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

“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.”

ENGLAND

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)

Daily positive COVID tests

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

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

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

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)

Leading to National policy change and mandate

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

<table>
<thead>
<tr>
<th>Severity</th>
<th>Oxygen Saturation</th>
<th>NEWS2</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SEVERE</strong></td>
<td>$O_2 \leq 92%*$ or lower</td>
<td>$\geq 5$</td>
<td>URGENT HOSPITAL ASSESSMENT</td>
</tr>
<tr>
<td><strong>MILD</strong></td>
<td>$O_2 \geq 95%*$ or higher</td>
<td>$0-2$</td>
<td>UNLIKELY TO NEED HOSPITAL CARE</td>
</tr>
<tr>
<td><strong>MODERATE</strong></td>
<td>$93% - 94%*$</td>
<td>$3-4$</td>
<td>WATCH CAREFULLY, CONSIDER COMMUNITY/HOSPITAL ASSESSMENT</td>
</tr>
</tbody>
</table>

*$O_2 sats$ are $2\%$ or more less than usual  
*$O_2 sats$ are $1\% - 2\%$ less than usual  

*Or if $O_2 sats$ are $3\% - 4\%$ less than usual  
*Or if $O_2 sats$ are $1\% - 2\%$ less than usual
When should you worry/not worry in COVID

**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 O₂ saturations
- Self-escalate if worsening of symptoms/saturations

**Managing COVID @home**

WHERE?

- Community led
- Integrated Care
- Hospital Led

**Symptoms**

- Oximeters
- Diaries
- Telephone check-ins
- Apps/Dashboards

**LOW TO HIGH RESOURCE**

- Instruction on pulse oximetry & what to do with results
- COVID Virtual Ward: First contact with a patient after discharge from hospital
- Simulation e-learning

**Managing COVID @home**

- Community led
- Integrated Care
- Hospital Led

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- **Symptoms**
- Oximeters
- Diaries
- Telephone check-ins
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**Instruction on pulse oximetry & what to do with results**

**COVID Virtual Ward: First contact with a patient after discharge from hospital**

**Simulation e-learning**

**Patient COVID monitoring diary and instructions**
MILD COVID
Always consider non-COVID causes

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

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

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

CEBM symptoms severity predictor

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Odds ratio of death/admission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sputum</td>
<td>1.3</td>
</tr>
<tr>
<td>Dizziness</td>
<td>1.3</td>
</tr>
<tr>
<td>Cough</td>
<td>1.1</td>
</tr>
<tr>
<td>Nausea or vomiting</td>
<td>1.0</td>
</tr>
<tr>
<td>Diarrhoea</td>
<td>1.0</td>
</tr>
<tr>
<td>Headache</td>
<td>0.8</td>
</tr>
<tr>
<td>Sore throat</td>
<td>0.8</td>
</tr>
<tr>
<td>Nasal Congestion</td>
<td>0.6</td>
</tr>
</tbody>
</table>

Patient instruction and info is critical
### SEVERE COVID

- 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

**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 Should I worry?

**What symptoms are most dangerous?**

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Odds ratio of death/admission</th>
</tr>
</thead>
<tbody>
<tr>
<td>BREATHLESSNESS</td>
<td>4.3</td>
</tr>
<tr>
<td>Severe MYALGIA</td>
<td>2.0</td>
</tr>
<tr>
<td>CHILL / RIGORS</td>
<td>2.4</td>
</tr>
<tr>
<td>Severe FATIGUE</td>
<td>1.4</td>
</tr>
</tbody>
</table>

**Empower patients to call back if they get worse**

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

### 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 resting or lying down
    - Severe muscle aches or weakness
    - Difficulty speaking or swallowing
    - Have a pulse oximeter, your oxygen level is 94% or less, if continuous, to be lower than your normal reading when you are not feeling sick
    - Severe or new chest pain or pressure
    - Sneeze or sneeze

- **Attend your nearest A&E within an hour or call 999**
  - A minority of people with COVID-19 will suffer with severe symptoms. You should attend A&E as quickly as possible or call 999 immediately if you experience the following:
    - Your blood oxygen level is 92% or less (see your reading measured on your pulse oximeter)
    - You are unable to complete short sentences, can’t talk due to breathlessness
    - Your breathing gets worse suddenly
    - Or if you develop these more general signs of serious illness:
      - Cough that doesn’t go away
      - Coughing up blood with pain or bloody skin
      - Collapse or faint
      - Develop a rash that doesn’t fade when you press over it
      - Become agitated, confused or very drowsy
      -34 Placed your arms or are passing out and may lose your senses

- **You can access 111**
  - Online at www.111.nhs.uk
  - By phone: 111

- **You should tell the operator you may have coronavirus**

### Safety netting

- Attend your nearest A&E within an hour or call 999.
- If you develop severe symptoms, call 111 immediately.
- Keep yourself and others safe by practicing social distancing.
- Wear a face covering in public places.
- Wash your hands frequently with soap and water.
- Avoid touching your face.
- Monitor your temperature if you have symptoms.
- Stay home if you are feeling unwell.
- If you test positive for COVID-19, follow the isolation guidelines.
Patient reassurance & partnership is key

