WHY? ~~Late~~ Early presentations   Silent hypoxia

usually well man with a PMH of hypertension/asthma

14.4 first symptoms -> isolation, partner worked in care home

21.4 1st NHS call -Not breathless

23.4 2nd NHS call Terrible cough, joint pains- Not breathless

24.4 3rd NHS call asked if he was breathless – Not breathless

24.4 partner was admitted with hypoxia via ambulance
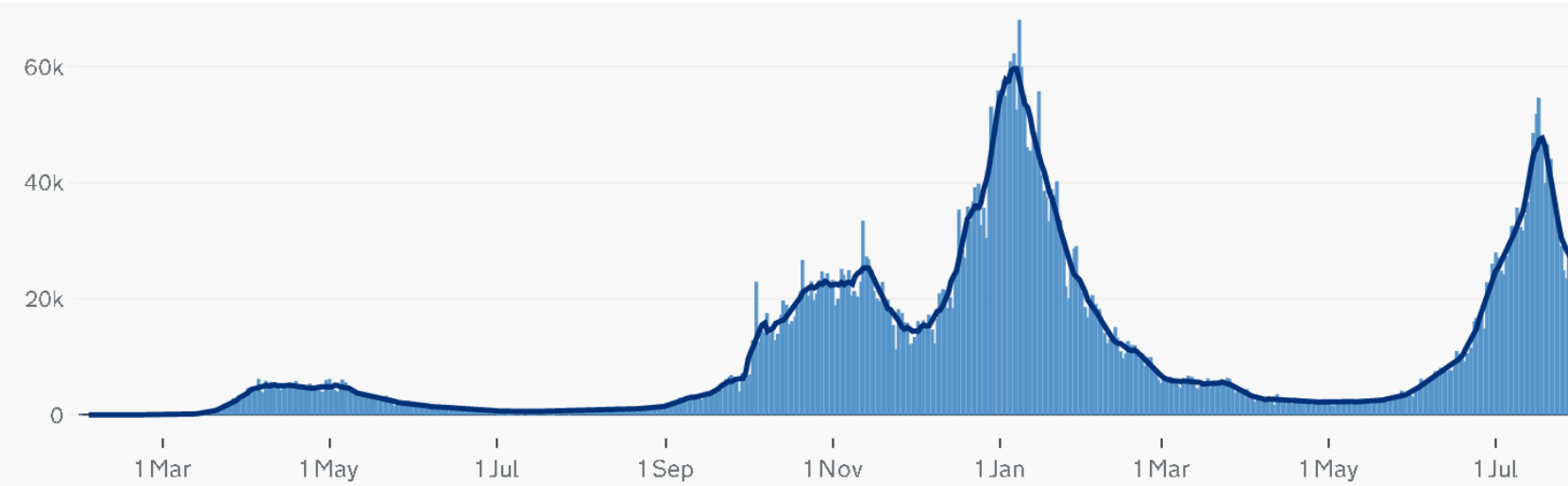
28.4 He died

"a characteristic of this virus that causes oxygen saturation levels of some sufferers to fall to dangerously low levels without them suffering conspicuous difficulties when breathing."

The battle for lives will be won at home

It will be educated, empowered patients and aligned triage systems & clear community clinical guidelines that will save more lives than ventilators

Prof. Matt Inada-Kim Acute Physician, Hampshire Hospitals NHS Foundation trust & University of Southampton
National Clinical Director Infection, Antimicrobial resistance, Deterioration, COVID oximetry, NHS England & NHS Improvement
@mattinadakim

ENGLAND

NHS England

Daily positive COVID tests

56 million population
5.9 million COVID cases
319,279 COVID hospital admissions
72,792 COVID hospital deaths

PROTECT & INFORM PATIENTS

Resources for patients to self monitor symptoms & O2 saturations
Clear public messaging for patients on what normal COVID recovery looks like, and when/how they should call for help*
Reassurance that patients/relatives will be rapidly assessed & escalated should deterioration occur*

PROTECT the HEALTH SYSTEM

Reduced attendance/admission of low-risk patients (with normal oxygen saturations/symptoms)
Improved discharge of recovering patients
Minimize use of inappropriate attendance/treatments (e.g. oxygen in normoxia, expensive drugs)
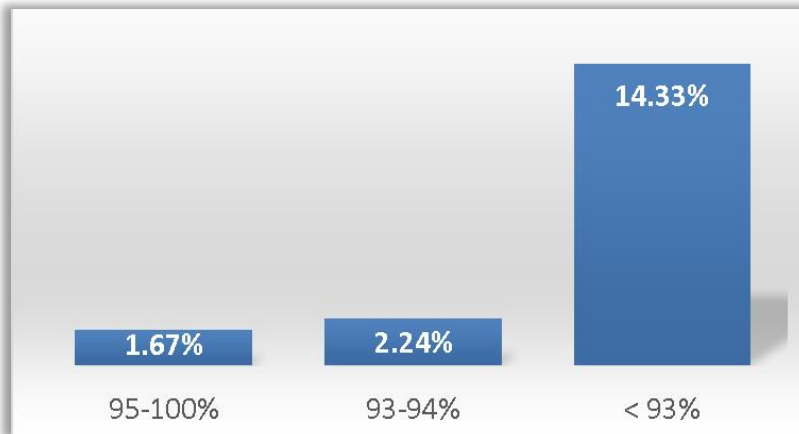
WHY ?

