

the differential impact of the COVID-19 pandemic on the sleep and mental wellbeing of CYP with and without SEN.

**Methods** NIHR Children and Young People MedTech Co-operative, Sheffield Children's NHS Foundation Trust, and The Sleep Charity carried out an online survey between 23 June 2020 and 17 August 2020. The 77-item survey was shared via social media platforms.

**Results** 559 participants were included in the analyses, 15.74% of whom reported having a CYP with SEN. While sleep changes due to the pandemic were largely similar for both groups, CYP with SEN (40.91%) were more likely to get or wake up during the night than CYP without SEN (40.91% vs 27.18%). CYP with SEN were significantly more likely than children without SEN to be demotivated (61.44% vs 31.57%), sad and tearful (36.15% vs 19.35%) or anxious and stressed (43.48% vs 14.82%) during the pandemic, as well as to report that increased anxiety was more likely to contribute to poorer sleep (43.48% vs 14.82%).

**Conclusion** While the majority of CYP in both groups reported sleep changes due to the pandemic, CYP with SEN experienced more sleep disturbance. The findings provide initial evidence to suggest that the pandemic may have had a greater impact on the sleep and mental wellbeing of CYP with SEN compared to CYP without SEN.

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#### THE COMFORT PROJECT: DEVELOPMENT OF CUSTOM-MADE MASKS FOR CHILDREN USING NON-INVASIVE VENTILATION

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Non-invasive ventilation (NIV) is assisted respiratory support delivered via facemask for people with chronic respiratory failure. Commercial NIV masks are available but masks that fit well are difficult to find for children who have small or asymmetrical facial features. Compromised ventilation can have significant health and quality of life impacts for patients and their families.

The overarching aim of the project was to improve comfort, fit and performance of NIV masks for children using 3D technology.

The needs of patients, parents/carers and healthcare professionals from 6 UK centres was ensured through events advising on mask design and research procedures. 3D scanning technologies were compared in vitro using workflows and deviation analysis and with 3 healthy and 19 patient volunteers. Early design concepts were tested and the final

**Abstract 29 Table 1** COMFORT project: development of custom-made masks for children using non-invasive ventilation

Oxygen parameters	Usual mask	Bespoke mask
Median O <sub>2</sub>	95%	98%
Dip index	20.4	8.0
Time <90%	5.8%	1.1%
Min O <sub>2</sub>	71%	79%

prototype selected using a test mannequin and adult volunteers. Prototype masks were manufactured using biocompatible materials to IOS 13485 quality standards and evaluated with 19 patients. Feedback on fit, comfort and facial marking and oximetry data to demonstrate ventilator effectiveness were collected. The potential cost-effectiveness of the customised masks was assessed using an economic model.

A handheld structured light 3D scanner was selected due to superior resolution, ease of use, availability and cost. The final design was a semi-bespoke hybrid approach. 11/15 (73%) evaluation participants reported comfort and fit that was as good or better than their usual mask. 5/11 (45%) were unable to wear the mask due to poorly fitting headgear despite a well-fitting mask. All physiological ventilation parameters were improved (table 1). Preliminary health economics analysis demonstrated that to achieve a 5% improvement in fit and ventilation, a custom-made mask would be cost effective at a price below £500.

A series of in vitro, user-perspective, healthy volunteer and patient evaluations informed the development of custom-made masks for children using NIV.

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#### A COMPARISON OF MASIMO RAD97 AND SOMNOTOUCH OXIMETERS IN THE ASSESSMENT OF SLEEP DISORDERED BREATHING IN PAEDIATRIC PATIENTS

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**Introduction** Overnight oximetry is recommended as an initial screening tool to diagnose sleep disordered breathing (SDB) in children (Hang et al 2015). Oximetry is a key component of cardio-respiratory sleep studies (CRSS). Most CRSS equipment has integrated oximeters. This study aims to compare the oxygen saturation data obtained by the standalone Masimo Rad97 oximeter to the integrated Somnotouch oximeter.

**Abstract 30 Table 1** A comparison of Masimo Rad97 and Somnotouch oximeters in the assessment of sleep disordered breathing in paediatric patients

	Somnotouch RESP	Masimo rad 97	p-value
Mean Oxygen Saturation	96 +/- 3.9	96.4 +/- 3.9	0.007
ODI3	11.5 +/- 16.3	18 +/- 27.1	0.0006
Number of desaturations	173.3 +/- 498.6	149.2 +/- 239.1	0.004
Time SpO <sub>2</sub> = < 90%	5.3 +/- 19.4	5.3 +/- 18.9	0.85

**Method** This was a retrospective study including children aged 2 months – 15 years of age. CRSS were performed using Somnotouch RESP (including Flow, RIPsum, Heart rate and Saturations) alongside standalone pulse oximetry using Masimo Rad97, both Somnotouch RESP and Masimo Rad 97 sleep and wake times were identical. Masimo Rad 97 uses an averaging time of 2-4 seconds compared to 4 seconds for Somnotouch RESP oximeter. Statistical analysis was performed with Graphpad Prims 9 using the Wilcoxon signed rank test .

