

Wales COVID-19 Evidence Centre (WC19EC) Rapid Evidence Summary

The effectiveness of home monitoring using pulse oximetry in people with COVID-19 symptoms to guide future management

Report number – RES 00005 (June 2021)

TOPLINE SUMMARY

What is a Rapid Evidence Summary?

An interim evidence briefing to inform further work and provide early access to key findings. The report is based on a limited search of key resources and the assessment of abstracts. Priority is given to studies representing robust evidence synthesis. No quality appraisal or evidence synthesis are conducted, and findings should be interpreted with caution.

Background / Aim

During the COVID-19 pandemic, pathways have emerged for managing patients at home with an aim of **limiting the spread of the virus** and **prioritising health care resources**. Pulse oximetry, a non-invasive device, can be used to **monitor oxygen levels in people with COVID-19** at home to **guide management decisions** such as hospital admission. **We looked for evidence on the use of oximetry in the home setting, to determine subsequent management of people with COVID-19 symptoms** (This updates the Health Technology Wales Rapid Summary 'Oximetry to guide COVID-19 management', produced 17th June 2020.)

Key Findings

1. Six clinical guidelines consider home pulse oximetry to identify deteriorating patients however **recommendations were based on the consensus of clinical experts**. [The NICE NG191 guideline](#) highlights that **different pulse oximeters have different specifications**, and that some can under- or overestimate readings.
2. The most recently published UK rapid review ([Greenhalgh et al 2021](#), published 25th March 2021) notes that **clinical support is also needed** and **recommends more research to understand the safety and effectiveness to optimise service models and referral pathways**. [The Oxford COVID Evidence Centre](#) rapid review reports that **smartphone applications should not be used as oximeters** due to a lack of evidence of their effectiveness.
3. Primary studies published since March 2021 were **limited to three observational studies, one pilot study and one conference abstract**. In addition, local service

evaluations were identified which reported a mix of outcomes. There is **an ongoing systematic review**, with an estimated completion date of 31st August 2021.

4. **WC19EC decision was not to proceed to rapid review at this stage**, because there is unlikely to be sufficient published research that will support decision making (28.6.21).

Policy Implications

The **safety** and **cost effectiveness of home monitoring with pulse oximetry is uncertain**. It is **unclear** whether the acquisition costs and clinician time for monitoring would be offset by changes in patient management. There **could be additional costs** if patients inappropriately delay presentation, or conversely there could be unnecessary emergency department attendances.

Disclaimer: The views expressed in this publication are those of the authors, not necessarily Health and Care Research Wales. The WC19EC and authors of this work declare that they have no conflict of interest.

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1. What is a Rapid Evidence Summary?

Rapid Evidence Summaries are designed to provide an interim evidence briefing to inform further work and provide early access to key findings. They are based on a limited search of key resources and the assessment of abstracts. Priority is given to studies representing robust evidence synthesis. No quality appraisal or evidence synthesis are conducted, and the summary should be interpreted with caution.

2. Production of report

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WC19EC Team:

- Adrian Edwards, Alison Cooper, Natalie Joseph-Williams, Rebecca-Jane Law, Ruth Lewis, Micaela Gal involved in drafting Topline Summary, review and editing

This review should be cited as:

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3. Requesting stakeholder group

This question was originally submitted to Health Technology Wales by Welsh Government's Technical Advisory Cell.

This version updates the original Rapid Summary 'Oximetry to guide COVID-19 management', produced 17th June 2020.

4. Context/Background

During the COVID-19 pandemic, pathways have emerged for managing patients at home or in the community, with an aim of limiting the spread of the virus and prioritising health care resources. While people experiencing acute respiratory failure generally have an increased respiratory rate, in some hypoxic people with COVID-19 a normal respiratory rate has been observed, which has been termed 'silent hypoxia'. Silent hypoxia may contribute to delays in people seeking appropriate care. Pulse oximetry to monitor people with COVID-19 in the

home and community settings may be effective in detecting people with silent hypoxia earlier, and guiding subsequent management such as hospital admission or palliative care. A **pulse oximeter is a non-invasive device** which uses the absorbance of different wavelengths of light **to measure peripheral oxygen** saturation of haemoglobin in the blood, expressed as a percentage (SpO₂).

We updated the search originally undertaken for the Health Technology Wales Rapid Summary. We looked for evidence on the use of oximetry in the home setting, to determine subsequent management of people with suspected or confirmed COVID-19.

5. Research question (used to inform the searches)

Review question	
The effectiveness of home monitoring using pulse oximetry in people with COVID-19 symptoms to guide future management	
Participants	People with suspected or confirmed COVID-19
Intervention / exposure	Pulse oximetry
Comparison	Usual care (no monitoring)
Outcomes	Any
Setting	Home
Other Study Considerations	
We prioritised the highest tier evidence available, e.g., systematic reviews. Where 'high level' evidence is not available we will consider 'lower level' evidence, such as primary studies. Narrative reviews were not included. Studies in the hospital and intensive care settings were not considered. Studies on exertional hypoxia (exercise tests) were not included. In addition, studies describing the association between physiological parameters (SpO ₂) and outcomes such as mortality and length of stay were not considered.	

