



BMJ Open Study protocol for randomised clinical trial comparing the effectiveness of side-lying sleep positioning to back-lying at reducing oxygen desaturation resulting from obstructive sleep apnoea in infants with cleft palate (SLUMBR2)

Aleksandra Metryka ¹, Claire Cunniffe,² Hazel J Evans,³ Johanna G Gavlak,³ Nichola Hudson,⁴ Nigel Kirby,⁵ Monica Lakhanpaul ^{6,7}, Yin-Ling Lin,⁸ Clare Murray,^{9,10} Azita Rajai,¹ Helen Robson,⁹ Anne Schilder,^{11,12} Tanya Walsh,⁸ Iain Bruce^{9,10}

To cite: Metryka A, Cunniffe C, Evans HJ, *et al.* Study protocol for randomised clinical trial comparing the effectiveness of side-lying sleep positioning to back-lying at reducing oxygen desaturation resulting from obstructive sleep apnoea in infants with cleft palate (SLUMBR2). *BMJ Open* 2021;**11**:e049290. doi:10.1136/bmjopen-2021-049290

► Prepublication history for this paper is available online. To view these files, please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2021-049290>).

Received 21 January 2021
Revised 10 March 2021
Accepted 17 March 2021



© Author(s) (or their employer(s)) 2021. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

For numbered affiliations see end of article.

Correspondence to

Dr Iain Bruce;
iain.bruce@manchester.ac.uk

ABSTRACT

Introduction The craniofacial abnormalities found in infants with cleft palate (CP) decrease their airway patency and increase their risk of obstructive sleep apnoea (OSA). We hypothesise that optimising sleep position in infants with CP may improve airway patency and offer a 'low-cost, high-impact' intervention to prevent the negative impacts of OSA. Because cleft centres give inconsistent advice about sleep position: some recommend back-lying and others side-lying, we will compare these in a randomised controlled trial.

Methods and analysis The aim is to determine the clinical effectiveness of side-lying as compared with back-lying sleep positioning in terms of reducing oxygen desaturation resulting from OSA in 244 infants aged 3–5 weeks of age, diagnosed with an isolated CP in/by UK cleft centres. Primary outcome is the 4% Oxygen Desaturation Index measured using pulse oximetry during sleep.

Research plan 1. Multicentre randomised controlled trial of side-lying compared with back-lying sleep positioning in reducing oxygen desaturation resulting from OSA in infants with CP at one month of age. 2. Internal pilot questionnaire-based study to support parents and clinicians regarding study participation, seeking to identify and address any barriers to recruitment. Monitoring data from the internal pilot will be used in the final analysis. 3. Co-development of new UK recommendations with Cleft Lip and Palate Association (CLAPA) regarding sleep position for infants with CP.

Ethics and dissemination The study protocol has received the favourable opinion of the West Midlands-South Birmingham Research Ethics Committee. Study results will be published on affiliated webpages and in peer-reviewed publications and conference contributions.

Trial registration number NCT04478201.

Strengths and limitations of this study

- This study addresses an important evidence gap regarding the optimal sleeping position of infants with a cleft palate.
- All cleft centres in the UK will be invited to participate in the study.
- This study will produce sleep-position recommendations for future practice at UK cleft centres.
- Non-adherence due to randomised allocation being different to advice given by the cleft centre.

INTRODUCTION

The craniofacial abnormalities found in children with cleft palate (CP)¹ lead to reduction in airway size, and risk of airway obstruction ranging from intermittent airway collapse during sleep (obstructive sleep apnoea, OSA)² to potentially life-threatening airway compromise³ necessitating intubation or a tracheostomy. Children with CP are at increased risk of OSA when compared with otherwise 'healthy' children. There is evidence that severe OSA may be found in infants before cleft repair.^{2–4} In children and adults, sleep position is known to influence the patency of the airway during sleep. When investigating the effect of sleep position on OSA in infants with CP, the best sleep position would be expected to cause less airway collapse and a reduced frequency of oxygen desaturations resulting from OSA. Altering sleep position in infants with CP may offer a

'low-cost, high-impact' intervention to limit the negative impacts of OSA.

