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Evaluation report

Chronic obstructive pulmonary disease (COPD) Virtual Ward

South and West Hertfordshire
Health and Care Partnership

March 2023

Health Innovation Manchester

Eastern AHSN

HWE ICS — Hertfordshire and West Essex Integrated Care System

NHS West Hertfordshire Teaching Hospitals NHS Trust

NHS Central London Community Healthcare NHS Trust

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Acknowledgements

Background

This report summarises the findings of an evaluation conducted by Eastern Academic Health Science Network (AHSN) and Health Innovation Manchester (HInM), the AHSN for Greater Manchester, on behalf of the national Innovation Collaborative for digital health.

The collaborative is a learning and support system for health and care professionals delivering technology-enabled innovations to support people at home.

It is commissioned by NHS England (NHSE) and delivered in partnership with the AHSN Network, with HInM as lead AHSN.

With thanks

This evaluation would not have been possible without the input of staff at South and West Hertfordshire Health and Care Partnership (SWHHCP) and Watford General Hospital (WGH), which is part of West Hertfordshire Teaching Hospitals NHS Trust (WHTH).

We would like to thank Watford General Hospital's COPD Virtual Ward staff and the Central London Community Healthcare NHS Trust (CLCH) team, with special thanks to:

- Dr Andy Barlow, Consultant Respiratory Physician, Divisional Director for Medicine at WHTH, and formerly Clinical Lead for Virtual Wards and Oximetry@Home in the East of England (January to October 2021)
- Jonathan Phimister, Business Analyst, Business Intelligence team, WHTH
- Maria Buxton, Consultant Respiratory Physiotherapist and Service Lead, CLCH
- Debbie Foster, Associate Director for Integrated Care, WHTH
- Phil Ellis, Clinical Field Engineer, Masimo
- Chris Richmond, Head of Delivery, Evaluation and Future Focus, NHSE Digital Health Team

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Table of abbreviations

Abbreviation	Definition
HInM	Health Innovation Manchester
AHSN	Academic Health Science Network
WHTH	West Hertfordshire Teaching Hospitals NHS Trust
SWHHCP	South and West Herts Health and Care Partnership
CLCH	Central London Community Healthcare NHS Trust
VW	Virtual Ward
VH	Virtual Hospital
DECAF	Dyspnea, Eosinopenia, Consolidation, Acidemia, Atrial Fibrillation
MDT	Multi-Disciplinary Team
ABC MDT	Asthma, Bronchiectasis and COPD Multi-Disciplinary Team
COPD	Chronic Obstructive Pulmonary Disease
SOP	Standard Operating Procedures
EPR	Electronic Patient Records
NASSS	Non-adoption, Abandonment, Scale-up, Spread, Sustainability Framework
B&RE	Benefits & Rapid Evaluation
HF	Heart failure
HMT	His Majesty's Treasury
LoS	Length of Stay
RLoS	Reduced Length of Stay
NHSE	NHS England
GIRFT	Get It Right First Time
ROI	Return on Investment
NIV	Non-Invasive Ventilation

Executive summary

1   About this report

1.1   Purpose

This report presents findings from an evaluation of a chronic obstructive pulmonary disease (COPD) virtual ward (VW) that falls within a virtual hospital (VH) managed by South and West Hertfordshire Health and Care Partnership (SWHHCP). The COPD VW is one of two VWs that fall within the SWHHCP virtual hospital, the second being a heart failure VW.

It aims to inform the potential wider adoption of the VW model across the UK and understand the model's potential to support people with other health conditions. It also considers the success of SWHHCP VW objectives to improve patient care, clinical outcomes, healthcare utilisation, and patient and staff satisfaction.

1.2   Overview

A virtual hospital can be defined as an all-encompassing group of virtual wards that cover a range of conditions, allowing patients to receive the care they need at home safely and conveniently, rather than being in hospital. Supporting patients at the place they call home, this model of care can include using remote monitoring apps, technology platforms and medical devices such as pulse oximeters. Support may also involve face-to-face care from multi-disciplinary teams based in the community.

Patients are admitted to the VW upon discharge from an inpatient bed and monitored continuously using Masimo technology, with regular contact from a multi-disciplinary team (MDT). Patients can also be admitted to the VW from A&E or a GP home visit. The evaluation sought to understand seven areas of interest:

1. the typical characteristics of VW patients
2. VW usage patterns
3. potential of the VW to reduce secondary care length-of-stay (LoS)
4. potential of the VW to reduce secondary care readmissions
5. VW patient experiences and views
6. staff experiences and views on VW implementation, delivery and impact
7. indicative VW cost-benefit in terms of immediate and long-term impact on healthcare utilisation

1.3   Method

The evaluation adopted a mixed method approach involving quantitative, qualitative and economic analysis. It utilised data recorded routinely by SWHHCP clinical systems and by the continuous monitoring technology, supplemented with information from staff interviews and VW patient surveys.

Quantitative analysis involved a three-arm cohort comparison, designed to increase the possibility of determining the incremental impact of service features.

- **Historic control**: patients admitted to WHTH pre-pandemic from December 2018 to June 2019 inclusive (n=365).
- **MDT only**: patients assessed by the MDT during the intervention window but not onboarded to the VW from December 2021 to June 2022 inclusive (n=248).
- **VW patients:** patients assessed by the MDT and onboarded to the VW from December 2021 to June 2022 inclusive (n=46).

The historic control time period was chosen as the base comparator because it is the last full year prior to COVID-19 and the December to June window is determined as directly comparable to the intervention window, accounting for seasonal effects and winter pressures.

Additionally, the trust's peak for NHSE performance against waiting time benchmarks for emergency patients peaked in 2019, when a pilot project named Senior Medics Assessment Review and Treatment (SMART) was running. This involved redesigning the patient pathway to ensure that patients had the input of a medical consultant at an earlier point than had previously happened.

SMART helped to move the trust's four-hour performance nationally from the lower to the upper quartile and also won the 2020 HPMA Academy Wales Award for Excellence in Organisational Development. This means 2019 data represents the most stringent comparator and a genuine gold standard against which new projects should be measured.

The virtual hospital programme at WHTH was initiated as part of a broader piece of transformation work which includes the 'ABC MDT'. All airways disease admissions are discussed here and the experience of GPs, specialist nurses (both hospital and community-based), respiratory consultants, physiotherapists, physiologists and palliative care consultants are brought to bear. VH decision-making is endorsed through this meeting as the senior decision-making platform. Exploring the MDT-only outcomes attempts to *isolate* the MDT-effect from the VH-effect.

2　Key findings

Overall, it is evident the VW model represents a safe, effective alternative to inpatient care; improving outcomes, positively impacting patient experience and delivering cost efficiencies compared to traditional care pathways.

Analysis shows a positive impact on patient care across almost all measures, although some notable limitations should be considered including the size of the intervention cohort and the rapid nature of this evaluation.

- The VW demonstrated favourable healthcare utilisation outcomes compared to the other cohorts, with an observed reduction in both inpatient LoS, arising from increased clinical confidence, and a reduction in the number of repeat readmission events.

- VW patients at risk of deterioration are more likely than patients discharged without the VW support to be identified in a timely way and escalated appropriately back into an acute inpatient setting.

- Patient experience was positively impacted, with the majority reporting feeling well prepared for their transition to the VW and then safely cared for in the community.

- Staff gave positive feedback and clear recommendations for continued improvement, including developing additional patient information, future development of the technology pathway to support virtual consultations routinely, and enhanced referral routes.

- The VW demonstrates a positive benefit-cost ratio based on both initial set-up costs and recurring resources required to sustain the model, suggesting a favourable economic case.

3　Findings by area

3.1　Typical characteristics of virtual ward patients

The VW patient cohort tended to be older than the MDT-only and historic control cohorts, with more than 80% aged 60 or over (38 of 46). DECAF scores, which predict acute exacerbation of COPD, ranged between 0 (low risk) and 3 (high risk) for VW patients.

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DECAF Score	Percentage of patients under each DECAF
0	30%
1	30%
2	34%
3	6%

Those high-risk patients with a DECAF score of 2 or 3 suggest patients of a higher acuity were safely supported for early discharge using the VW model than would otherwise occur without continuous monitoring.

COPD was the primary diagnosis for 52% of VW admissions. A different respiratory condition was the primary diagnosis for an additional 30% (82% in total), with COPD often featuring as a secondary diagnosis.

Primary Diagnosis	Percentage of patients
COPD	52%
Different Respiratory Condition	30%
Other	18%

3.2   Virtual ward usage patterns

On average, approximately eight patients (8.3) per month were onboarded to the VW. They were supported by one or more of four main methods of contact: a telephone call to record readings, telephone clinical review, virtual consultation, or face-to-face healthcare professional visit.

The evaluation was based on 46 individual patients totalling 50 admissions to the VW between December 2021 and June 2022 inclusive. Several patients were admitted to the VW on multiple occasions.

VW patients received four reading calls, one clinical review call, fewer than one virtual consultation and fewer than one face-to-face visit per day on average. This is in accordance with the VW SOPs planned call regime. Patients with a DECAF score between 0 and 2 received a similar number of visits and calls.

The predicted LoS for patients entering the VW was 14 days, however for those admitted to the VW:

- the average VW LoS was 7 days.
- 86% had a LoS of 10 days or fewer (n=43).
- nearly half had a LoS of 6 to 10 days (n=24, 48%)
- 14% had a LoS of more than 10 days (n=7) to a maximum of 22 days

Patients were discharged from the VW to one of four discharge destinations. Of 50 admissions:

- 12% were discharged with no further WHTH action (n=6)
- 66% were discharged for ongoing care by community care, CLCH (n=33)
- 10% were discharged for re-discussion at the MDT meeting (n=5)
- 12% were re-admitted to a physical bed (n=6)

The most common discharge destination for patients under each of the four DECAF scores was to ongoing care by CLCH. Those with a DECAF score of 2 were least likely to be re-admitted to a physical bed.

DECAF	Discharged with no further WHTH actions	For on-going care by CLCH	For Re-discussion at MDT	Re-admitted to physical bed
0	7%	60%	13%	20%
1	13%	67%	7%	13%
2	12%	71%	12%	6%

3.3   Potential to reduce secondary care length-of-stay

The average (mean) physical hospital bed length-of-stay (LoS) in secondary care was lower for VW patients, suggesting the VW model enables earlier supported discharge into the community. It was observed at:

- 5 days for VW patients
- 8.1 days for MDT-only patients
- 5.2 days for historic control patients

3.4   Potential to reduce secondary care readmissions

Almost half of VW patients (46%) were not readmitted to hospital as a secondary care emergency for COPD or any other cause within 90 days. Of the remainder:

- 43% had at least one emergency readmission within 30 days
- 4% had at least one emergency readmission within 31 to 60 days
- 7% had at least one emergency readmission within 61 to 90 days

For COPD causes specifically, the majority of VW patients (70%) were not readmitted to hospital as an emergency. Of the remainder:

- 20% were readmitted as an emergency within 30 days
- 4% were readmitted as an emergency within 31 to 60 days
- 7% were readmitted as an emergency within 61 to 90 days

Non-emergency readmissions for COPD-specific or any other cause were moderately higher among VW patients compared to the MDT-only cohort.

- 54% of VW patients were readmitted for a COPD-specific cause compared to 48 per cent of MDT-only patients.
- 30% of VW patients were readmitted for another cause compared to 23 per cent of MDT-only patients.

VW rates are driven by identification of patients at risk of deterioration and appropriate escalation back into an acute setting. This accounts for 15% of all VW patient readmissions occurring within 1 day or less of discharge from the VW.

When these occurrences are removed:

- 22% of VW patients were readmitted for a COPD-specific cause compared to 23% of MDT-only patients
- 46% of VW patients were readmitted for any cause compared to 48% of MDT-only patients

The average number of readmissions per patient was higher in the MDT-only compared to the VW cohort, suggesting MDT-only patients are more likely to have multiple readmission events (0.87 vs 0.78 average number of readmissions <90 per patient between the MDT-only and VW cohorts).

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3.5 Virtual ward patient experience and views

All patients mentioned that being able to be in their own home while being monitored and being able to contact staff was what they liked most about the VW.

Some commented that this allowed them to feel safe, to feel that people were caring, and that being more relaxed was beneficial to their comfort and breathing issues.

Generally, patients reported they felt adequately prepared and confident about using the equipment fully or to some extent. However, some reported challenges, which are grouped as those relating to using the equipment and aspects of communication.

All respondents reported they were satisfied with the way concerns were answered, that they were given adequate information about risks, that the equipment was explained to them, and that they had been involved in decisions about their treatment.

Respondents suggested that various staff roles had answered their questions, including the monitoring team, specialist nurse, on-call nurse, and respiratory consultant.

Some provided suggestions for improvements, including:

- extending out-of-hours advice line
- closer liaison and more communication with various departments including with GP and social care or a social worker
- providing a printed leaflet to give to patients "explaining what a virtual ward is and how it operates so they don't feel they are just being discharged and forgotten"
- screen the patients more

3.6 Staff experience and views

Staff felt there was organisational readiness for the launch and implementation of the COPD VW, highlighting staff and teamwork as a key enabler and critical to success.

The referral process was described as being very quick, with some issues around making sure patient information like the discharge summary was available to the community team before the home visit on Day 1 in the first month of implementation. This was acknowledged as being mainly resolved.

Some staff mentioned some initial technical issues in the first few weeks that were then resolved. Concerns were expressed over potential problems when the level of care is removed on discharge from the VW and whether the current model encourages self-monitoring and self-care in the most appropriate way for all patients.

Overall, staff felt the right patients were being admitted to the VW and the criteria, consent process and safety nets put in place for readmittance to the hospital meant the processes were working appropriately.

Some staff commented that in the first few weeks there were some challenges relating to the appropriateness of patients being admitted to the COPD VW.

Staff received positive feedback from patients, who felt secure and liked the level of care provided by the VW. Feedback from family and carers to staff was positive, including that the VW enabled them to feel involved and had given them a better understanding of the condition and care.

3.7   Indicative cost-benefit

Overall, the VW represents a cost-beneficial model for caring for patients with acute COPD exacerbations, based on the impact on reducing length of stay and the number of repeat readmissions within 90 days of discharge.

The VW demonstrated a positive benefit-cost ratio of £1.12:1 under the lower, more conservative scenario, or £1.45:1 in the upper bound scenario, when considering all costs incurred over the evaluation period.

The net-present value, the difference between costs and benefits realised, was £6,370 over the evaluation period, or £24,400 per annum with optimism bias correction (OBC) included.

Cost-benefit analysis outputs per lower and upper estimates, all costs included for duration of the evaluation period

Metric	With OBC (Lower scenario)	Without OBC (Upper scenario
Total Fiscal Value	£60,800	£78,840
Benefit-Cost Ratio	£1.12:1	£1.45:1
Net Present Value	£6,370	£24,400
Per Patient Net Benefit	£128	£488

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Extrapolated over a 12-month period and excluding any initial, one-off expenditure, this ratio increases to £1.25:1 under the lower scenario and to £1.62:1 in the upper scenario with a net present value of £28,930 per annum. The per patient benefit per VW episode is £263 to £656 respectively for each scenario.