A. Home oxygen levels predict outcomes
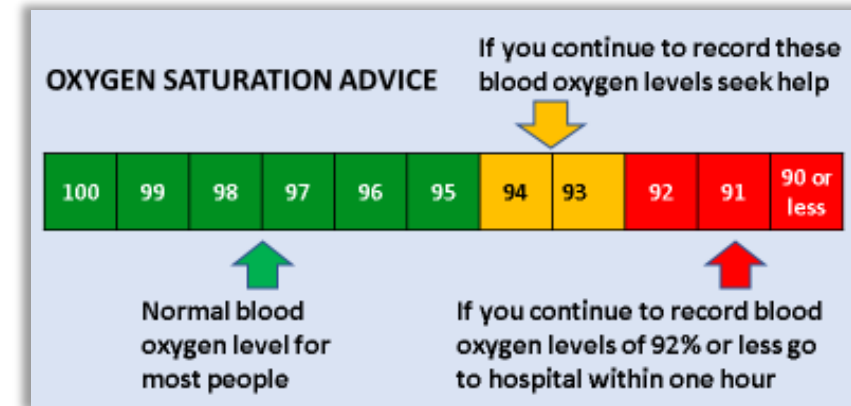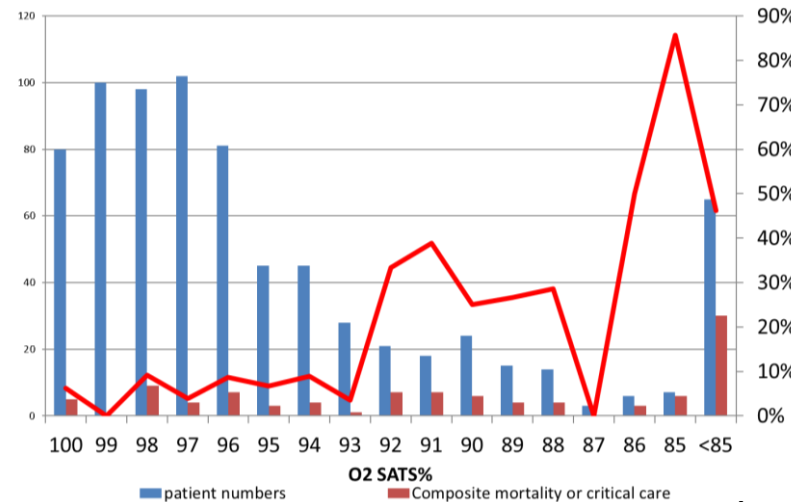**B.** Does admitting deteriorating COVID patients earlier save lives?

outcomes for symptomatic patients at home

- Linked data from patients recording oxygen levels, age and outcomes.
- Monitoring the trends of symptoms & oxygen saturations predicts who of these are likely to do badly

5 day mortality (N= 1,212)

Composite ICU/mortality (N= 1,212)

OXYGEN SATURATION ADVICE

If you continue to record these blood oxygen levels seek help

| 100 | 99 | 98 | 97 | 96 | 95 | 94 | 93 | 92 | 91 | 90 or less |

Normal blood oxygen level for most people

If you continue to record blood oxygen levels of 92% or less go to hospital within one hour

Validation of home oxygen saturations as a marker of clinical deterioration in patients with suspected COVID-19

Leading to National policy change and mandate

NHS England COVID Safety netting guidance

Matthew Inada-Kim, Francis P Chmiel, Michael J Boniface, Helen Pocock, John J. M. Black, Charles D Deakin

617/1080 COVID admissions had Sats 95-100%

WHAT? Aligned national pathways across all settings, for all groups

Community (GP, domiciliary care, care homes)
Ambulances
Prisons, Learning Disabilities, mental health
Hospitals

Always consider Non-COVID/other pathologies

SEVERE	MODERATE	MILD
O_2 **92%***or lower	O_2 **93 - 94%***	O_2 **95%*** or higher
≈ NEWS2 ≥ 5	≈ NEWS2 3-4	≈ NEWS2 0-2
*Or if O2 sats >4% less than usual	*Or if O2 sats 3-4% less than usual	*Or if O2 sats are 1-2% less than usual
URGENT HOSPITAL ASSESSMENT	**WATCH CAREFULLY, CONSIDER COMMUNITY/HOSPITAL ASSESSMENT**	**UNLIKELY TO NEED HOSPITAL CARE**

WHERE ?