Oxygen desaturations are known to have negative effects on the well-being of children and adults. Children with CP are at increased background risk of impairment in learning, memory and cognition³ with OSA recognised as having a potentially deleterious effect on cognitive development.³⁻⁵ In addition, infants with CP are at risk of poor weight gain and 'failure to thrive',⁴⁻⁸ which can be further exacerbated by co-existing OSA. The increased work of breathing associated with OSA, leads to increased energy expenditure, in infants already at risk of reduced calorific intake due to cleft-related feeding difficulties. Poor nutritional status is a significant, and potentially reversible, barrier to the desired surgical repair of a CP in infancy or early childhood.

OSA can have significant and permanent negative effects on health and development in infants with CP. An observational study in a group of children with cleft lip and/or palate, reported that severe OSA in infancy had a significant negative impact on neurocognition, quality of life and weight gain measurable at 3 years.⁸

Infant sleeping position is an emotionally charged topic: In 2009, the Department of Health published a leaflet entitled 'Reduce the risk of cot death' (www.nhs.uk) which advises parents to 'place your baby on the back to sleep, in a cot in a room with you.' We have found that there is a lack of evidence and clinical consensus regarding sleep position for infants with CP (7/12 UK centres advised side-lying and 5/12 back-lying).⁹ This is confusing for parents and health professionals who have repeatedly expressed the need for clear and consistent information about the best sleeping position.

Rationale

Pierre Robin sequence (PRS) is considered to be an extreme type of CP, associated with a markedly underdeveloped mandible and significantly increased risk of OSA. The standard sleep position advice given for PRS is a side-lying position. Studies in infants with PRS have reported an improvement in feeding difficulty and subsequent weight gain, following early intervention to improve the airway.¹⁰ Side-lying positioning has been postulated as a simple, low-cost therapeutic intervention to improve airway patency in children with OSA¹¹ and those undergoing general anaesthesia¹¹⁻¹³ or sedation.¹⁴

Cleft lip and/or palate are among the most common birth defects, occurring in approximately 1 per 500-700 births,¹⁵ of which approximately 45% have an isolated CP.¹⁶ The provision of care for these children is organised into Regional Cleft Networks, comprising of one or two surgical centres. The Cleft Networks have a proven track-record of clinical and research collaboration, enhanced by a highly functional lead clinical nurse specialists (CNS) group that serves to facilitate dissemination of knowledge and sharing of best-practice initiatives.

Aim and objectives

The aim of this project is to determine the clinical effectiveness in infants with CP of side-lying as compared with back-lying sleep positioning in reducing oxygen desaturation resulting from OSA. This is to develop evidence-based recommendations for cleft centres regarding the optimum sleep position for infants with CP. This will be achieved by:

- ▶ Comparing oxygen saturation during sleep in the side-lying and back-lying positions at 1 month of age (4 weeks±1 week).
- ▶ Comparing self-reported sleep quality between the side-lying and back-lying groups evaluated in a parental questionnaire.

Providing information in consultation with parents that could be used to inform the development of guidelines and recommendations for sleeping position of infants with a CP.

METHODS AND ANALYSIS

This study protocol (V.1.1, 2020) describes the design of a multicentre randomised controlled trial (RCT) of sleep position in infants with CP in the UK. The study protocol conforms with the Standard Protocol Items: Recommendations for Interventional Trials¹⁷ while the RCT will conform to the Consolidated Standards of Reporting Trials statement for reporting RCTs.¹⁸

An unblinded, RCT of side-lying compared with back-lying sleep positioning in reducing oxygen desaturation resulting from OSA in infants with CP. Infants meeting the eligibility criteria will be randomised to side-lying or back-lying in a ratio 1:1 using a minimisation routine incorporating a random element to reduce predictability. Minimisation factors will be clinical site and syndrome suspected or indicated (yes/no). Allocations will be delivered via a password-protected web-based system. The allocated position will only be used on the night(s) when the infant is monitored for the study purposes. If the first attempt at oxygen monitoring is unsuccessful parents will have the chance to keep the equipment for another night. Thereafter, parents will be free to revert back to the standard sleep position as advised by their cleft centre, should it be different than that used for the monitoring period. All centres represented at our preparatory meeting with the UK Lead CNS group, confirmed that the side-lying position was recommended in some infants at their centre, irrespective of whether it was the standard advice used. As such, all centres had experience of the side-lying position. It was decided not to change the specific advice that centres give to parents regarding how to position the infant in a side-lying position, but any standard written or verbal information would be collected by the study documents. Study is planned to begin recruitment in June 2021.