Cost-benefit analysis outputs per lower and upper estimates, recurring costs only, per annum

Metric	With OBC (Lower Scenario)	Without OBC (Upper Scenario)
Total Fiscal Value	£145,950	£189,210
Benefit-Cost Ratio	£1.25:1	£1.62:1
Net Present Value	£28,930	£72,200
Per Patient Net Benefit	£263	£656

4 Recommendations

SWHHCP should continue delivering the VW and explore further expansion of the model into other care pathways outside of COPD and heart failure, considering our suggestions for further future improvements and learnings from initial implementation.

We have several suggestions for any future analysis that builds on this evaluation.

- Expanding the size of the intervention cohort to enable exploration of the degree of statistical significance of any observed effects.
- Increasing completion rates of the patient survey to ensure full representation of the diversity of patient experience in a way which is recognised as reflective of the VW cohort.
- Involving data from other healthcare services supporting patients on the VW, including through more extensive engagement with primary care.
- Exploring wider impacts on patient quality of life, including through a cost-utility analysis leveraging recognised health economic techniques and through engagement with patients' families and carers.
- Reviewing the number of calls made to patients on the VW and co-design remote interventions with patient groups to reduce staff resources and the cost attached.

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Main report

1 Background

1.1 The challenge

Reducing pressures on NHS secondary care is a national priority. The NHS Long Term Plan[1] set out a clear need to update the NHS care model by focusing on population health and moving more care out of hospital, reducing demand for emergency services.

In June 2018, the secretary of state for health and social care announced a national ambition to lower physical hospital bed occupancy, reducing the number of long stays by 25% by December 2018 and by 40% by March 2020.

Two NHS England campaigns[2] aim to provide patients with a better care experience by ensuring they are discharged from hospital without unnecessary delay.[3]

Early discharge when clinically appropriate may provide a viable means of reducing the pressure on acute care services and reduce the impact of a long stay in hospital on patients' functional decline due to deconditioning.

A Public Health England paper on the wider impacts of COVID-19 on physical activity, deconditioning and falls in older adults[4] found 50% of patients experience functional decline between admission and discharge.

Early discharge can prove difficult for patients who present with minimal to no symptoms before rapidly deteriorating.[5]

1.2 About virtual wards and virtual hospitals

To reduce the clinical risk of discharging patients early, patients may be monitored by clinicians through a virtual ward (VW) that in some instances falls within a virtual hospital.

A virtual hospital can be defined as an all-encompassing group of virtual wards that cover a range of conditions, allowing patients to receive the care they need at home safely and conveniently, rather than being in hospital.

This support may involve face-to-face care from multi-disciplinary teams based in the community and so they may be considered comparable to other specialist services normally provided within an acute environment, known as 'Hospital at Home'.

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[1] The NHS Long Term Plan
[2] NHS England Reducing long stays: empowering patients' campaign and Reducing long stays: where best next campaign
[3] NHS England RLoS
[4] Public Health England Wider impacts of COVID-19 on physical activity, deconditioning and falls in older adults
[5] The Health Foundation, Improving hospital discharge in England: the case for continued focus and support

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VW services are technology-enabled by design, with patients remotely managed via a digital platform with oversight from a clinical team to maximise the opportunity they offer for patients, carers and staff.[6]

They help to transform post-discharge care by enabling patients to leave hospital sooner whilst being monitored remotely from their home, thereby providing an opportunity to narrow the gap between demand and capacity for secondary care beds with a safe alternative to admission and/or early discharge.

NHS England's 2022/23 priorities and operational planning guidance[7] outlines the importance of VWs in restoring services, meeting new care demands and reducing care backlogs arising from the pandemic.

Integrated care systems (ICSs) are requested to scale these services with the aim of creating additional bed capacity through efficient and productive use of resource while managing patients.

1.3   About the partnership

South and West Hertfordshire Health and Care Partnership (SWHHCP) is an ICS partnership between:

- West Hertfordshire Teaching Hospitals NHS Trust (WHTH)
- Central London Community Healthcare NHS Trust (CLCH)
- Hertfordshire Community NHS Trust
- Hertfordshire Partnerships University NHS Foundation Trust
- Hertfordshire County Council
- Primary care, represented at the time by Herts Valleys Clinical Commissioning Group which is now part of the Hertfordshire and West Essex ICS

SWHHCP's vision is *'all partners working effectively together to reduce health inequalities and improve the health and wellbeing of people in South and West Hertfordshire.'*

VWs are a SWCHHCP transformation priority. In March 2020 it launched a Covid-19 VW across West Hertfordshire that achieved national recognition and onboarded more than 4,000 patients by the end of October 2020.[8]

An evaluation of the first phase of the Covid VW suggested a cost-effective model of care for patients and concluded: "*The […] Covid Virtual Ward has delivered good quality care*

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[6] NHS England Supporting information for ICS leads: Enablers for success: virtual wards including hospital at home
[7] 2022/23 priorities and operational planning guidance
[8] Early prognostication of COVID-19 to guide hospitalisation versus outpatient monitoring using a point-of-test risk prediction score

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for this patient cohort, at a cost that is below that of treating the patients in an acute setting." [9]

SWHHCP has collaboratively built on this model by expanding the VW to other clinical conditions, in the first instance including patients with chronic obstructive pulmonary disease (COPD) and, separately, those with heart failure (HF), forming the SWHHCP VH.

This evaluation focused on the SWHHCP COPD VW and pathway only.

1.4   About the virtual ward model

The model is designed to provide high quality care in the patient's home and facilitate:

- early discharge for patients who require an initial period of inpatient care, and

- admission avoidance, to prevent unnecessary use of acute inpatient facilities where equivalent care can be delivered safely in the patients' own home

The COPD VW aims to build on and enhance the WHTH Covid-19 VW model and the existing community supported discharge programmes delivered by CLCH.

The VW model aligns with the trust's integrated airways disease service policy and the underlying principles of placing patients' needs at the centre of care, matching work activity with the appropriate healthcare professionals, and of integrated care in the newly formed integrated care partnership (ICP).

The COPD VW is part of the asthma, bronchiectasis and COPD multi-disciplinary team (ABC MDT) standard operating procedures (SOPs).

Physiological information and clinical information needed to support the VW is captured using continuous monitoring technology supplied by Masimo.

In conjunction with other forms of measurement, a number of key readings are captured from patients including heart rate, respiratory rate, temperature, blood pressure, weight, peripheral perfusion index and EDI, a measure of intravascular fill and or pre-load.

These are utilised by the hub team to calculate a National Early Warning Score (NEWS2) used to identify acutely ill patients as a measure of deterioration.

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[9] CVW Evaluation v5.0 – internal review not available in public domain. Access provided to the evaluation team by SWHHCP

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1.5 Virtual ward pathway stages

1.5.1 Referral

- Referrals are managed by the ABC MDT with each patient discussed at an MDT meeting, which occur three times per week.

- Details about inclusion and exclusion criteria and how to ensure correct patients are identified for safe discharge to the VW are provided later in this section and specified further in the SOP (see Appendix 1).

1.5.2 Onboarding

- Patients agree monitoring arrangements and a discharge and escalation plan.

- Patients are provided with the Masimo monitoring equipment and instructions on what to do. Where necessary a tablet with the Masimo software pre-loaded is provided.

- A discharge summary is emailed to the CLCH team and the GP.

- A referral form and pathway information are shared with WHTH and CLCH staff via InfoFlex, a clinical data management system.

- CLCH community respiratory nurses and physiotherapists visit each patient on their first day on the VW, known as Day One, to conduct a face-to-face patient review and answer any questions about the monitoring equipment.

1.5.3 Monitoring

- Masimo's continuous monitoring technology provides data on heart rate, respiratory rate, temperature, blood pressure, peripheral perfusion index quality indicator and EDI, a measure of intravascular fill and or pre-load.

- Patients wear a device or a number of devices 24 hours/day, which transmits data to the Masimo platform, such as their oxygen saturation level. Readings such as blood pressure and weight are reported manually by patients to the hub nurses.

- Patients are clinically supervised by the WHTH consultant respiratory physician(s) on duty, including a pro-active daily telephone call as part of the daily ward round.

- Hub nurses review the continuous data logs for VW patients overnight and prioritise the consultant ward round accordingly. Hub nurses are a new role specific to the VW, undertaken by junior sisters employed by WHTH. Their responsibilities include screening patients for referral, onboarding patients to the VW, monitoring patients' data on the Masimo platform and making daily calls to patients.

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- Hub nurses perform data accrual using the Masimo platform and populate a NEWS2 chart recorded on InfoFlex.

- Hub nurses call patients four times per day, or an alternative agreed number of calls, and record this data on InfoFlex.

- Hub nurses monitor the Masimo platform and respond to patients should rapid escalation be required or where a patient requests additional telephone support between 8am and 4pm seven days a week. Breaches of any thresholds in the monitoring device trigger a call from the hub nurses.

- WHTH liaise closely with colleagues from CLCH as part of the multi-disciplinary team to ensure that patients who would benefit from further community support, including home visits, have access to this provision.

- CLCH staff provide community-based support including virtual and face-to-face visits if required and update the patient's record on InfoFlex.

- Escalation routes are dependent on the time of day and day of the week (see figures 2 and 3).

1.5.4 Recovery and discharge

- Patients are intended to be managed on the COPD VW for up to 14 days depending on clinical review.

- All patients are reviewed by the MDT via referral at the conclusion of their stay.

- The MDT review all cases against Best Practice Tariff (BPT) criteria, a national standard that aims to reduce unexplained variation in clinical quality and encourage best practice, high quality, cost-effective care. The criteria include a spirometry and specialist lifestyle review including smoking cessation.

- Patients are discharged to the appropriate destination and all cases given a definitive management plan.

- Patients, friends, family, or an NHS volunteer collect the monitoring equipment to return to WHTH.

- The COPD VH platform automatically generates a clinical summary on discharge. This summary is emailed to the patient's GP.

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Figure 1, below, shows the three layers of intervention used by the virtual ward.

Figure 1: COPD Virtual Ward monitoring layers
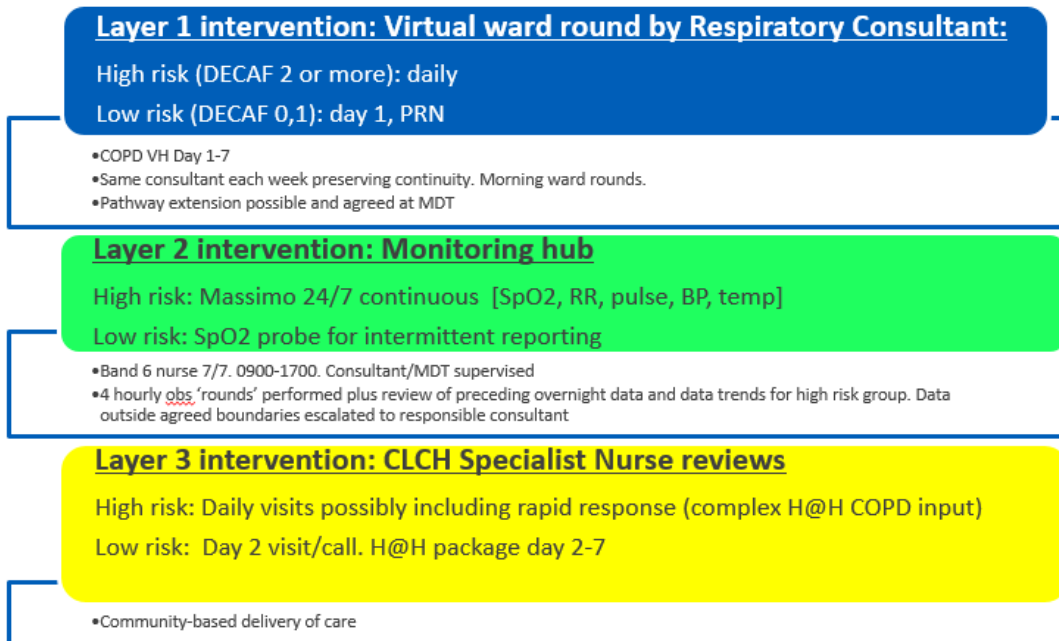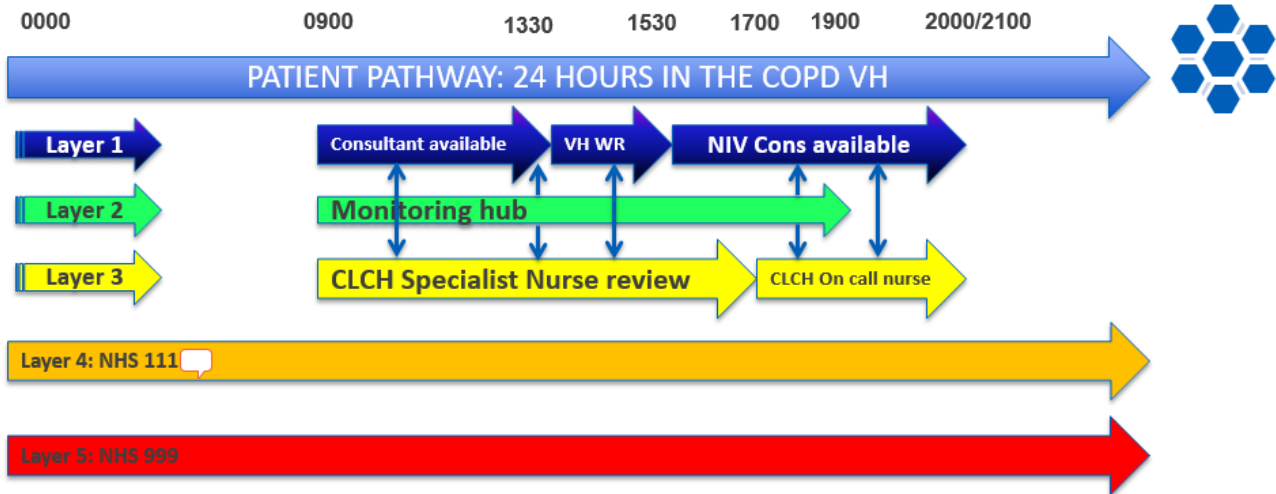
Layers of escalation/governance

Layer 1 intervention: Virtual ward round by Respiratory Consultant:

High risk (DECAF 2 or more): daily

Low risk (DECAF 0,1): day 1, PRN

- COPD VH Day 1-7
- Same consultant each week preserving continuity. Morning ward rounds.
- Pathway extension possible and agreed at MDT

Layer 2 intervention: Monitoring hub

High risk: Massimo 24/7 continuous [SpO2, RR, pulse, BP, temp]

Low risk: SpO2 probe for intermittent reporting

- Band 6 nurse 7/7. 0900-1700. Consultant/MDT supervised
- 4 hourly obs 'rounds' performed plus review of preceding overnight data and data trends for high risk group. Data outside agreed boundaries escalated to responsible consultant

Layer 3 intervention: CLCH Specialist Nurse reviews

High risk: Daily visits possibly including rapid response (complex H@H COPD input)