Aligned Patient Pathway

Patient at home

Deterioration

Hospital

**Blood Oxygen Level**

<table>
<thead>
<tr>
<th>Level</th>
<th>What to do / When to seek help</th>
</tr>
</thead>
<tbody>
<tr>
<td>95-100%</td>
<td>Stay at home and continue to check your blood oxygen level regularly</td>
</tr>
<tr>
<td>93-94%</td>
<td>Check your blood oxygen level again and within an hour&lt;br&gt;1. If it’s still 93 or 94% seek help&lt;br&gt;2. If concerning symptoms seek help &lt;br&gt;• Shortness of breath&lt;br&gt;• Chills/high fever&lt;br&gt;• Severe aches/tiredness&lt;br&gt;• Collapse/Confusion</td>
</tr>
<tr>
<td>92% or below</td>
<td>Check your blood oxygen level again straight away if it’s still 92% or below go to hospital immediately</td>
</tr>
</tbody>
</table>

**MILD**

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

**MODERATE**

Sats 93-94% with < 3% desaturation on exertion*<br>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<br>Additional risk factors, clinical concern**<br>or NEWS2 ≥ 3

**CONSIDER DISCHARGE**

Lower acuity<br>Lower clinical concern

Home Patient Self monitoring

Higher acuity<br>Higher clinical concern

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

ADMISSION

Concerning symptoms**<br>• SHORTNESS OF BREATH<br>• Chills/chills<br>• Severe myalgia/fatigue<br>• Collapse/Confusion

Consider discharge if Clinically stable Within 24-48 hours
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.

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

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

### Active patients on CO@h monitoring

![Graph showing active patients on CO@h monitoring]

- 300,000 population covered per hub

---

**Covid**

<table>
<thead>
<tr>
<th>Name</th>
<th>NHS number</th>
<th>Gender</th>
<th>Date of birth</th>
<th>Submitted by</th>
<th>Breathless</th>
<th>Heart rate</th>
<th>SpO2</th>
<th>Body temp</th>
<th>General feeling</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL-SHOWAIRE, WAEEIQ SADI (MR)</td>
<td>944 930 4173</td>
<td>Male</td>
<td>24-Nov-1900</td>
<td>Clinician</td>
<td>Not</td>
<td>66</td>
<td>94</td>
<td>37.5</td>
<td></td>
</tr>
<tr>
<td>CARDEN, IDONY (MRS)</td>
<td>944 931 0149</td>
<td>Female</td>
<td>30-Jul-1974</td>
<td>Clinician</td>
<td>More, can speak</td>
<td>55</td>
<td>98</td>
<td>36.9</td>
<td></td>
</tr>
<tr>
<td>COURTNEY, WRIGHT RICKY (MR)</td>
<td>944 930 8292</td>
<td>Male</td>
<td>20-Apr-2008</td>
<td>Clinician</td>
<td>More, cannot speak</td>
<td>95</td>
<td>98</td>
<td>37.5</td>
<td></td>
</tr>
<tr>
<td>DIGNAM, Matt (DR)</td>
<td>966 698 8354</td>
<td>Male</td>
<td>18-May-1956</td>
<td>Patient</td>
<td>More, can speak</td>
<td>66</td>
<td>91</td>
<td>38.0</td>
<td>Same</td>
</tr>
<tr>
<td>FIELDING, MONTE (MR)</td>
<td>944 930 6583</td>
<td>Male</td>
<td>21-May-2008</td>
<td>Clinician</td>
<td>Not</td>
<td>99</td>
<td>98</td>
<td>36.5</td>
<td></td>
</tr>
<tr>
<td>SHILLINGFORD, DAVE (MR)</td>
<td>944 930 4912</td>
<td>Male</td>
<td>25-Mar-2008</td>
<td>Clinician</td>
<td>Same, can speak</td>
<td>135</td>
<td>94</td>
<td>35.0</td>
<td></td>
</tr>
<tr>
<td>WINSKILL, TEMPLE (MR)</td>
<td>944 930 9574</td>
<td>Not specified</td>
<td>12-Feb-2008</td>
<td>Clinician</td>
<td>Same, can speak</td>
<td>135</td>
<td>94</td>
<td>35.0</td>
<td></td>
</tr>
</tbody>
</table>
IMPACT

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

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

https://jamanetwork.com/journals/jama-health-forum/fullarticle/2779695
COVID Oximetry at home (CO@h) patients that are admitted have **Reduced Mortality, Length Of Stay, Intensive Care Admissions & Readmissions**

<table>
<thead>
<tr>
<th></th>
<th>Non CO@h</th>
<th>CO@h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Length of stay</td>
<td>13.2 days</td>
<td>6.9 days</td>
</tr>
<tr>
<td>Deaths within 30 days</td>
<td>20.5% (130 / 633)</td>
<td>5.8% (8 / 137)</td>
</tr>
<tr>
<td>ICU</td>
<td>8.2% (52 / 633)</td>
<td>3.6% (5 / 137)</td>
</tr>
<tr>
<td>Readmissions within 30 days</td>
<td>8.7% (55 / 633)</td>
<td>0% (0 / 137)</td>
</tr>
</tbody>
</table>

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

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".
COVID Oximetry Implementation across England

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

Dec 2020
35% - 19.6 million

Jan 2021
60% - 33.6 million

Feb 2021
100% - 56 million

IMPROVEMENT STRATEGY across AHSNs
5-10 million population regions
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

Thanks for listening!

Global Learning, sharing and collaboration

@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
- Glycaemic 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.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/2765184?guestAccessKey=f30eeab5-9fd6-4e64-991a-cd285ff5d8a&utm_source=silverchair&utm_campaign=jama_network&utm_content=covid_weekly_highlights&utm_medium=email#comment-wrapper

Exertion oximetry testing

RCP
https://www.rcplondon.ac.uk/projects/outputs/news2-additional-implementation-guidance

RCGP

RCEM