yes	No	Yes
Resuscitation	Ineffective	Not done	Not done	Effective	Not done	Effective
Post-mortem findings	Marked lung congestion, less relevant findings¶	Mild lung congestion	No abnormality	NA	Mild lung congestion	NA
Interpretation	Cardiac arrhythmia	CNS shutdown	CNS shutdown	Central apnoea	CNS shutdown	Obstructive apnoea

Tomson T et al., 2008 (The Lancet Neurology)

SUDEP case reports

An Electroclinical Case-Control Study of Sudden Unexpected Death in Epilepsy.

Lhatoo, SD, Faulkner, HJ, Dembny, K, Trippick, K, Johnson, C, Bird, JM. *Ann Neurol* 2010;68(6):787–796.

OBJECTIVE: Sudden unexpected death in epilepsy (SUDEP) accounts for approximately 1 in 5 deaths in patients with epilepsy, but its cause remains unexplained. A recorded seizure resulting in death in our center appeared to suggest that postictal generalized electroencephalographic (EEG) suppression (PGES) and apnea are implicated in SUDEP. Our objective was to determine the association between PGES, as a possible identifiable EEG marker of profound postictal cerebral dysfunction, and SUDEP. **METHODS:** We studied 10 adult patients from our video-telemetry database who had 30 documented epileptic seizures during video-EEG recording and who later died of SUDEP. They were compared with 30 matching live controls with 92 epileptic seizures taken from the same database. Clinical and EEG findings were analyzed. **RESULTS:** PGES was seen in 15/30 (50%) case and 35/92 (38%) control seizures. A Mann-Whitney U test showed that PGES was significantly longer in the generalized motor seizures of the SUDEP group ($p < 0.001$). After adjustment for variables, odds ratio analysis of all seizures indicated significantly elevated odds of SUDEP with PGES durations of >50 seconds ($p < 0.05$). Beyond 80 seconds, the odds were quadrupled ($p < 0.005$). After adjustment for variables, for each 1-second increase in duration of PGES, the odds of SUDEP increased by a factor of 1.7% ($p < 0.005$). **INTERPRETATION:** Prolonged PGES (>50 seconds) appears to identify refractory epilepsy patients who are at risk of SUDEP. Risk of SUDEP may be increased in direct proportion to duration of PGES. Profound postictal cerebral dysfunction, possibly leading to central apnea, may be a pathogenetic mechanism for SUDEP.

BRIEF COMMUNICATION

Ictal hypoventilation contributes to cardiac arrhythmia and SUDEP: Report on two deaths in video-EEG-monitored patients

*Lisa M. Bateman, †Mark Spitz, and *Masud Seyal

*Department of Neurology, University of California, Davis, Sacramento, CA, U.S.A.; and †University of Colorado Health Sciences Center, Aurora, CO, U.S.A.

SUMMARY

Sudden unexplained death in epilepsy (SUDEP) is a common cause of death in patients with epilepsy, with cardiorespiratory dysfunction and a primary cessation of cerebral function proposed as causes. We report two cases of SUDEP in patients with intractable temporal lobe epilepsy undergoing video-EEG (electroencephalography) telemetry at two centers. Both had secondarily general-

ized convulsions. EEG, electrocardiography (ECG), and respiratory changes in these two patients are reported herein. Ictal/postictal hypoventilation may contribute to SUDEP with the resulting hypoxemia and acidosis leading to failure of recovery of cortical function and eventual cardiac failure.

KEY WORDS: Sudden unexpected death in epilepsy, SUDEP, Epilepsy monitoring unit, Hypoxemia, Hypercapnia.

SUDEP in the media



Introduction

- Adverse events need to be anticipated and prevented to ensure patient safety
- Reviewed literature for safety standards
 - Surveys
 - Guidelines

Surveys

An International Survey of Long-Term Video/EEG Services:

Fitzsimons, Mary; Browne, Geraldine; Kirker, John; Staunton, Hugh. *Journal of Clinical Neurophysiology* 17(1), January 2000: 59-67

Epilepsy Surgery Programme, Department of Neurology, Beaumont Hospital, Dublin, Ireland

To determine current practices in the provision of video-EEG services, the authors conducted an international survey by post. The aim of the survey was to evaluate, by reference to other centres, how and why certain things are done, be assured that their own center is providing a quality service, identify weaknesses in their service, and from this, set improvement goals and objectives. A purposive sampling method was used by sending questionnaires to 78 hospitals where it was believed a long-term video-EEG monitoring service existed. Completed survey questionnaires were returned from 42 centres. Although the survey mechanism may have resulted in self-selection bias, evaluation of the responses provides information on patient management, staffing levels, equipment, and equipment management. Ultimately, these data may aid in identifying a minimum set of requirements for the provision of a video-EEG telemetry service.

Summary

- To determine the current practice in the provision of VT to develop minimum set of requirements
- 42 units including 13 in Europe
- **77% continuously monitored by staff and/or relative**
- **52% had 24h dedicated nurses**
- **38% had nurse alarm bells**
- **64% had continuous ECG monitoring**
- Conclusion: risk management/quality assurance programs required
- **No specific guidance re staffing levels**

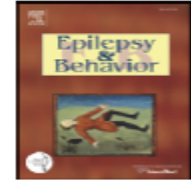
FULL-LENGTH ORIGINAL RESEARCH

Video-EEG monitoring: Safety and adverse events in 507 consecutive patients

*†Judith Dobesberger, *Gerald Walser, *Iris Unterberger, *Klaus Seppi, *Giorgi Kuchukhidze,
*†Julia Larch, *Gerhard Bauer, *Thomas Bodner, *Tina Falkenstetter, ‡Martin Ortler,
*Gerhard Luef, and *†Eugen Trinka

*Department of Neurology, Innsbruck Medical University, Innsbruck, Austria; †Department of Neurology,
Paracelsus Medical University, Christian Doppler Clinic, Salzburg, Austria; and ‡Department of Neurosurgery,
Innsbruck Medical University, Innsbruck, Austria

- Retrospective study 507 patients (413 seizures) in single unit
- Adverse events in 11% seizures
 - Post ictal psychosis 5%; Injuries 4%; Status epilepticus 2%
- 91% occurred during the first 4 days
- Occurred equally during day and night
- Risk factors included
 - Older age
 - Long duration epilepsy
 - Psychiatric comorbidities
 - History of Sz related injuries and SE
- **Recommendations;**
 - **Identify high risk patients**
 - **24 hour surveillance including at weekend by specially trained staff**



Risk of adverse events on epilepsy monitoring units: A survey of epilepsy professionals

P.O. Shafer^{a,*}, J. Buelow^b, D.M. Ficker^c, M.J. Pugh^d, A.M. Kanner^{e,f}, P. Dean^g, P. Levisohn^h

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^d South Texas Veterans Health Care System and Department of Epidemiology and Biostatistics, University of Texas Health Science Center at San Antonio, San Antonio, TX, USA

^e Rush Medical College at Rush University, Chicago, IL, USA

^f Laboratory of EEG and Video-EEG Telemetry, Rush University Medical Center, Chicago, IL, USA

^g Miami Children's Hospital, Miami, FL, USA

^h University of Colorado School of Medicine and Children's University, Aurora, CO, USA

- Retrospective study: self reporting of adverse events over last year
- 70 units in USA participated
- 48 units (69%) had constant observation of patients by health care professional.
- % of units surveyed reported these adverse events:
 - Falls 68% ; Status epilepticus 63%
 - Post ictal psychosis 54%;Pneumonia 10%
 - Cardiac arrest 7%; Fracture 6%
 - **Death 3%**; Intracranial electrodes dislodged 38%
- **Conclusion: study is foundation for enhancing patient safety but no recommendations given**

Safety of Long-term Video-Electroencephalographic Monitoring for Evaluation of Epilepsy

