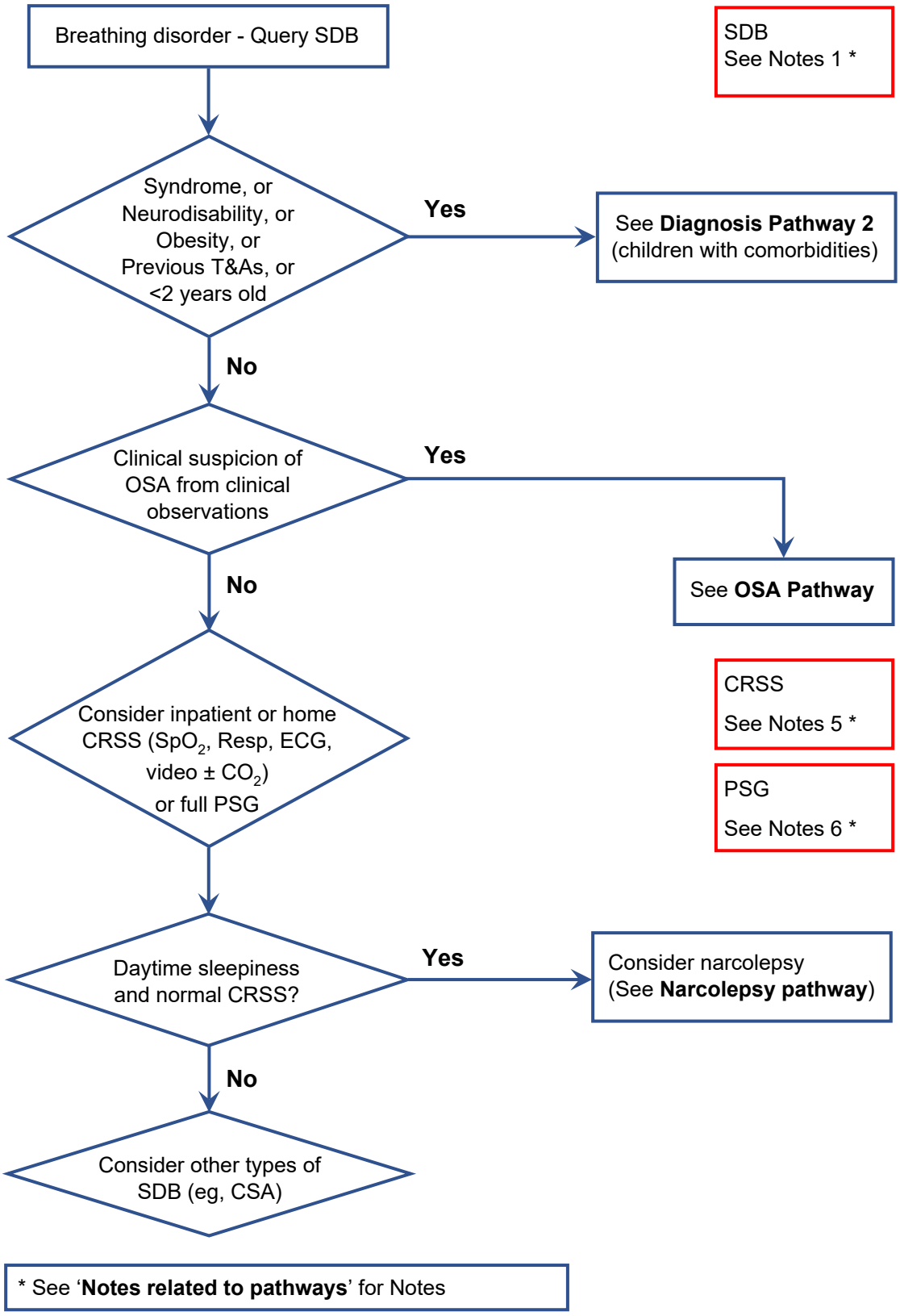
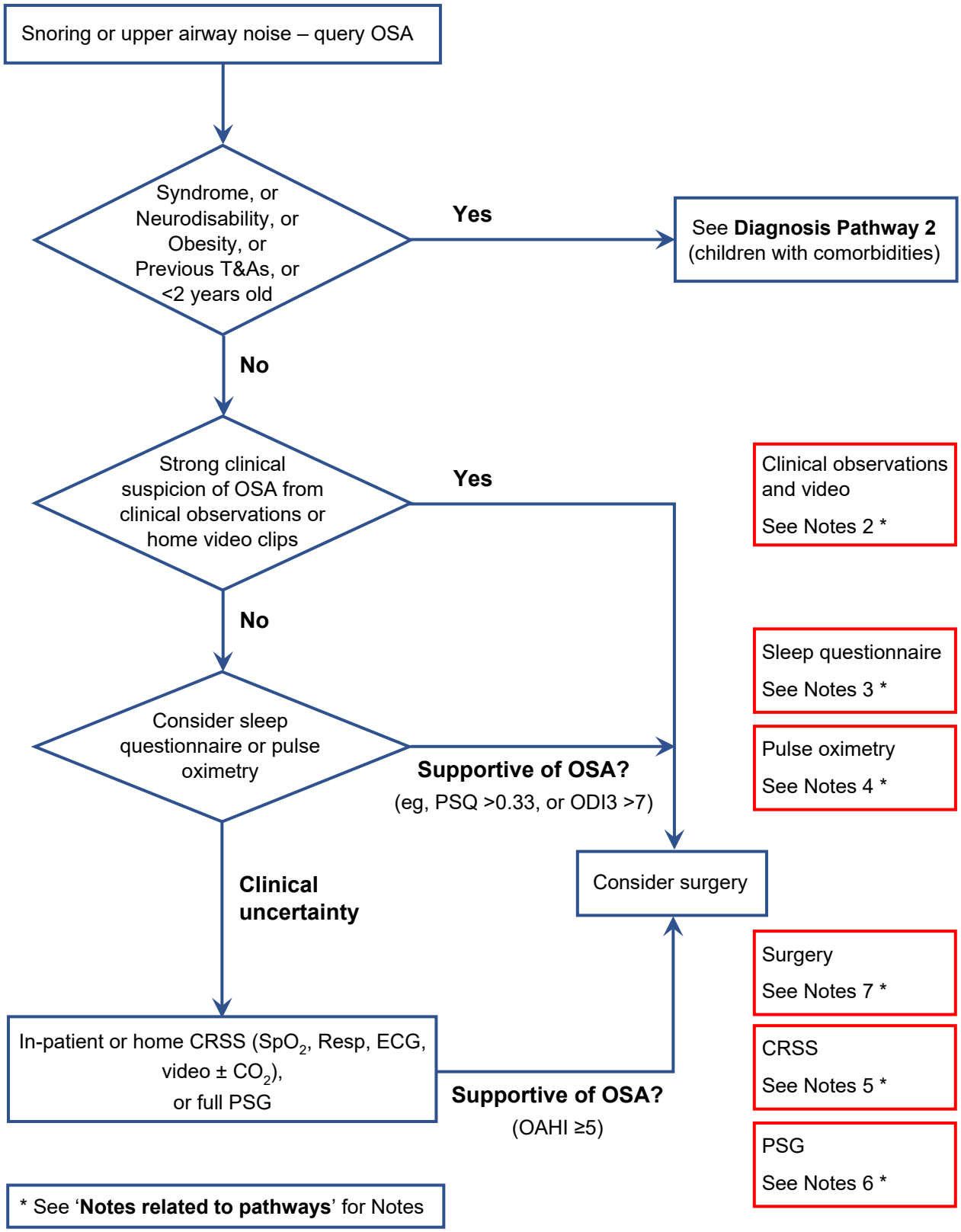
Appendix 1 – Clinical pathways/optimal process information