Managing COVID @home

Community led - Integrated Care - Hospital Led

Inclusion Criteria

1. Diagnosis of COVID-19: either clinically or positive test result **AND**
2. Symptomatic **AND Clinical Concern OR**
3. Aged 65 years or older **OR** for patients *under* 65 years at High Risk

Flexible Resource- sensitive models
Self-Monitoring (minimal clinical supervision)
Diaries of Symptoms & Trend of O_2 saturations
Self-escalate if worsening of symptoms/saturations
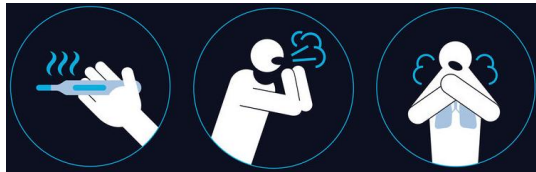
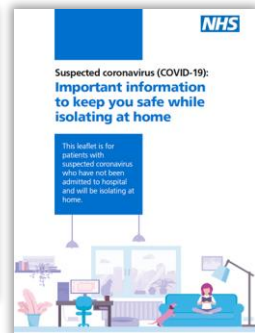*Symptoms* *Oximeters* *Diaries*   Telephone check-ins   *Apps/Dashboards*
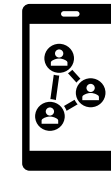
LOW **TO** **HIGH** **RESOURCE**

instruction on pulse oximetry & what to do with results
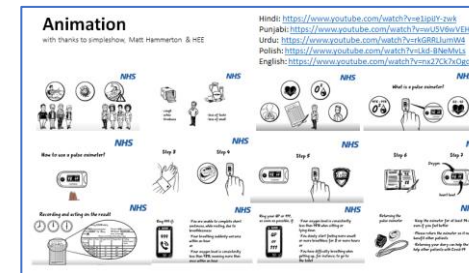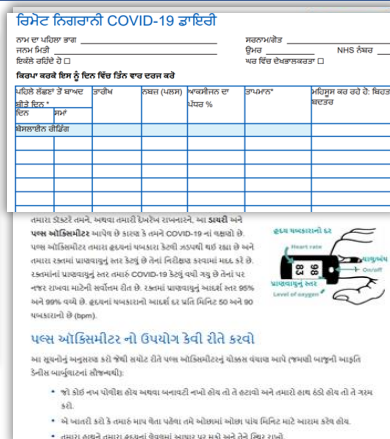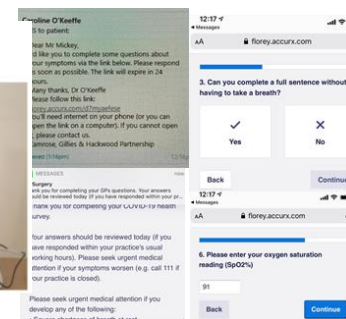
When should you worry/not worry in COVID

Patient COVID monitoring diary and instructions

Simulation e-learning

MILD COVID

Always consider non-COVID causes

What symptoms are usual?
When NOT to contact health services for help

- **What is normal recovery?**
- **What are non-worrying symptoms?**

CEBM symptoms severity predictor

High Risk ≥ 50, Comorbidities/HCP/SOB/Clin.worry,
Low Risk < 50, No Comorbidities, no Clinician worry

In the majority, full recovery is usual within 4 weeks

	Odds ratio of death/admission
Sputum	1.3
Dizziness	1.3
Cough	1.1
Nausea or vomiting	1.0
Diarrhoea	1.0
Headache	0.8
Sore throat	0.8
Nasal Congestion	0.6

Mild COVID-19 symptoms

These are common symptoms. You may not have all of these but still feel unwell.

- High temperature: you feel hot to touch on your chest and back. If you have access to a thermometer, a reading of 38 degrees celsius or higher
- Cough
- Muscle ache or tiredness
- Mild chest pain
- Dizziness or headache
- Loss of taste or sense of smell
- Diarrhoea and vomiting
- Rashes.

Supporting your recovery

- Most people recover from coronavirus within four weeks.
- You may have mild symptoms and feel unwell for a short time before slowly starting to feel better.
- To help you recover, you may wish to try:
  - Rest
  - Paracetamol or ibuprofen (providing there is no medical reason for you not to take it)
  - Regular fluids
- Coronavirus can leave some people feeling unwell for a long time - this is known as long COVID.

Patient instruction and info is critical

SEVERE COVID

When Should I worry?
What symptoms are most dangerous?

- **Are you feeling Better/worse?**
- **Trends of breathing symptoms**
- **Trends of Oxygen saturations**

High Risk ≥ 50, Comorbidities/SOB/Clin.worry,
Low Risk < 50, none of the above

Empower patients to call back if they get worse

	Odds ratio of death/admission
BREATHLESSNESS	4.3
Severe **MYALGIA**	2.0
CHILL / RIGORS	2.4
Severe **FATIGUE**	1.4

- Your breathing gets worse **suddenly**
- You are unable to complete short **sentences** at rest
- New breathlessness at rest

Timings of patients who deteriorate
Days 5-7 Silent hypoxia
Days 7-11 Significant breathlessness
Beware of a reduction in O$_2$ sats
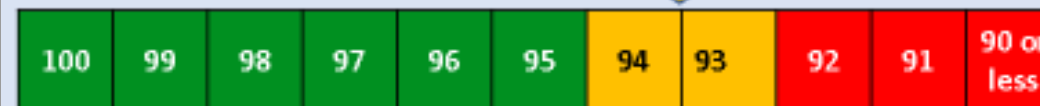
Increase frequency of contacts days 4-9

When and where to seek medical advice

Contact NHS 111
If you experience any of the following COVID-19 symptoms, you should contact 111 as soon as possible.