KATHERINE H. NOE, MD, PhD, AND JOSEPH F. DRAZKOWSKI, MD

Mayo Clin Proc. 2009;84(6):495-500

- Medical complications from VT
- Retrospective: 428 patients (109 with seizures)
- Single unit: 24hr surveillance by CP and nurse ratio of 1 to 4 patients
- Adverse events:
 - Status epilepticus 1%
 - Potentially serious ECG abnormalities 3%
 - Post ictal psychosis 2%
 - Vertebral fractures in GTCS 4%
 - No falls, lacerations, dental injuries
- Suggests standardised guidelines for monitoring and safety strategies

Guidelines

ILAE Commission Report

Recommendations Regarding the Requirements and Applications for Long-term Recordings in Epilepsy

*Demetrios Velis, †Perrine Plouin, ‡Jean Gotman,
§Fernando Lopes da Silva, and the members
of the ILAE DMC Subcommittee on Neurophysiology

**Department of Clinical Neurophysiology and the Epilepsy Monitoring Unit, Dutch Epilepsy Clinics Foundation, Heemstede, The Netherlands; †Department of Neurophysiology, Necker Hospital for Sick Children, Paris, France; ‡Montreal Neurological Institute and Hospital, McGill University, Montreal, Quebec, Canada; §Swammerdam Institute for Life Sciences, University of Amsterdam, Amsterdam, The Netherlands*

- Patient safety issues:
 - Electrical safety
 - Availability of life support equipment
 - Nothing on surveillance

SPECIAL REPORT

Essential services, personnel, and facilities in specialized epilepsy centers—Revised 2010 guidelines

*David M. Labiner, †Anto I. Bagic, ‡Susan T. Herman, §Nathan B. Fountain, ¶Thaddeus S. Walczak, and ¶#Robert J. Gummit for the National Association of Epilepsy Centers¹

*Department of Neurology, University of Arizona, Tucson, Arizona, U.S.A.; †Department of Neurology, University of Pittsburgh, Pittsburgh, Pennsylvania, U.S.A.; ‡Department of Neurology, University of Pennsylvania, Philadelphia, Pennsylvania, U.S.A.; §Department of Neurology, University of Virginia, Charlottesville, Virginia, U.S.A.; and Departments of ¶Neurology and #Experimental/Clinical Pharmacology, University of Minnesota, Minneapolis, Minnesota, U.S.A.

- Recommend for nurses on epilepsy monitoring units:
 - Higher than standard nurse-to-patient ratio but ratio not stipulated
 - Educational programs for nurses
 - Nursing protocols for patient safety
- Management of seizure emergencies
 - Access to resuscitation equipment
 - Access to ITU care if needed for status epilepticus

American Epilepsy Society EMU symposium 2008 (unpublished)

- Survey of physicians (n=257) and nurses
- Variable supervision levels (about 50% units had constant nurse supervision)
- Continuous supervision by a staff supported when appropriate by automated seizure detection program is ideal
- For intracranial video telemetry, continuous monitoring is mandatory
- Epilepsy staff nurses must be continuously present on site.
- EEG technologists must be continuously available

Guidelines and Surveys

- **Recommendation:**
 - Infrastructure and Personnel requirements in VT units
 - Methods of seizure monitoring
 - Protocols for AED withdrawal
 - Management of prolonged seizures or status epilepticus
 - Patient safety protocols and quality measures
- **However, universally standardised benchmark for the efficacy of safety measures in VT units is lacking**
- **Hence, the current audit investigates the requirements for health care professional surveillance of patients in video-telemetry units**

Form B : Seizures

Safety of patients and
influencing factors

FORM B :

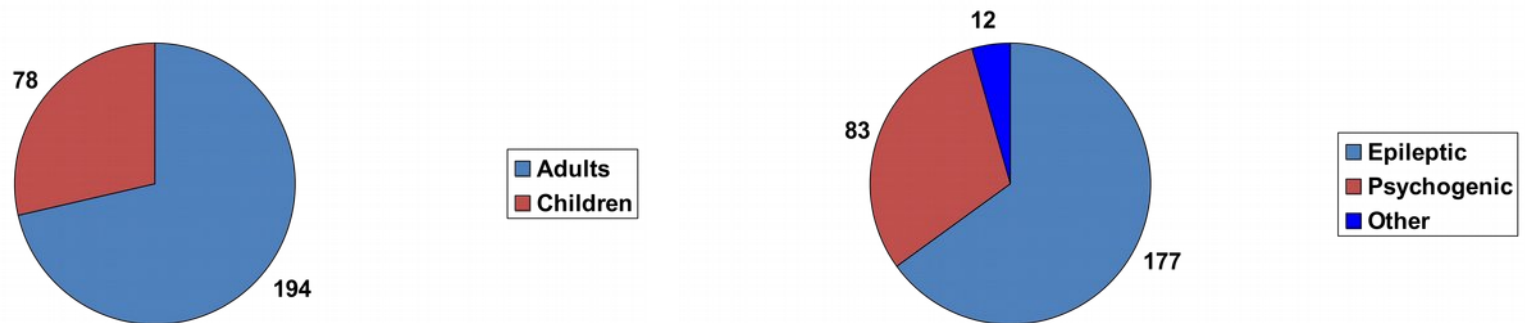
- Please complete one form for each of the first five attacks from five consecutive patients admitted for video-telemetry.
- Please exclude attacks provoked by Clinical Physiologist performing activation techniques

Postcode of Centre (Please complete)		Project Code (Do not complete. For office use only)	
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1. Was the patient monitored on the adult or paediatric unit?	Adult/Paediatric
2. Was the patient in a single occupancy cubicle or multiple occupancy bay?	Single cubicle/multiple bay
3. What was the nature of the attack?	Epileptic Non-epileptic (psychogenic) Other (please give details)
4. What were the main clinical manifestations of the seizure? Please provide a brief description	
5. Please circle any of the following options that best summarises the attacks: more than one description may apply.	Epileptic Negative motor phenomena/motor arrest Astatic eg slumping as part of a complex partial seizure Myoclonic Oro-facial, manual automatisms eg lipsmacking, plucking clothes Mild lower limb automatisms (mild movements lower limbs) Hypermotor (ie thrashing around) Tonic Tonic clonic Other Non-epileptic events Apparent unresponsiveness Slumping Obvious thrashing around Other

6. Using the 24 hour clock, what time did the initial clinical (not EEG) manifestations of the seizure begin (= T1)?	
7. Using the 24 hour clock, what time did the clinical manifestations of the seizure finish, including the post ictal confusional state (= T2)?	
8. How long was the seizure in seconds (T1 – T2)?	
9. Was the seizure attended to by health care professional?	Yes/No
10. Was a relative present at the time of the seizure?	Yes/No
11. Using the 24 hour clock what time did the health care professional attend to the patient (= T3)?	
12. What was the latency in seconds between the first initial clinical manifestations and the care from the health care professional (= T1-T3)?	
13. Did any adverse event occur during the seizure?	Yes/No
if 'Yes' please circle all that apply	Fall out of bed/ Fall from standing/ Fall from chair Hit head/ Hit limbs Status epilepticus/ Subconvulsive status epilepticus Psychosis/ Wandering Seizure unnoticed and found on post acquisition review Other (please list)
14. Do you feel that any adverse event was prevented during the seizure due to intervention by nursing staff/relative or friend?	Yes/No
15. If yes – what was prevented and by whom, (for example the patient was prevented from rolling out of bed, by nurse steadying the patient during the seizure)	
16. When was the VT study reviewed following acquisition?	