Study design

Patient and public involvement

Research described by this protocol follows a feasibility study, entitled: 'Does sleep position influence sleep

disordered breathing in infants with CP: A feasibility study.’ There is an agreement among parents and clinicians that there is an unmet need in this area which requires investigation. SLUMBR2 development was directed by the results from *Side Lying and Upperairways Maintenance in Babies Requiring Surgery for cleft palate* (SLUMBR2) feasibility study in which we have investigated the possibility of this trial and spoke with parents about their willingness to take part and the importance of breathing during sleep.¹⁹ Preparation of SLUMBR2 and SLUMBR2 has been done in collaboration and with full support of the Cleft Lip and Palate Association (CLAPA, working to improve the lives of people born with a cleft and their families in the UK) who have been supportive of the study from the very beginning.

Recruitment setting

The SLUMBR2 study is a multicentred RCT. All cleft centres in the UK will be eligible to participate in the study provided that they are prepared to allow sleep position to be randomised. Participating centres will be required to allow for randomisation of the sleep position for their patients participating in the study. Parents will be randomly assigned advice regarding sleep position for their child, either side-lying or back-lying. It is possible that for some parents this advice will be different to that they received from their local cleft centre. Parents will only be asked to follow study related advice during their participation in the study, that is, up to 3 days (2 nights).

Participants recruited in the initial 6 months from opening the first study site will be asked to complete an additional questionnaire collecting information about their experience of participating in the study (online supplemental appendix 1). After 6 months, this information will be analysed and used as a basis for potential changes to the recruitment process and technical information on using the monitor, with the aim of supporting parents to consent to join the study.

Parents will be asked to record in a sleep log the starting sleep position and the sleep position when the baby wakes for feeds and/or at the end of sleep. Parents will record the time awake and asleep to aid the respiratory paediatrician and physiologist with reporting the oximetry traces. The mode of feeding (eg, breast milk, formula or combination feeding) and details of any nutritional supplementation used will be recorded in the sleep questionnaire, completed by parents. Parents will be asked to complete a bespoke sleep questionnaire (online supplemental appendix 2) to capture information regarding parental perception of sleep quality during the study period.

The study will run for 36 months, with a 30-month recruitment window. We aim to recruit 244 children to the study (122 side-lying and 122 back-lying).

Target population

Inclusion criteria

- ▶ Infants diagnosed with an isolated CP under the care of a collaborating centre.

- ▶ Parents willing to give consent and able to complete study procedures.

Exclusion criteria

- ▶ Infants with associated cleft lip.
- ▶ Infants born prematurely (before 37 weeks gestation).
- ▶ Infants with cardiorespiratory disease.
- ▶ Infants requiring an intervention to assist with breathing (nasopharyngeal airway).
- ▶ Infants requiring an intervention to assist with feeding (nasogastric tube).

Primary outcome

Oxygen saturation during sleep at 1 month of age (expressed 4% oxygen desaturation index, ODI-4). Oximetry is considered the mainstay of assessment of oxygenation in infants and will be the primary outcome measurement instrument. The ODI-4 represents the average number of times that oxygen saturation falls by at least 4% from baseline every hour.

Secondary outcomes

- i. Other commonly used oximetry parameters including mean oxygen saturation (SpO₂), nadir SpO₂, ODI-3, the proportion of total sleep time (TST) with oxygen saturation below 97%,⁵ 95%,²⁰ 90%,⁵ and 80% at age 1 month.
- ii. Weight at age 1 month (4 weeks±1 week).
- iii. Length and head circumference at age 1 month (4 weeks±1 week).
- iv. Adverse events.

Sample size

Data from the feasibility study²¹ and published studies²² have reported estimates of the SD of the primary outcome ODI-4 in the side-lying infants at 4 weeks to range from 8 to 11 units, with a higher SD observed in the back-lying group. The observed difference in mean ODI-4 between the side-lying and back-lying infant cohorts was 15 units (a standardised effect size of 0.91).²¹ It was considered a smaller but more realistic difference in means of five units to be a clinically important difference (SD 10), a standardised effect size of 0.5. The sample size calculation comparing two means with unequal variances for the primary outcome was, therefore, based on a standardised effect size of 0.5. To account for potential unequal variances in each group a variance ratio of 2 was used in the calculations. To detect a difference of 0.5 SDS with 80% power and alpha equal to 0.05 would require 96 infants to be monitored in each arm of the trial (a total of 192 participants). Informed by the multicentre feasibility and oximetry studies the sample size will be inflated to 244 participants in the RCT, to allow for potential attrition of 21%.