Low risk: Day 2 visit/call. H@H package day 2-7

- Community-based delivery of care

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Figure 2: COPD Virtual Ward weekend escalation routes

- Escalation routes will vary dependent on the time of day
- The monitoring hub will review all patients observations according to risk status and also provide 0900-1900 telephone advice to patients
- Nurses can escalate to available consultant and vice versa
- Patients can contact monitoring hub 0900-1900

Figure 3: COPD Virtual Ward weekday escalation routes
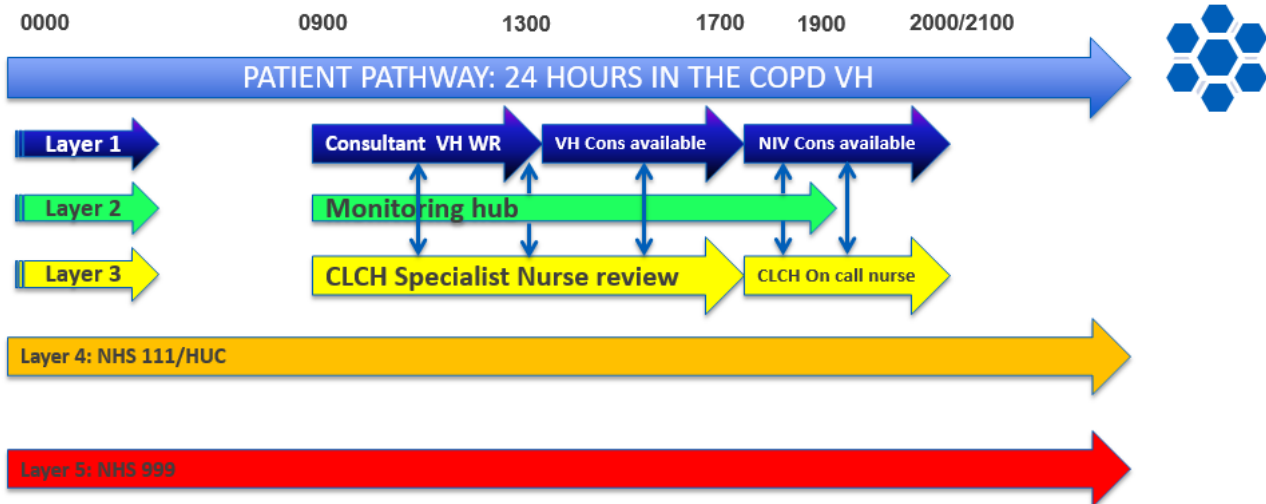
- Escalation routes will vary dependent on the time of day
- The monitoring hub will review all patients observations according to risk status and also provide 0900-1900 telephone advice to patients
- Nurses can escalate to available consultant and vice versa
- Patients can contact monitoring hub 0900-1900
- At 'risk patients' need agreed escalation plans in place by 1700 every day available to emergency teams

1.6   COPD Virtual Ward inclusion and exclusion criteria

Patient inclusion criteria:

- less than 85 years of age
- no additional complex social or physical requirements
- clearly demonstrating a positive clinical trajectory
- receiving oxygen via nasal cannula at no more than 4 l/min, with resting saturation of peripheral oxygen maintained between 88 and 92%
- willing to be discharged with oxygen
- has no contraindications to being prescribed oxygen at home
- DECAF score[10] of 3 or less on admission

VW patient DECAF scores ranged between 0 and 3. A score of between 0 and 1 represents patients typically considered suitable for early discharge.

For the purposes of our evaluation, DECAF is used as a proxy measure of the severity of a patient's condition on admission to the VW.

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[10] DECAF is a commonly used predictor of a COPD patient's in-hospital mortality risk and comprises; D, dyspnoea, E, eosinopenia, C, consolidation on chest X-ray, A; acidemia, F, atrial fibrillation (AF).

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Patient exclusion criteria:

- complex medical needs over and above O2 requirements
- clinically unstable
- confused or has impaired cognitive abilities
- requires complex social arrangements
- not discussed or agreed by the ABC MDT

1.7 Implementation

The COPD VW was implemented in three phases.

- Phase 1: November 2021, facilitated discharge. Patients are referred to the COPD VW from the acute ward at WHTH.

- Phase 2: December 2021, admission avoidance. Patients are referred to the COPD VW from Accident and Emergency (A&E) at WGH.

- Phase 3: February 2022, direct community on-boarding. Patients who are referred to the COPD VW from CLCH and later general practice.

This evaluation was conducted during phases 1 and 2 and does not include the phase 3 expansion.

2 Evaluation overview

2.1 Purpose

In October 2021, NHS England (NHSE) commissioned the Academic Health Science Network (AHSN) to conduct a rapid evaluation of the COPD VW and its implementation in SWHHCP.

This commission is part of the national Innovation Collaborative for digital health, a learning and support system for health and care professionals delivering technology-enabled innovations to support people at home.

The evaluation commenced with a structured process of co-design, working together with a representative group of stakeholders across local delivery partners, the AHSN Network and NHSE, led by a collaborative steering group, to determine the evaluation aim and scope.

The purpose of this evaluation was to demonstrate whether the VW has successfully delivered its intended objectives of improving patient care, clinical outcomes, healthcare utilisation and staff and patient satisfaction, with a view to informing wider adoption of the VW model outside of COPD into other clinical conditions.

It is intended to build on the emerging evidence base surrounding the adoption of technology-enabled care at home to provide valuable insight to members of SWHHCP alongside ICS teams across England and national policy leads who are seeking to develop or continue to improve their own VW services.

2.2 Questions

The evaluation sought to answer seven questions.

1.   Who are the patients admitted to the VW?
2.   Are there any patterns in usage for patients on the VW?
3.   Can the VW reduce length of stay in secondary care?
4.   Can the VW reduce re-admissions into secondary care?
5.   What are the experiences and views of the service users on the VW?
6.   What are the experiences and views of staff on implementation, delivery and impacts of the VW?
7.   What is the indicative cost-benefit of the VW in terms of immediate and long-term impact on healthcare utilisation?

2.3 Method

We used a mixed method approach combining quantitative, qualitative and economic insight. As such the evaluation has three distinct but inter-related components, each with their own evaluation questions, design, measurement strategies and analysis plans.

2.3.1 Quantitative evaluation

We used data extracted from sources including Masimo, InfoFlex and WHTH's Cerner EPR to inform reporting of process measures and capture indicators related to the implementation and usage of the COPD VW across patient groups. It measured the impact of the VW on utilisation of healthcare services including, specifically, any reduction in length-of-stay (LoS) when admitted to secondary care and any reduction in re-admission rates over 30, 60 and 90 days.

2.3.2 Qualitative evaluation

We considered user feedback from a patient survey and captured self-reported information directly from service users across a range of metrics designed to inform commissioning. A series of semi-structured interviews and focus groups with staff sought to understand their experiences of VW implementation, perceptions of facilitators and barriers to implementation and impact on workforce efficiency, satisfaction and care provided.

2.3.3 Health economics evaluation

We used quantitative work for a cost-benefit analysis of the VW, extrapolating findings into medium to long term effects on healthcare utilisation.

2.4 Scope

Patients fulfilling the eligibility criteria and onboarded to the VW from Watford General Hospital (WGH), or patients within the comparator groups specified below, were considered to be in scope.

The scope for qualitative analysis included members of the COPD VW team, such as locality staff and healthcare professionals who have been involved in its design and delivery.

Quantitative and health economics analysis adopted a three-arm approach to increase the possibility of determining the incremental service impact of the COPD MDT alone, or the COPD MDT in combination with continuous monitoring via the VW.

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Individual patients were placed into one of three cohorts:

- **Historic control**

This included patients admitted to WHTH pre-pandemic from December 2018 to June 2019 with COPD as the primary complaint.

- **MDT-only**

This included patients assessed by the MDT but not onboarded to the VW during the intervention window of December 2021 to June 2022 inclusive.

- **Virtual Ward patients**

This included patients assessed by the MDT and then moved to VW onboarding during the intervention window as above.

2.5   Comparators

The historic control time period was chosen as the base comparator because it is the last full year prior to COVID-19 and the December to June window is determined as directly comparable to the intervention window, accounting for seasonal effects and winter pressures.

This enabled a before-and-after comparison to services selected by the evaluation steering group to reflect the usual standard of care prior to the MDT's introduction.

Additionally, the trust's peak for NHSE performance was in 2019, when a pilot project named Senior Medics Assessment Review and Treatment (SMART), involving medical consultant input in the emergency department, took place.

SMART helped to move the trust's four-hour performance nationally from the lower to the upper quartile and also won the 2020 HPMA Academy Wales Award for Excellence in Organisational Development. This means 2019 data represents the most stringent comparator and a genuine gold standard against which new projects should be measured.

Any data pertaining to patients outside of the above parameters was excluded.

3 Detailed methodologies

3.1 Quantitative methods

The WHTH Business Intelligence (BI) team provided quantitative data by pooling structured, coded data extracted from InfoFlex and Cerner, along with data from Masimo in the form of a person-level pseudonymised dataset across all three cohorts with consistent unique identifiers. This matching of person-level data has facilitated a comparison of the demographic characteristics and case mix of each cohort to enable a like-for-like comparison.

The contents of this person-level dataset are specified in Appendix 5. In summary, it combined information on patient demographics, outpatient attendances, urgent and emergency care usage, inpatient admissions including reason for admission and LoS, and data points recorded as part of the MDT and collected via continuous monitoring.

As the evaluation team had no ability to readily re-identify patients this dataset constituted effectively anonymous data but maintained its utility in enabling the triangulation of multiple patient variables to support isolation of confounding factors.

- Data provided by the WHTH BI team for the purposes of this evaluation was based on 46 individual patients totalling 50 admissions to the VW between December 2021 and June 2022 inclusive. Several patients were admitted to the VW on multiple occasions.

Equivalent data was sourced for the MDT and historic control cohorts, with the exception of data items only recorded at the point of admission to the VW, such as DECAF score.

This was to understand whether a difference in healthcare utilisation and outcomes between groups could be observed following the introduction of the VW.

- The MDT-only cohort consisted of 248 patients with 573 equivalent admissions between December 2021 and June 2022 inclusive.

- The historic control cohort consisted of 365 patients and 438 admissions from the pre-pandemic comparator period.

3.2 Qualitative methods

The qualitative evaluation aimed to primarily consider experiences and views of VW patients and staff involved in VW design and delivery, including confidence, degrees of satisfaction and barriers and facilitators to implementation.

We used a range of qualitative methods to gather feedback including patient experience surveys, staff interviews and focus groups.

Questions were informed by the Picker patient experience survey and the domains within the Non-adoption, Abandonment, Scale-up, Spread, and Sustainability (NASSS) framework.[11]

3.2.1 Patient survey

All patients admitted to the SWHHCP COPD VW from its December 2021 launch to the end of the data collection period in June 2022 (n=46) were invited to participate by completing a patient experience survey with different options made available to facilitate completion and return.

The hospital administration team provided VW patients with a link to an online version of the survey alongside a paper copy and stamped addressed envelope.

Patients were asked to complete the survey towards the end of their time on the VW in a format easiest for them.

WHTH volunteers who collect VW equipment from patients were asked to help by collecting completed surveys in tandem and returning them to the hospital.

The online survey was created in Zoho One, allowing the team responsible for the qualitative evaluation to access online responses directly.

The survey consisted of 19 questions to explore patient experience of the VW, satisfaction with treatment and care, any reasons for non-adherence, and overall impression of the benefits and challenges of being in a VW.

This included 13 Likert scale questions and six free text questions. A full copy is provided in Appendix 3.

We received 10 paper and five online surveys. Two of the latter were incomplete and not included in the analysis, which therefore considered responses from 13 patients out of the 46 who entered the VW, equating to a response rate of 39%.

Of the patients who responded, 10 were admitted to the VW from the hospital ward within phase 1 of the implementation plan, two were admitted from A&E within phase 2 of the implementation plan and one did not answer this question.

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[11] Greenhalgh et al 2017

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Analysis of Likert scale questions provide a general statistical summary of responses, while analysis of free text questions used thematic coding to identify commonly occurring themes.

3.2.2 Staff interviews and focus groups

We emailed staff involved in the COPD VW's design or delivery to invite them to participate in a semi-structured interview or focus group.

The evaluation team applied a snowball sampling approach, starting with lists of relevant staff provided by staff in senior management, then asking staff participating in interviews or focus groups for suggestions of additional staff we should invite to participate.

We provided staff with a participant information sheet and consent form. Interviews and focus groups were conducted online using Microsoft Teams.

The interview schedule consisted of 20 questions that explored challenges and benefits related to five key themes:

- VW pathway and delivery processes
- impacts on staff
- patient roles, characteristics and expectations
- organisational readiness and implementation
- monitoring and evaluation

A full copy of the interview schedule is provided in the Appendix 4 for information

Interviews and focus groups were recorded and transcribed. Each participant was given a unique numeric identifier to de-identify them prior to the transcripts being imported into NVivo for analysis.

We conducted two separate focus groups and six individual interviews between May and June 2022 lasting between 24 and 58 minutes, with a mean of 48 minutes.

The sample totalled 18 staff out of the 21 contacted, from both WHTH and CLCH, involved in VW design and implementation.

Roles represented were consultant, respiratory nurse specialist, respiratory nurse, respiratory physiotherapist, VW senior responsible officer (SRO), associate director of integrated care, and lead for community services.

We used thematic analysis to explore participants' experiences and views of the COPD VW. Coding allowed common themes across the sources of qualitative data to be identified and grouped into key themes.

The evaluation team drew on domains identified in the NASSS framework to inform our analysis where appropriate.

3.3 Economic analysis

Several forms of economic analysis can be adopted to evaluate the impact of any new health intervention, including cost-utility analysis, cost-effectiveness analysis, cost-minimisation analysis, cost-benefit, and budget-impact analysis.

We used cost-benefit analysis as our preferred model for this evaluation, given the focus on sustainability of the VW model and the implications for longer-term investment, along with availability of staffing resource capacity to maintain the VW and support patients in the community.

The modelling approach was adapted from recognised best practice for local project appraisal and evaluation including the HM Treasury Green Book methodology and the five-case model.

We also used supplementary guidance developed by the Greater Manchester Combined Authority Research Team (formerly New Economy) on how to translate this for the purposes of local transformation partnerships and public service reform.[12]

3.3.1 Costs

Our analysis focused retrospectively on the delivery of the VW model between December 2021 and June 2022 inclusive.

It utilised actual observed data regarding benefits realised and costs incurred, as detailed in the quantitative analysis section, alongside actual costs from reported expenditure provided by the SWHHCP team, as opposed to budgeted figures.

These costs combined both staffing resources, including medical time, nursing time and other non-clinical support, with technology resources such as remote monitoring devices and other materials like printing and stationery resources.

The two key benefits streams relate to the impact of the VW on reducing overall healthcare utilisation and improving appropriate, timely care for patients.

Specifically, this involves reducing LoS at initial inpatient admission, anticipated to reduce through earlier supported discharge, and reducing re-admissions within 90 days of discharge through proactive, continuous patient monitoring in a community setting.

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[12] The Green Book and accompanying guidance and documents.

