This is an author produced version of The unwritten rules of teaching and learning sleep scoring: practical hints and tips.

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Proceedings Paper:
Introduction

- The American Academy of Sleep Medicine’s (AASM) manual (Berry et al., 2015) for the scoring of sleep and associated events provides standardised international guidelines for both adult and paediatric sleep scoring.
- This guidance is essential for those who evaluate and interpret polysomnography (PSG) recordings. Unfortunately, other than this manual, there is very limited guidance available for sleep scoring novices.
- The current work follows the experiences of a sleep physiologist with 27 years experience (RK), training a novice (JB) to sleep stage and score arousals. The learning process was documented to enable the authors to reflect on the most effective teaching and learning strategies, the pitfalls and the top tips learnt along the way.

Methods

- The data analysed were home PSG recordings conducted as part of a case-control study on paediatric narcolepsy using a standard sleep staging montage.
- 43 studies were scored manually according to the AASM (2012) paediatric scoring criteria. 21 recordings were from children with narcolepsy and 22 recordings were from healthy gender and age-matched controls.
- The novice (JB) scored a study independently before watching the sleep physiologist (RK) score the same study so that any discrepancies in the scoring could be discussed and learning goals for the next scoring session set.
- The inter-scorer agreement was calculated by exporting the scoring data from the sleep scoring programme (Embla® RemLogic™ PSG Software) into excel so that 30 second epoch by epoch comparisons and the overall percentage of agreement could be determined.

Results

- The sleep staging agreements are displayed in Figure 1.
- Lack of video, pulse rate and respiratory patterns meant that the scorers were completely reliant on sleep channels when analysing the data.
- Agreement improved over time. The average agreement for the recordings from children with narcolepsy was 77.6% and the average agreement for recordings from healthy gender and age matched controls was 91.2%.
- Low agreement was mainly due to artefactual PSG recordings which were difficult to score. Recordings from healthy control children were easier to score due to their more typical sleep patterns and less artefactual data.
- Throughout the process, learning points were noted (Table 1 & 2).

Table 1. The tricky bits to take into consideration

<table>
<thead>
<tr>
<th>Drowsiness vs N1 sleep</th>
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<tbody>
<tr>
<td>REM vs wakefulness</td>
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<td>Vertex sharps vs K complexes</td>
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<tr>
<td>When to start scoring SWS</td>
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<tr>
<td>Diary cards are helpful, but can be inaccurate and mislead the scorer</td>
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<td>Wakeness can look like theta</td>
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<td>Alpha not always present</td>
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<tr>
<td>Primary signals ‘bleeding’ into other channels</td>
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<tr>
<td>Adapting when you have missing channels</td>
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<td>Some eyes roll, others not as clearly</td>
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<td>Age related differences</td>
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<table>
<thead>
<tr>
<th>Artifacts</th>
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<tbody>
<tr>
<td>Respiratory artifact</td>
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<tr>
<td>ECG artifact</td>
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<tr>
<td>Electrode popping artifact</td>
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<tr>
<td>Electrical interference</td>
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<td>Muscle artifact</td>
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Table 2. Top tips

### Before Starting
- Familiarity of sleep scoring package
- Know expected hypnogram for age
- Full understanding of lights on & lights off
- Full understanding of reporting calculations (e.g. total sleep time, sleep efficiency)

### New to Scoring
- Referral letters, previous PSGs
- Tune in to the patient’s EEG
- Start with the easy bits (SWS)
- Relook at the transitional bits at the end

### Getting Better at Scoring
- Learn artefacts
- Learn age related differences
- Learn fragmented studies due to sleep disorders
- Learn to score arousals

### Maintaining Scoring Competency
- Regular but random inter-rater scoring
- Encourage sleep centres to keep examples that are good for teaching
- Designate a person to be AASM updates champion to disseminate to others

Conclusions and Suggestions for Future Work

- We recommend that it takes a novice approximately 6 months to learn to sleep stage and score arousals.
- Learning to score sleep accurately requires close expert supervision, hands on scoring experience and regular reflection on the learning process.
- Setting small manageable learning goals for the next scoring session improved performance and monitoring progress increased the confidence of the learner.
- There is a need for the development of more resources to help with scoring “real life” data (for example data collected from home PSG recordings).
- There is also a need for the development of UK wide support and inter-rater scoring for those working in isolation.

Reference