Diagnosis Pathway 1 (Children without comorbidities)



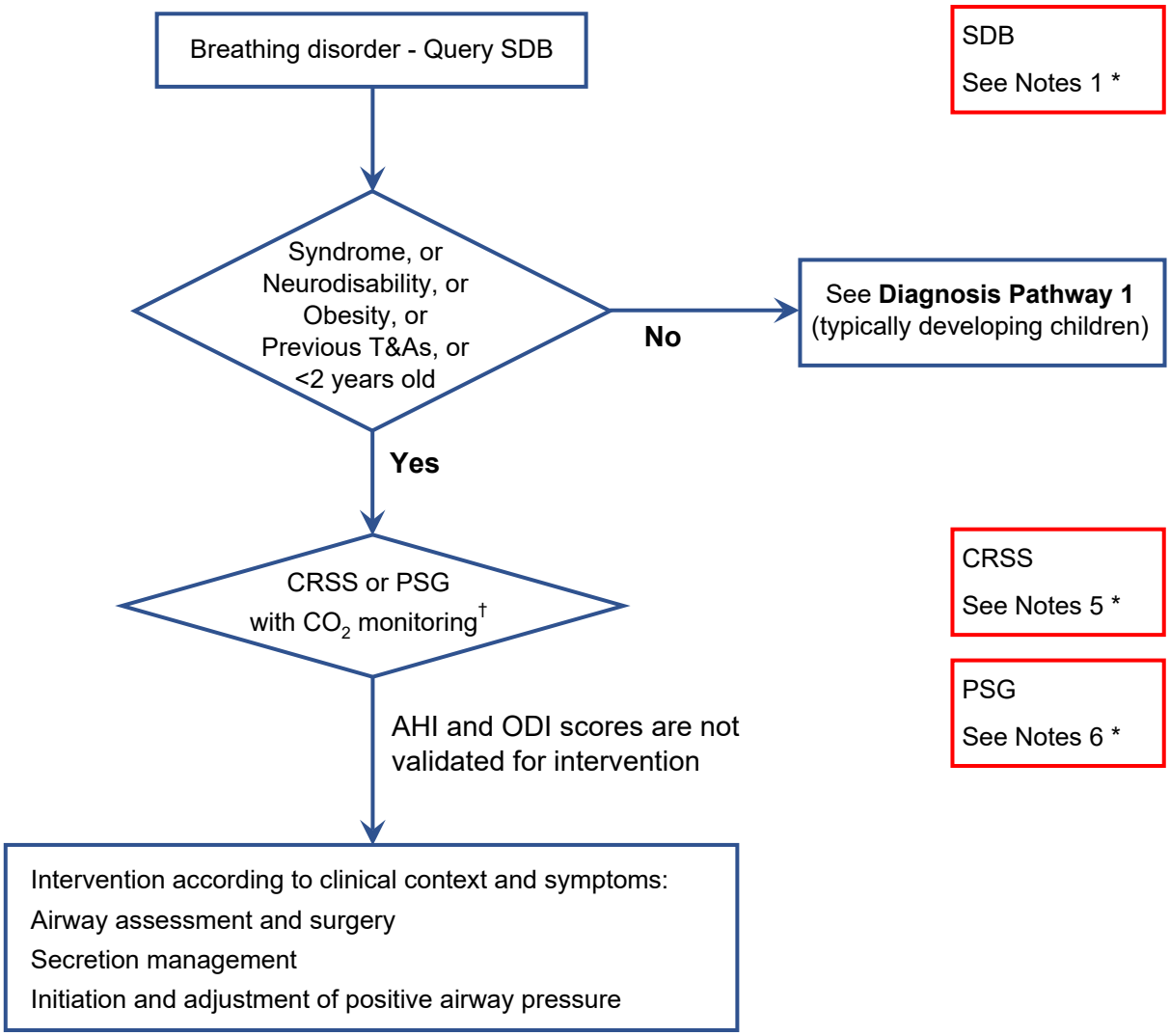
CRSS, cardiorespiratory sleep study; CSA, central sleep apnoea; OSA, obstructive sleep apnoea; PSG, polysomnography; SDB, sleep-disordered breathing; SpO_2, oxygen saturation; T&As – tonsillectomy and adenoidectomy.