As a result, and due to the minimal degree of modelling and extrapolation required, the degree of optimism bias adjustment is moderate.

Optimism bias adjustment is the multiplier within the model that accounts for the psychological tendency for programmes at inception to systematically under-estimate costs and over-estimate the anticipated benefits.

We took the perspective of the healthcare system, specifically WHTH, when conducting our modelling. It is worth noting that as such, the monetised values applied to generate a proxy indication of the fiscal benefit of the VW will not translate to cash-releasing savings in every instance.

Instead, they represent a reflection of the opportunity cost of activity otherwise avoided, such as staff time and materials.

The MDT-cohort was selected as the most appropriate counterfactual for comparative analysis, as it was deemed by members of the evaluation steering group as the most likely reflection of current service provision and the clinical operating model for these patients in the absence of the VW.

Any cost and benefits realised should therefore be considered as in addition or marginal of, the impact of the MDT in isolation.

4 Results

4.1 Characteristics of virtual ward patients

The VW admitted 50 cases involving 46 patients between December 2021 and June 2022 inclusive, meaning some were admitted more than once.

All 50 admissions are included in this analysis, distinguishing where necessary between unique counts of patients, as derived from the pseudonymised patient-level linked dataset, and their respective admission events.

The first of the four evaluation questions each relate to a range of analysis regarding these 46 patients and their outcomes in comparison to those in the historical control and MDT-only comparator cohorts.

4.1.1 Age and gender

Patient age was recorded in 5-year age bands. Overall, those onboarded to the VW were aged between 45 and 84 with admissions among the youngest band, aged 45 to 49, least common (4%).

More than 80% of patients were aged 60 and over (38 of 46), and those in the 80 to 84 age band accounting for around a third of all admissions (30.4%).

Figure 4: Virtual ward patient age by 5-year age band
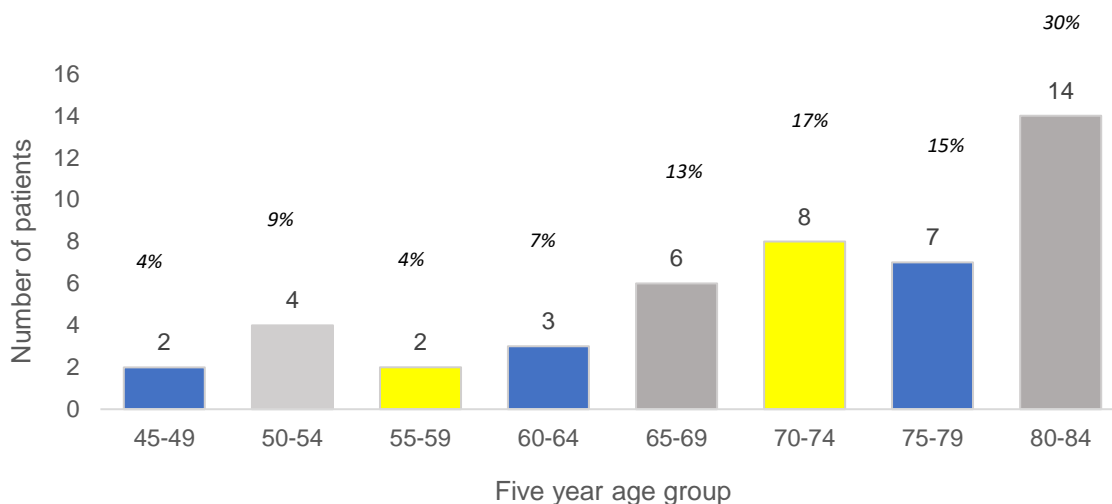
The historic control and MDT-only cohorts had a broader range of age groups including younger patients in particular, with a small proportion of MDT-only patients aged under 35 (5.6%). Both cohorts featured a number of older individuals, with around 3% of the MDT cohort aged 90 and over.

The youngest patients within the historic control cohort were aged between 25 to 29 (0.3%) while the oldest were aged 90 and over (12.9%). The two most common age groups in this cohort were those aged between 75 and 79 (17.8%) and 85 to 89 (16.4%).

Figure 5: Age distribution by cohort
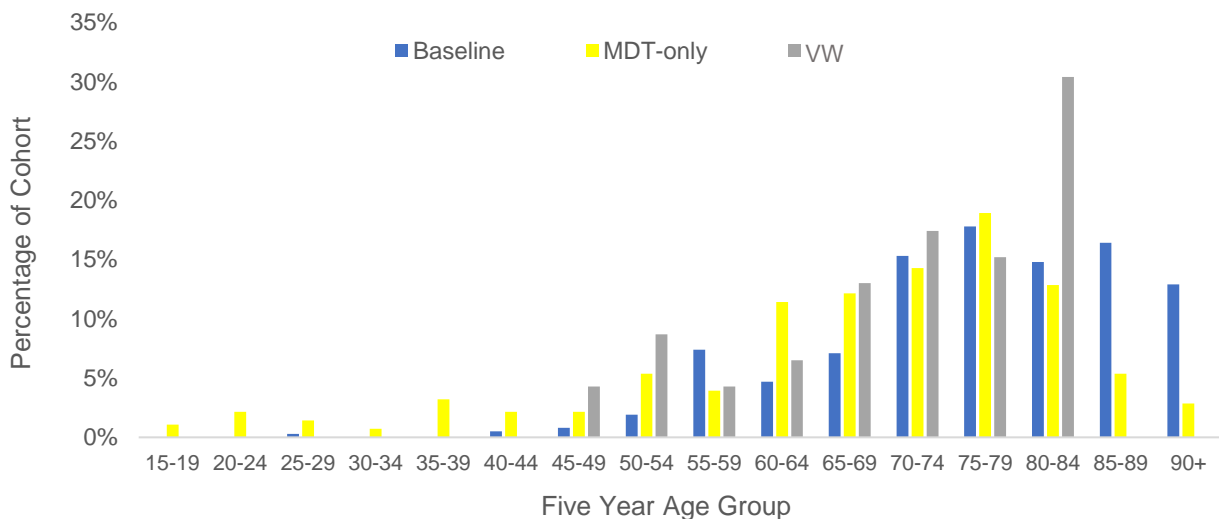
Age distributions were broadly consistent across all three evaluation arms, except the VW cohort had a smaller proportion of younger patients and a larger proportion of patients within the 80-to-84-year age band compared to MDT-only or historic control cohorts. The proportion of males and females was broadly equivalent in all three cohorts.

Figure 6: Percentage of male and female patients by cohort

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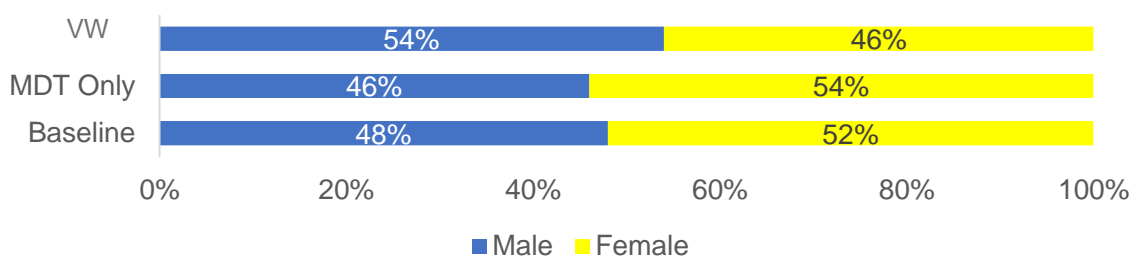
4.1.2 Ethnicity

Ethnicity data was recorded for most patients across all 3 cohorts. The largest single ethnic group was White – British, which made up 91% of all patients onboarded to the VW, compared to 88% in the historic control and 83% in the MDT cohorts.

This suggests the cohort of VW patients were slightly over-representative of White – British populations when compared to the historic control cohort and against the local population.

Four per cent of the VW cohort were 'any other White background (including Irish)' and accounted for 5% and 6% of the historic control and MDT cohorts respectively. A small percentage of patients identified as having another ethnic background, including Asian or Asian British (2%).

Ethnicity data was incomplete for several patients at the point of inpatient admission, which is consistent with recognised challenges in NHS clinical data management around the recording of ethnicity data.

Table 1: Recorded ethnicity by cohort

Ethnicity	Historic Control	MDT	VW
White – British	88%	83%	91%
Any other White background	5%	6%	4%
Black or Black British	0%	1%	0%
Mixed	0%	0%	0%
Asian or Asian British	3%	4%	2%
Other ethnic groups - any other ethnic group	0%	1%	0%
Not stated	3%	4%	2%

4.1.3 DECAF score

A commonly used predictor of a COPD patient's in-hospital mortality risk is their DECAF score.[13] A score of between 0 and 1 indicates a low risk and typically represents a patient considered suitable for early discharge. A score of 2 indicates an intermediate risk, while between 3 and 6 indicates a high risk.

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[13] D; dyspnoea, E; eosinopenia, C; consolidation, A; acidemia, F; atrial fibrillation

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For the purposes of our evaluation, DECAF has been used as a proxy measure of the severity of a patient's condition on admission to the VW.

For patients on the VW, DECAF scores ranged between 0 and 3. The most common DECAF for patients on the VW was a score of 2, accounting for 34% of patients, while 60% were classified in the low-risk category and an equal number of patients distributed across DECAF 0 and 1.

A small number of patients (n=3, 6%) admitted to the VW had a DECAF score of 3. In combination with those patients at DECAF 2, this suggests patients of a higher acuity were supported safely for early discharge using the VW model than would otherwise occur without continuous monitoring.

Table 2: Patients onboarded to the VW by DECAF score at point of VW admission

DECAF Score	Number of admissions to VW	Percentage of admissions
0	15	30%
1	15	30%
2	17	34%
3	3	6%
Total admissions to VW	**50**	**100%**

4.1.4 Primary Diagnosis on admission and referral source

Several different primary diagnoses were recorded for patients upon initial admission to an inpatient hospital bed. The main reasons across all three cohorts was either '*Chronic Obstructive Pulmonary Disease or Bronchitis without Interventions*' or another admission reason related to diseases of the respiratory system.

COPD was the primary diagnosis for 52% of VW cohort admissions, with other respiratory conditions accounting for a further 30% (82% total). COPD was often a secondary diagnosis in these cases.

The remaining 18% received another diagnosis including heart disease, a hernia, or complications arising from a Covid-19 infection, but were subsequently deemed eligible for onboarding to the VW.

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**Figure 7: Primary diagnosis on admission, patients then onboarded to VW**
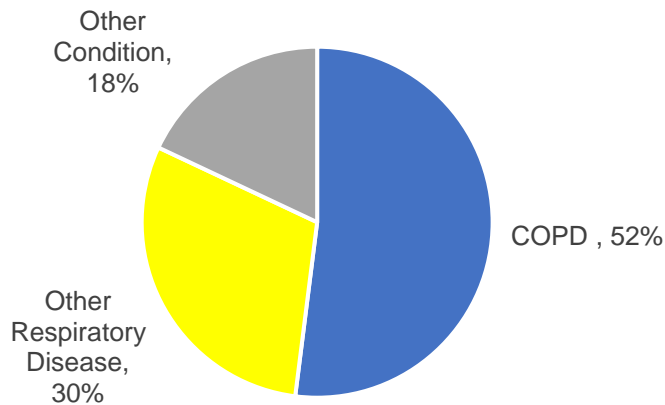
VW patients had a lower proportion of non-respiratory related conditions compared to the MDT-only cohort, (18% compared to 42%) with a greater proportion of other non-COPD respiratory conditions coded at admission (30% as opposed to 23% in the MDT).

The percentage of patients who were identified as having COPD were higher in the VW cohort (52%) compared to the MDT cohort (42%).

Given the nature of the inclusion criteria and how the baseline cohort has been defined – as any patient admitted due to COPD within the historic baseline period – 100% of those patients have COPD listed as their primary complaint and have therefore been excluded from Figure 8.

Figure 8: Primary diagnosis on admission for VW and MDT-only cohorts
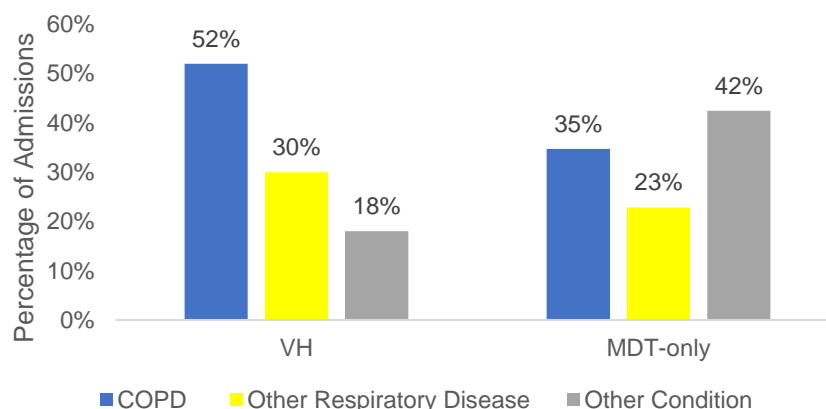
COPD remained the most likely reason for admission amongst the VW cohort across all DECAF scores, followed by other respiratory conditions.

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Patients with a higher DECAF score (DECAF 2) were moderately more likely to be coded as having COPD as their primary reason for admission, although as the numbers of patients within each cohort is comparatively small, we cannot determine whether this difference is significant.

**Figure 9: Virtual ward cohort primary diagnosis on admission by DECAF score (excluding DECAF 3)**
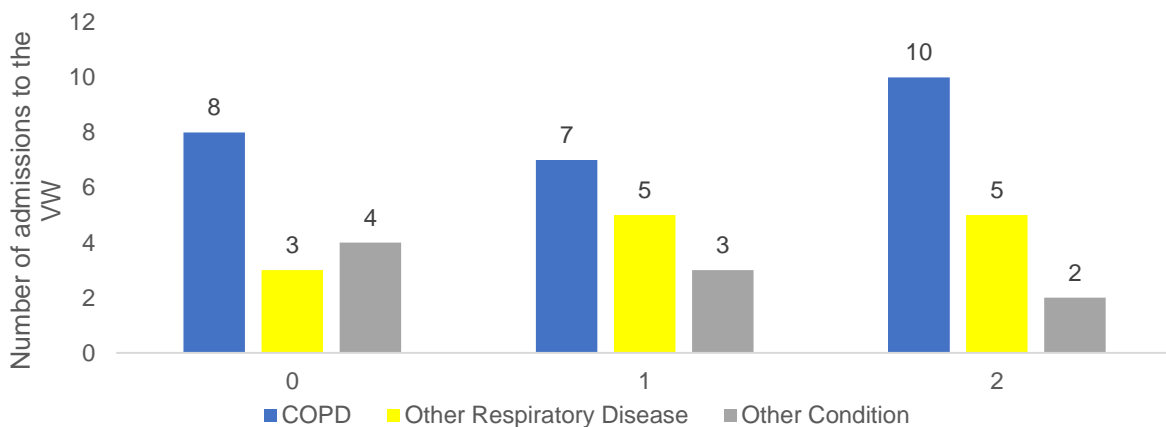
Referrals for patients to be onboarded to the VW came from several sources, with the most from the hospital ward (78%).