Statistical analysis

This will follow a prespecified and approved statistical analysis plan. The primary analysis of the RCT data will use intention to treat. Baseline data will be analysed to



assess the comparability of the demographic and clinical characteristics of the participants. Data from the trial arms will be compared using generalised linear models and adjusted for minimisation covariates where appropriate under the intention to treat principle. Estimates of treatment effect size will be reported as differences in means for continuous outcomes, and risk ratios/ORs for dichotomous outcomes and reported along with 95% CIs. Subgroup analyses will explore the effects of sleep position on infants with, and without, associated syndromes being suspected by the responsible clinical team, through subgroup treatment interactions, at a stricter alpha level 0.01. Reasons for exclusions from analysis will be clearly detailed in the statistical analysis plan.

Data collection

Sleep oximetry for one night will be recorded in the home at age 3–5 weeks. Domiciliary sleep oximetry monitoring (amount of oxygen in the blood) reflects usual UK practice, producing data which is readily applicable to routine clinical practice.

Motion resistant pulse oximetry with a 2 s averaging time (Masimo Rad oximeter) will be recorded during sleep from a securely attached toe sensor. The technical specifications and interpretation guidelines of the Australasian Sleep Association (2019) will guide study protocol development.²³ If the first night's diagnostic study is inadequate or incomplete (less than 5 hours of sleep), then a second night will be offered.

Data from oximeters at relevant participating centres will be downloaded onto their local National Health Service (NHS) drives and sent to the University Hospital Southampton NHS Foundation Trust (UHS) for analysis by a respiratory physiologist (Gavlak) or respiratory paediatrician (Evans). Transfer of the oximetry file will be done between encrypted nhs.net emails. In addition to oximetry data participating centres will send a sleep log to UHS to aid with interpreting the data. Data from respective centres sent to UHS will be distinguished

with a pseudonym which could only be linked to participant's identifiable information by their recruiting centre. Following analysis at UHS, ODI-3 and ODI-4 values and mean SpO₂, nadir SpO₂, the proportion of TST with oxygen saturation below 97%, 95%, 90% and 80% will be recorded in the study database by CTR staff in Cardiff.

Background and demographic information will be collected including the nature of the CP, smoking habits of family members and first part of the home postcode. Participant's general practitioner's (GP) and health visitor (HV) details will also be collected and their GP will be informed about participation in the SLUMBR2 study. Participant's GP and HV details will be collected in the case report form (CRF).

During the monitoring period, the parents of participants will be asked to complete the, SLUMBR2 Sleep questionnaire (online supplemental appendix 2) and sleep log. Additionally, immediately following the monitoring period the study experience questionnaire (online supplemental appendix 1) will be completed by parents of those participants who were recruited in the first 6 months of the study opening. Six months will be counted from the time the first study site was open to recruitment to allow for simultaneous data collation and analysis from all sites.

Study procedures

Data will be collected at two time points (table 1).

- ▶ Screening/baseline.
- ▶ Home monitoring (when the child is aged between 3 and 5 weeks)—at least one overnight sleep period over 1–2 nights.

Screening

All babies with isolated CP will be screened by the CNS for their inclusion into the SLUMBR2 RCT (ie, it will be checked if they fulfil the inclusion criteria). Parents with babies that fulfil the inclusion criteria, will be approached initially by the specialist nurses from the

Table 1 Schedule for study procedures

	Screening	Recruitment and baseline	Home monitoring at 1 month of age	End of study
Assessment of eligibility criteria	x			
Informed consent		x	x	
Review relevant medical history	x	x		
Demographics		x		
Weight, length, head circumference		x	x	
Sleep log			x	
SpO ₂ monitoring			x	
Assess adverse events		x	x	x
Concomitant medication check		x	x	
Study experience questionnaire*				x

*Only for study participants recruited within the initial six months of the study opening.

cleft team at that site. The nurse specialist will talk to the parents in more detail about the study and will give parents the parent/guardian information sheet (online supplemental appendix 3 and informed consent form online supplemental appendix 4). All sites will be asked to keep a screening log throughout the study. Information regarding eligibility, reasons for ineligibility, and the eventual recruitment outcome (consented/not consented) will be collected. This will help to monitor recruitment levels, participation rates and the number of patients seen within the site.