6. Summary of the evidence base

6.1 Type and amount of available evidence

Table 1. Summary of review evidence identified

Evidence type	Total identified	Comments
Systematic reviews (SRs) Rapid reviews (RRs)	6	Six reviews (either rapid or systematic) consider home pulse oximetry. One protocol for an ongoing systematic review was identified.

Clinical Guidelines (CGs)	6	Six clinical guidelines consider home pulse oximetry; however, the recommendations are based on the consensus of clinical experts
Economic evaluations (EE)	None found	
Primary Studies	5, 1 protocol	

A more detailed summary of included evidence can be found in Table 2.

6.2 Key findings

- The [NICE NG191 rapid guideline](#) on managing COVID-19 recommends that, in the community, reduced oxygen saturation levels measured by pulse oximetry should be used to help identify people with COVID-19 with the most severe illness. It further recommends that, when pulse oximetry is available in primary and community care settings, the [NHS England's guide to pulse oximetry](#) should be used to assess the severity of illness and detect early deterioration in people aged 18 and over with COVID-19. In children, the guideline recommends that oxygen saturation levels below 91% in room air at rest should be used to detect early deterioration. **The guideline highlights that different pulse oximeters have different specifications, and that some can under- or overestimate readings, especially if the saturation is borderline. These recommendations were based on the consensus of the expert panel.**
- The NHS England guide makes recommendations for people with confirmed or possible COVID-19, either living in their own homes or residents of care homes, which are relevant to patients at an early stage of the disease and sent home from A&E or discharged following short hospital admissions. This guide is cross-referenced in [NICE NG191 rapid guideline](#) and the [British Geriatrics Society Guidance](#) for people with COVID-19 in care homes. It recommends that patients attend their **nearest A&E within an hour or call 999** immediately their blood oxygen level **remains 92% or less**, after taking a repeat measurement immediately. It also recommends that patients **contact NHS 111 or their GP** as soon as possible if their blood oxygen level is **94% or 93%** while sitting or lying down, and remains at this level after being rechecked within an hour. **The guidance gives detailed recommendations on planning an assessment using pulse oximetry. It is unclear how the recommendations in the NHS England guide were derived.**
- The [SIGN 161](#) and [NICE NG188](#) Rapid Guidelines on managing the long-term effects of COVID-19 were developed collaboratively, together with the Royal College of General Practitioners. They recommend that self-monitoring at home should be considered, for example ... pulse oximetry, if this is agreed as part of the person's assessment. **The recommendation regarding oximetry was based on expert opinion and a rapid narrative review which made practice recommendations for primary care in the UK (Greenhalgh et al, 2020).**
- HIQA searched for controlled trials on oximetry, but none were found. The Expert Advisory Group noted that as **there are potential harms associated with all interventions**, including non-pharmaceutical interventions, interventions must have a robust safety profile. **They must be subject to the appropriate governance before they can be recommended for widespread use in the ambulatory or primary care setting.** This is important given the serious risks of harm associated with unproven interventions.

- Several systematic reviews and rapid reviews identify that there is a **paucity of evidence for home oximetry for people with confirmed or suspected COVID-19.**
- Some systematic reviews conclude that **smartphone applications should not be used as oximeters due to a lack of evidence on their effectiveness.** These findings, cited by Whiting et al (2020), the SIGN evidence review on the assessment of COVID-19 in primary care, and the review 'Are there any evidence-based ways of assessing dyspnoea (breathlessness) by telephone or video?' by the Oxford COVID Evidence Centre are based on the Oxford COVID-19 Evidence Service 2020 rapid review '[Should smartphone apps be used as oximeters?](#) Answer: No' rapid review by the Oxford COVID Evidence Centre.
- The SIGN evidence review also highlighted that the Remote COVID-19 Assessment in Primary Care (RECAP) score, which includes pulse oximeter reading as one of twelve items, is currently being validated.
- Greenhalgh et al. (2020) 'Management of post-acute covid-19 in primary care' and [Greenhalgh et al. \(2021\)](#) 'Remote management of covid-19 using home pulse oximetry and virtual ward' find that pulse oximeters used at home can detect hypoxia associated with acute COVID-19. [Greenhalgh et al. \(2021\)](#) **notes that home oximetry requires clinical support**, such as regular contact with a health professional in a virtual ward setting. The study updated previous rapid reviews, but found that **more research is needed to understand the safety and effectiveness of home oximetry and to optimise service models and referral pathways.**
- Since the most recently published rapid review, **three observational studies, one pilot study, once conference abstract and one protocol for a qualitative study were identified.**
- **Literature searches have already been completed for an ongoing systematic review** of pulse oximetry as a remote monitoring tool during a pre-hospitalisation period or post-discharge for confirmed or presumptive adult COVID-19 patients, due to be published in August 2021. The search date is not stated in the protocol. As such, it is not clear whether all recently published primary studies will be included. The search strategy includes five databases, including those for preprints. It will include all study types, not restricted by language and published since December 2019. It is not clear how much overlap there is likely to be with the most recently published rapid review identified, as Greenhalgh et al, (2021) does not state the PICO used, nor give a detailed search strategy. However, it states that they 'summarised and updated some rapid systematic reviews'. This **ongoing systematic review is likely to update other previously published** systematic reviews such as Whiting et al, (2020) and Greenhalgh et al (2020).
- A search for local service evaluations in the NHS identified a rapid evaluation of remote home monitoring models during COVID-19 (available from: https://wessexahsn.org.uk/img/projects/VW_evaluation_FINAL_slideset_for_dissemination_12th_Oct_2020.pdf) which comprised a rapid literature search and qualitative research, undertaken over July to September 2020. The study considered different home monitoring models, implemented in different sites in the UK, including pre-hospital (managed in primary care), pre-hospital (managed in secondary care), step-down care (patient is discharged and followed-up) and mixed. **The study reports a mix of outcomes such as deterioration, hospital and intensive care admissions, deaths, patient experience and set-up and running costs. It is unclear whether these data are already included within existing systematic reviews or primary studies.** The search for local service evaluations also identified a report on 'remote oximetry in community care for COVID-19 patients (RECOxCARE) in the South East' (available at: <https://www.nhsx.nhs.uk/covid-19-response/technology-nhs/remote-oximetry-in-community-care-for-covid-19-patients-recoxcare-in-the-south-east/>). The report based on an observational, non-controlled

