



ADULT TO PEDIATRIC POLYSOMNOGRAPHY: SOME INSIGHTS

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There are many sleep laboratories being asked to perform studies on children lately since physicians are more aware of the consequences of poor sleep in the pediatric population and that early treatment can markedly improve these behavioral, scholastic and cognitive consequences. However, performing sleep studies on children can be frustrating and problematic and can lead laboratories to limit their pediatric sleep studies or stop doing them altogether. In order to assure the successful implementation of performing pediatric sleep studies in your laboratory, it will first be necessary to understand where some of the difficulties may occur. There are four main aspects of performing sleep studies on children that will determine a successful outcome: The sleep laboratory environment, scheduling pediatric sleep studies, updating your policy and procedure manual and optimizing the scoring for accuracy and speed.

When performing sleep studies on children, one of the most important aspects to consider will be the physical environment. The bedroom should be similar to bedrooms used for adult sleep patients. The bedroom should have suction, supplemental O₂ and air capability. Suctioning may be needed for patients that may need secretions cleared such as those patients with a tracheotomy. Some patients may require supplemental O₂ delivery when the patient is in the laboratory particularly if the reason for the study is to determine the efficacy of exogenous O₂. Finally, having the capability to deliver air may be necessary to provide misted air such as for an open tracheotomy or for the drying of collodion used by many sleep laboratories studying children to assure that leads remain on the child throughout the entire study.

The bedroom environment for children should be designed for safety issues as well. Quick access to the bedroom by the technologist is critical if the child becomes medically unstable, behaviorally volatile, confused or simply requires frequent access during the night by the technologist. During a sleep study, many children and some caregivers may require frequent and rapid access to the bedroom as compared to many adult sleep studies. Subsequently, difficult access to the bedroom may be a source of frustration for the technologist and caregiver and can result in potential medical compromise for the children. Rapid access to the bedroom with a bed that has rails is an important safety issue and can directly affect the success of your pediatric sleep program.

The ideal environment for pediatric polysomnography may also include a separate set-up room and a bed for a caregiver. While a separate set-up room is not critical, it can be helpful if the set-up itself was traumatic. In these cases, moving the child from a set-up

room to the relative quiet and comfort of the child's bedroom can have a calming effect on the child (and parent) as this action signifies the set-up, for the most part, is completed and bedtime is near. A VCR or DVD player located in a room separate from the bedroom implies that the bedroom is to be solely for sleeping. Finally, a set-up room can be easily fitted with a filtration system to remove collodion vapors and provides technologists a safe place to store the collodion.

A separate bed for a caregiver will be critical for your pediatric laboratory since performing sleep studies on anyone under the age of 18 on an outpatient basis requires one caregiver responsible for the patient to remain with the patient during the study in case consent for emergency medical procedures, though highly unlikely, is necessary. Separate sleeping arrangements are also necessary to avoid caregiver co-sleeping; a practice that can possibly influence the interpretation of the sleep study.

Finally, the environment should include sensitive and discrete audio and video capability. Children who snore may do so very softly and it is imperative that the recording technologist and sleep clinician hear these sounds and report them accurately. There is evidence that children with even primary snoring (PS), or snoring that does not meet the criteria for obstructive sleep apnea (OSA), can yield alterations in respiratory arousal and REM percentage compared to non-snoring control subjects. Additionally, there were deleterious effects on measures related to attention, social problems and anxious/depressive symptoms in children with PS. Sensitive audio has a direct influence upon the accurate characterization of sleep-related breathing noises. Moving the microphone closer to the patient to better hear the child and exclude other noises in the room such as a CPAP machine or snoring parent can be helpful as well.

A clear video can reveal much about the sleeping child. The video should capture the child from the torso up while minimizing the bedding and furniture. A view of the full body may only be necessary when the patient has a movement disorder or confusional arousal. Clear video is also necessary to document if the eyes are open or closed as this information helps determine if a young patient or a patient with equivocal EEG waveforms is asleep or not. In some infants or patients with severe central nervous system problems, it may be difficult to determine sleep onsets and awakenings from polysomnographic data alone. It is difficult for these populations to remain awake with their eyes closed and the ability to see the patient clearly often provides useful data.