The screening log should be maintained by the research team at the site and should be emailed (to secure nhs.net email address only) to the SLUMBR2 trial manager at the Manchester University NHS Foundation Trust (MFT) every 2 months.

Baseline

After consent is obtained, baseline demographics (including nude birth weight (measured at 0–7 days)—from the personal child health record (The Red Book), related medical history, parental smoking status will be collected and recorded in the CRF. This information will either be obtained at a routine visit or at the Home Visit, whichever one occurs first. It is possible that due to the COVID-19 pandemic routine visit with the cleft nurse will take place over the telephone or via a video call.

Home monitoring 1, day 1

The cleft nurse will arrange home monitoring to help with the setup of the oximeter (sleep monitoring).

The home monitoring will be scheduled to occur when the infant is 4 weeks old (± 1 week) and free of signs of respiratory tract infection. The sleep study should be done overnight. We are aiming to record sleep oximetry during one period of sleep lasting at least 5 hours. The infants' weight, length and head circumference measured within the last 1 week of the oximetry monitoring will be recorded (if available)—from personal child health record (The Red Book).

Sleep questionnaire

Parents will be given a questionnaire to complete (online supplemental appendix 2). The questionnaire aims to capture information regarding parental perception of sleep quality during the sleep study. The questionnaire will enable the comparison with reported symptoms of OSA in infants with CP and sleep position.

Sleep oximetry monitoring

The cleft nurse will set up the oximeter with the participant study number. The information will enable the study team to identify which baby the recording belongs to once it is downloaded. The nurse will then explain to the parent/s how to switch the monitor on/off and how to attach the SpO₂ sensor to their infant. This will be done either in person if a home visit is possible or via the telephone/video call if a visit is to be a virtual one as part of the local measures for COVID-19. Parents will

also be given a written instructions showing how to use the oximeter and web-link to an instruction video which they could view at any time to refresh their knowledge. The parents will be instructed to record in the sleep log if they remove the monitor or the baby wakes for a feed. The SpO₂ probe can be left on while the baby is feeding.

It is standard practice to silence the oximeter alarm for NHS home oximetry services. However, for the purposes of this study we will set the alarm at SpO₂ 70% and heart rate 80, a value that we would not expect to normally record during infant sleep.

The monitor will record the following parameters:

Mean SpO₂

Nadir SpO₂

ODI-3 and 4 (ODI-3 and ODI-4).

TST with oxygen saturation below 97%, 95%, 90% and 80%.

After the monitoring period has finished, parents will remove the SpO₂ probe and switch off the machine (switching off the machine will not lose the data, it will be stored). For safety purposes, all of the sleep oximetry sessions will be reviewed by the study respiratory physiologist or paediatrician within 2 weeks of the date of monitoring.

The respiratory physiologist and paediatrician (assessors) who will analyse oximetry readings will be blinded to the sleep position allocation. On the night of oximetry monitoring parents will complete the sleep log, where they will record if the sleep position is as randomised, as well as wake times. The sleep log will be provided to the oximetry assessors to aid with the analysis by helping to identify the sleep and wake times. Sleep log will also measure compliance with randomisation. As such assessors will not know the sleep position and will be blinded.

Procedures for assessing safety

All of the sleep oximetry studies will be reviewed by the study respiratory physiologist (Gavlak) or paediatrician (Evans) within 2 weeks of the date of monitoring. Sleep monitoring is usually done at home in babies with CP who present with airway problems. Babies recruited to this study will not have airway concerns sufficient to mandate an airway intervention and therefore we would not expect clinically significant desaturation events. At initial site recruitment the 'emergency' contact details for each cleft team will be collated, along with a written description of the local pathway for onward referral of any infant with suspicion of significant OSA.