Obstructive sleep apnoea pathway



CRSS, cardiorespiratory sleep study; OAHI, obstructive apnoea hypopnoea index; ODI3, oxygen desaturation index; OSA, obstructive sleep apnoea; PSG, polysomnography; PSQ, paediatric sleep questionnaires; SDB, sleep-disordered breathing; SpO_2, oxygen saturation; T&As – tonsillectomy and adenoidectomy.

Diagnosis Pathway 2 (Children with comorbidities)



* See '**Notes related to pathways'** for Notes

† Spirometry can also be considered, but has not been included in the evidence review

CRSS, cardiorespiratory sleep study; AHI, apnoea hypopnoea index; ODI, oxygen desaturation index; PSG, polysomnography; SDB, sleep-disordered breathing; T&As – tonsillectomy and adenoidectomy.

Pulse oximetry optimal monitoring time/process

Optimal pulse oximetry settings for monitoring SDB in children

Oximetry variable	Optimal setting(s)
Motion artefact removal	Motion artefact removal should be used.
Averaging time	2-3 seconds
Monitoring time (hours)	4-6 hours continuous sleep duration if moderate-to-severe SDB is suspected. >6 hours continuous sleep duration if mild SDB is suspected.
Monitoring time (nights)	1 night for children without comorbidities. Consider >1 night for children with comorbidities. Consider >1 night if initial period of monitoring not representative of child's sleep.

Pulse oximetry measurements suggestive of an abnormality in children >2 years of age

Oximetry variable	Abnormal measurement
ODI4	A cut-off of >4/hr
ODI3	A cut-off of >7/hr
Mean SpO_2	<95%
Clustering and depth of desaturation events should also be considered (eg, mean >4% desaturation nadir <90%, or 3 episodes of desaturation <80%)	

Precautions when analysing home pulse oximetry

Care should be taken when defining 'total sleep time' as different centres can use different definitions (eg, total recording time or sleep time documented in an overnight sleep diary)
Oximetry cannot discriminate between obstructive or non-obstructive events or determine hypoventilation.