- Feeling breathless or difficulty breathing, especially when standing up or moving
- Severe muscle aches or tiredness
- Shakes or shivers
- If you use a pulse oximeter, your blood oxygen level is 94% or 93% or continues to be lower than your usual reading where your normal oxygen saturation is below 95% (re-take a reading within an hour first)
- Sense that something is wrong (general weakness, severe tiredness, loss of appetite, peeing much less than normal, unable to care for yourself – simple tasks like washing and dressing or making food).

You can access 111:
- Online at www.111.nhs.uk
- By phone 111
- Via your GP.
You should tell the operator you may have coronavirus.

Attend your nearest A&E within an hour or call 999
A minority of people with COVID-19 will suffer more severe symptoms. You should attend A&E as quickly as possible or call 999 immediately if you experience the following:

- Your blood oxygen levels are 92% or less (retake your reading immediately first)
- You are unable to complete short sentences when at rest due to breathlessness
- Your breathing gets worse suddenly.

OR if you develop these more general signs of serious illness:
- Cough up blood
- Feel cold and sweaty with pale or blotchy skin
- Collapse or faint
- Develop a rash that doesn't fade when you roll a glass over it
- Become agitated, confused or very drowsy
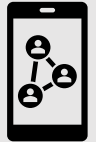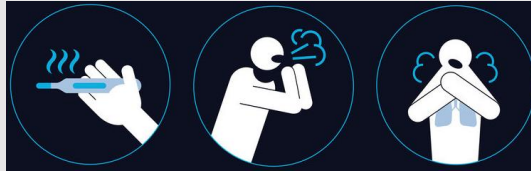- Stopped passing urine or are passing urine much less than usual.

You should tell the operator you may have coronavirus and if you use a pulse oximeter give your oxygen saturation reading. These symptoms require urgent medical attention.

OXYGEN SATURATION ADVICE

If you continue to record these blood oxygen levels seek help

| 100 | 99 | 98 | 97 | 96 | 95 | 94 | 93 | 92 | 91 | 90 or less |

Normal blood oxygen level for most people

If you continue to record blood oxygen levels of 92% or less go to hospital within one hour

Safety netting

Aligned Patient Pathway

Patient reassurance & partnership is key

Patient at home → **Deterioration** → **Hospital**

| Blood Oxygen Level	What to do / When to seek help
95-100%	Stay at home and continue to check your blood oxygen level regularly
93-94%	Check your blood oxygen level again and within an hour 1. If it's still 93 or 94 % seek help 2. If concerning symptoms seek help • Shortness of breath • Chills/high fever • Severe aches/tiredness • Collapse/Confusion
92% or below	Check your blood oxygen level again straight away If its still 92% or below go to hospital immediately

MILD
Sats ≥ 95% and < 3% desaturation on exertion*

MODERATE
Sats 93-94% with < 3% desaturation on exertion*
OR ≥ 95% with ≥ 3% desaturation on exertion*

SEVERE
Sats 92% or less
OR 93-94% with ≥ 3% desaturation on exertion*

*40 step exertion test, Attach Sats probe, Walk 40 steps whilst monitoring or 1 minute Sit-to-Stand

CXR, bloods
Additional risk factors, clinical concern** or NEWS2 ≥ 3

Concerning symptoms**
• SHORTNESS OF BREATH
• Chills/rigors
• Severe myalgia/fatigue
• Collapse/Confusion

Yes

NO

ADMISSION
Consider discharge if Clinically stable Within 24-48 hours

CONSIDER DISCHARGE

Lower acuity
Lower clinical concern

Home Patient Self monitoring

Higher acuity
Higher clinical concern

Clinician supervised VIRTUAL WARD
Telephone service +/- app
Supporting early discharge to maintain hospital capacity
If resources allow

Chris's story

Chris Harris
COVID-19 patient

I don't know how bad it would have got.
It was a life saver

Suspected coronavirus (COVID-19):
Important information to keep you safe while isolating at home

This leaflet is for patients with suspected coronavirus who have not been admitted to hospital and will be isolating at home.

Chris was given the oximeter and assessed after testing positive
He was admitted at Day 8 of his COVID illness with oxygen saturations of < 93% without significant breathlessness
He made a full recovery and was at home within 7 days.

https://vimeo.com/486820611
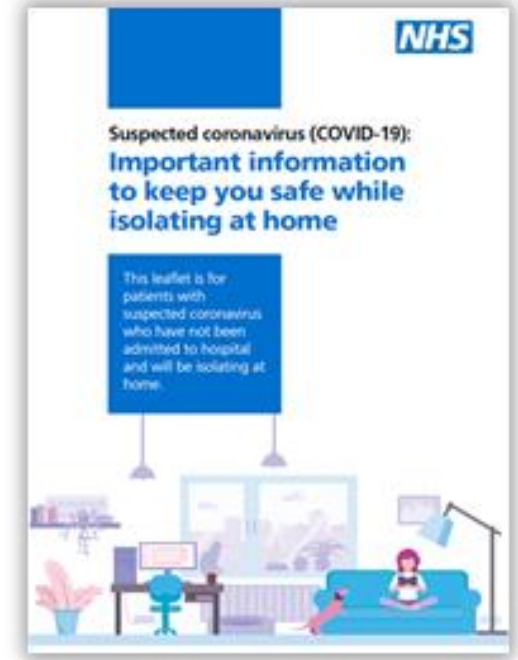
North Hampshire CO@h Service