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The audio and video system can also be helpful to capture or avoid events on the part of the parent in the case of abuse such as Munchausen syndrome by proxy. Munchausen syndrome by proxy is when a caregiver, seeks attention from the medical community by inducing real or apparent symptoms of a disease in a child. While this form of abuse is quite rare, it is even more unlikely this behavior will be captured in the laboratory on the audio or video system since the parent knows these systems are in place. Therefore, with audio and video running, the child's sleep study will be more representative of the true presence of sleep-related pathology.

While the sleep laboratory environment is critical to the successful performance of sleep studies on children, the laboratory's policy and procedure manual (P&P) can also have a significant impact on the successful transition to studying children. A thorough P&P manual specific to pediatric polysomnography should reflect differences that may be encountered in studying children as opposed to adults. The pediatric-specific P&P manual should be carefully crafted with attention to all developmental levels.

The technologists performing pediatric sleep studies, as well as all of the personnel in the sleep laboratory, should be very familiar with the P&P content. It should include differences in scheduling, set-ups, data generation and interactions with patients and their caregivers. The P&P should include the specific reasons and necessity for starting CPAP or supplemental O₂ during the study. For example, is it appropriate in your laboratory to do a split-night CPAP study on a child and what is the age cut-off for this procedure? Many common problems in a pediatric sleep laboratory can

be avoided with a carefully crafted child-specific P&P manual and it should also include scheduling differences.

Scheduling a pediatric sleep study differs from scheduling an adult sleep study in several very important ways. Pediatric patients should be scheduled to arrive early in the evening, should be set-up and put to bed as soon as possible and their studies should be run as long as possible in the morning. While most adults retire later in the evening, most pediatric patients arrive to the sleep laboratory around their usual bedtime. Additionally, the technologist performing the pediatric sleep study may need more time to get through the set-up; usually about an hour in most cases. Scheduling one technologist to come in early to do the set-up and run the study and another technologist to finish the study in the morning is one strategy that can maximize recording time. This strategy will allow you to obtain the child's complete sleep-state architecture and cyclicity as well as allow the child to awaken naturally in the morning. Scheduling and running a pediatric sleep study similar to scheduling an adult's sleep study risks premature termination of the study thereby aborting the child's longest and perhaps most informative REM period.

When scheduling a pediatric sleep study, all personnel should be aware of the pending pediatric study. This is necessary so that arrangements can be made for the appropriate technologists and equipment. In this regard, clear communication with the technologists is vital and can in and of itself be an integral reason for the failure of a sleep laboratory "getting into" pediatric sleep. Most laboratories identify those technologists most capable of performing pediatric sleep studies. While all technologists in your sleep laboratory should be able to accurately perform pediatric sleep studies, scheduling these studies with your pediatric "experts" will provide you with the best possible study to score. The "expert" can then teach other technologists because, as with many things, sometimes seeing it done is believing it can be done.

Finally, scoring your pediatric sleep studies can be a source of frustration that can ultimately lead to a decision on the part of a sleep laboratory to reduce or terminate the acceptance of children. One way to avoid many of the frustrations in scoring children is to establish and maintain a mentoring relationship with someone who is capable of reviewing a scored record and providing accurate feedback on a regular basis. Ideally the mentor should be a physician with a complete understanding not only of sleep and its disorders, but also someone well versed in pulmonary medicine, electroneurodiagnostics, cardiology and behavioral psychology. Further, using an appropriate collection system for children considering the nuances associated with pediatric polysomnography will be instrumental in successful scoring. With mentoring and an appropriate collection system, scoring pediatric sleep studies accurately and competently can be accomplished, in time, with minimal frustration and maximal speed.

Performing sleep studies on a pediatric population when you are used to an adult population has some pitfalls that can easily be avoided with some foresight, planning and staff cooperation. The main areas to be concerned about when starting to accept children for sleep studies are: the sleep laboratory environment, scheduling pediatric sleep studies, updating your policy and procedure manual and optimizing the scoring for accuracy and speed. If you can address these issues, ideally before the requests start rolling in, you will improve upon your chances of success with this population, maintain laboratory morale and provide a positive and safe experience for all of the patients seen in your sleep laboratory.