evaluation (low-quality evidence) states that the results show a reduction in COVID-19 emergency department mortality, a >35% reduction in emergency department attendances, a >20% reduction in hospital admissions from care homes and a reduction in emergency department attendances from assessment centres. It also reports on patient experience.

- **In addition, the search for local service evaluations identified a record for an ongoing evaluation which will take place between November 2020 and June 2021, and which will incorporate clinical and cost effectiveness, implementation issues and patient and clinician experiences.** The record is available at: <https://www.nwlondonccg.nhs.uk/professionals/primary-care/remote-monitoring>.

6.3 Areas of uncertainty

Remaining uncertainties include:

- ***Current guidelines make recommendations largely based on the consensus of clinical experts.***
- Should the population include both people who have been discharged from hospital and people who are being managed in primary care?
- Should the comparator be no monitoring, or home monitoring of other clinical factors?
- Are interventions including pulse oximetry following exercise tests, conducted at home, relevant (exertional hypoxia)?
- Are interventions which use pulse oximetry as part of a suite of tests/measurements relevant (e.g. RECAP score)?
- Which thresholds for oxygen saturation and which changes in management are relevant?
- Should the monitoring be clearly defined (by whom, how often)?

6.4 Options for further work

UK-based clinical guidelines make recommendations on home monitoring with pulse oximetry. However, the recommendations are generally based on the consensus of clinical experts.

The most recently published rapid review (Greenhalgh et al 2021, published 25th March 2021) sought to update previously published rapid reviews. It found that **more research is needed to understand the safety and effectiveness** of home oximetry and to optimise service models and referral pathways.

Primary studies published since March 2021 were limited to three observational studies, one pilot study and one conference abstract. In addition, local service evaluations were identified which reported a mix of outcomes and some cost data (relating to setting up and running the service).

No formal health economic studies were identified by the guidelines and systematic reviews, and none were identified which were published since March 2021.

There is an ongoing systematic review, currently in the data extraction phase, with an estimated completion date of 31st August 2021. It is **not clear whether all recently published primary studies will be included** in this systematic review, as searches have already been completed.

7. Next steps

Decision was not to proceed to rapid review because there is unlikely to be sufficient published research findings for a rapid review and clear advice, that will support decision making; 28.6.21.

8. Methods

COVID-19 specific and general repositories of evidence reviews noted in our resource list were searched on 09/06/21. We also checked the references and resources listed in HTW's original Rapid Evidence Summary for any updates (e.g. more recent versions of living evidence reviews or guidelines, or updated/fully published versions of preprints). An audit trail of the search process is provided within the resource list (Appendix). Searches were limited to English-language publications and did not include searches for primary studies if secondary research relevant to the question was found. Search hits were screened for relevance by a single reviewer. Priority was given to robust evidence synthesis using minimum standards (systematic search, study selection, quality assessment, appropriate synthesis). The secondary research identified was not retrieved as full text or formally quality assessed. The included research may vary considerably in quality and the degree of such variation could be investigated during rapid review work which may follow-on. Citation, recency, evidence type, document status and key indications were tabulated for all relevant secondary research identified in this process.