Active patients on CO@h monitoring
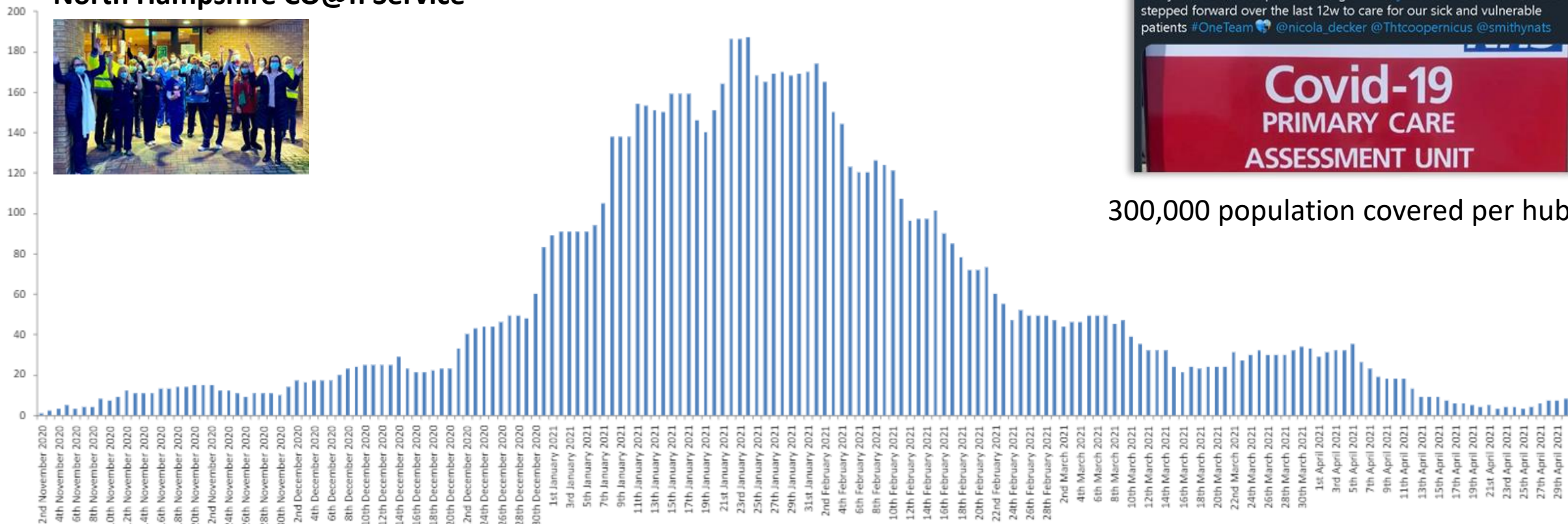
The N. Hampshire Winter Assessment Hub opened in early November and today saw its 2,000th patient. A huge #thankyou to all the staff who have stepped forward over the last 12w to care for our sick and vulnerable patients #OneTeam 👥 @nicola_decker @Thtcoopernicus @smithynats

Covid-19 PRIMARY CARE ASSESSMENT UNIT

300,000 population covered per hub

Name	NHS number	Gender	Date of birth	Submitted by	Breathless	Heart rate	SpO2	Body temp	General feeling	
AL-SHOWAIER, WAFEEQ SADI (MR)	944 930 4173	Male	24-Nov-1900	Clinician	Not	66	94	37.5		View patient
CARDEN, IDONY (MRS)	944 931 0149	Female	30-Jul-1974	Clinician	More, can speak	55	98	36.9		View patient
COURTNEY, WRIGHT RICKY (MR)	944 930 8292	Male	20-Apr-2008	Clinician	More, cannot speak	95	98	37.5		View patient
DIGNAN, Matt (DR)	966 098 8354	Male	18-May-1956	Patient	More, can speak	60	91	38.0	Same	View patient
FIELDING, MONTE (MR)	944 930 6583	Male	21-May-2008	Clinician	Not	99	99	36.5		View patient
SHILLINGFORD, DAVE (MR)	944 930 4912	Male	25-Mar-2008							View patient
WINSKILL, TEMPLE (MR)	944 930 9574	Not specified	12-Feb-2008	Clinician	Same, can speak	135	94	35.0		View patient

IMPACT

A. Reduced Admissions & length of stay
B. Reduced overall mortality rates
C. Safe model of care
D. Reduced future Hospital attendance/admission

A Percentage of South East regional COVID emergency admissions Length of stay

% Ambulance COVID admissions 95-100% oxygen sats

Safety netting & Non-conveyance pulse oximetry packs

B The mortality rates of COVID admissions 1st v 2nd peak

Sustained reduction in mortality rates in COVID 28% to 16-18% between 1st and 2nd peaks

C https://www.medrxiv.org/content/10.1101/2020.10.07.20208587v2

Throughput and outcome	Pre-hospital Model		Early discharge from the hospital Model	
	No. of patients	% of monitored patients	No. of patients	% of monitored patients
Patients triaged	1861	107.1	354	102.1
Patients remotely monitored	1737	100.0	347	100.0
Patients deteriorated and escalated	174	10.0	42	12.2
Deaths	20	1.1	3	0.9
Discharged alive from remote monitoring service	1639	94.4	320	92.2