Following its introduction in the second service development phase, A&E accounted for the second largest percentage of referrals (10%) with the asthma, bronchiectasis and COPD multi-disciplinary team (ABC MDT) identifying patients while in the department.

Several referrals were from a post-take ward round, where a consultant first reviewed patients monitored by doctors, while a single referral (n=1) came from another unspecified source. This referral pattern was consistent across all age groups, with the ward representing the most common route of referral to the VW regardless of 5-year age group.

Figure 10: Referral source to the virtual ward
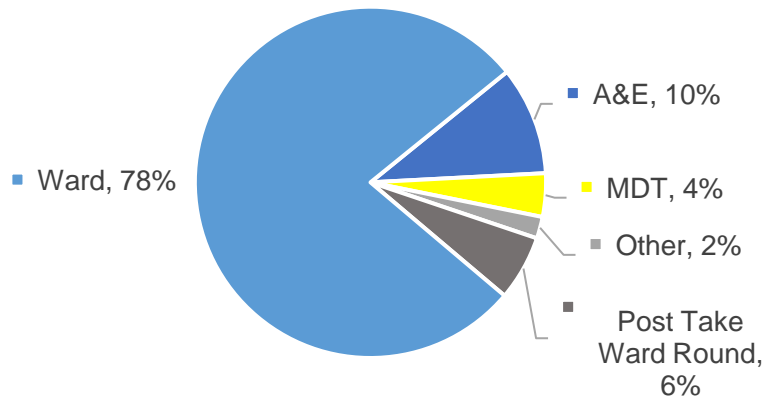
The ward was the only source of referral recorded for some age groups, including those aged from 45 to 59. A&E onboarding most frequently occurred for patients aged 60 to 64 (33% of this age group) and aged 70 to 74 (30% of this age group).

Figure 11: Referral source to the virtual ward by 5-year age band
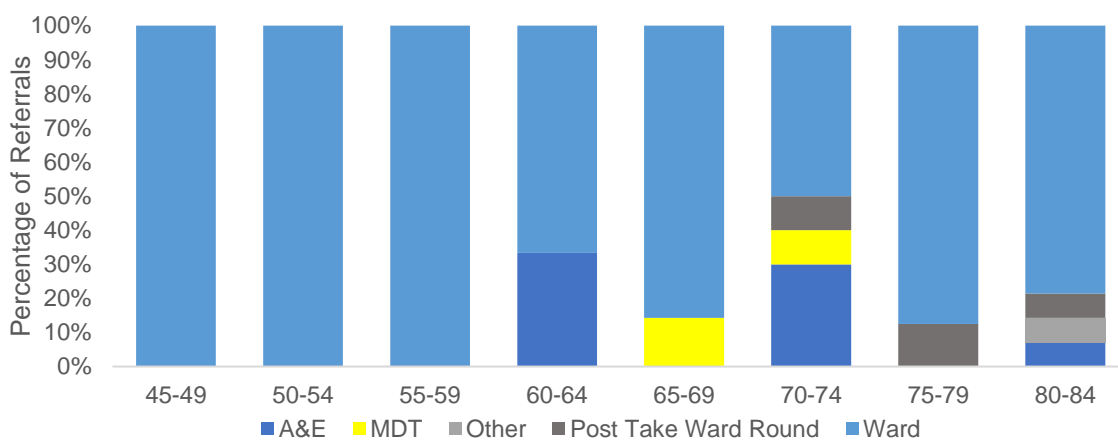

4.2 Usage patterns among virtual ward patients

4.2.1 Admissions by month

Overall, monthly admissions to the VW varied during the six-month evaluation period, with an average of approximately eight patients onboarded per month (8.3).

The greatest number onboarded in a single month was in February 2022 (n=15), while the lowest occurred in December 2021 (n=3), shortly after the VW was launched.

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The second lowest number occurred in May 2022 (n=4), reflecting the operational implementation of the VW and the overall volume of patients attending secondary care over that period.

**Figure 12: New admissions to the virtual ward by month**
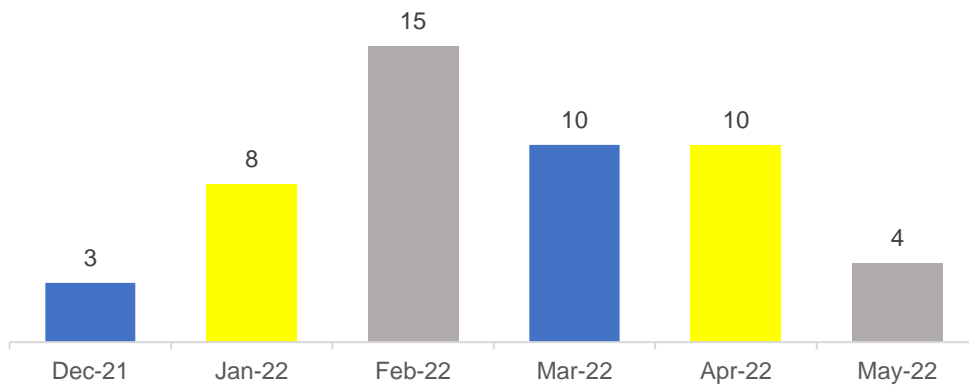
4.2.2 Duration of stay

According to the COPD VW monitoring SOP (Appendix 2) patients were intended to stay on the VW for up to 14 days, at which point they should be discharged including to other forms of ongoing care.

Only four of the 50 admissions (8%) exceeded this 14-day threshold and represent cases for which it was clinically appropriate to do so.

Figure 13: Number of patients by duration of virtual ward stay
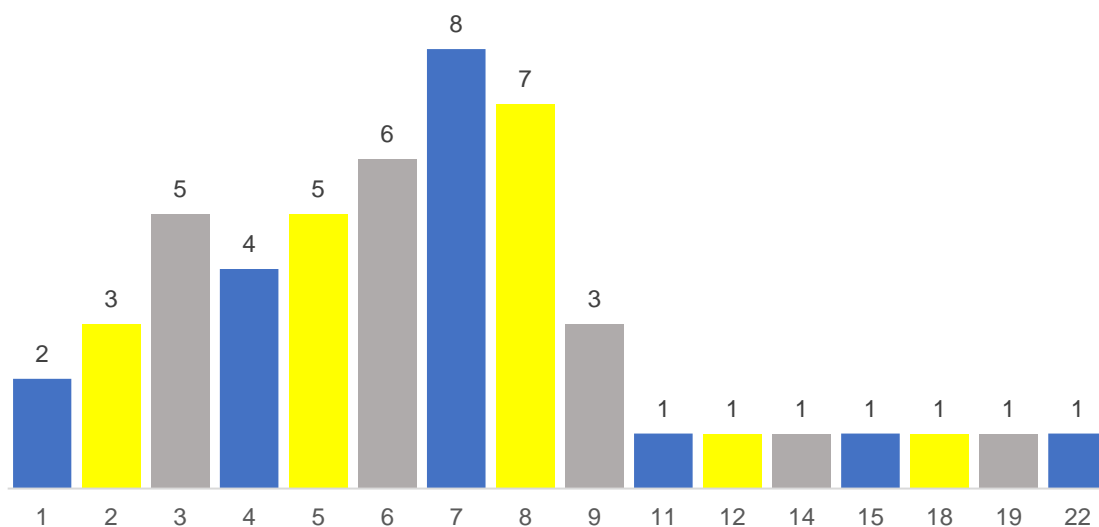
The median length of stay (LoS) for patients in the VW was seven days, which was also the most commonly occurring spell length.

Of the 50 VW admissions, the majority of stays were 10 days or fewer (86%, n=43) while 14% lasted for more than 10 days (n=7). The maximum LoS was 22 days for a single patient.

Figure 14: count of virtual ward stays by 5-day length-of-stay bracket
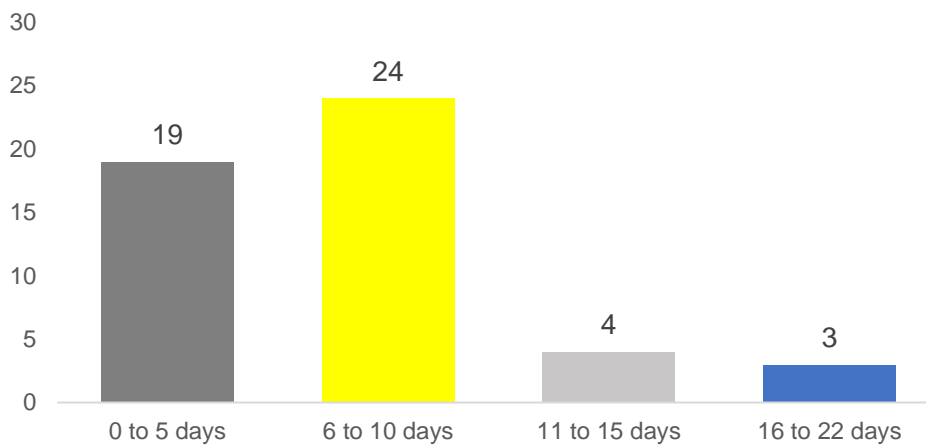

The duration of a patient's stay in the VW varied in line with their DECAF score.

On average, patients with a DECAF score of 1 were on the VW for approximately 8.5 days, compared to 7.4 days for those with a DECAF score of 2 and 6 days for those with a DECAF score of 3.

Those with a DECAF score of 0 displayed the shortest overall average length of stay on the VW at 5.3 days per patient.

Figure 15: Average virtual ward length-of-stay by DECAF score
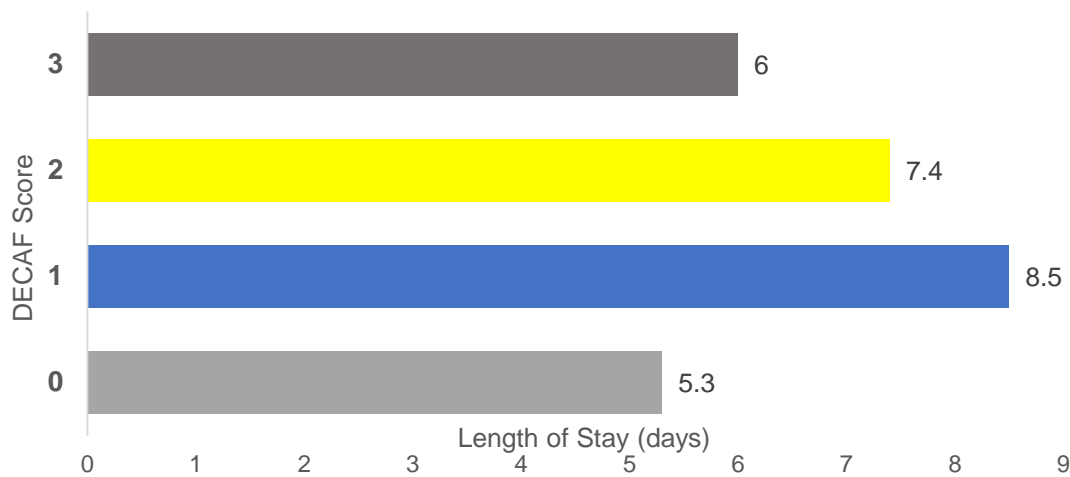
4.2.3 Clinical support to virtual ward patients

Patients onboarded to the VW were contacted by different healthcare professionals in a coordinated and regular basis, in addition to their continuous monitoring through the technology patients received when onboarded.

The four main forms of communication with patients in the VW were telephone calls for Masimo readings, calls for a clinical review, virtual consultations and face-to-face visits by a healthcare professional.

Patients received telephone calls to record data from the hub nurses four times per day, or an alternative number of times agreed with the patient. They also received daily clinical telephone calls from the WHTH consultant respiratory physician(s) on duty.

This approach was intended to support patients who may lack confidence in using the technology and to ensure, through early implementation, no critical readings were missed. CLCH staff also provided community-based support through virtual calls and face-to-face visits if required.

As anticipated from the SOP, telephone calls were more common than face-to-face visits or virtual calls.

Figure 16: Total number of contacts for all virtual ward patients
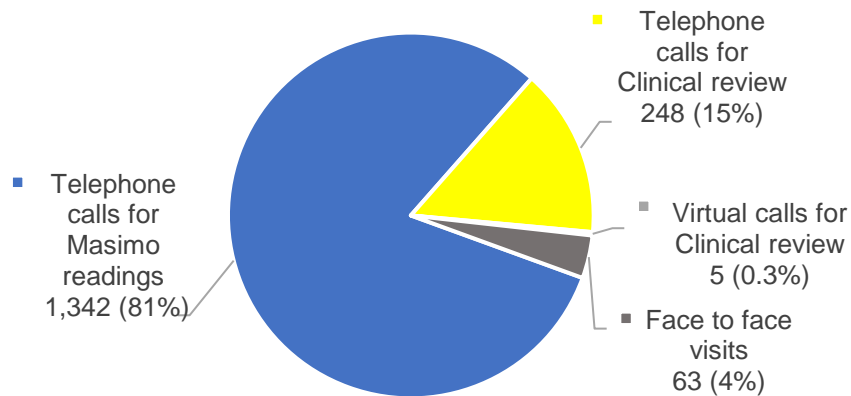
Considering all contacts with VW patients:

- 80.9% were telephone calls for Masimo readings
- 15% were telephone calls for a clinical review
- 0.3% were virtual calls with a clinician
- 3.8% were face to face visits

A total of 1,342 Masimo reading telephone calls were recorded during the evaluation period, alongside 248 clinical review calls, five virtual calls and 63 face-to-face visits.

4.2.4 Average calls and visits while in the Virtual Ward

Patients were contacted daily by telephone for Masimo readings and clinical reviews and less often for virtual calls or face to face visits. On average they had more than one face-to-face visit, 27 Masimo reading calls and five clinical review calls during their VW stay.

As expected, the longer a VW patient stay, the more calls received. The patient with the longest VW stay of 22 days received 89 calls.

Table 3: Average calls and visits per virtual ward patient by length-of-stay

Length of Stay on the VW	Average Number of virtual calls for a clinical review	Average Number of face-to-face visits	Average Number of telephone calls for a Masimo reading	Average Number of telephone calls for a clinical review
1	0.0	0.0	2.0	1.5
2	0.0	0.3	3.3	0.7
3	0.0	1.4	11.8	2.8
4	0.0	1.8	15.5	3.3
5	0.6	1.2	20.2	3.8
6	0.0	1.2	22.8	4.2
7	0.1	1.5	27.1	4.9
8	0.0	1.4	32.1	5.4
9	0.0	0.3	35.3	5.7
11	0.0	4.0	42.0	9.0
12	1.0	2.0	46.0	13.0
14	0.0	1.0	55.0	9.0
15	0.0	1.0	51.0	4.0
18	0.0	1.0	68.0	13.0
19	0.0	0.0	70.0	17.0
22	0.0	3.0	89.0	13.0
VW Average	**0.01**	**1.3**	**26.8**	**5.0**

In addition to the total number of calls and visits, we calculated the number of interactions per patient per day on the VW, to account for any variation that may naturally arise as a result of patients having a longer VW LoS.