**Results** A total of 25 studies were included in the analysis (19 males and 6 females). Table 1 shows the comparison between the oxygen saturation data recorded on Somnotouch RESP integrated oximeter and standalone Masimo Rad 97.

**Conclusion** Our study shows there is a significant difference in oxygen saturation data obtained by these two different pulse oximeters; these differences are likely to be due to differences in technical specifications and merit further investigation. Our study therefore highlights the need for specialist physiologist review of oximetry studies.

### 31 THE ASSOCIATION OF DELTA POWER DURING SLEEP WITH CONCURRENT NOCTURNAL AND NEXT-DAY PAIN: RESULTS FROM A COHORT OF FEMALE PARTICIPANTS WITH TEMPOROMANDIBULAR JOINT PAIN

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**Introduction** Existing data demonstrate reduced delta power during sleep in chronic pain and depressed patients. However, there has been little examination of the relationship between delta power and next-day reports of pain. We tested the extent to which nocturnal (during the concurrent sleep period) and daytime pain reports are associated with delta power during sleep, as well as the extent to which this association is moderated by depressive symptoms. We hypothesised that reduced delta power and SWS would be associated with increased pain, pain catastrophising, and pain sensitivity.

**Methods** 149 female participants with insomnia and temporomandibular joint pain (TMD) were recruited. We examined nocturnal and daytime measures of pain (pain severity, average pain), pain catastrophizing, and objective pain sensitivity (obtained through quantitative sensory testing (QST)), and calculated relative nocturnal delta (0.5-3.4 Hz) power using polysomnography. We fit linear regression models correcting for depressive symptom severity, age, and total sleep time, and further examined the moderating effect of depression severity on these measures.

Results reduced delta power was associated with increased average nocturnal pain (Unstandardized  $\beta = -17.67$ ,  $p = 0.02$ ), morning pain (Unstandardized  $\beta = -15.67$ ,  $p = 0.02$ ), and average next-day pain (Unstandardized  $\beta = -16.74$ ,  $p = 0.03$ ). Depression severity did not moderate these relationships. Delta power was not significantly associated with objective pain-sensitivity, nocturnal, or daytime pain catastrophising. However the association between nocturnal pain catastrophising and delta power was moderated by depressive symptom severity ( $p$

$= 0.04$ ). Simple slopes analysis revealed that when participants had low depressive symptoms ( $<13$  CESD), increased delta power significantly predicted reduced nocturnal pain catastrophising.

**Discussion** These findings demonstrate that delta power during sleep is associated with both nocturnal and daytime experience of pain in patients with TMD. In patients with TMD and low depressive symptoms, reduced delta power was associated with increased nocturnal pain catastrophising.

### 32 SLEEP QUALITY, MENTAL HEALTH, AND CIRCADIAN RHYTHMS DURING COVID LOCKDOWN – RESULTS FROM THE SLEEPQUEST STUDY

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**Introduction** Behavioural responses to COVID-19 lockdown will define the long-term impact of psychological stressors on sleep and brain health. Here, we tease apart factors that help protect against sleep disturbance. We capitalise on the unique restrictions during COVID-19 to understand how time of day of daylight exposure and outside exercise interact with chronotype and sleep quality.

**Methods** Participants completed our online ‘SleepQuest’ Study between 29th April 2020- 13th May 2020 and were followed up between 5th November 2020 -2nd December 2020. The SleepQuest survey comprised a set of validated questionnaires probing sleep quality, depression, anxiety, and attitudes towards sleep alongside bespoke questions on the effect of COVID-19 lockdown on sleep, time spent outside and exercising and self-help sleep measures.

**Results** 3474 people from the UK (median age 62, range 18-91) completed the baseline data with 2781 participants followed up. Results showed sleep quality was negatively affected by the first UK lockdown restriction [mean PSQI at baseline 8.12 (2.92)] however from baseline to follow up, sleep quality improved (mean PSQI Difference=2.21; 95% CI=[2.12,2.33.]) Factors that predicted poor prolonged sleep quality were baseline sleep quality ( $P < 0.001$ ), anxiety ( $P < 0.001$ ) and attitudes towards sleep ( $P < 0.01$ ). Better sleep quality was associated with going outside and exercising earlier, rather than later in the day. However, the benefit of being outside early is driven by improved sleep in ‘owl’ ( $p = 0.0002$ ) and not ‘lark’ ( $p = 0.27$ ) chronotype, whereas the benefit of early exercise (inside or outside) did not depend on chronotype.

**Discussion** We have provided evidence to suggest anxiety and dysfunctional attitudes towards sleep predicted poorer prolonged sleep quality. Defining the interaction between chronotype, mental health and behaviour will be critical for targeted lifestyle adaptations to protect brain health through current and future crises.