CRSS optimal monitoring time/process

Optimal CRSS monitoring times for diagnosing SDB in children

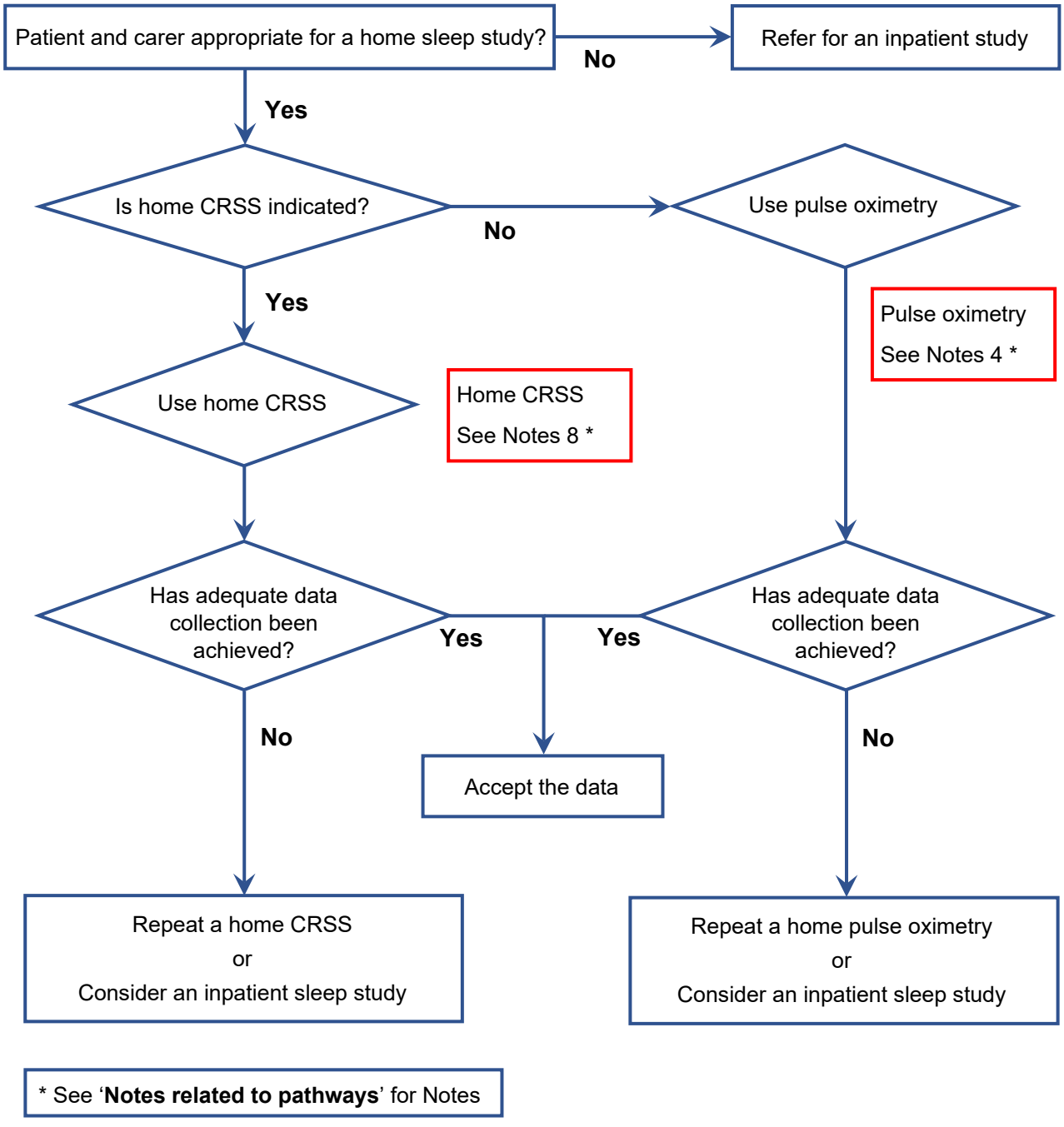
CRSS variable	Optimum
Monitoring time (hours)	4-6 hours continuous sleep duration if moderate-to-severe SDB is suspected. >6 hours continuous sleep duration if mild SDB is suspected.
Monitoring time (nights)	1 night for children with/without comorbidities. >1 night if initial period of monitoring not representative of child's sleep.

Considerations if a CRSS is normal

If a cardiorespiratory sleep study (CRSS) is normal but symptoms are ongoing, a repeat CRSS should be performed.

If a child has a normal CRSS, but has daytime sleepiness, narcolepsy can be considered (see the Narcolepsy pathway).

Home monitoring pathway



CRSS, cardiorespiratory sleep study.

