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| Date | Tuesday 24th November |

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| Title of paper | The use of pulse oximetry in primary care for children under two |

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| Responsible Director  | Martin Waddington |
| Clinical Lead | Nicola Burbidge |
| Confidential | Yes |[ ]  No |[x]  Items are only confidential if it is in the public interest for them to be so |

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| The Governing Body is asked to: |
| * Note the case for using paediatric finger pulse oximeters in Hounslow GP practices
* Endorse and approve the recommendation to supply all Hounslow GP practices with finger pulse oximeters for children under the age of 2.
* Agree the ongoing source of funding for additional sensors as required by GP practices
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| Summary of purpose and scope of report |
| BackgroundFinger pulse oximetry allows for simple, non-invasive and quick estimation of arterial oxygen saturation (SpO2) and pulse rate. It is recommended by the British Thoracic Society (BTS) and Scottish Intercollegiate Guidelines Network (SIGN) that accurate measurement of oxygen saturation is essential in all children with acute wheezing, and that pulse oximetry should be readily available in both primary and secondary care settings.1Due to their simplicity of use and ability to provide continuous and immediate oxygen saturation values, pulse oximeters are routinely used in emergency medicine, however they are less used in the community when assessing whether children require assessment in secondary care. ‘Normal’ SpO2 values have not been specifically defined, but are known to vary with age and with altitude.2 Mean SpO2 in infants and children at sea level has been reported as 97 – 99%, although this may be slightly lower in neonates and young infants (93-100%). Current recommendations are that children with acute wheeze and saturations <94% require immediate high flow oxygen therapy with target SpO2 of 94-98%. In addition, low oxygen saturations after initial bronchodilator therapy predicts a subgroup of children with severe asthma. One study found that children with SpO2 ≤91% after initial bronchodilator therapy predicted a 16-fold increased need for hospital admission.3 Central cyanosis is difficult to detect in infants and young children, and therefore prompt pulse oximetry is recommended for reliable assessment of hypoxaemia in this age group.The following recommendations will be made in this paper:1. GPs should have access to accurate pulse oximetry equipment, which give reliable readings and can be used on any age group, based on evidence and guidelines from the CQC, NICE and BTS, which recommend the use of SpO2 as an adjunct to other clinical signs in the assessment and management of acutely unwell children.
2. GPs should, if possible, measure oxygen saturations in children presenting with:
	1. Acute asthma/wheeze
	2. Bronchiolitis
	3. Lower respiratory tract infection/pneumonia
	4. Fever
	5. Croup/upper airway obstruction
3. A handheld pulse oximeter should be used with a suitable infant sensor to ensure accurate SpO2 and pulse rate readings.

Case for introducing paediatric pulse oximeters into GP practicesAdult oximeters are currently used widely within primary care, however the challenge facing GPs is that it can be difficult to collect reliable readings for children without the use of specialised paediatric equipment. Adult style probes are usually only suitable for children heavier than 20-30kg, and a wrap-around sensor is usually required to ensure reliable measurements in children less than 20kg. There are paediatric fingertip probes available, however, these are often only recommended for children larger than 15kg. For small children, it is necessary to have a separate emitter and detector which are secured on either side of a capillary bed. This can be done by using a disposable probe, however it is recommended that a reusable probe is used as these are useful in spot checks and are more cost effective. GPs face a second challenge in that inappropriate referrals into secondary care can be made on the basis of inaccurate or falsely low SpO2 readings. For example, SpO2 values below 92% generally indicate the need for oxygen therapy and assessment in hospital, however an inaccurate SpO2 reading can result in an unnecessary referral.6 The use of pulse oximetry allows for an immediate assessment of SpO2 levels and enables GPs to confidently refer wheezy children along the most appropriate pathway. Current use of pulse oximetry in primary careSome preliminary research was conducted to understand the current use of pulse oximeters in Hounslow GP practices. All Hounslow GPs were asked to provide information on the following:* Whether they use pulse oximetry in their practice
* How many kits they have and which model they use
* Whether the equipment provides reliable readings for children under 2 years old