As secondary evidence was limited a further targeted search for primary literature was conducted to inform options for further work. A date cut-off was applied from March 2021, to capture relevant primary research published since the most recent rapid review. Findings from such studies have not been tabulated but an indication is given of the amount of literature for different aspects of the question.

Based on advice from a clinical expert, a **subsequent search was undertaken on 23rd June 2021 for local UK service evaluations**. A google search of 'oximetry covid-19 NHS' was used.

Date of Search	June, 2021
Search Concepts Used	Oximet* Oximetry Oximeter
Search Completed by	Sophie Hughes; Health Technology Wales

8.1 Brief literature search results

Summary of the extent the secondary/tertiary research

Table 2. Summary of included evidence

Secondary / tertiary research for home monitoring with oximetry

Resource	Citation	Recency (Search dates)	Evidence type	Status	Key findings from abstracts	Reviewer comments
TRIP	NICE, 2021.COVID-19 rapid guideline: managing COVID-19 (NG11) https://www.nice.org.uk/guidance/ng191	Search dates not reported. Published 23 March 2021. Updated 03 June 2021	CG	Published	<p>Population: Applicability: UK, directly applicable Recommendation: In the community: Use the following signs and symptoms to help identify people with COVID-19 with the most severe illness: ... reduced oxygen saturation levels measured by pulse oximetry.</p> <p>Recommendation: When pulse oximetry is available in primary and community care settings, to assess the severity of illness and detect early deterioration, use</p> <ul style="list-style-type: none"> • NHS England's guide to pulse oximetry in people 18 years and over with COVID-19 • oxygen saturation levels below 91% in room air at rest in children and young people (17 years and under) with COVID-19 	Both recommendations were based on the consensus of the expert panel. The panel agreed that using pulse oximetry to measure oxygen saturation threshold levels is appropriate for helping identify people with acute COVID-19 in primary or community care, and to predict outcomes such as hospitalisation. The panel agreed to cross-refer to NHS England guidance on pulse oximetry in assessment in adults in the community, but not for children. The recommendation on children was based on consensus.

					Be aware that different pulse oximeters have different specifications, and that some can under- or overestimate readings especially if the saturation level is borderline. Overestimation has been reported in people with dark skin.	
HTW Rapid Evidence Summary	NHS England. Pulse oximetry to detect early deterioration of patients with COVID-19 in primary and community care settings. 12 January 2021, Version 1.1 https://www. england.nhs .uk/coronavi rus/wp- content/uplo ads/sites/52 /2020/06/C0 445-remote- monitoring-	Search dates not reported. Published 12 th January 2021	CG	Published	Population: People with confirmed or possible COVID-19, either living in their own homes or residents of care homes, in primary and community health settings. Relevant to patients at an early stage of the disease and sent home from A&E or discharged following short hospital admissions. Applicability: UK, directly applicable Recommendations: People with possible COVID-19 should be assessed for alternative diagnoses before remote monitoring of deterioration with COVID-19. They should be given clear advice on what to do if their symptoms deteriorate. Attend your nearest A&E within an hour or call 999 immediately if... your blood oxygen is 92% or less. Check	Evidence base used to derive recommendations is unclear.

	in-primary-care-jan-2021-v1.1.pdf				<p>your blood oxygen again straight away- if it's still 92% or below, go to A&E immediately or call 999.</p> <p>Ring your GP or 111 as soon as possible if... your blood oxygen level is 94% or 93% while sitting or lying down and remains at this level after being rechecked within an hour. If your blood oxygen level is usually below 95% but it drops below your normal level, call 111 or your GP surgery for advice.</p> <p>The guidance gives detailed recommendations on planning an assessment using pulse oximetry in the 'COVID Oximetry @home standard operating procedure</p>	
TRIP	<p>NICE, 2020. COVID-19 rapid guideline: managing the long-term effects of COVID-19 (NG188).</p> <p>https://www.nice.org.uk/</p>	<p>Searches conducted on 22 and 28 October 2020, with surveillance up to 28 October 2020.</p>	CG	Published	<p>Population: Ongoing symptomatic COVID-19 (signs and symptoms from 4 weeks to 12 weeks) or post-COVID-19 syndrome (signs and symptoms continuing for more than 12 weeks and not explained by an alternative diagnosis)</p> <p>Applicability: UK (directly applicable)</p> <p>Recommendation: Consider supported self-monitoring at</p>	<p>Recommendation based on expert opinion and a rapid narrative review* which NICE assessed as low/very low quality using the CASP critical appraisal checklist (systematic reviews).</p> <p>*Greenhalgh T, Knight M, A Court C, Buxton M, Husain L. Management of post-acute COVID-19 in primary care. BMJ 2020;370:m3026. DOI:</p>