May 6, 2021

COVID-19 Home Monitoring After Diagnosis and Health Care Utilization in an Integrated Health System

Anita D. Misra-Hebert, MD, MPH[1]; Xinge Ji, MS[2]; Lara Jehi, MD, MHCDS[3]; et al

> Author Affiliations | Article Information

D

Hospital attendance	30 day Odds Ratio	0.85
	90 day Odds Ratio	0.94
Hospital admission	30 day Odds Ratio	**0.62**
	90 day Odds Ratio	0.70

https://jamanetwork.com/journals/jama-health-forum/fullarticle/2779695

IMPACT

COVID-19 patients admitted to hospital from Nov. 2020 to Mar. 2021, compared outcomes if they had/had not been monitored by CO@h

	Non CO@h	CO@h
Average Length of stay	**13.2 days**	**6.9 days**
Deaths within 30 days	**20.5%** (130 / 633)	**5.8%** (8 / 137)
ICU	**8.2%** (52 / 633)	**3.6%** (5 / 137)
Readmissions within 30 days	**8.7%** (55 / 633)	**0%** (0 / 137)

COVID Oximetry at home (CO@h) patients that are admitted have
Reduced Mortality, Length Of Stay, Intensive Care Admissions & Readmissions

47,053 COVID-19 patients, 4384 (9.3%) were remotely monitored, they consulted in the emergency department less frequently (p = 0.05), were hospitalized less frequently (p < 0.01), had shorter hospital stays (p < 0.0001), and had a lower mortality rate in their first hospitalization (p = 0.03).

NATIONAL SPREAD
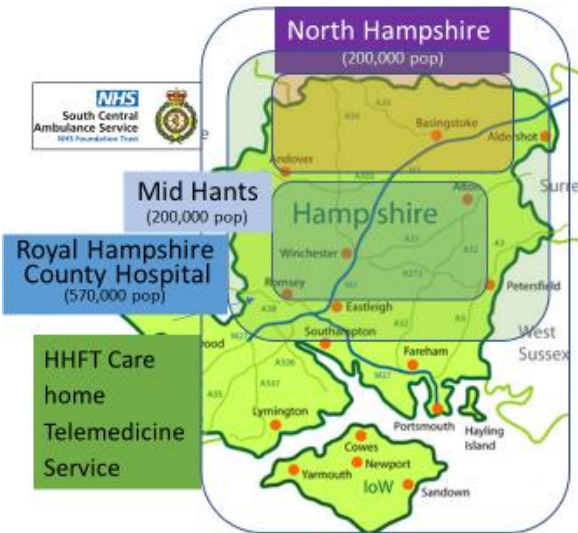
Start Local Clinicians, patients & managers
(1,000 oximeters & test it- 300,000 population)

Establish the WHY? evidence/science

Form Regional & National networks
(Buy 200,000 oximeters- 20 million population)

Standardised pathways
Virtual care resources / toolkits
Digital tech / apps

**Get Funding , National mandate,
Run learning events/webinars**
Engage Leaders cultural, religious, political
(Buy 700,000 oximeters- 55 million)

A nationwide collaboration for 56 million

COVID-19
Clinical management
Living guidance
25 January 2021
World Health Organization

BREAKING @WHO recommendation for COVID oximetry at home / virtual wards.

👏 Front line NHS staff doing this everywhere

Mike Best, 66, a patient at Mill Street Medical Practice, was one of the first patients to receive a pulse oximeter after being referred to the Covid Oximetry at Home service stating that the service "saved his life".

STAY HOME • PROTECT THE NHS • SAVE LIVES

The N. Hampshire Winter Assessment Hub opened in early November and today saw its 2,000th patient. A huge #thankyou to all the staff who have stepped forward over the last 12w to care for our sick and vulnerable patients #OneTeam 🌍 @nicola_decker @Thtcoopernicus @smithynats

Job satisfaction is when at the end of a long working day you finish by onboarding a patient onto the COVID virtual ward and the patient then says 'i suffer from anxiety but I now feel very reassured about going home'☺️👌 @mattinadakim