44 responses were received out of a total of 54 GPs. 26 GPs responded to say that they do not use pulse oximetry at all within their practice. 18 GPs do use pulse oximetry, however although the equipment is reliable for adults, GPs did not report that these work reliably on children under the age of 2. GPs reported using a range of models such as the Nonin, Merlin Medical, H Schein, and Contec. Available options and recommendationsImperial College Healthcare Trust clinicians carried out an analysis of different pulse oximetry models, with a focus on devices which are specifically suitable for use in primary care (see Appendix 1). All pulse oximeters considered have a selection of different probes and sensors for use with different age groups. From this analysis and through discussions with GPs, clinicians and CCG commissioners, the Nonin and Masimo models were proposed for further consideration. The Nonin 8500 series was selected as the preferred option as Hounslow GPs have found it to be reliable when used on adults, it is more cost effective and it is also used by London Ambulance Service (LAS).

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| Manufacturer/ model | List price (excl. VAT) | Reusable probes? | Comments | Order of preference |
| **Nonin**8500 series | £431.95 for oximeter, sensor and pack of 25 wraps (wraps free of charge) | Yes | Used by London Ambulance Service and Hounslow GPsSupported by Imperial clinicians | 1 |
| **Masimo**Rad-5/5v | £736 for oximeter, sensor and pack of 12 wraps | Yes | The bulk of trial data has been performed with Masimo devices, showing them to be reliable | 2 |

Impact of pulse oximetry on the wider paediatric pathway including PAU and Asthma ServiceIntroducing paediatric pulse oximetry in Hounslow GP practices will impact on the wider paediatric pathway by helping to ensure referrals are made appropriately into secondary care, for example A&E, UCC, PAU or the Asthma & Wheeze service, based on accurate SpO2 and pulse rate readings.It is recommended that SpO2 monitoring is a compulsory part of the referral process into the community Asthma & Wheeze Service and the PAU at West Middlesex University Hospital (WMUH) to reduce occurrences of inappropriate referrals. This can be built into the referral templates on SystmOne for children who present with asthma and wheeze, bronchiolitis, pneumonia/LRTI, febrile illness, croup and upper airway obstruction. This must however be used in conjunction with other clinical signs, such as breathing and respiratory rate, in the assessment of an acutely unwell child. TrainingSome training and support must be available for GPs to ensure the equipment is used correctly and effectively. One option would be for the manufacturer to provide this training at a HEAT conference. A second option, as suggested by a leading consultant at Imperial College Healthcare Trust, would be to develop an educational video clip which can be shared amongst primary care professionals. EvaluationIt is recommended that a piece of evaluation work is carried out after 3-4 months to assess the impact of introducing paediatric pulse oximetry into Hounslow GPs. This will be supported by the Hounslow Joint Commissioning team and could take the form of a survey or interview with GPs to establish:* Frequency of use of pulse oximetry kits
* Impact of use (e.g. parental and GP confidence)
* Impact on number of referrals to secondary care (e.g. Asthma & Wheeze Service, PAU etc.)

There may also be an opportunity for the Hounslow Joint Commissioning team to support clinicians to deliver a presentation at a Healthy London Partnership event to share learning with other local areas. |

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| Quality & Safety/ Patient Engagement/ Impact on patient services |
| Introducing pulse oximetry into primary care will help to ensure that referrals into secondary care are made appropriately on the basis of reliable SpO2 levels. This should reduce the number of inappropriate referrals from primary care to secondary care. The use of pulse oximetry in primary care will enable acutely unwell children to be referred directly to the most appropriate service, such as A&E, PAU or Asthma & Wheeze service. In addition, it will improve parental confidence in primary care assessment and referral processes.  |