Results : 272 seizures

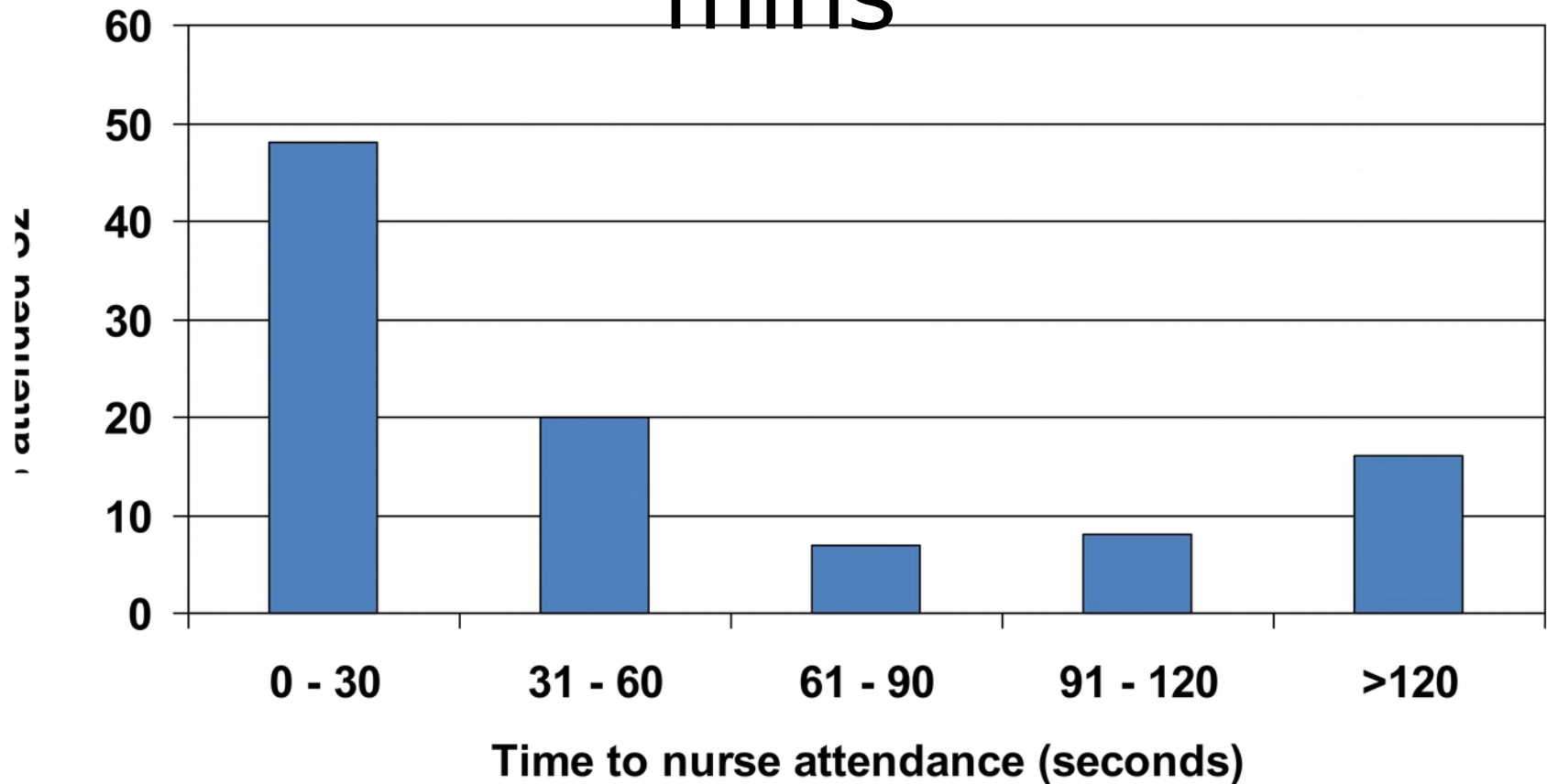


Seizure length : <1second – 22 hours; Median 1 minute 40 seconds

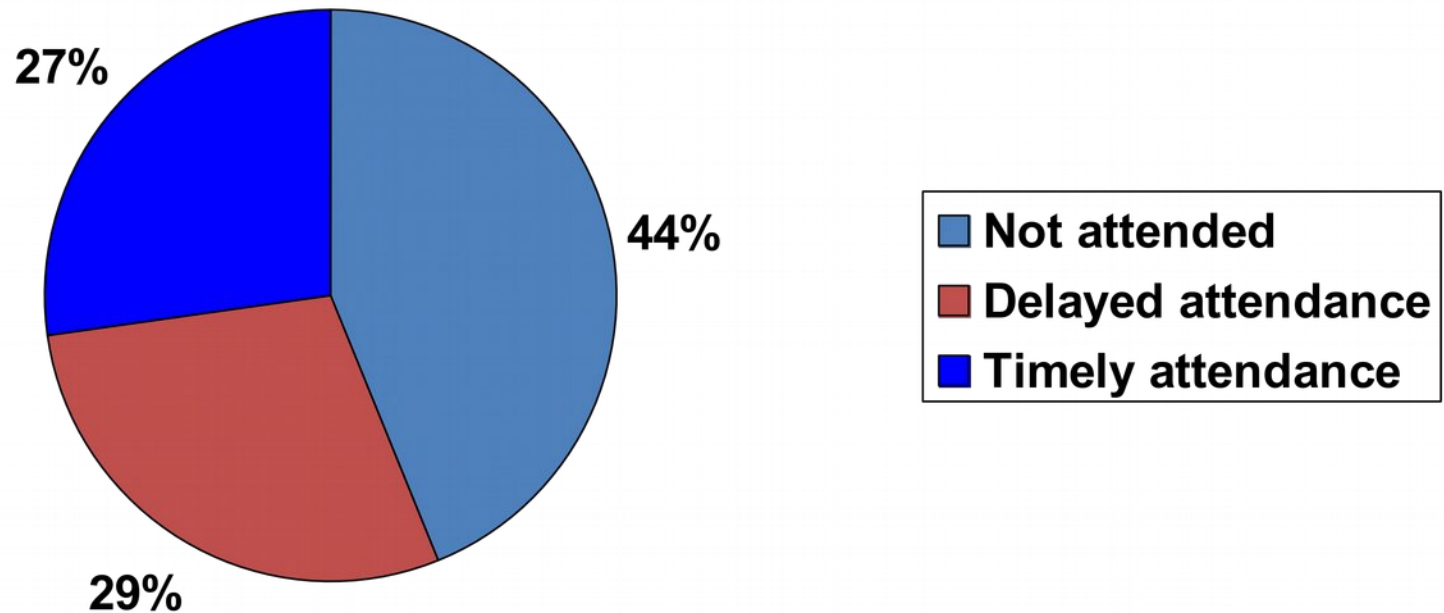
Attendance in Seizures

	% Seizures
Attended by Nurse	56
Attended by Relative	36
Attended by Nurse or Relative	78
Attended by Neither Nurse nor Relative	22