Covid-19
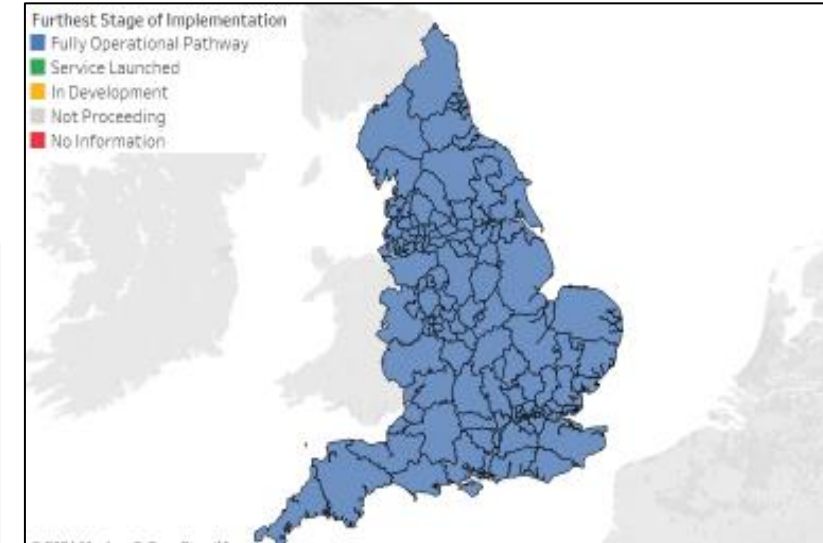PRIMARY CARE
ASSESSMENT UNIT

NHS

COVID Oximetry Implementation across England

Training COVID-19 patients to self monitor/escalate
- Early identification of deterioration
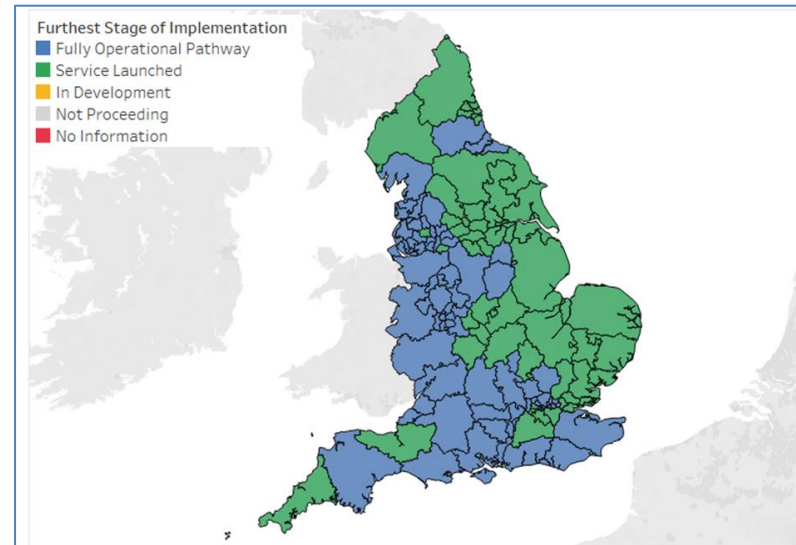- Admission avoidance
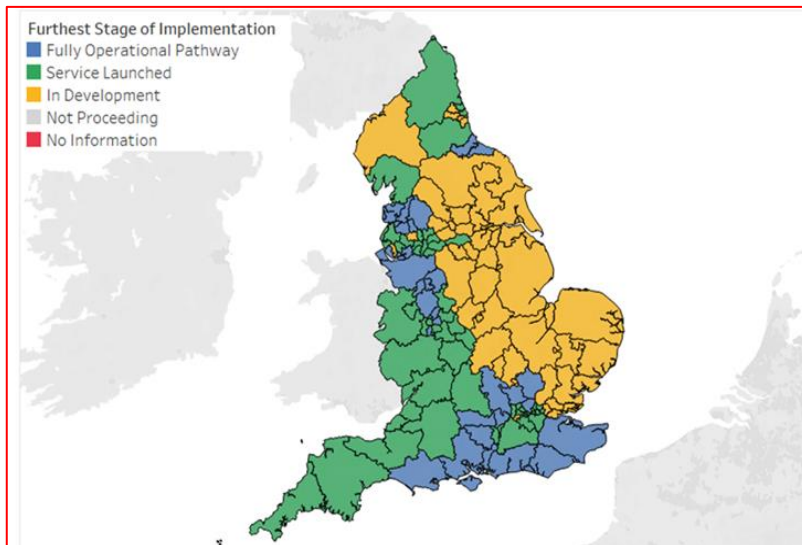- Early safe discharge

Feb 2021
100%- 56 million

Jan 2021
60%- 33.6 million

Dec 2020
35%- 19.6 million

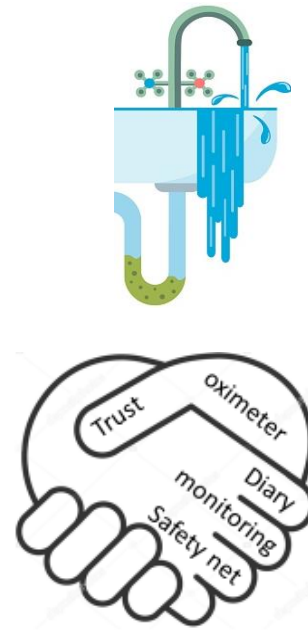**IMPROVEMENT STRATEGY across AHSNs**
5-10 million population regions

COVID-19 Clinical management

Living guidance 25 January 2021

World Health Organization

Conditional recommendation for

For symptomatic patients with COVID-19 and risk factors for progression to severe disease who are not hospitalized, we suggest the use of pulse oximetry monitoring at home as part of a package of care, including patient and provider education and appropriate follow-up (conditional

Trust oximeter Diary monitoring Safety net

COVID REMOTE MONITORING AND MANAGEMENT AT HOME

Wednesday 5 May, 8.30–9.30pm (India Standard Time) / 3–4pm (UK BST)

This is the first in a series of UK-India COVID-19 webinars from the South Asia Health Foundation and the Academic Health Science Network (AHSN Network), sharing our experiences of COVID-19 and the use of pulse oximetry in the UK, with health and care professionals in other countries.