	guidance/ng188				home, for example heart rate and blood pressure and pulse oximetry, if this is agreed as part of the person's assessment. Ensure that people have clear instructions and parameters for when to seek further help.	https://doi.org/10.1136/bmj.m3026 [See below]
TRIP	SIGN, 2020. Managing the long-term effects of COVID-19 (SIGN 161). https://www.sign.ac.uk/media/1833/sign161-long-term-effects-of-covid19-11.pdf	Searches conducted on 22 and 28 October 2020, with surveillance up to 28 October 2020	CG	Published	Population: People who have signs and symptoms that develop during or after an infection consistent with COVID-19, continue for more than four weeks and are not explained by an alternative diagnosis. people with ongoing symptomatic COVID-19 or post-COVID-19 syndrome in any setting, including primary care and community settings, secondary care and rehabilitation services. Applicability: UK, directly applicable Recommendations: Consider supported self-monitoring at home, for example...pulse oximetry, if this is agreed as part of the person's assessment. Ensure that people have clear instructions and parameters for when to seek further help.	As above. This is a UK-wide guideline developed collaboratively by SIGN, NICE, and the Royal College of General Practitioners.

TRIP	British Geriatrics Society, 2020. COVID-19: Managing the COVID-19 pandemic in care homes for older people https://www.bgs.org.uk/resources/covid-19-managing-the-covid-19-pandemic-in-care-homes	Search dates not reported. First published 30 th March 2020. Last updated 18 th November 2020.	CG	Published	Population: Care home residents with COVID-19 Applicability: UK Guidance: Care homes should ensure that staff have the skills and equipment to be able to conduct pulse oximetry on residents with suspected or confirmed COVID-19. In England, training and support for using pulse oximetry is available and the [NHS England] COVID Oximetry @home monitoring diary' has been tailored for home usage.	Evidence base used to derive recommendations is unclear, however, the guidance references the NHS England COVID Oximetry @home monitoring diary, which accompanies the NHS England Guide 'Pulse oximetry to detect early deterioration of patients with COVID-19 in primary and community care settings'.
TRIP	HIQA, 2021. Advice to the National Public Health Emergency Team: Interventions in an ambulatory setting to prevent	Search dates not reported. Published 5 February 2021	CG	Published	Population: People with confirmed or suspected COVID-19, in the community setting Applicability: Ireland, partially applicable Advice: As there are potential harms associated with all interventions, including non-pharmaceutical interventions, interventions must have a robust safety profile. They must be subject to the	HIQA advice was informed by an evidence synthesis comprising two elements: <ul style="list-style-type: none"> Evidence for the effectiveness of pharmaceutical and non-pharmaceutical interventions, in the community setting, aimed at reducing progression to severe disease in individuals with confirmed or

	<p>progression to severe disease in patients with COVID-19 https://www.higa.ie/sites/default/files/2021-02/Interventions-to-prevent-progressionAdvice.pdf</p>				<p>appropriate governance before they can be recommended for widespread use in the ambulatory or primary care setting. This is important given the serious risks of harm associated with unproven interventions.</p>	<p>suspected COVID-19. (Including only controlled trials with published effectiveness data)</p> <ul style="list-style-type: none"> • Input from the COVID-19 Expert Advisory Group <p>No evidence was included on pulse oximetry. Oximetry was considered by the Expert Advisory Group, who considered the potential harms associated with the widespread use of pulse oximetry by patients, in the absence of clinical supervision. The group felt it may lead to delayed presentation by patients who have been falsely assured by readings that have been incorrectly taken or taken using devices that have not been validated. In addition, the group felt that this intervention could contribute to anxiety and additional emergency department attendances in others where their baseline clinical context has not been taken into consideration. It was noted that remote pulse oximetry monitoring of COVID-19 patients in the community has been deployed by at least one hospital, but that this is in</p>
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						the context of validated devices for which there is centralised monitoring and ongoing clinical oversight.
VA-ESP	Oxford COVID-19 Evidence Service, 2020. Should smartphone apps be used as oximeters? Answer: No. https://www.cebm.net/vid-19/question-should-smartphone-apps-be-used-as-oximeters-answer-no/	Search date not reported. Published 19 th May 2020.	RR	Published	Population: Not reported Applicability: Not reported Advice: There is no evidence that any smartphone technology is accurate for the measurement of blood oxygen saturation for clinical use. Furthermore, the scientific basis of such technologies is questionable. Oxygen saturation levels obtained from such technologies should not be trusted in the clinical assessment of patients.	The study reports the search strategy used, though not the dates on which the search was undertaken. The strategy combined search terms for oximetry with those for telemedicine/smartphone using AND, therefore studies on pulse oximetry using conventional devices are not included. The study critically appraised two included academic papers (validations of smartphone technologies for measuring blood oxygen levels). Advice was based on the expert input of a Professor of Electrical Engineering who specialises in medical devices.
<i>HTW Rapid Evidence Summary</i>	SIGN, 2020 Evidence Review: Assessment of COVID-19 in Primary Care: The Identification of	Search for most recent version of evidence review search was conducted in November 2020	RR	Published	Population: People in the community presenting to primary care with potential COVID19 for search purposes include all people presenting with potential COVID19 including hospital-based studies given lack of studies in the population of interest.	The intervention of interest (pulse oximetry) was not explicitly mentioned in the PICO. The findings relating to oximetry were based on two studies: <ul style="list-style-type: none"> Oxford COVID-19 Evidence Service, 2020. Should smartphone apps