Abnormal result suspicious of OSA

In the event that a sleep oximetry study is considered abnormal, as indicated by the review from the study respiratory physiologist (Gavlak) or respiratory paediatrician (Evans) within 2 weeks of the date of monitoring, the local cleft team will be contacted by UHS (Gavlak and/or Evans). All abnormal readings considered of clinical concern will prompt an urgent written report of the oximetry findings to the responsible cleft team within 2 weeks, and an

additional telephone contact may be made with the cleft team dependent on the level of concern. An example of an oximetry finding that would be considered of clinical concern would be an ODI-4% > 25. The Chief Investigator will be informed of an abnormal sleep study at the same as the local cleft team.

Result not suspicious of OSA

The parents and responsible cleft team will receive written confirmation from the UHS (Gavlak and/or Evans) of studies considered to be normal, not later than 4 weeks after the date of monitoring.

End of study

The day after the oximetry monitor is delivered to the participant, study staff will telephone families to check if successful monitoring has occurred. In an instance when more time with the machine is needed the participant will keep the oximetry machine for another night. Following the completion of sleep oximetry recording, oximetry machines will be either collected by the study staff or by a courier who will return them to the site which recruited the participant. Collection will be arranged by the recruiting site. In order for a courier to be arranged the recruiting site will share the participant's address with the courier. Participants' permission to share their address with the courier will be recorded in the informed consent form.

Adverse events

No medicinal product is being given in this study. Reactions to the monitoring are highly unlikely but the study staff will record any adverse events in the CRF during the phone call following the delivery of the oximetry machine or when the equipment is returned. We will record what the illness is (eg, upper respiratory tract infection), whether any medication was given. Adverse events will be followed up for up to 28 days or until resolution, whichever date is sooner.

Potential risks and benefits

Potential risks

SLUMBR2 is an RCT which means that infants will be randomly allocated to one of the two sleeping positions, side-lying or back-lying. This means that there is a chance that for the 1–2 nights during the study some participants will be asked to follow advice that is contrary to the standard advice given by their cleft centre. This may cause distress to some participants. Current UK practice is that some Cleft Networks recommend side-lying and others back-lying sleep position as standard, and all recommend side-lying in some infants if they are concerned about airway obstruction. As such, both of the sleep positions being compared would represent 'standard' practice in some UK centres. The probe from the oximeter will be attached to a toe, to limit the chance of entanglement in the cable.

Known potential benefits

There are no known direct potential benefits to participating. However, the infant will have an oximetry reading which will be reviewed by a respiratory physiologist, which they would not obtain as part of routine care. This may offer additional reassurance for parents or identification of potential healthcare issues as indicated by parents in the SLUMBR2 feasibility study.

Study closure

The end of the study is defined to be the date on which data for all participants is frozen and data entry privileges are withdrawn from the study database. However, the study may be closed prematurely by the data monitoring committee. The study management group (SMG) have the right at any time to terminate the study for clinical or administrative reasons.

Review of study continuation will be initiated by the SMG within 2 weeks of the following instances taking place:

- ▶ Recorded cot death of one of the study participants, past and active.
- ▶ Recall of study equipment.
- ▶ Harm to the participant caused by study equipment.
- ▶ New evidence unequivocally showing one of the study positions was safer than other.

The end of the study is defined to be the date on which data for all participants is frozen and data entry privileges are withdrawn from the study database. An end of study notification will be submitted to the Research Ethics Committee (REC) within 90 days of this date. An end of the study notification will be submitted to the REC within 15 days if the study is terminated prematurely. Investigators will inform the parents of participants of any premature termination of the study and ensure that the appropriate follow-up is arranged for all involved. A summary report of the study will be provided to the REC within 12 months of the end of study notification.

All data will be stored for at least 10 years, in accordance with the sponsor's standard operating procedure (SOP). Any queries or concerns about the data, conduct or conclusions of the study can also be resolved in this time. Limited data on the participants and records of any adverse events may be kept for longer if recommended by an independent advisory board.

STUDY MONITORING

Study monitoring will be carried out to ensure that the rights and well-being of human participants are protected during the course of a clinical trial. The study will be subject to the audit and monitoring regimen of MFT, the study sponsor, in line with applicable MFT SOP and policies. The study will have, as a minimum, an annual survey sent out for completion by a member of the local research team.