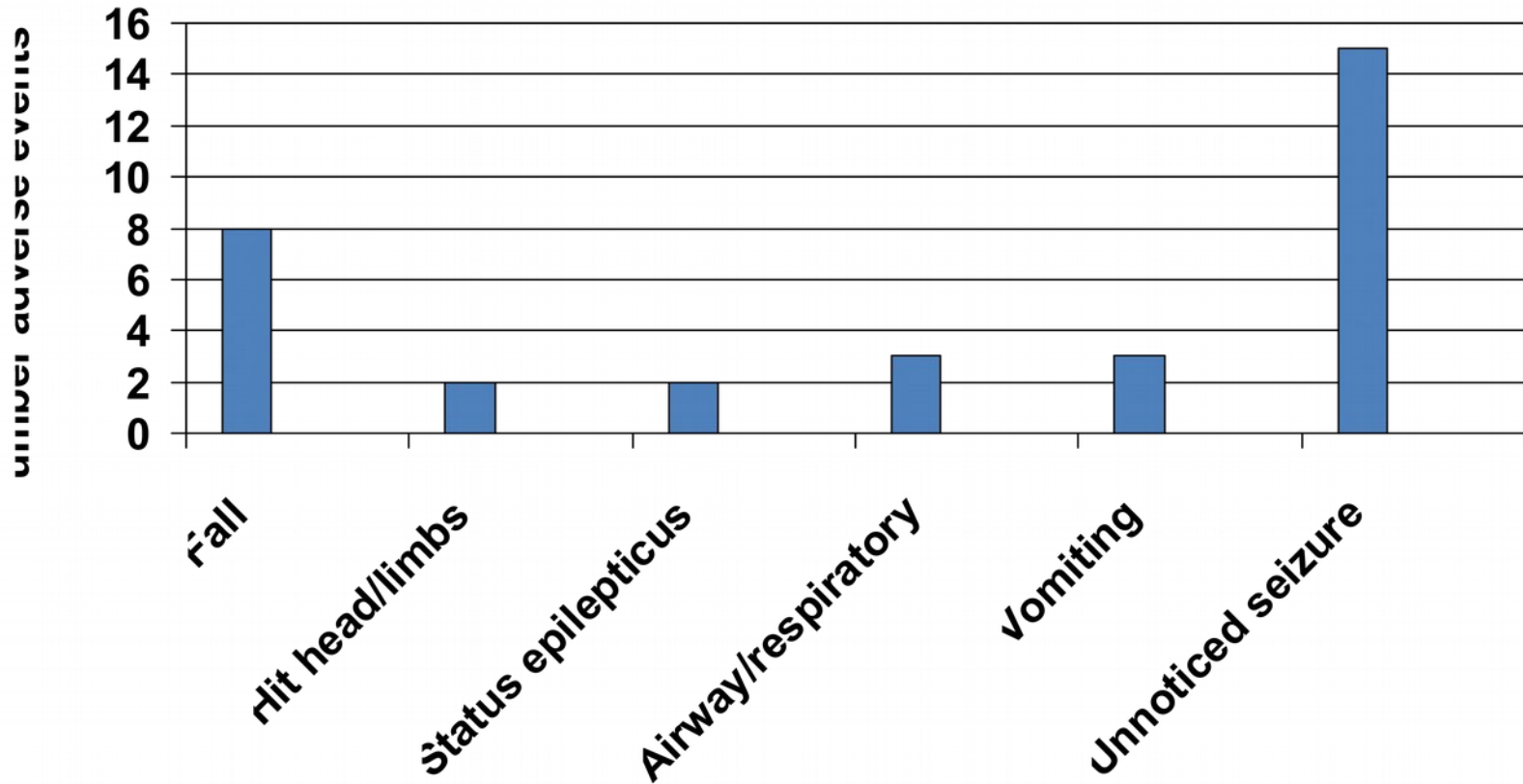
Timing of Nurse attendance (n = 153):
Median 32 sec Range 0 sec – 56 mins



Nurse attendance: Summary



Adverse events n = 33 in 272 Sz (12%)

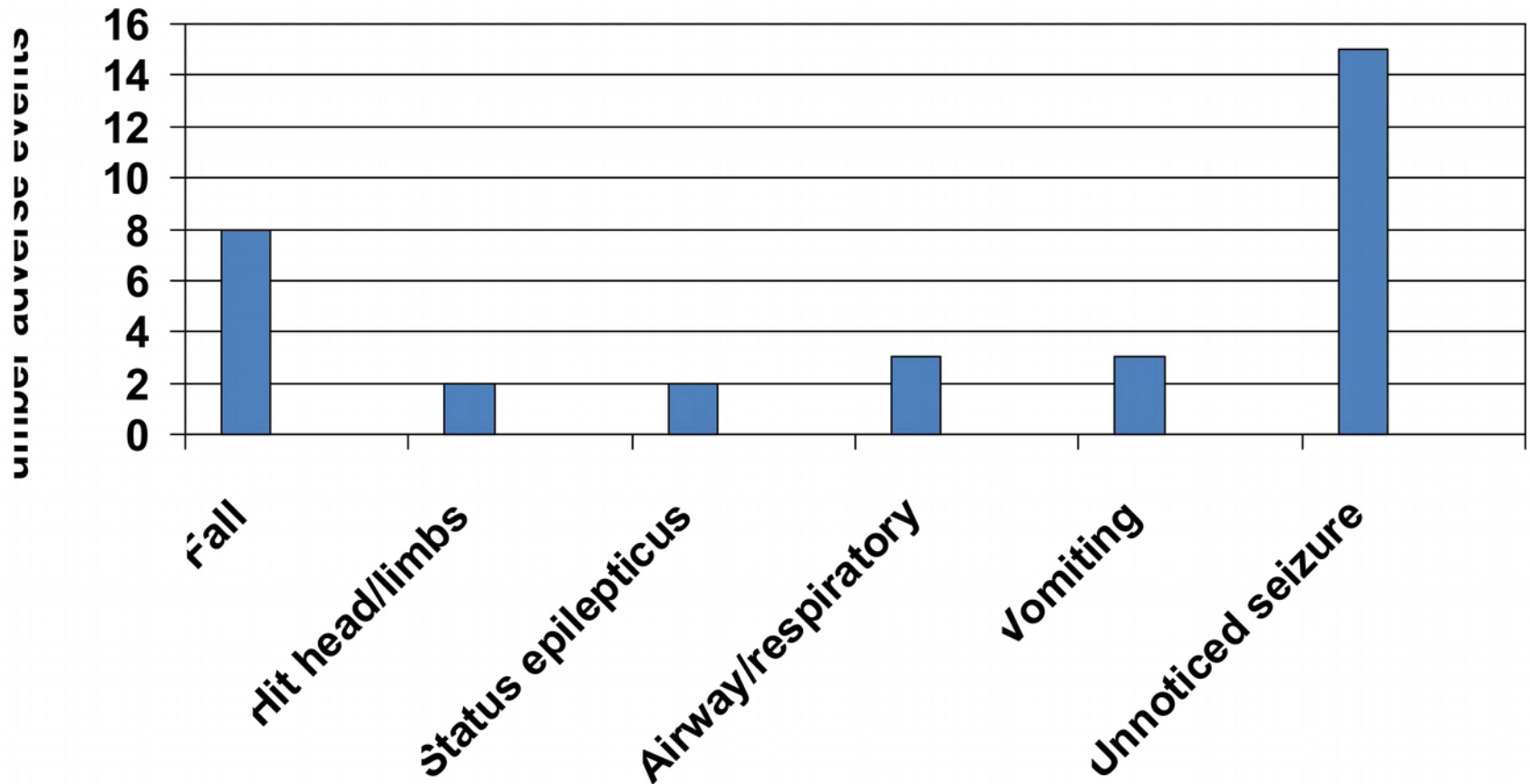


Adverse events: Night = 52% Day = 48%

Unnoticed seizures n = 15

- 13 epileptic
- All involved motor features
- 4 major motor features:
 - GTCS x 2
 - Hypermotor automatisms
 - Tonic/atonic