	<p>Symptoms, Signs, Characteristics, Comorbidities and Clinical Signs in Adults which may Indicate a Higher Risk of Progression to Severe Disease.</p> <p>https://www.sign.ac.uk/our-guidelines/assessment-of-covid-19-in-primary-care/higher-risk-of-progression-to-severe-disease/</p>	<p>Date first published: 07/05/2020 Revised: 21/07/2020; 03/02/2021 Publication date of this version: 03/02/2021</p>		<p>Applicability: UK, directly relevant Findings: Smartphone apps should not be used as oximeters. When taking a reading with a pulse oximeter the finger should be warm and, although a low reading is cause for concern, a normal one should not necessarily reassure as young, fit patients in particular can compensate well in the early stages of deterioration.</p> <p>The Remote COVID-19 Assessment in Primary Care (RECAP) score is a currently being validated. RECAP is an 'early warning score' for the remote assessment of suspected COVID-19 in primary care. Published in November 2020 and based on wide-ranging consultations with UK clinicians and a rapid review of published and preprint literature, the score includes twelve items (pulse rate, temperature, fever, respiratory rate, shortness of breath, pulse oximeter reading, tiredness, muscle aches, new confusion, duration of symptoms, shielded list and</p>	<p>be used as oximeters? Answer: No</p> <ul style="list-style-type: none"> Greenhalgh T, Thompson P, Weiringa S NA, Husain L, Dunlop M, Rushforth A, Nunan D, de Lusignan S, Delaney B. What items should be included in an early warning score for remote assessment of suspected COVID-19? qualitative and Delphi study. <i>BMJ open diabetes research & care</i> 2020 10(11):e042626
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					other risk factors for poor outcome (age, obesity, ethnicity). Each clinical item includes suggested cut-off values and assessment methods which could be used over telephone or video link and where the patient/carer has no access to instruments.	
HTW Rapid Evidence Summary	Oxford COVID-19 Evidence Service, 2020. COVID-19: Are there any evidence- based ways of assessing dyspnoea (breathless ness) by telephone or video? https://www.cebm.net/COVID-19/are-there-any-evidence-based-ways-of-assessing-dyspnoea-	Search dates not reported. Published 2 nd April 2020	SR	Published	Population: Patients with breathlessness in acute primary care settings Applicability of included studies: NR Recommendations: Oximetry devices supplied to patients. Commonly used in respiratory medicine clinics but have not yet been evaluated in a primary care setting. The study cross-references Oxford COVID-19 Evidence Service, 2020. Should smartphone apps be used as oximeters? Answer: No.	Search strategy not clear. Study states that recommendations are based on expert opinion, pending further research

	breathless by telephone or video/					
Hand search of reference list of NICE NG188	Greenhalgh et al., 2020. Management of post-acute covid-19 in primary care https://www.bmj.com/content/370/bmj.m3026	10 th July 2020	SR	Published	Population: Patient who has a delayed recovery from an episode of covid-19 that was managed in the community or in a standard hospital ward. Applicability: UK, directly applicable Recommendations: Home pulse oximetry can be helpful in measuring breathlessness	Oximetry recommendations based on NHS England guide 'Pulse oximetry to detect early deterioration of patients with COVID-19 in primary and community care settings'. [See above]
HTW Rapid Evidence Summary	Whiting, P., and Elwenspoek, M. Accuracy of self-monitoring heart rate, respiratory rate and oxygen saturation in patients with symptoms suggestive of COVID infection. 2	Date searches conducted: 1/4/2020	SR	Published	Population: various patient populations, none were conducted in patients with symptoms of acute respiratory infection. Applicability: Samsung Health Application was also found to be accurate for measuring oxygen saturation for patients with saturation levels in the normal range but performed less well among those with hypoxia. The scientific basis for the use of smartphone apps for this purpose is questionable and so we would not recommend their	Originally searched for systematic reviews, then expanded to primary studies on home monitoring of oxygen saturation published at any time. They included studies that reported information on accuracy or agreement with an accepted measurement method. Studies in healthy volunteers excluded. For oximetry, the study included three studies, including the Oxford COVID-19 Evidence Service rapid review 'Should smartphone apps be used as oximeters? Answer: No.'