ETHICS AND DISSEMINATION

The study protocol has received the favourable opinion of the West Midlands-South Birmingham Research

Ethics Committee. All participating sites must be granted NHS permission by their local Research Office prior to commencing recruitment. On completion of our study, the findings will be incorporated into clinical practice for the benefit of patients via the Lead CNS group (Hudson, chair). CNSs provide ‘hands-on’ care for infants with CP in the home and hospital settings and are ideally placed to highlight research priorities. They have been instrumental in defining and contextualising the research question. In addition, we will disseminate study results through Cleft Network study days and will create a short video which will summarise our study findings and recommendations which will be hosted on the websites <https://www.clapa.com/news-item/slumbers-sleep-study/>, <https://Health-talk.org>, <https://Mft.nhs.uk>, <http://craniofacialsociety.co.uk/>, <https://www.lullabytrust.org.uk/>. It will be co-developed with parents and CLAPA to inform parents and healthcare practitioners about the best sleep practice for infants with CP.

STEPS TO MITIGATE AGAINST THE IMPACT OF THE COVID-19 PANDEMIC

The study team acknowledge that the COVID-19 pandemic has impacted on the delivery of clinical research. Wherever possible and safe, the RCT will be delivered as intended. Steps are being taken to ensure that study information (eg, Participant Information Sheet) can be distributed electronically or by mail. Similarly any data that we collect (eg, sleep questionnaires and the sleep log) and informed consent can be collected electronically or by mail, to limit contact between researchers and families. Details of the impact of local and national restrictions at individual sites will be recorded on a monthly basis, using a bespoke impact document that would be available to the SMG, sponsor and funder.

Author affiliations

¹Research and Innovation, Manchester University NHS Foundation Trust, Manchester, UK

²Cleft Lip and Palate Association (CLAPA), London, UK

³Department of Respiratory Paediatrics, Southampton Children’s Hospital, Southampton, UK

⁴Salisbury NHS Foundation Trust, Salisbury, UK

⁵Centre for Trials Research, Cardiff University, Cardiff, UK

⁶Policy & Practice Department, UCL Great Ormond Street Institute of Child Health Population Policy and Practice, London, UK

⁷Community Paediatrics, Whittington Health NHS Trust, London, UK

⁸School of Dentistry, The University of Manchester, Manchester, UK

⁹Royal Manchester Children’s Hospital, Manchester University Hospitals NHS Foundation Trust, Manchester Academic Health Science Centre, Manchester, UK

¹⁰Division of Infection, Immunity and Respiratory Medicine, The University of Manchester Faculty of Biology Medicine and Health, Manchester, UK

¹¹evidENT, UCL Ear Institute, London, UK

¹²NIHR University College London Hospitals Biomedical Research Centre, London, UK

Correction notice Author name Claire Cunniffe has been corrected.

Acknowledgements The study team would like to thank all members of the SMG and SAG from the preceding SLUMBRs Feasibility study (PB-PG-0213–30058), the Cleft Lip & Palate Association (CLAPA) and Craniofacial Society of Great Britain &

Ireland (CFSGBI). In particular, thanks are due to Trish Bannister for supporting the work from the beginning.

Contributors AM contributed to the study design and drafted the manuscript. CC, HJE, JGG, NH, NK, ML, Y-LL, CM, AR, HR, AS, TW and IB contributed to the study design and revised the manuscript. All authors read and approved the final manuscript.

Funding This work was supported by National Institute for Health Research (NIHR) grant number (PB-PG- NIHR201173).

Disclaimer The views expressed are those of the author(s) and not necessarily those of the NIHR or the Department of Health and Social Care.

Competing interests None declared.

Patient consent for publication Not required.

Provenance and peer review Not commissioned; peer reviewed for ethical and funding approval prior to submission.