Home ventilation

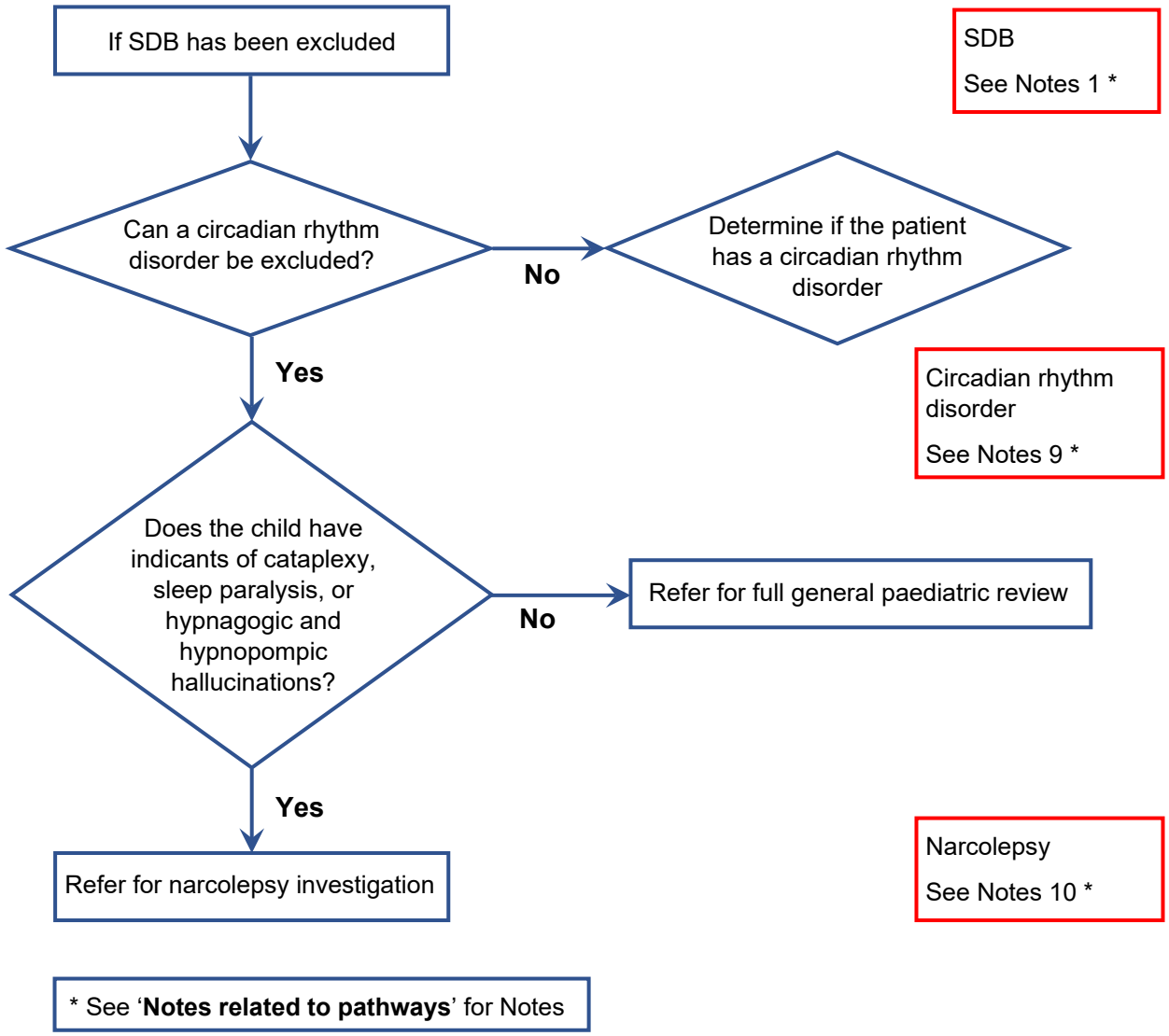
Pulse oximetry and CO_2 monitoring

CPAP or BiPAP treatment

For children receiving continuous positive airway pressure therapy (CPAP) or bi-level positive airway pressure (BiPAP), regular monitoring should be provided with a minimum of pulse oximetry and carbon dioxide monitoring.

When downloading from a CPAP device or ventilator, it should be noted that many ventilator algorithms, such as apnoea hypopnoea index (AHI), have not been validated in children.

Narcolepsy pathway



SDB, sleep-disordered breathing.