	<p>April 2020. Available from: https://arcw.nihr.ac.uk/research-and-implementation/covid-19-response/accuracy-of-self-monitoring-heart-rate-respiratory-rate-and-oxygen-saturation-in-patients-with-symptoms-suggestive-of-covid-infection/</p>				<p>use for measuring oxygen saturation. These findings should be interpreted with caution due to the very small number of studies available.</p>	
LitCovid	<p>Greenhalgh T, Knight M, Inada-Kim M, Fulop N, J, Leach J, Vindrola-Padros C et al. Remote manageme</p>	<p>Search dates not reported Published 25th March 2021</p>	RR	Published	<p>Population: Not reported Applicability: Not reported Findings: Pulse oximeters used at home can detect hypoxia associated with acute covid-19 Home oximetry requires clinical support, such as regular phone contact from a</p>	<p>The study methods state that rapid systematic reviews undertaken earlier in the COVID-19 pandemic were updated and summarised for this study, which also refers to the NHS England national guidance on oximetry. Study authors sought to include academic literature and grey</p>

	<p>nt of covid-19 using home pulse oximetry and virtual ward support <i>BMJ</i> 2021; 372:n677 doi: https://doi.org/10.1136/bmj.n677</p>				<p>health professional in a virtual ward setting More research is needed to understand the safety and effectiveness of home oximetry and to optimise service models and referral pathways</p>	<p>literature to reflect current best practice. Narrative review includes perspectives of authors from different sectors. Included evidence: Oxford COVID-19 Evidence Service, 2020. Should smartphone apps be used as oximeters? Answer: No. Oxford COVID-19 Evidence Service, 2020. COVID-19: Are there any evidence-based ways of assessing dyspnoea (breathlessness) by telephone or video? Kalin, A., Javid, B., Knight, M. et al. Direct and indirect evidence of efficacy and safety of rapid exercise tests for exertional desaturation in Covid-19: a rapid systematic review. <i>Syst Rev</i> 10, 77 (2021). https://doi.org/10.1186/s13643-021-01620-w (not included in this rapid evidence summary as the intervention is an exercise test) Singh K, Sidhu MS, et al. Remote home monitoring (virtual wards) during the covid-19 pandemic: a living systematic review https://doi.org/10.1101/2020.10.07.20208587 (not included in this rapid evidence summary as oximetry not mentioned)</p>
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<p>PROSPERO</p>	<p>Ahmed Alboksmaty, Thomas Beaney, Ana Luisa Neves, Jonathan Clarke, Sarah Elkin, Ara Darzi, Paul Aylin. Using pulse oximetry in remote home monitoring of COVID-19 confirmed and presumptive patients: a systematic review. PROSPERO 2021 CRD42021 254171 Available from: https://www.crd.york.ac.uk/prospero/display_record.php?ID</p>	<p>Searches registered as completed on PROSPERO record (as of 15/06/21), search dates not reported</p>	<p>SR</p>	<p>Protocol</p>	<p>Population: adult COVID-19 confirmed or presumptive patients, aged 18 or above, monitored and managed at home Applicability: UK Review question: How practical and effective is it to use pulse oximetry for remote monitoring of COVID-19 confirmed and/or presumptive patients?</p>	<p>The systematic review will include all study types, including proof-of-concept research, feasibility studies, observational studies and clinical trials. It will consider both peer-reviewed literature and preprints. At-home monitoring can be during a pre-hospitalisation period or post-discharge. Pulse oximetry can be the only monitoring tool or among a monitoring package.</p>
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RR Rapid review; CG Clinical guideline; EE Economic Evaluation; HTA health technology assessment; SR systematic review

Primary research published since March 2021

Study type	Total	Comments
Observational studies	3	2 preprint
Pilot studies	1	
Conference abstracts	1	
Qualitative studies	1	Protocol
Local service evaluations	3	2 +1 ongoing

9. About the Wales COVID-19 Evidence Centre

The Centre integrates with worldwide efforts to synthesise and mobilise knowledge from research. We operate as part of [Health and Care Research Wales](#) with a core team, hosted in the Wales Centre for Primary and Emergency (including Unscheduled) Care Research (PRIME).

The centre core team of the centre works closely with collaborating partners in [Health Technology Wales](#), [Wales Centre for Evidence-Based Care](#), [Specialist Unit for Review Evidence centre](#), [SAIL Databank](#), [Bangor Institute for Medical & Health Research/ Health and Care Economics Cymru](#), and the [Public Health Wales Observatory](#).

Together we aim to provide around 50 reviews per year, answering the priority questions for policy and practice in Wales as we meet the demands of the pandemic and its impacts.

Director: Professor Adrian Edwards

Email: WC19EC@cardiff.ac.uk

Website: <https://healthandcareresearchwales.org/about-research-community/wales-covid-19-evidence-centre>

10. Appendix

A single list of resources has been developed for guiding and documenting the sources searched as part of Rapid Evidence Summary. Not all resources will be searched, and some sources will be searched as part of the subsequent Rapid Review (or Rapid Evidence Map).