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| Finance, resources and QIPP |
| To calculate the number of pulse oximeters required, quotes were gathered from the Nonin manufacturer based on varying assumptions about the number of devices required. Within Hounslow there are 25 ‘small’ GP practices (5,000 patients or less), and 29 ‘large’ GP practices (5,000 or more). The following costs are proposed to the Clinical Board for consideration:

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| Description | List price per unit | Comments | Total units | Discount | Total cost (incl. VAT) |
| **Nonin 8500** pulse oximeter with adult soft sensor**Nonin** Infant Reusable Flex Sensor **8008J** (1m cable). Includes a pack of 25 FlexiWraps | £349£82.95 | One pack of FlexiWraps is included for free. GPs can reorder additional packs for #13.16 per pack as required | 135**\*** (2 for small practices, 3 for large) | 35% for the oximeter, 20% for the sensor | **£47,500.02** |
| 83 (1 for small practices, 2 for large) | 30% for the oximeter, 20% for the sensor | **£30,941.76** |
| 54 (1 for small practices, 1 for large) | 25% for the oximeter, 20% for the sensor | **£20,130.57** |
| **Masimo Rad-5v** oximeter with adult finger probe**Masimo** LNCS YI Reusable sensor12 Foam Wraps | £550£170£16 | First pack of wraps not included | 137**\*** (2 for small practices, 3 for large) | 40% for the oximeter, 30% for the sensor | **£74,473.20** |
| 83 (1 for small practices, 2 for large) | 40% for the oximeter, 30% for the sensor | **£47,061.00** |
| 54 (1 for small practices, 1 for large) | 35% for the oximeter, 30% for the sensor | **£31,914.00** |

\* \*the original figure is 137 units however 2 GP practices already use this model and would not require a new unit. It is anticipated there is potential for cost savings throughout the system from the reduction of inappropriate referrals due to falsely low saturation readings. However further analysis is requried to fully understand the implications of this. |

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| Equality / Human Rights / Privacy impact analysis |
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| Risk | Mitigating actions |
| There is a lack of comparative analysis of different pulse oximeter devices hindering a full comparison of different models | Close working with clinical leads to understand the advantages and disadvantages of each model |
| It is difficult to reliably compare and contrast equipment from a user perspective as most information is only available from the manufacturer and third-party sellers who provide a range of brands. | Engagement with GPs and clinical leads to understand which equipment they have used and guide decision-making |

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| Supporting documents |
| Analysis of Pulse Oximetry Models  |

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| Governance and reporting(list committees, groups, other bodies in your CCG or other CCGs that have discussed the paper) |
| Committee name | Date discussed | Outcome |
| Name | DD/MM/YYYY |  |
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**References**

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2. Fouzas S, Priftis KN, Anthracopoulos MB. Pulse oximetry in pediatric practice. *Pediatrics* 2011; 128(4): 740-52.
3. Wright RO, Santucci KA, Jay GD, Steele DW. Evaluation of Pre- and Posttreatment Pulse Oximetry in Acute Childhood Asthma. *Academic Emergency Medicine* 1997; 4(2): 114-117.
4. Care Quality Commission. *Nigel's surgery 1: Agreed principles for defibrillators, oxygen and oximeters.* Available at: *http://www.cqc.org.uk/content/nigels-surgery-1-agreed-principles-defibrillators-oxygen-and-oximeters (accessed 4th November 2015).*
5. BTS/SIGN (2009) . *BTS/SIGN Guideline for the Management of Asthma, 2009 revision. BTS 2009 guidelines.* Available at https://www.brit-thoracic.org.uk/document-library/clinical-information/asthma/btssign-asthma-guideline-2009/ [Full guideline]
6. NICE (2015). *Bronchiolitis in children : diagnosis and management, NICE Guideline June 2015*.Available at: http://www.nice.org.uk/guidance/ng9/resources/bronchiolitis-in-children-51048523717 [Full guideline]