Supplemental material This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

ORCID iDs

Aleksandra Metryka <http://orcid.org/0000-0001-9871-5167>

Monica Lakhanpaul <http://orcid.org/0000-0001-5288-3325>

REFERENCES

- Imamura N, Ono T, Hiyama S, *et al*. Comparison of the sizes of adenoidal tissues and upper airways of subjects with and without cleft lip and palate. *Am J Orthod Dentofacial Orthop* 2002;122:189–94.
- MacLean JE, Fitzsimons D, Fitzgerald DA, *et al*. The spectrum of sleep-disordered breathing symptoms and respiratory events in infants with cleft lip and/or palate. *Arch Dis Child* 2012;97:1058–63.
- MacLean JE, Fitzsimons D, Hayward P, *et al*. The identification of children with cleft palate and sleep disordered breathing using a referral system. *Pediatr Pulmonol* 2008;43:245–50.
- Maclean JE, Waters K, Fitzsimons D, *et al*. Screening for obstructive sleep apnea in preschool children with cleft palate. *Cleft Palate Craniofac J* 2009;46:117–23.
- Montgomery-Downs HE, Gozal D. Sleep habits and risk factors for sleep-disordered breathing in infants and young toddlers in Louisville, Kentucky. *Sleep Med* 2006;7:211–9.
- Horemuzova E, Katz-Salamon M, Milerad J. Breathing patterns, oxygen and carbon dioxide levels in sleeping healthy infants during the first nine months after birth. *Acta Paediatr* 2000;89:1284–9.
- Pandya AN, Boorman JG. Failure to thrive in babies with cleft lip and palate. *Br J Plast Surg* 2001;54:471–5.
- Smith DM, Losee JE. Cleft palate repair. *Clin Plast Surg* 2014;41:189–210.
- Davies K, Bruce IA, Bannister P, *et al*. Safe sleeping positions: practice and policy for babies with cleft palate. *Eur J Pediatr* 2017;176:661–7.
- Lidsky ME, Lander TA, Sidman JD. Resolving feeding difficulties with early airway intervention in Pierre Robin sequence. *Laryngoscope* 2008;118:120–3.
- Arai Y-CP, Fukunaga K, Ueda W, *et al*. The endoscopically measured effects of airway maneuvers and the lateral position on airway patency in anesthetized children with adenotonsillar hypertrophy. *Anesth Analg* 2005;100:949–52.
- Arai Y-CP, Fukunaga K, Hirota S, *et al*. The effects of chin lift and jaw thrust while in the lateral position on stridor score in



- anesthetized children with adenotonsillar hypertrophy. *Anesth Analg* 2004;99:1638–41.
- 13 Arai Y-CP, Nakayama M, Kato N, *et al.* The effects of jaw thrust and the lateral position on heart rate variability in anesthetized children with obstructive sleep apnea syndrome. *Anesth Analg* 2007;104:1352–5.
- 14 Litman RS, Wake N, Chan L-ML, *et al.* Effect of lateral positioning on upper airway size and morphology in sedated children. *Anesthesiology* 2005;103:484–8.
- 15 Ahmed MK, Bui AH, Taioli E. *Designing strategies for cleft lip and palate care*, 2016.
- 16 CRANE database - Home 2019. Available: <https://www.crane-database.org.uk/> [Accessed 09 July 2019].
- 17 Chan A-W, Tetzlaff JM, Gøtzsche PC, *et al.* Spirit 2013 explanation and elaboration: guidance for protocols of clinical trials. *BMJ* 2013;346:e7586.
- 18 Moher D, Hopewell S, Schulz KF, *et al.* Consort 2010 explanation and elaboration: updated guidelines for reporting parallel group randomised trials. *J Clin Epidemiol* 2010;63:e1–37.
- 19 Davies K, Lin Y-L, Glenny A-M, *et al.* Parental experience of sleep-disordered breathing in infants with cleft palate: comparing parental and clinical priorities. *Cleft Palate Craniofac J* 2019;56:222–30.
- 20 Hunt CE, Corwin MJ, Lister G, *et al.* Longitudinal assessment of hemoglobin oxygen saturation in healthy infants during the first 6 months of age. Collaborative Home Infant Monitoring Evaluation (CHIME) Study Group. *J Pediatr* 1999;135:580–6.
- 21 Murray C *et al.* Does sleep position influence sleep disordered breathing in infants with cleft palate: a feasibility study? *The Cleft Palate-Craniofacial Journal* 2020.
- 22 Evans HJ, Karunatileke AS, Grantham-Hill S, *et al.* A cohort study reporting normal oximetry values in healthy infants under 4 months of age using Masimo technology. *Arch Dis Child* 2018;103:868–72.
- 23 Twiss J, Chawla J, Davey MJ, *et al.* Overnight oximetry for evaluating paediatric obstructive sleep apnoea: technical specifications and interpretation guidelines. *J Paediatr Child Health* 2019;55:1279.