Adverse events



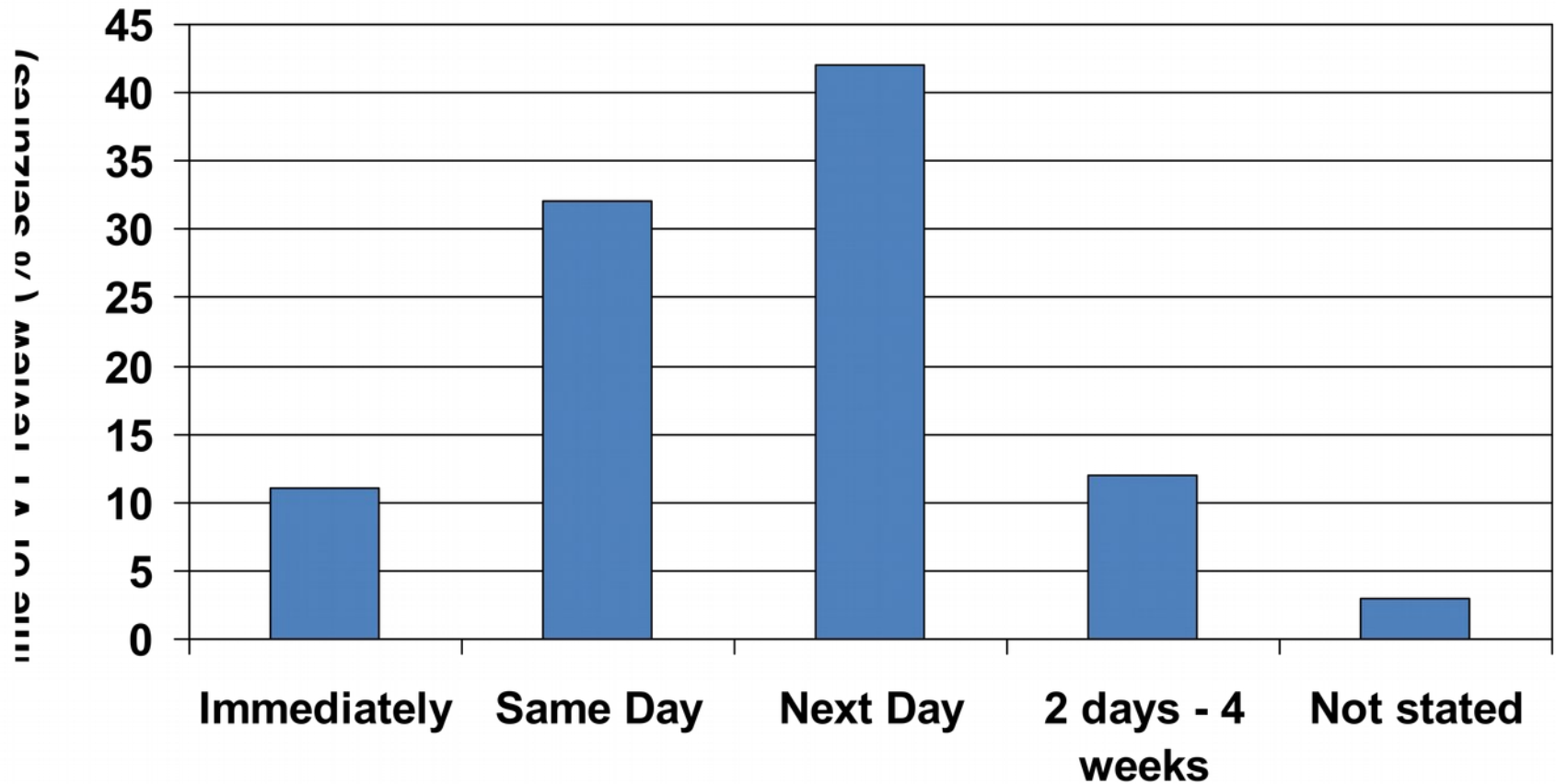
Physical adverse events n = 18 (7%)

- 16 (89%) attended
- Time to attendance
 - Median 40 s Range 0 – 130 s
- 5 within 30 s
 - 4 were where nurse was present
- 13 (72%) where physical adverse events occurred were not attended in timely fashion

Adverse Events prevented

- 33 adverse events prevented
 - Falls/Injury/Hypoxia
- By Nurse : 26 By Parent : 7
- 8/26 prevented by nurse, already in room
- Median latency to nurse attendance in these patients was short
 - 18 s cf latency 32 s for all patients

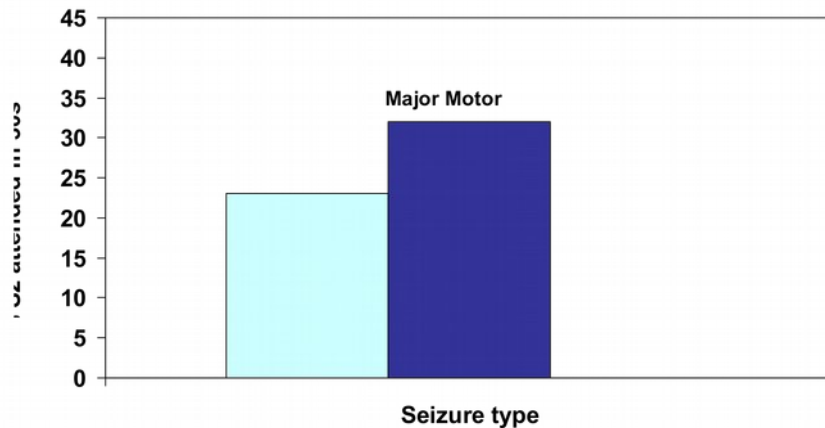
Time of VT review



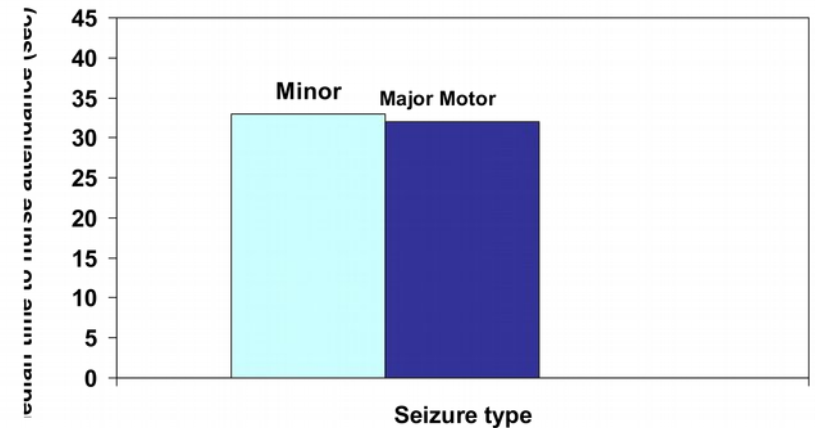
What possible factors affect whether nurses attend their patients quickly?

- Type of seizure
- Type of nurse
- Type of room
- Type of observation method
- Number of nurses
- Presence of a relative