- Lessons learned from the UK's National Health Service – COVID Oximetry @home and COVID virtual ward models
- A COVID early warning system
- Tips for treating silent hypoxia
- Resources available
- Question and answer session

Essentials of
Home based monitoring and virtual care in COVID-19
Monday, 10 May 2021, 7.30pm to 8.30pm (IST)

Evidence base on home monitoring in acute Covid-19

Guidance on oximetry

Training for Health Professionals in remote monitoring

Prioritisation decisions in resource-limited settings

StepOne   The George Institute for Global Health   India

EMPOWERING PATIENTS with devices & training in how

to spot & escalate deterioration in COVID **WORKS**

- Reducing **mortality**
- Reducing **admissions** & expediting **discharge**
- Reducing hospital **length of stay** (& ICU)

Protecting patients & **protecting the health system** from being overwhelmed

Global Learning, sharing and collaboration

Thanks for listening!

@mattinadakim

appendices

RESOURCES

NHS England Pulse oximetry guidance

NHS England COVID virtual ward guidance

NHS England Diary for virtual ward translated versions (Urdu, Arabic, Punjabi, Gujarati)

NHS England Diary for pulse oximetry for virtual wards (English)

NHS England COVID virtual care Standard operating procedure

NHS England How to apply for pulse oximeters

NHS England Covid Isolating at Home Safety Netting leaflet

Adult pulse oximetry monitoring diary animation HEE

Pulse oximetry videos multiple languages

North Hampshire Covid Virtual Ward SOP

Call handler SOP for clinicians

Remote monitoring quick start guide - Winchester PCN

Virtual ward Clinical competency resources

Using volunteers to support Covid virtual ward models

Oximeter decontamination protocol Winchester

Covid Virtual Ward Models rapid evaluation UCL

Remote monitoring using pulse oximeters in care homes

Covid Oximetry at Home FAQs Wessex AHSN

Glyacaemic management with dexamethasone treatment at home

HSJ CO@h training resources

COVID Virtual ward evaluation slideset

World Health Organisation recommendation for Home pulse oximetry

Blog Oximetry virtual wards

PUBLICATIONS

Remote management of covid-19 using home pulse oximetry and virtual ward support

Remote home monitoring (virtual wards) during the COVID-19 pandemic: a systematic review

Validation of home oxygen saturations as a marker of clinical deterioration in patients with suspected COVID-19

Triage Into the Community for COVID-19

Predictors of clinical deterioration in patients with suspected COVID-19 managed in a 'virtual hospital' setting: a cohort study

Direct and indirect evidence of efficacy and safety of rapid exercise tests for exertional desaturation in Covid-19: a rapid systematic review

WEBINARS

TED COVID virtual wards

Innovation in COVID patient pathways- Oxford

COVID oximetry at home- West of England

Setting Up a COVID Oximetry at Home Virtual Ward- North East North Coast

Virtual ward with pulse oximetry- Wessex

Remote monitoring using pulse oximetry in care homes webinar Q&A

Physiology and symptoms in Severe COVID cases

https://www.nejm.org/doi/full/10.1056/NEJMoa2002032
https://www.thelancet.com/pdfs/journals/lancet/PIIS0140-6736(20)30566-3.pdf
https://www.cebm.net/covid-19/covid-19-signs-and-symptoms-tracker/
https://www.bmj.com/content/368/bmj.m1182
https://www.bmj.com/content/368/bmj.m1091
https://www.nice.org.uk/guidance/ng165

Epidemiology of COVID and Identification of high-risk patients

https://www.medrxiv.org/content/10.1101/2020.05.06.20092999v1
https://jamanetwork.com/journals/jamainternalmedicine/fullarticle/2766086?guestAccessKey=f316379c-c1a3-4c7c-993f-13eb407dfac7&utm_source=silverchair&utm_campaign=jama_network&utm_content=covid_weekly_highlights&utm_medium=email
https://jamanetwork.com/journals/jama/fullarticle/2765524?guestAccessKey=2db35cb2-066d-4270-bb5f-935cc1da51a6&utm_source=silverchair&utm_campaign=jama_network&utm_content=covid_weekly_highlights&utm_medium=email
https://jamanetwork.com/journals/jama/fullarticle/2765184?guestAccessKey=f30eeab5-9fd6-4e64-991a-cd285ffc5d8a&utm_source=silverchair&utm_campaign=jama_network&utm_content=covid_weekly_highlights&utm_medium=email#comment-wrapper
https://www.nejm.org/doi/full/10.1056/NEJMcp2009575?source=nejmtwitter&medium=organic-social

Exertion oximetry testing

https://www.cebm.net/covid-19/what-is-the-efficacy-and-safety-of-rapid-exercise-tests-for-exertional-desaturation-in-covid-19/

RCP

https://www.rcplondon.ac.uk/projects/outputs/news2-additional-implementation-guidance
https://www.rcplondon.ac.uk/education-practice/advice/specialty-specific-guidance-clinical-care-and-treatment-covid-19

RCGP

https://www.rcgp.org.uk/covid-19/latest-covid-19-guidance-in-your-area.aspx https://elearning.rcgp.org.uk/mod/page/view.php?id=10568

RCEM

https://www.rcem.ac.uk/RCEM/Quality_Policy/Clinical_Standards_Guidance/Local_Guidance/RCEM/Quality-Policy/Clinical_Standards_Guidance/Local_Guidance.aspx?hkey=3765ca3b-617c-427c-a4af-57fca689a0de#coronavirus