Throughout the duration of their stay, patients on average received 3.6 telephone calls per day to record Masimo readings. This is in line with the figures anticipated based on the SOP that suggests a standard of four calls per day, unless otherwise agreed with a patient who may request fewer calls.

In addition to this, patients received an average of 0.67 telephone calls for a clinical review and 0.17 face to face visits per day. A very small number of virtual calls were made for clinical reviews (0.01 per day on the VW), although these were more unusual.

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Table 4: Number of calls and visits, per day spent on the virtual ward

	Telephone calls for Masimo readings	Telephone calls for a clinical review	Face to face visits	Virtual calls for a clinical review
Average number of interactions	3.64	0.67	0.17	0.01
Proportion of total interactions	80.9%	14.9%	3.8%	0.3%

4.2.5 Discharge destinations from the virtual ward

VW patients were discharged to one of four destinations. Of the 50 admissions:

- 5 were discharged for re-discussion at the MDT meeting (10%)
- 6 were re-admitted to a physical bed (12%)
- 6 were discharged with no further actions from WHTH (12%),
- 33 were discharged for ongoing care by CLCH (66%)

Table 5: Number of virtual ward patients referred to each discharge destination

Discharged with no further WHTH actions	For on-going care by CLCH	For Re-discussion at MDT	Re-admitted to physical bed
6	33	5	6

Ongoing care by CLCH was the most common destination for VW patients in each DECAF score group. Those with a DECAF score of 2 were least likely to be re-admitted to a physical bed and most likely to require ongoing care by CLCH.

Figure 17: Discharge destination from the virtual ward by DECAF score

Legend: ■ Discharged with no further WHHT actions   ■ For on-going care by CLCH   ■ For re-discussion at MDT   ■ Re-admitted to physical bed
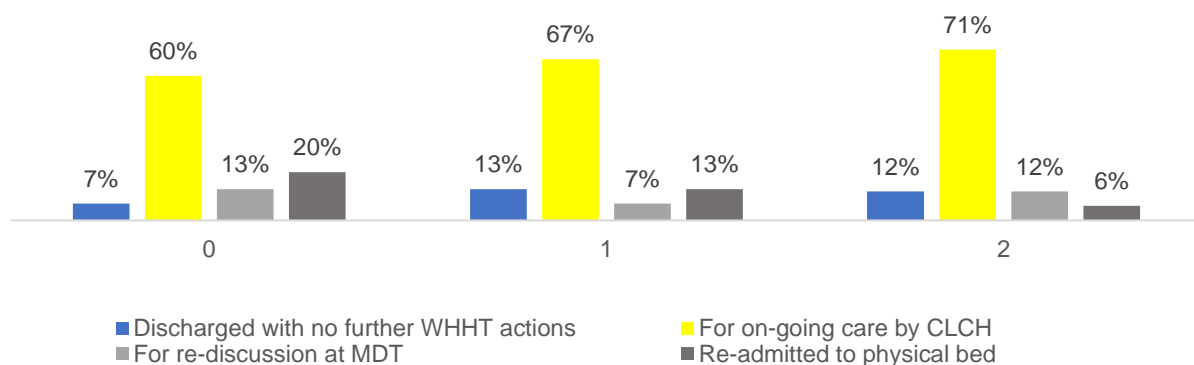
4.3 Potential of the virtual ward to reduce length-of-stay

4.3.1 Overview

It has been hypothesised that VW support can lead to a reduction in the initial acute length-of-stay (LoS) for patients due to a variety of factors. These include a possible greater degree of clinical confidence in safe discharge due to added support and the 'safety net' the VW provides for a patient returning home and stepped down.

For each initial admission, the acute length of stay has been calculated as the difference in days between the patient's admission to an inpatient bed and the point at which the patient was discharged back into a community setting.

For all cases within the dataset, this matches the date at which the patient was then onboarded to the VW. It is theoretically possible a patient may be onboarded to the VW whilst their acute discharge continues to be processed, leading to a slight overlap in dates while the patient remains in an acute setting.

This methodology was applied across each of the three evaluation cohorts to compare the average LoS for VW patients with that of those supported by the COPD MDT and pre-Covid at initial (index) admission.

4.3.1 Results

Utilising this methodology, the average LoS in a hospital bed for index admissions in the VW cohort was shorter compared to both the MDT-only and very slightly shorter compared to the historic control cohorts. VW patients had an average inpatient LoS of 5 days, in contrast to the MDT-only average of 8.1 days and the historic control average of 5.2 days.

**Figure 18: Average acute inpatient length-of-stay by cohort at index admission**
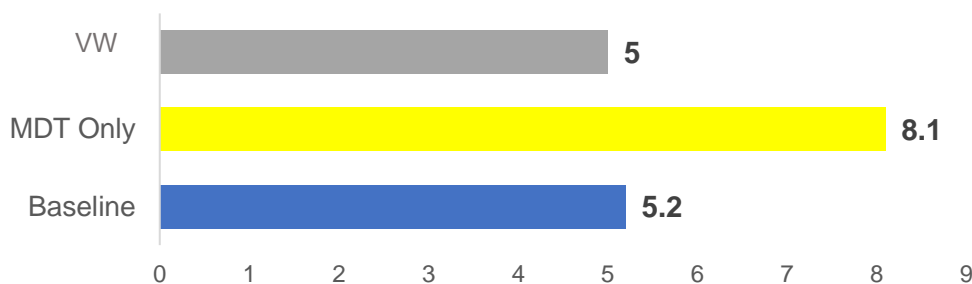
This LoS reduction was consistent when considering various reasons for admission, based on the patient's chief complaint or primary diagnosis.

Across each of the three categories, the overall LoS reported was lower in the VW cohort than for the MDT-only cohort, at 3.2 versus 4.1 days for COPD causes, 8.0 versus 10.6 days for other respiratory diseases, and 2.5 versus 7.3 days for all other categories.

We excluded the historic control cohort from this analysis as it includes COPD-cause admissions only. It is not possible to determine whether the differences in LOS between cohorts is statistically significant due to the limited sample size, particularly for the VW group.

Figure 19: Average length-of-stay by diagnosis on admission by two cohorts
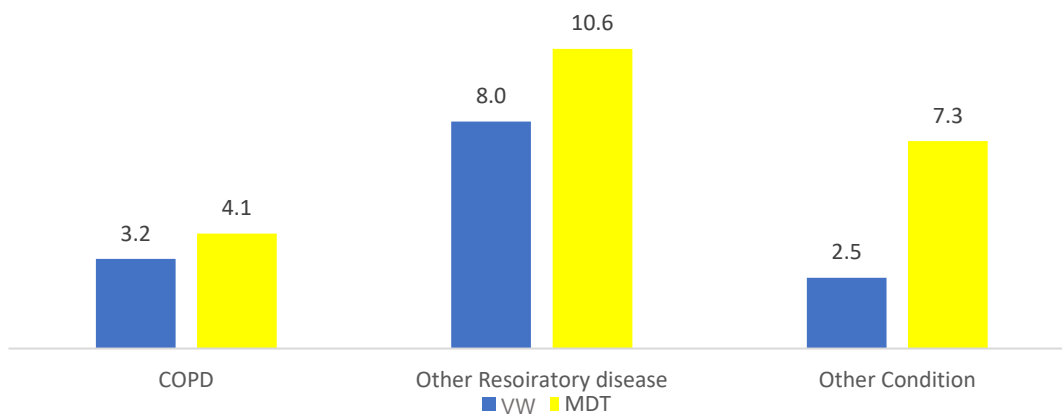
4.4   Potential of the virtual ward to reduce secondary care readmissions

We evaluated readmission rates in line with established methodology used by the National Asthma and COPD Audit Programme (NACAP).[14] This calculates the proportion of all patients experiencing at least one non-elective emergency readmission within 30, 60 or 90 days from their index admission, defined as first recorded admission for the same patient within the observed period.

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[14] NACAP Outcomes of patients included in the 2017/18 COPD clinical audit, 2020, NACAP Outlier Measures Selection and Finalisation Policy.

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This is distinct from other methods of calculating readmission rates that focus on the count of admission events whereby the numerator, the number of emergency readmissions, is simply divided by denominator, the total number of admissions over a given time period.

The evaluation steering group decided aligning with the NACAP approach was the most clinically-appropriate method, as it accounts for any skew in the data that may otherwise arise from a single individual being readmitted multiple times. This provides the greatest clinical utility in understanding how patients who would otherwise be in an acute bed are managed in a community setting.

It is worth noting we have analysed both all-cause and COPD-causes for this evaluation, while NACAP focus specifically on all-cause readmissions.

4.4.1 Indexing

We established which admission would be considered the index admission for each of the three time periods of interest. This enabled a calculation of the time between this event and any subsequent readmission and classification by 30, 60 and 90-day categories, recognising the overlap between each.

Indexing admissions in this way ensures that the analysis accounts for a scenario where a patient may have had an initial admission before the observed time period, causing their first admission within that window (otherwise their index admission) to be flagged incorrectly as a re-admission that would lead to an over-representation of the readmission incidence.

VW patient readmissions have only been assessed if they were after the point at which they were onboarded to the VW, to determine the differential impact. Adopting this methodology ensures a like-for-like comparison between cohorts.

Readmission categories of 30, 60 and 90 days are then individually totalled and segregated based on whether they were for all causes or COPD-specific causes.

4.2.2 Results

Records show 50 separate instances of a patient being onboarded to the VW and 119 acute inpatient admissions (across both index admissions and readmissions) recorded between December 2021 and June 2022, for a total of 46 individual patients. Considering all causes:

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- 46% had no readmission within 90 days (n=21)
- 43% were readmitted at least once within 30 days (n=20)
- 4% were readmitted between 31 and 60 days (n=2)
- 7% were readmitted between 61-90 days (n=3).

The most common diagnosis on readmission for both the VW and MDT-only cohorts was COPD acute exacerbation.

Figure 20: Hospital bed readmissions following virtual ward discharge, all causes
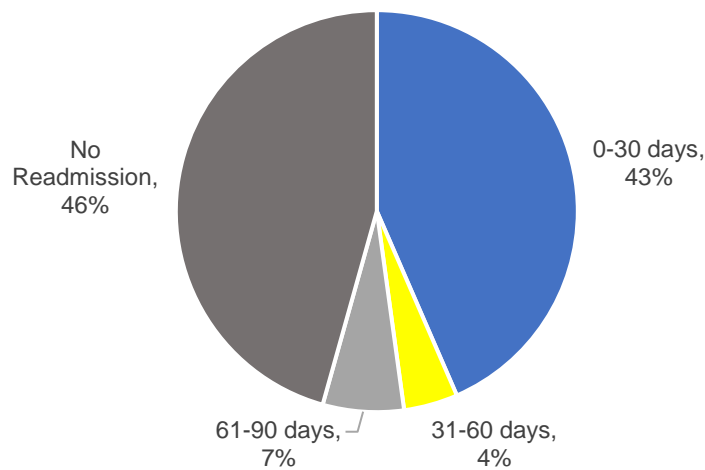
The majority of VW patients were not readmitted for a COPD-specific cause within 90 days:

- 70% were not readmitted within 90 days (n=32)
- 20% were readmitted at least once within 30 days (n=9)
- 4% were readmitted at least once within 31 to 60 days (n=2)
- 7% were readmitted at least once within 61 to 90 days (n=3)

Figure 21: Hospital bed readmissions following virtual ward discharge, COPD-specific
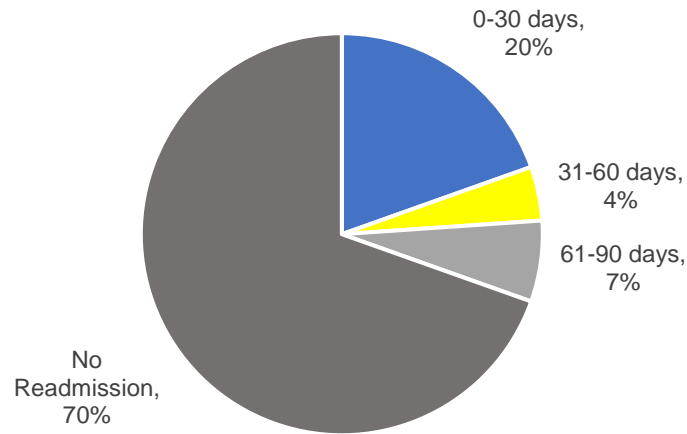

VW patients experienced a higher degree of readmissions compared to the MDT-only cohort when analysed in line with the NACAP methodology.

Just over half of VW patients (54%) were readmitted at least once within 90 days of their index admission (22%), compared to just under half (48%) of MDT-only patients (n=95).

The historic control cohort is excluded from all-cause analysis as it comprises COPD-cause admissions only.

Figure 22: comparison of 90-day hospital bed readmissions following discharge for MDT-only and Virtual Ward cohorts
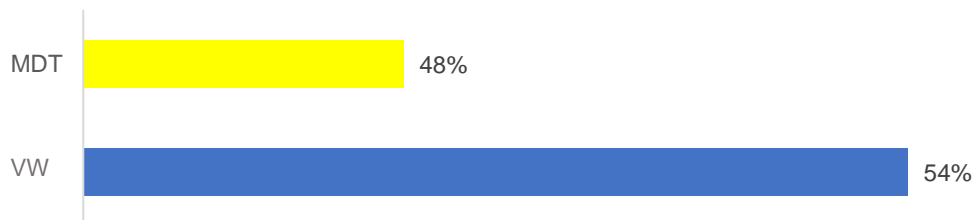
Please note that the baseline cohort has been excluded from any analysis of all-cause readmissions as the inclusion criteria for the baseline data extract related to COPD cause

Considering readmissions within 90 days for COPD-specific causes:

30% of VW patients were readmitted at least once (n=14),
23% of the MDT-only cohort were readmitted at least once (n=57)
13% of the historic control cohort were readmitted at least once (n=47)

Figure 23: Comparison of 90-day COPD-specific hospital bed readmissions following discharge
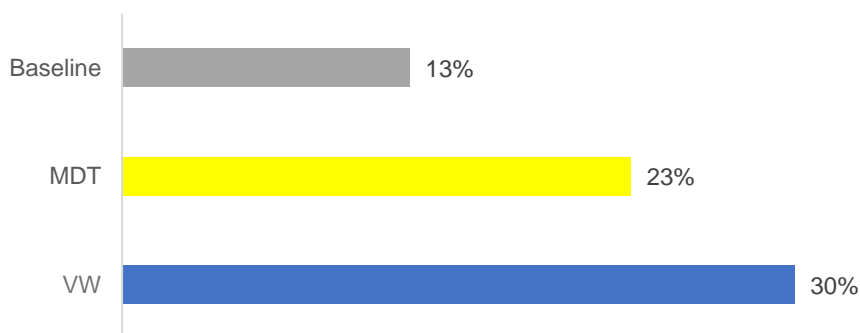