Effect of seizure type on nurse attendance

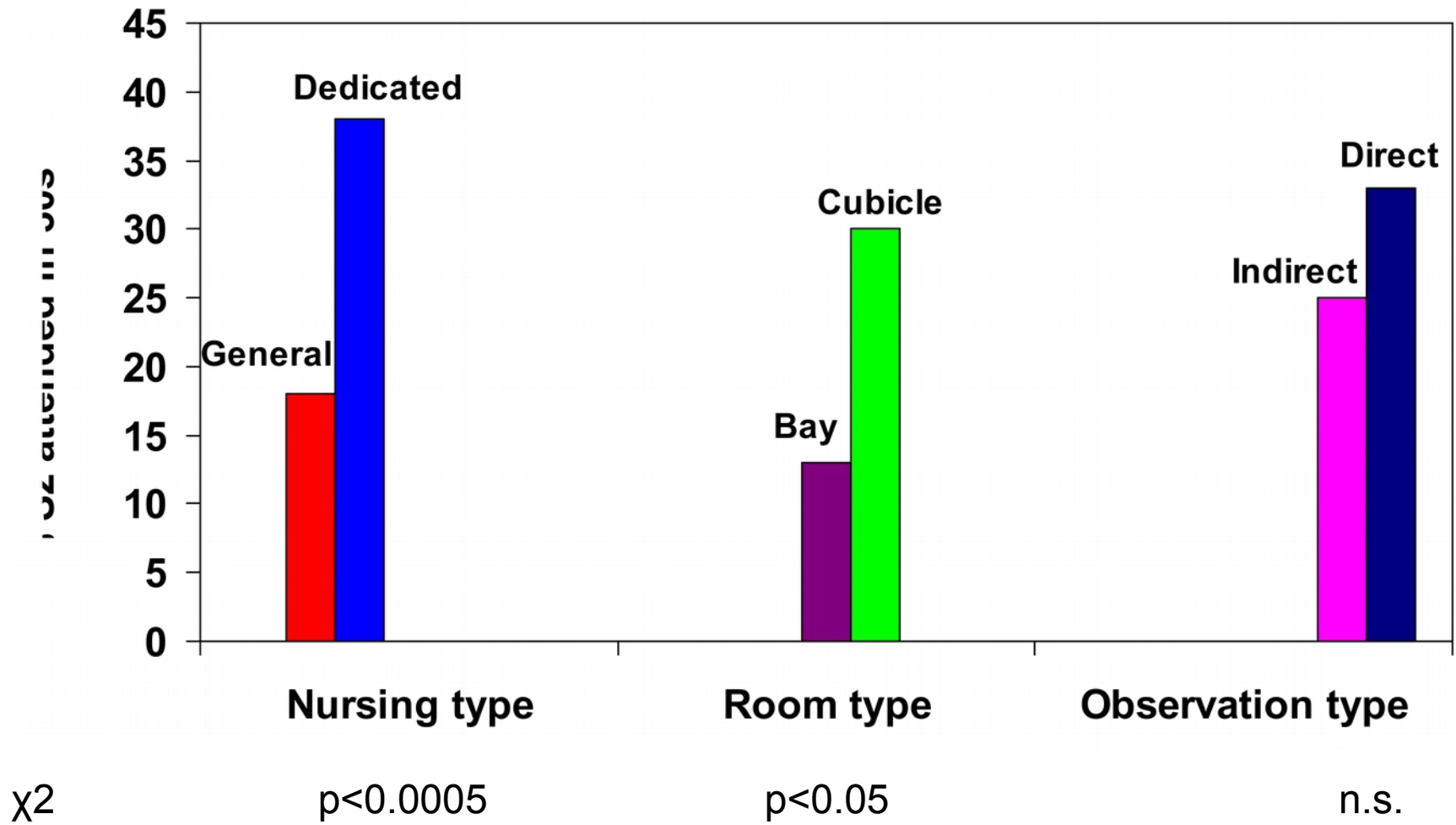


χ^2 n.s.



Mann Whitney U n.s.

Variables affecting timely attendance

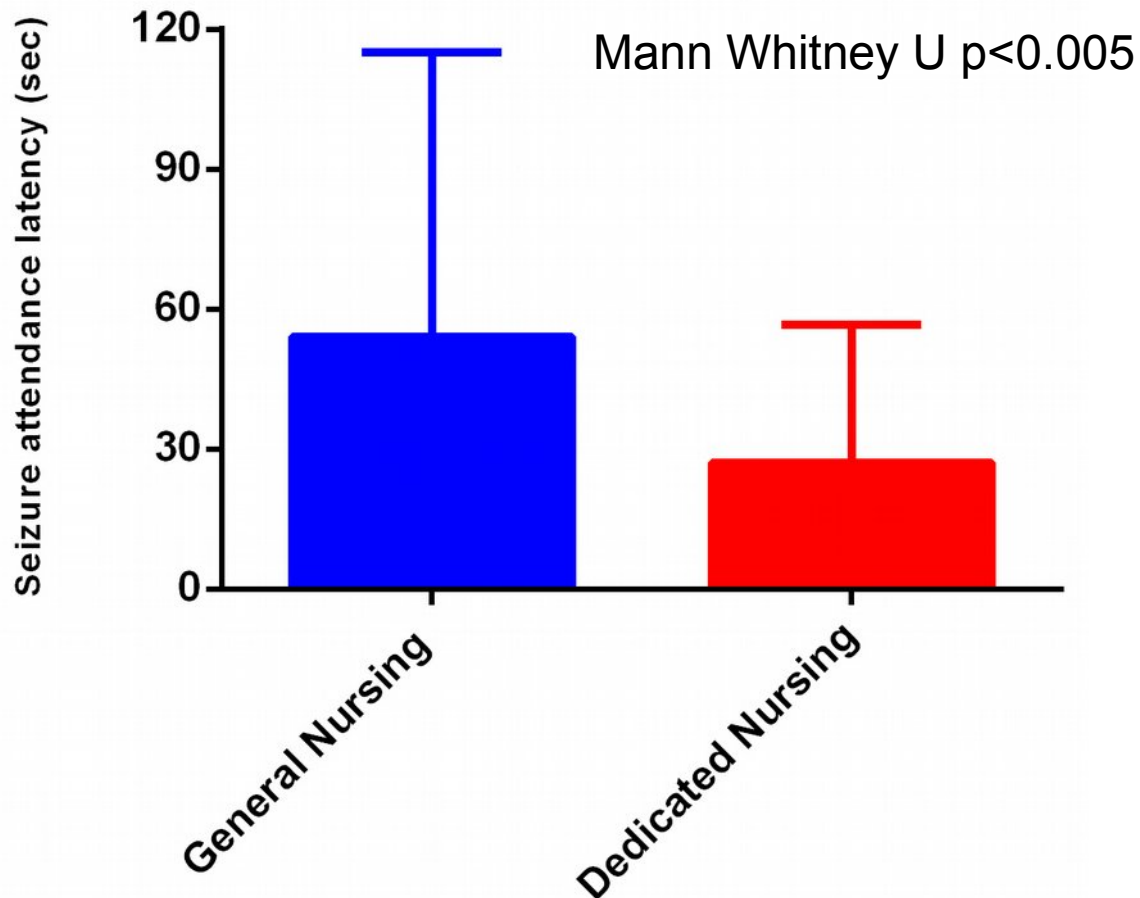


Multivariate analysis

- With thanks to Dr Jeremy Bland
- Linear/non-linear regression results below
- Log-linear analysis (and χ^2) suggests that room type only appears significant because of association between cubicles and dedicated nurses

Nursing type	< 0.0001
Room type	ns
Direct observation	ns

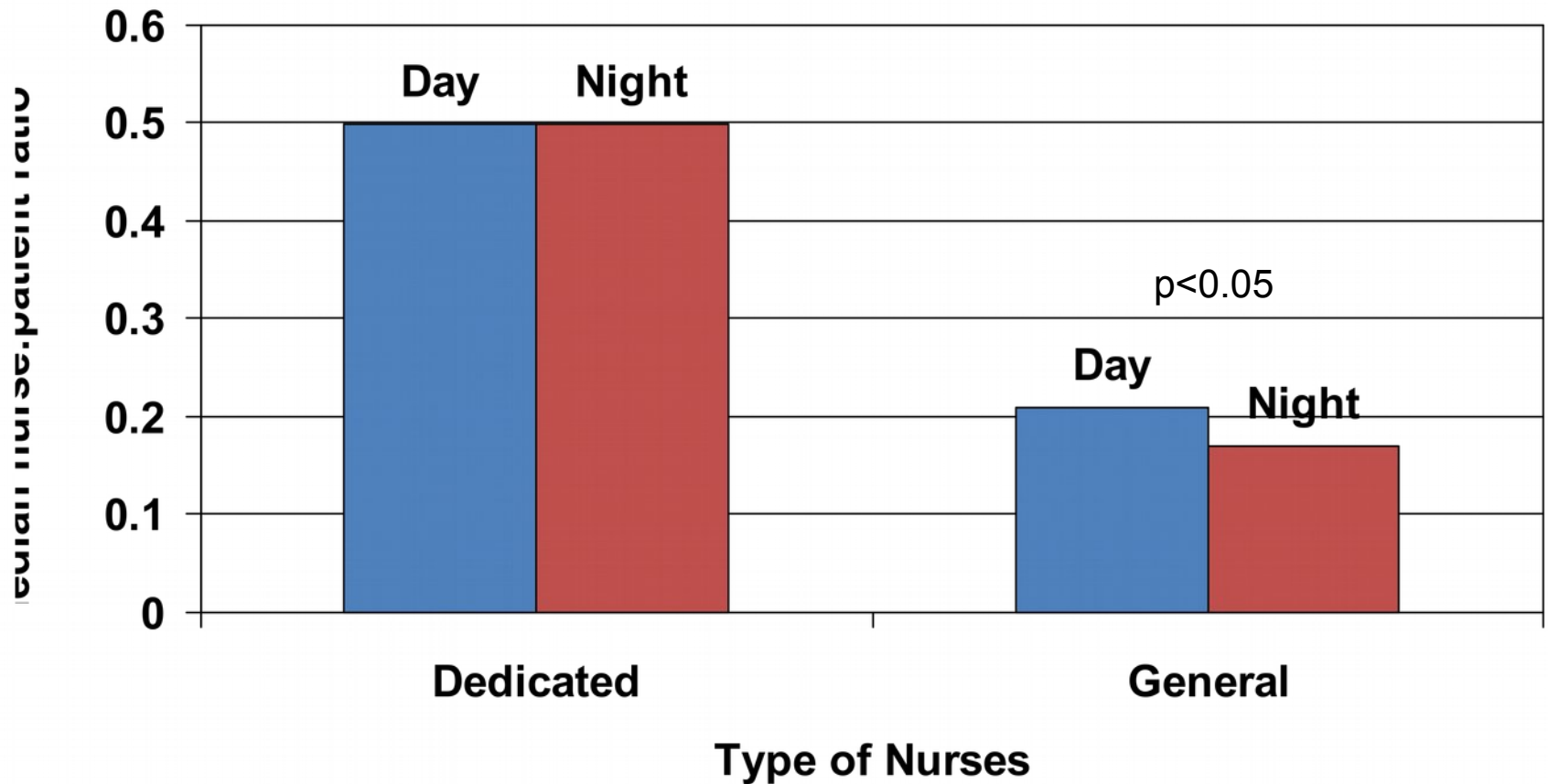
Effect of nursing type on attendance times