Each resource will be recorded as being:

- searched; nothing found
- searched; results found;
- not searched; not relevant
- not searched, maybe relevant

10.1 List of resources searched

Resource	Key words used	Date searched	Success or relevancy of the retrieval.
Priority COVID resources for reviews (All should be searched)			
Cochrane COVID Review Bank https://covidreviews.cochrane.org/search/site	<u>Oxi*</u>	<u>09/06/2021</u>	Searched, nothing found
VA-ESP https://www.covid19reviews.org/index.cfm	<u>Oximet*</u>	<u>09/06/2021</u>	Searched, results found
L*OVE – COVID-19	<u>Oximetry,</u> <u>Oximeter</u>	<u>09/06/2021</u>	Searched, nothing found

https://app.iloveevidence.com/loves/5e6fdb9669c00e4ac072701d?population=5e7fce7e3d05156b5f5e032a&classification=systematic-review			
Collabovid https://www.collabovid.org/	<u>Oximet*</u>	<u>09/06/2021</u>	Searched , nothing found
Additional COVID resources for reviews <i>(Tailor the list according to the topic and potential evidence base. In some cases it may be preferable to scan the main (generic) source rather than COVID-19 specific product; listed under secondary research)</i>			
LitCovid https://www.ncbi.nlm.nih.gov/research/coronaviruses/	<u>Oximetry</u>	<u>09/06/2021</u>	Searched , results found
Rolling collaborative review of Covid-19 treatments - Eunetha (not a searchable database but a list of living reviews) https://eunetha.eu/covid-19-treatment/	<u>Oximet*</u>	<u>09/06/2021</u>	Searched , nothing found
For technology/ treatment questions			
International HTA database (ITS-HTA) (for technology questions only) https://database.inahta.org/	Oximeter, Oximetry	<u>09/06/2021</u>	Searched , nothing found
EUnetHTA – COVID 19 response (not a searchable database but a lists of evidence covering diagnostics and treatments) https://eunetha.eu/services/covid-19/	Oximeter, Oximetry	<u>09/06/2021</u>	Searched , nothing found
Additional COVID resources for guidelines			
Trip (Trip Pro can be accessed by an institutional based subscription based via institution, otherwise use Trip) add an additional COVID search term and filter by UK guidelines, covers NICE, and SIGN. Can also filter for non-UK guidance if stakeholder requests it) https://labs2020.tripdatabase.com/	Oximetry Covid-19	<u>09/06/2021</u>	Searched , results found
Additional COVID resources for primary studies			
L*OVE primary studies	Oximetry (date restriction: published since March 2021)	<u>09/06/2021</u>	Searched , results found
https://app.iloveevidence.com/loves/5e6fdb9669c00e4ac072701d?population=5e7fce7e3d05156b5f5e032a&classification=primary-study			
Cochrane COVID-19 Study Register https://covid-19.cochrane.org/	Oximetry Created: Last 3 months	<u>09/06/2021</u>	Searched , results found

LitCovid https://covid-19.cochrane.org/	Oximetry (date restriction: published since March 2021)	<u>09/06/2021</u>	Searched , results found
Secondary research resources for reviews (non-COVID-19) (Tailor the list according to the topic and potential evidence base, talk to stakeholder before proceeding with this type of search)			
Cochrane Database of Systematic Reviews (CDSR) https://www.cochranelibrary.com/cdsr/reviews			
Campbell Collaboration https://www.campbellcollaboration.org/better-evidence.html			Not searched, maybe relevant
JBI (via OVID) (Subscription based service – WCEBC has a subscription)			Not searched, maybe relevant
Epistemonikos https://www.epistemonikos.org/en/advanced_search			Not searched, maybe relevant
PROSPERO https://www.crd.york.ac.uk/prospéro/	Oximeter	15/06/2021	Searched , results found
Pubmed Clinical Queries https://pubmed.ncbi.nlm.nih.gov/clinical/			Not searched, maybe relevant
PubMed Filter by systematic reviews, reviews or meta-analysis once search undertaken) https://pubmed.ncbi.nlm.nih.gov/			Not searched, maybe relevant
Secondary resources for reviews relevant to local/UK context			
Health Technology Wales- Coronavirus (COVID-19) Evidence reviews and research (not a searchable database but lists of evidence appraisal reports, topic exploration reports, rapid summaries, economic reports, impact and externally published reports) https://www.healthtechnology.wales/covid-19/	Oximetry (rapid evidence summary, not published)	<u>09/06/2021</u>	Searched , results found
Healthcare Improvement Scotland – COVID-19: Evidence for Scotland (not a searchable database but a lists of once for Scotland guidance, rapid evidence reviews, NIC	Oximetry, oximeter	<u>09/06/2021</u>	Searched , nothing found

rapid guidelines evidence covering diagnostics and treatments)			
http://www.healthcareimprovementscotland.org/our_work/coronavirus_covid-19/evidence_for_scotland.aspx			
Ireland, HSE Library, Covid-19 Summaries of Evidence not a searchable database but a list of all summaries of evidence that HIQA have been asked to address) https://hselibrary.ie/covid19-evidence-summaries/	Oximetry, oximeter	<u>09/06/2021</u>	Searched , nothing found
SAGE https://www.gov.uk/government/organisations/scientific-advisory-group-for-emergencies			Not searched, maybe relevant