Figure 24: Comparison of all-cause readmissions to a hospital bed after discharge for MDT-only and VW cohorts
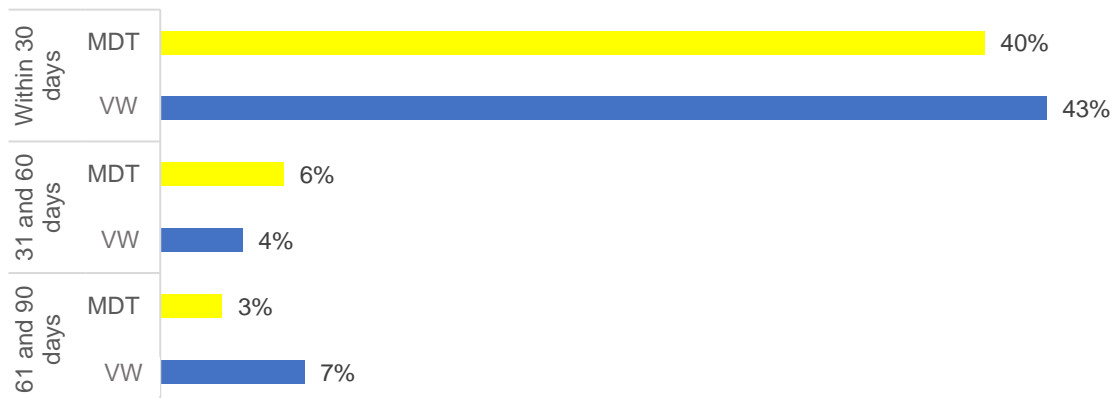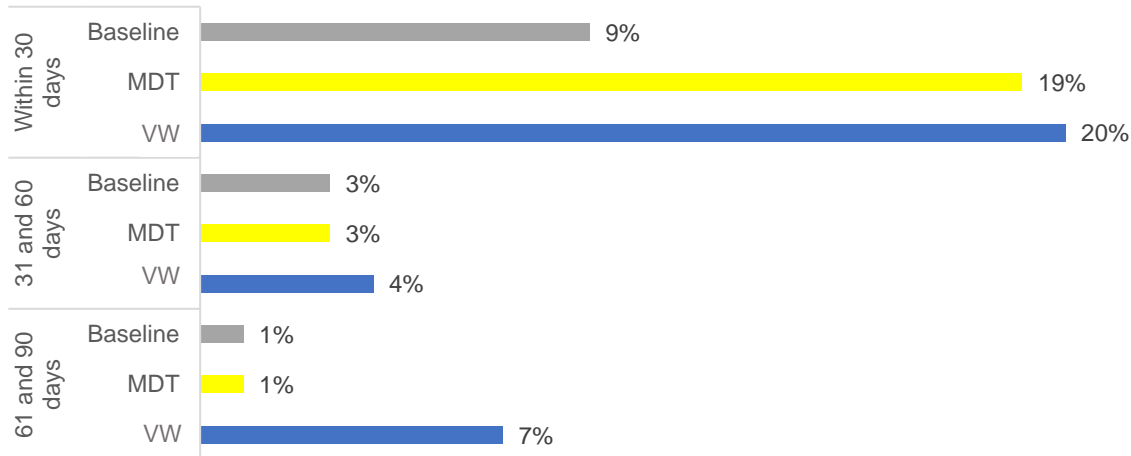
Figure 25: Comparison of COPD-specific readmissions to a hospital bed after discharge for all cohorts

Within 30 days	Baseline	9%
	MDT	19%
	VW	20%
31 and 60 days	Baseline	3%
	MDT	3%
	VW	4%
61 and 90 days	Baseline	1%
	MDT	1%
	VW	7%

### 4.2.3 Considering clinical escalation

The observed higher rate of readmissions in the VW cohort is primarily driven by a proportion of patients who were readmitted within less than 1 day of being discharged from the VW (15%, n=6), where the reason for discharge is readmission to a physical acute inpatient bed.

This suggests these events arose due to appropriate clinical escalation by hub staff in line with the recognised SOP, informed by the early identification of a patients who is deteriorating and proactively stepped-up to be managed in an acute setting.

Readmission rates between the VW and MDT-only cohort are broadly comparable across both all-cause and COPD-specific admissions when such readmission events are excluded from the analysis.

- 46% of VW patients were readmitted for all causes compared to 48% of the MDT-only cohort.
- 22% of VW patients were readmitted for a COPD-specific cause compared to 23% of the MDT-only cohort.

Figure 26: Comparison of all-cause and COPD-specific readmissions for MDT and virtual ward cohorts, with readmissions due to appropriate escalation excluded
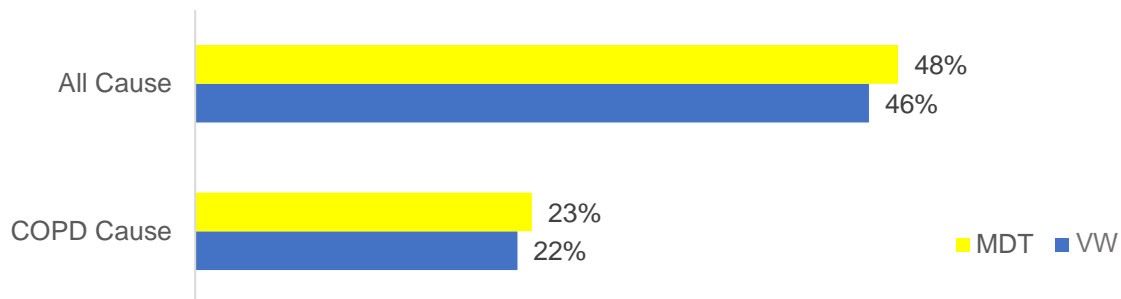
The average number of readmissions in fewer than 90 days from discharge per patient was moderately higher for all causes in the MDT-only cohort (0.87) than the VW cohort (0.78) suggesting a higher rate of repeat readmission events.

This trend is reversed for COPD-specific causes, at 0.31 on average per patient in the MDT-only cohort compared to 0.35 on average per patient in the VW cohort.

Table 6: Mean readmissions within fewer than 90 days of index admission per patient for MDT-only and virtual ward cohorts

	All Causes		COPD-Specific Causes	
	MDT	**Virtual Ward**	**MDT**	**Virtual Ward**
Average number of readmissions <90 days per patient	0.87	0.78	0.31	0.35

4.5 Experiences and views of virtual ward patients

4.5.1 Key insights

Table 7 provides a summary of patients' responses to the Likert scale questions related to aspects of their experience, satisfaction and confidence while on the VW.

Several key insights arose from these questions and free text answers.

- All patients mentioned that being able to be in their own home while being monitored and able to contact staff was what they liked most about the VW.

- Some commented that the VW allowed them to feel safe, that they felt people were caring, and being more relaxed was beneficial to their comfort and breathing.

4.5.2 Benefits

Comments on benefits included:

- *"being able to be at home but with the safety net of virtual ward"*

- *"being able to be relaxed at home and have family visit"*

- *"being at home, being able to understand my readings"*

- *"knowing I was being monitored helped me relax, this was important for my breathing issues"*

Generally, patients reported feeling adequately prepared and confident about using the equipment fully or to some extent, while only one patient reported feeling unprepared and unconfident that help was available when needed.

All respondents reported that they had followed the treatment and monitoring plan, apart from one patient who mentioned one occasion when they overslept, and one patient who mentioned not always managing to send blood pressure results when away from home.

4.5.3 Patient satisfaction

All respondents reported feeling satisfied with the way their concerns were answered, they were given adequate information about risks, the equipment was explained, and they had been involved in decisions about their treatment.

Respondents suggested that various staff roles had answered their questions, including the monitoring team (n=5), specialist nurse (n=3), on-call nurse (n=2) and respiratory consultant (n=1).

Three respondents reported that sometimes they felt they could not find someone to talk to about concerns while on the VW (definitely n=1, 8% and to some extent n=2, 15%).

One respondent reported feeling family or carers did not have enough opportunity to talk to a member of healthcare staff.

4.5.4 Challenges and improvements

Most commented they had no challenges and had found the VW easy (n=6, 46%).

Others reported challenges relating to using the equipment or aspects of communication, which are summarised with example comments in Table 8.

When asked for suggestions for how the VW may be improved, responses suggest overall patients felt their experience was positive.

Eight patients said they had no suggestions for change, with comments including:

- "*staff were absolutely superb, friendly, knowledgeable and always happy to help*"

Others suggested improvements, including the following verbatim comments:

- *"extending out of hours advice line"*

- *"closer liaison and more communication with various departments including with GP and social care/social worker"*

- *"providing a printed leaflet to give to patients explaining what virtual ward is and how it operates so they don't feel they are just being discharged and forgotten."*

- *"screen the patients more"*

Table 7: Summary of patient responses to Likert questions

Did you feel adequately prepared during admission for your time on the Virtual Ward? (n=12)		
Yes, fully prepared	58%	7
Yes, to some extent	33%	4
No, I felt unprepared	8%	1
How confident did you feel about using the equipment? (n=12)		
Yes, completely confident	58%	7
Yes, to some extent	42%	5
No, not confident	0%	0
Do you feel you were involved in decisions about your treatment and care on the Virtual Ward? (n=12)		
Yes, definitely	67%	8
Yes, to some extent	33%	4
No	0%	0
Did you feel confident that help was available when needed? (n=13)		
Yes, definitely	69%	9
Yes, to some extent	23%	3
No	8%	1
Overall, did you feel that you were treated with dignity and respect while you were on the Virtual Ward? (n=13)		
Yes, definitely	100%	13
Yes, to some extent	0%	0
No	0%	0
Did a member of staff explain the purpose of the equipment supplied to you as part of the Virtual Ward? (n=12)		
Yes, completely	92%	11
Yes, to some extent	8%	1
No	0%	0
Do you feel you were given adequate information about risks and what to do if you had any concerns? (n=12)		
Yes, completely	75%	9
Yes, to some extent	25%	3
No	0%	0
If your family or carer, or someone close to you whilst on the Virtual Ward wanted to talk to a member of the healthcare staff, did they have enough opportunity to do that? (n=13)		
Yes, definitely	54%	7
Yes, to some extent	8%	1
No	8%	1
NA, no family or carer involved	30%	4

When you had questions to ask healthcare staff, were you satisfied with the way your concerns were answered? (n=13)		
Yes, completely	92%	12
Yes, to some extent	8%	1
No	0%	0
Did you ever feel that you could not find someone to talk to about concerns whilst on the Virtual Ward? (n=13)		
Yes, definitely	8%	1
Yes, to some extent	15%	2
No	77%	10

Table 8: challenges reported by patient experience survey respondents

Challenges	Example quotes
Using equipment	*"Only challenge was learning to use the equipment on my own"* *"Using my phone to access the information"*
Communication around access to advice	*"Lack of advice line out of hours… I had a problem with the equipment after helpline closed. Fortunately, the Community Respiratory Service advice line was still open and able to help"* *"The monitor lady wasn't where she said she would be and no one on reception knew how to contact her and the voicemail kept going to voicemail"* *"I was at home alone and the breathing was worrying me. I understand the need to discharge people, but I had never heard of the Virtual Ward. I think a printed leaflet explaining everything should be given to patients when they are admitted to it"*
Communication between different actors	*"Having to keep different departments up to date on my treatment"* *"Arranging for supply of medication if changed since discharge from hospital."* *"My benefits stopped as they had never heard of the Virtual Ward. Not advised to stop Aspirin so had to postpone muscle biopsy"*

4.6 Staff experience and views

4.6.1 Overview

This section explores the experiences and views of staff relating to implementation of the VW and explore aspects such as staff confidence, staff and patient satisfaction, barriers, and facilitators to implementation.

We have provided a synthesis of staff experiences and feedback grouped by themes linked to the COPD VW model and pathway. No weightings are applied due to the small sample size (n=18).

Aspects within each theme mentioned by more staff or given more emphasis in the data are identified first. We have described aspects where there was general consensus or differences in perspectives across staff groups or roles.

4.6.1.1 Organisational readiness and implementation

Staff reported feeling that there was organisational readiness for the COPD VW launch and implementation.

Staff from both WHTH and CLCH agreed there had been robust planning. This included recognition of the importance of taking time to develop and agree the SOP, data sharing processes, governance and accountability.

Feedback included the following comment:

"In terms of responsibility for the care of the patient that still sits with the consultants. So its consultant led, but a system delivery.

"But it was also about sharing that framework so that people understand it, we've had to do a lot of assurance to various different bodies in our system as to how we are managing the safety and how we're assuring ourselves it is a safe service." (Participant 4)

Some staff mentioned delays in the launch of the COPD VW relating to issues with staff recruitment and aligning with timings for their EPR.

The personalities and staff involved in driving the COPD VW, including the clinicians and the executive support were highlighted as key factors influencing the successful launch of the COPD VW.

4.6.1.2 Virtual ward pathway and delivery process

Staff all described the pathway and their roles in its delivery in line with the SOP. Most mentioned there had been no change or adaptations to the planned model for delivery, although some small adjustments were described as occurring in the first few weeks of implementation when issues arose and were solved, or as the teams learnt from the experience and continuously improved the service.

Staff working in WHTH and CLCH shared a consensus in how they acknowledged the importance placed on monitoring and evaluating implementation to inform practice and adapt the model.

Feedback included the following comment:

"In terms of COPD, yes, it is being reviewed. It has been like that right from the beginning. The people have been very open-minded about adapting the approach, whether that be overall or whether it just be for individual patients." (Participant 4)

4.6.1.3 Learning from the Covid Virtual Ward model

While all staff described how the COPD VW model built on learning from the Covid VW, which the team had been delivering since April 2020, there was some variation in staff reflections on how the model may need further adaptation for the COPD VW.

This included the required frequency of patient visits and the balance of different role types supporting the VW.

Feedback included the following comments:

"I think the model needs some tweaking. Also, the concept was taken from the COVID Virtual Ward where every other day we would go and see the patient. But now we only see the patient first day and then discharge them, and then they've got lots of telephone calls from the Virtual Ward, depending on their stats that are coming up and then they have a telephone call from the consultant every day, which I think what [name removed] was saying is, do we need that heavy hand from the consultant or can it be the respiratory nurses in the community then visit the patient, do the assessment and then if we have any complications we can always phone the consultant or the hub.

".. I'm not saying this is not the right model. I think it can be improved. I think it can be better." (Participant 3)

"There's a lot of learning from the COVID Virtual Ward. The COVID Virtual Ward went live at pace. There was a lot of learning we were able to use from that. So, I think we were very ready." (Participant 4)

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"I think it's been delivered in accordance to the plan. We just don't necessarily think the plan's the right one […] we go in on day one just to do the visual, if you like, and make sure everything's safe and patient understands.

"…then the consultant takes it on from there, which is a very heavy model really for someone who probably just needs to be reviewed to see how they are. […] anyway, that was what was put in place, and I think the reflection would be is that still necessary or not?" (Participant 9)

4.6.1.4 Referral process

Staff described the referral process as very quick. They explained how the community team receive the discharge summary via email when a patient is onboarded that is then attached to their record. This means the information is on the system by the time a nurse is allocated.

Staff described some issues in the first month of implementation around making sure patient information like the discharge summary was available to the community team before the 'Day One' home visit.