Day and Night

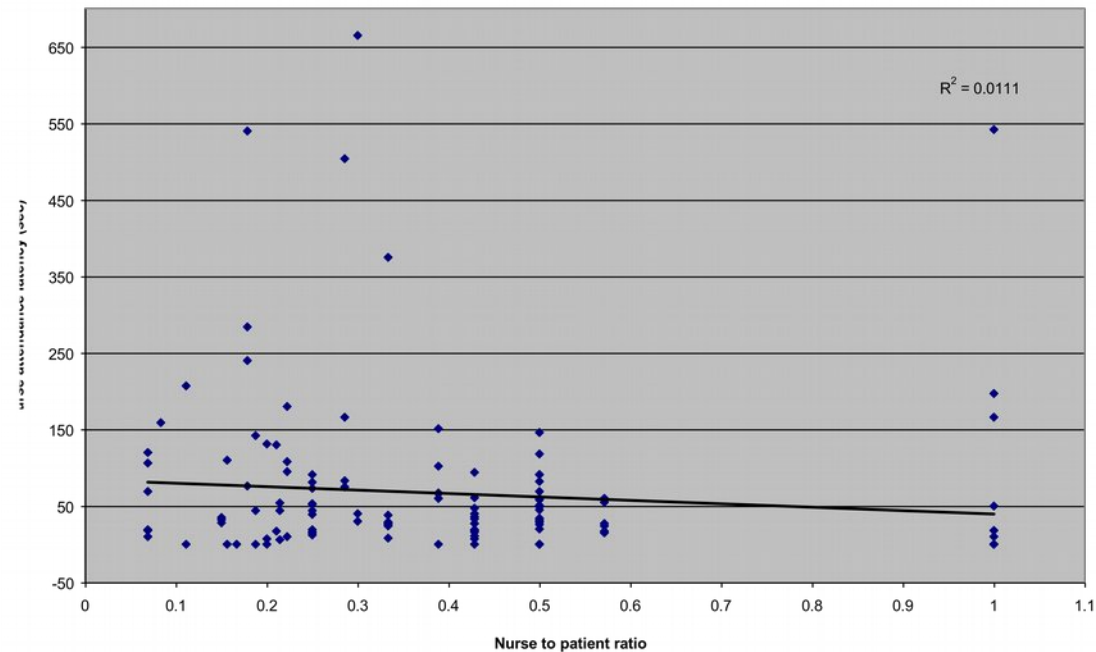
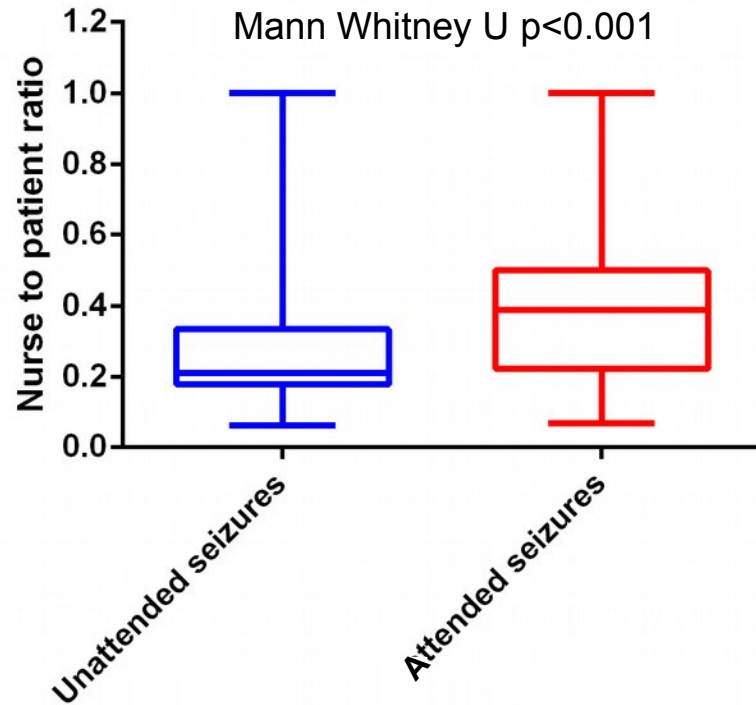


Nurse to patient ratios day & night



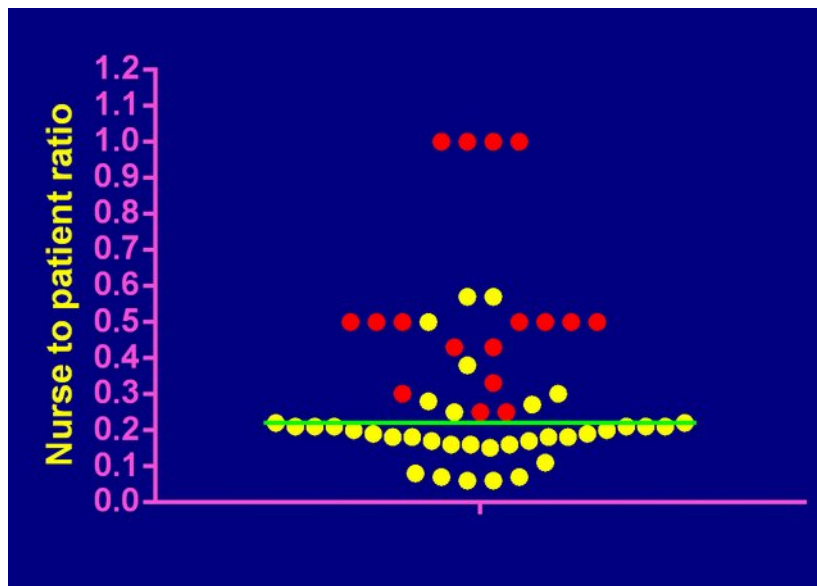
Mann Whitney U Dedicated vs General Nurse to patient ratio day $p<0.001$ and night $p<0.0001$

Effect of nurse to patient ratio on attendance



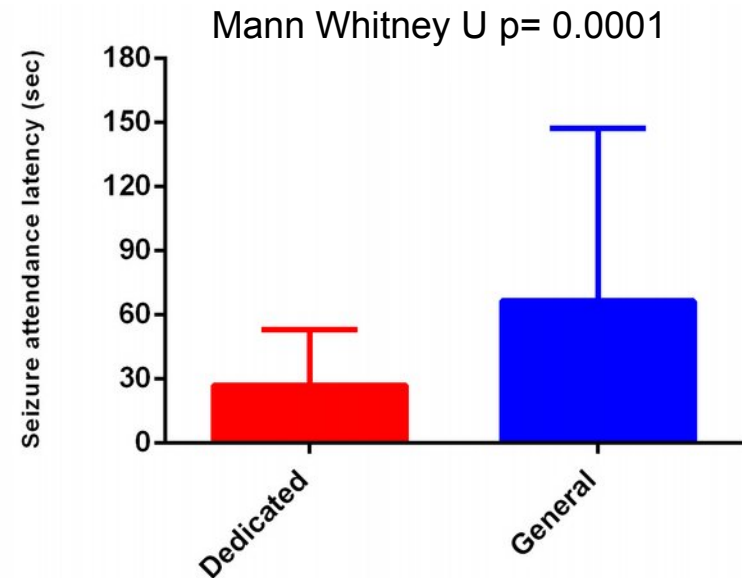
N.B. Significance lost if dedicated and general nursing analysed separately