Notes related to pathways

Notes 1	**Sleep disordered breathing (SDB)** An awareness of rare conditions in children, which may primarily present with excessive daytime sleepiness, should always be maintained.
Notes 2	**Clinical observations & video recordings** There is currently insufficient evidence to make recommendations for use of sleep video or audio recordings to diagnose SDB. Video and audio recordings do not have validated scoring systems. Clinicians use these in a similar way to clinical observation to support intervention to treat SDB, but there is no method for scoring overall severity in sleep.
Notes 3	**Sleep questionnaires** SRBD-PSQ ≥0.33 and OSA-18 ≥0.60 questionnaires are recommended for diagnosing moderate-to-severe obstructive sleep apnoea (OSA) (AHI ≥5) in children without comorbidities. Questionnaires are not validated in children <2 years of age. Due to a lack of evidence, the use of sleep questionnaires for diagnosing SDB in children with comorbidities is not supported at this time. Sleep questionnaires will not detect mild SDB. If higher diagnostic certainty is needed, further monitoring with pulse oximetry, CRSS or PSG are advised.
Notes 4	**Pulse oximetry** Pulse oximetry can be considered as a first-line diagnostic test for SDB in children, but a normal study does not exclude the presence of mild to moderate SDB. Pulse oximetry ODI4 >4/hour or ODI3 >7/hour is supportive of a diagnosis of SDB. Pulse oximetry does not discriminate between obstructive and non-obstructive events, and for this reason should be used with caution in children under 2 years and for children with comorbidities for diagnosing OSA. A normal pulse oximetry study does not exclude the possibility of hypoventilation. The addition of carbon dioxide monitoring (CO_2) to pulse oximetry does not increase the diagnostic yield in children without comorbidities. The addition of CO_2 monitoring to pulse oximetry can be considered for children with comorbidities and suspected SDB where hypoventilation is suspected.
Notes 5	**Cardiorespiratory sleep studies (CRSS)** CRSS can be considered as a first line diagnostic tool for children with, or without comorbidities. The addition of CO_2 monitoring to CRSS probably does not increase the diagnostic yield in children without comorbidities. The addition of CO_2 monitoring to CRSS can be considered for children with comorbidities and suspected SDB where hypoventilation is suspected.
Notes 6	**Polysomnography (PSG)** PSG provides information on sleep architecture, as well as arousals related and unrelated to respiratory events. PSG is mostly performed with supervision and as an inpatient; unsupervised diagnostic PSG can be done in the home setting with good effectiveness. PSG is done to diagnose sleep behaviour disorders, eg, parasomnias, and to exclude SDB, eg, in narcolepsy. PSG needs to be done in conjunction with multiple sleep latency testing to diagnose narcolepsy.

Notes 7	**Surgery** Adenotonsillectomy is an effective treatment for OSA, especially in typically developing children (ie, those without comorbidities). OSA might not necessitate surgery, especially if mild when a 'wait and see' approach or medical therapy may be appropriate. Surgery should be agreed between clinicians and patients and/or parents/carers. Surgery may require local health board agreements.
Notes 8	**Home CRSS** Home CRSS can be considered for children with, or without comorbidities if the patient and carer are deemed appropriate for home sleep studies
Notes 9	**Circadian rhythm disorder** Sleep onset and wake up times should be discussed with the patient and/or carer to elicit sleep time and sleep latency.
Notes 10	**Narcolepsy** As the pathognomonic symptoms of narcolepsy may be subtle, or may not be volunteered, directed questions in the clinical history should be used to elicit, or exclude a diagnosis of narcolepsy in children. As cataplexy may be subtle, both child and parents/carers should be asked about head nods, neck/shoulder posturing and eyelid/facial droop. These are typically associated with laughter but may also be associated with anger or frustration. Both child and carer(s) should be asked about sleep paralysis and hypnagogic and hypnopompic hallucinations.

AHI, Apnoea–Hypopnoea Index; CRSS, Cardiorespiratory Sleep Studies; ODI3, 3% Oxygen Desaturation Index; ODI4, 4% Oxygen Desaturation Index; OSA, obstructive sleep apnoea; PSG, polysomnography; SRBD-PSQ, Sleep-related Breathing Disorder scale of the Paediatric Sleep Questionnaire.