Attendance when Nurse to patient ratio is 0.25 – 0.5 (1:2 to 1:4)

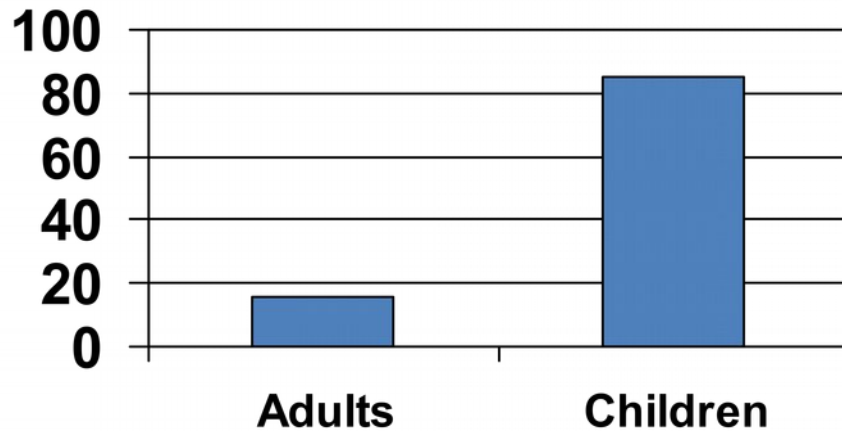


 Dedicated

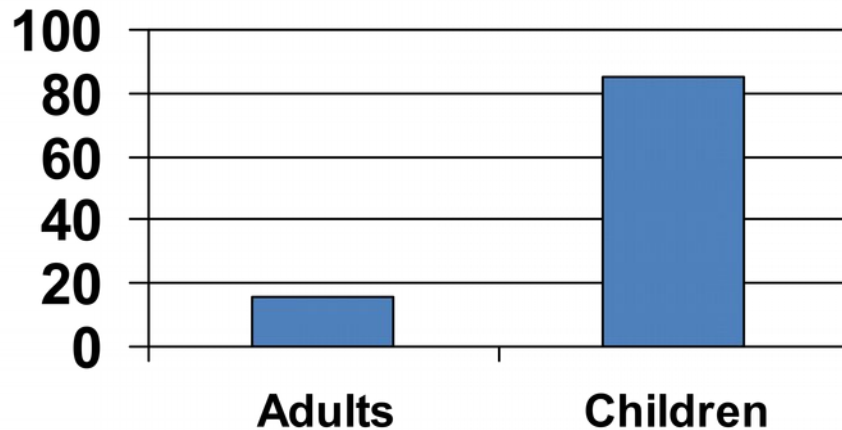
 General



Effect of relative presence on nurse attendance

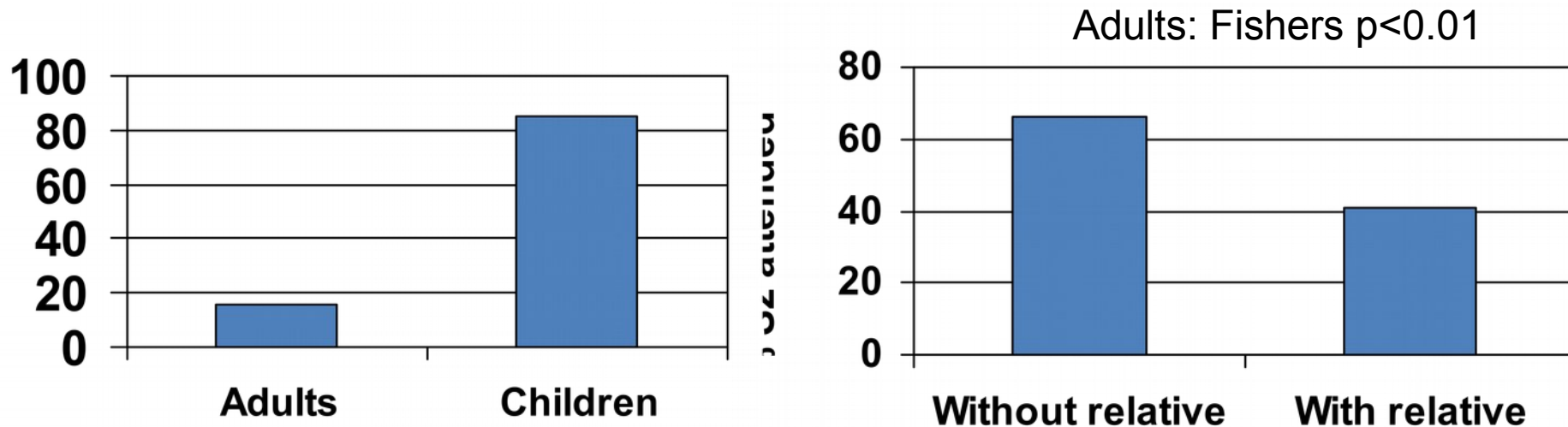


Effect of relative presence on nurse attendance



- In **children**: presence of relative made no difference to whether seizures attended or to latency to nurse attendance
- In **adults**: presence of relative made no difference to latency of nurse attendance

Effect of relative presence on nurse attendance



- In **children**: presence of relative made no difference to whether seizures attended or to latency to nurse attendance
- In **adults**: presence of relative made no difference to latency to nurse attendance

Conclusions 1

- Nursing supervision intensity is perceived to be inadequate in over half VT units
- Perception supported by only a quarter of seizures being attended within 30 seconds and nearly half not attended by healthcare professional at all
- Adverse events not unusual, occur equally during night and day and most are not attended to in a timely fashion
- Adverse events can be prevented if nurses attend seizures quickly
- ECG is universally recorded but only visible in 60% of units
- VT studies are usually reviewed within 24 hours but at least 12% were not

Conclusions 2

- Nursing attendance is not influenced by type of seizure
- **Dedicated nurses have a significant impact on improving timely nurse attendance**
- Room type and methods of patient observation are not important factors in determining timely nurse attendance
- Nurse to patient ratio has not been demonstrated to be an independent factor in determining whether patients are attended during seizures although results suggest a ratio of at least 1:4 to be most appropriate
- In adults the presence of a relative may negatively influence the possibility of nurse attendance

1:

Based on survey/service evaluation results

Standard 1: All VT units should have 24 hour surveillance by healthcare professionals (HCP).

Guideline: Direct observation of the patient may improve nurse attendance but other methods of observation such as the use of video monitors and nurse alarms are acceptable

Standard 2: The Healthcare professionals should be dedicated to the VT unit and not be expected to perform other duties even if telemetry beds are situated on a general ward.

Guideline: It is not possible to specify the optimum HCP:Patient ratio for a video telemetry unit but the evidence suggests that a ratio of not less than 1:4 may be appropriate

Standard 3: The level of HCP surveillance should be similar throughout each 24 hour monitoring period as adverse events occur at a similar frequency during the day and night

Standard 4: HCPs should be trained to recognise seizures and major disturbances of cardiac rhythms

Standard 5: Whilst the presence of a relative may be beneficial to patient safety, accompanying relatives should be encouraged to alert HCPs to all seizures occurring in the VT unit

Standard 6: The patient's heart rate should be clearly displayed to the monitoring HCP usually by ECG or alternatively by pulse oximetry, to allow prompt intervention during instances of serious ictal cardiac arrhythmias.

Standard 7: VT studies should be reviewed by Neurophysiology staff within 24 hours to reduce consequences of unnoticed seizures

Standards/Guidelines (provisional)

2: Other sources

Standard 8: A risk assessment for each patient should be performed on admission to determine the most appropriate positioning of furniture and bed, bathroom layout, the use of cot sides, floor padding etc to minimise physical injury during a seizure.

Standard 9: There should be a clear plan prior to admission for anticonvulsant reduction or withdrawal.

Standard 10: There should be facilities for emergency treatment of status epilepticus including availability of oxygen and access to ITU beds