This was acknowledged as being mainly resolved but one staff member did raise this as potentially an ongoing issue, in relation to referrals from A&E that began in phase 2 of implementation. They said:

"It would be nice to have the discharge summary even if they go to A&E. I don't know how it works but having the discharge summary is important and it's something that I haven't had for two of the patients I have seen." (Participant 2)

4.6.1.5 Appropriateness of patients admitted to the virtual ward

Overall, staff felt the right patients were being admitted to the VW and that the criteria, consent process and safety nets put in place for hospital readmittance meant processes were working appropriately.

Staff from WHTH and CLCH felt there were some challenges in the first few weeks relating to the appropriateness of patients being admitted to the COPD VW. Examples they provided included patients:

- who did not have COPD
- without an appropriate care package in place to enable them to manage their wider care needs
- with severe or complex health needs that required hospital care
- stable enough to not require the level of monitoring and daily calls provided in the VW

Feedback included the following comments:

"I have seen two patients, those who have been admitted from A&E, they are stable enough to go home. They were stable when I saw them …" (Participant 2)

"There's a slight disconnect, maybe between the Virtual Ward aspirations and what would be a safe ward discharge, because I think they're two parallel things in a way.

"You've got the Virtual Ward trying to look after respiratory patients at home with contact, but the patient safety, can they cope, have they got a good care package, that kind of thing. I mean that is a comprehensive discharge assessment that still needs to be done.

"It's not just they are appropriate for the Virtual Ward ... [specific example not included in quote] *… that was a very bad discharge that needed to be readmitted immediately and should never have happened, and we can't lose sight of that. If we then focus on one thing, you've still got to manage the patient as a whole."* (Participant 9)

4.6.1.6 Expectations of virtual ward patients

Staff explained that patients, depending on their treatment plan, are expected to wear one or a number of devices 24-hours-a-day, and to download the Masimo app and ensure it is connected to Wi-Fi and Bluetooth, so observations are directly transmitted to the platform.

The oxygen saturation probe needs to be changed every two or three days. Some patients are also required to monitor their own blood pressure. Patients agree with the hub team how they are going to be contacted and how often.

This is a variation from the four calls a day specified in the SOP as there was early recognition that not all patients want to be called this frequently, and so to align with individual patient preference.

If patients have any problems, they have the telephone number of the hub and are expected to call the hub nurses for advice.

At the end of their care, there is an agreement that patients return the equipment as and when they can and if they can't, the hospital provides someone to collect it, or arranges for its collection – could be a third party/voluntary sector.

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4.6.1.7   Technical support

Staff suggested some patients seemed worried and anxious about the device, especially if it lost connection, about having to do observations regularly, and about being ready to take regular telephone calls.

Hub nurses explained that in some cases patients struggled to get into the app and were asked to write their observations on paper, then report them to the nurses over the phone during the daily routine calls.

Feedback included the following comment:

"I have seen very anxious people, like you know 'have to submit this every two or every three hours and I haven't been able to, I don't know if the consultant is going to be calling me or not'. I think more education around this equipment that they are given in the hospital

"… also, it's difficult to know what time they are going to be called but that would be probably nice for them to know." (Participant 2)

Several staff mentioned that some of the initial technical issues experienced in the first few weeks had been resolved, including issues with batteries that meant staff needed to do additional home visits to change them.

Issues patients experienced when downloading the app on their own device were resolved by providing patients with a Masimo pre-loaded tablet.

4.6.1.8   Support and confidence

In general, staff agreed that patients who did struggle initially were able to manage the requirements with the right support. In some cases, family members were able to provide technical support.

Staff mentioned several activities as critical to building patient confidence, including developing relationships with the hub team, reassurance there is someone at the end of the phone, and the knowledge they can ask for a review or escalate concerns.

Staff felt the feedback they had from patients was positive and that patients felt secure and liked having the level of care the VW provides. Feedback from family and carers to staff was also mentioned as being positive, that the VW enabled them to feel involved and had given them a better understanding of the condition and care.

Some staff expressed concerns over potential problems when the level of care is removed on discharge from the VW and whether the current COPD VW model encourages self-monitoring and self-care in the most appropriate way for all patients.

Feedback included the following comment:

"The implication that in order to be 'safe' at home someone has to be monitored is not helpful for those with health anxiety who can become overly concerned with the data.

"The phone calls do not reassure as they rely on good patient reports and affect the patient psychologically as they look for clues as to how unwell they are to report back." (Participant 1)

In line with some of the patient feedback, staff felt that further guidance on what to expect at onboarding, during their time in the VW, and at the point of discharge would help patients to feel more prepared for their experience.

4.6.2 Virtual ward staffing

4.6.2.1 Overview

Several staff who shared their experiences and feedback highlighted staff and teamwork as key enablers critical to the success of the COPD VW. Comments included:

"So much of it has been about the teams, the clinical leadership has been outstanding, and we've been incredibly lucky with the staff that we've recruited into the team, they're really dedicated and enthusiastic and the willingness of everybody to make it work.

"And I suppose as SRO, one of my jobs was really to get that meeting of hearts and minds across the system from the different partners.

"Change doesn't always appeal to some, but certainly the clinicians that are involved, our GP rep for example, absolutely fantastic, fully supportive of it. And so, I would say they were the key enablers really." (Participant 4)

"I think that without that willing staff group that would have been impossible. But I think you know, COVID and something about that period of crisis… unlocked people's ability to innovate and to deliver, and systems became more amenable to rapid evaluation and rapid delivery of new ideas, new models of care. You know, I don't think we'd be talking here if Covid hadn't happened." (Participant 5)

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4.6.2.2   Key roles

The hub nurse is a new role specific to the VW, undertaken by junior sisters employed by WHTH. Their responsibilities include screening patients for referral, onboarding patients to the VW, monitoring patients' data on the Masimo platform and making daily calls to patients.

They described MDT meetings, which happen three times per week, as the place where the patient database is updated, and discharge summaries created.

Feedback from hub nurses included:

"Our main job is to bring the hospital closer to the home." (Participant 7)

"Patients they feel more competent because they are using the devices, they are calling us up and they're telling us 'OK, this is not right. What do you think? What should we do? Should I call an ambulance? So, there is someone at the end of the phone responding to all those questions, we are in a way, acting like a GP, we are in a way, acting like the ambulance team. So, it's a combination of everything I would say." (Participant 8)

Staff described building relationships with patients, understanding their needs and adapting the approach, and providing reassurance and emotional support as important aspects of the hub nurse role.

They acknowledge the hub nurse as an evolving role, where time is required to understand patient needs and build good working relationships across the whole staff team.

4.6.2.3   Specialist support

Hub nurses highlighted the important role of the specialist respiratory nurse in providing support and advice, also of the consultant and the liaison GP in facilitating communication and transitions between the hospital and general practice.

They described the community team of respiratory nurses and physiotherapists as a key resource to call if they needed to request additional home visits or escalate a concern. The community team make home visits on 'Day 1' and pick up extra visits if needed. One team member explained their role in the VW pathway:

"On the model that we are using at the moment … we only see them once. Unless we are concerned about something that we can highlight with the consultant or with the hub, then that will raise an issue. But the model is, we see them on the first day after discharge and then discharge them back to virtual ward and everything else is done through the virtual ward.

"Let's say, we discharge them back to the VW and along the way the consultant feels that they need to be seen again. They need someone to see them face to face. They will send in a referral and then we can go and see them. But we will consider that as a separate episode. But some of them are already known to the service, so after VW they might contact us for a different episode." (Participant 3)

4.6.2.4   Influence and opportunity

The community team highlighted they were running an advice line prior to the COPD VW and the VW's introduction has influenced how they work to support patients.

Some of the challenges staff described are explored in more detail in the subsequent sections of this report. It is noteworthy that some staff felt there was a missed opportunity to build on the experiences of previous models of care in the community.

Feedback included the following comment:

"I just think that there was an opportunity at the beginning of starting this to actually benchmark the model with other services that do the same thing, as [name removed] said, hospital at home for COPD has been done for many, many years now.

"It may be the first time in Watford, but it's not the first time that it's been done and certainly people on this team have actually had experience in setting it up and doing it before." (Participant 9)

4.6.2.5   Staff training

Staff were generally satisfied with the training they received on the information systems and Masimo technology.

The CLCH team had not yet received training on the Masimo platform at the time of our evaluation. They felt some training would enable them to support patients more and would be especially important once implementation moves to phase 3, when they will refer patients from the community to the VW.

Feedback included the following comment:

"I think everyone who is involved in patient with Virtual Ward, they have to have some training just so that they can troubleshoot when they go into the patient's house just to familiarise themselves with the equipment that is being used." (Participant 13)

Some staff reflected that learning was critical in implementing a new model of care and additional training on the wider aspects of the pathway and care would be beneficial.

Along with ongoing training on disease management, staff mentioned training and guidance would be beneficial on:

- the pathway for readmission to the VW
- who to contact with concerns about a patient
- suitability of the VW for different patients

Feedback included the following comments:

"*To suddenly change the process for patients, the staff, it's too many changes to expect it all to work straight away. You know, we'll have to educate the secondary care staff as to who are good patients for this type of hospital and who really are not suitable for this type of hospital.*" (Participant 1)

"*It's an ongoing learning, the more changes to VW the more we need to learn. However, VW staff who are directly in contact with patients, they need updating and ongoing training with disease progress and its management*" (Participant 6)

4.6.3 Staff perceptions of the benefits of the COPD Virtual Ward

At least one or more member of staff mentioned one of five different benefits.

- **Reduced bed days and length-of-stay**

  All staff seemed to agree reducing bed days and LoS were key drivers for the COPD VW and that a patient's recovery was likely to be expedited at home.

- **Better patient wellbeing and health**

  The general consensus is patients typically do better and recover faster at home.

- **Safe model to treat patients at home**

  Generally, all staff described the model as safe, with processes and systems in place to mitigate risks. This is discussed in more detail below.

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- **Cheaper model of care**

  Staff perceptions varied, with some highlighting that the staffing in the current COPD VW model may be greater than would otherwise be the case at discharge. This has been explored further in our economic analysis.

- **Increased clinical interaction and care**

  Staff perceptions varied, with some reflecting on the roles of consultants and hub nurses and identifying more staff engagement and time with patients to build relationships and provide reassurance as a benefit.

Other staff reflected that the SOP meant a decrease in face-to-face interaction between community clinical staff and patients and flagged potential impacts on their ability to support prevention and self-management, which they see as critical for COPD patients.

4.6.3.1 Success factors

Staff highlighted five success factors as critical to the current implementation or further improvement of the model.

- **Ensuring direct access for patients to specialist support**

- **Supporting VW patients who are willing to share positive experiences with others**

- **Well-motivated staff and good teamwork**

  Senior staff described the ability and willingness staff had shown to be flexible and make things work on the ground as vital to implementing the VW.

- **Well-planned management**

  Staff described the importance of planning the management of the pathway and developing a robust SOP for the early implementation of the VW. They also acknowledged the need to consider additional resource for management of the VW as it expands.

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- **Multi-disciplinary Team (MDT)**

  This was described as the engine that drives the VW pathway, where all those involved in a patient's care have an opportunity to discuss the case and decide next steps.

4.6.3.2   Challenges of the COPD Virtual Ward model

Staff recognised the model strengthened during the initial implementation phases through continuous learning and improvement processes. WHTH and CLCH staff shared a general consensus about various challenges and the recognition many were resolved.

Three main challenges were mentioned.

- **Getting governance and clinical accountability right**

  This was described as robust and clearly defined within the SOP but took time to develop and establish consensus.

- **Attitudinal barriers**

  The wider aspects of changing patients and staff perception of healthcare, providing assurance that it is safe, and bringing staff and patients on board.

- **Access to patient information and information governance agreements**

  While agreements are in place and defined in the SOP, several staff highlighted issues with operating across the two systems, InfoFlex and SystmOne, to allow staff in WHTH and CLCH to access patient information.

Staff mentioned some cases where accessing patient discharge information in a timely manner was an issue, which may relate to processes for information sharing and or the timings of MDT meetings, which occur three times a week.

4.6.4 Implementation considerations

Staff referenced several important considerations for implementation. Some, such as referrals and complex discharges, are interrelated.

They highlighted the theme of risk, along with staff allocation and resource, as key to understanding the impacts and implementation of the COPD VW.

As such both themes are discussed below in more detail than the other considerations.

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4.6.4.1 Patient safety and managing risks

Patient safety and managing risks were recognised as critical to ensuring patients and staff are onboard and recognised the model as optimal for their treatment journey.

Staff acknowledged the greatest risk is a deteriorating patient and that a patient at home may not access help as fast as one in a hospital bed, and that without face-to-face contact there may be an increased risk of missing vital signs.

The monitoring and escalation pathways built-in to the SOP were felt to be good mitigation against these risks.

Staff said the 100-day review was good evidence that there had been no incidents, and this was a safe service.

They highlighted challenges around the process and time needed to readmit a patient to the hospital when they deteriorated or were too ill to be on the VW.

Feedback included the following quote:

"*When I went to see her although her observations were ok-ish, she was unable to breathe and she was also an asthmatic patient as well as COPD. So, she was really, really struggling. But when they went back to the hospital they said no, she can be managed at home.*

"*So, there was this kind of toing and froing from the consultant at the hospital. He was kind of refusing her to be readmitted but in the end she was so unwell she had to be readmitted … it was like, you know, how much of that can you actually see from being at home? So, it can be a bit risky as well.*" (Participant 17)

4.6.4.2 Staffing allocation and resource

The VW model is staff-intensive and requires new roles like hub nurses and new ways of working for managing and delivering care, while VW staffing and the impact of patient touch points on workloads influences perception of the model.

Workforce was highlighted as a key challenge, particularly as the implementation moves to phase 3 to include referrals from the community. Additional resource was funded as part of the delivery plan, but challenges with recruitment were described as having a major impact on staff workload and well-being.

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This is particularly notable in the community team where priority is required to be given at short notice to the home visit on day one over existing patients, and the team has needed to provide the service seven days a week.

This has increased both workload and geographical spread of staff caseloads meaning more time is spent travelling to patients and a feeling that they are less familiar with the local services and resources that they may need to draw on to better support the patient.

WHTH staff highlighted the need to consider how consultants are allocated to daily calls as part of a ward round as this impacts the timing of the calls and the types of work consultants do.

Impacts of this on the cost effectiveness of the model and the patient experience may be important considerations as the service expands.

Staff involved in the design of the VW model described it as a shift towards a partnership approach where the patient has greater control over understanding and managing their health.

Some staff involved with delivery felt a lack of sufficient or appropriate staffing for the VW changed the emphasis in community services from preventive care and good self-management to avoid admission, to a medical model of care whereby they are phoned several times a day.

This is seen as a shift away from a patient phoning a service when needed, which the rest of the service encourages to reinforce self-management.

Feedback included the comment:

"The difference with VW is the management of risk by equipment and phone calls and the assumption that one visit from us [CLCH] on the day after discharge will be enough. While early discharge allows much more real-world rehab and is often an excellent way of getting someone back to their previous levels, we only see them day 1 which doesn't allow for this." (Participant 1)

Some staff highlighted how COPD as a long-term condition required a different model of care to an acute incident for patients on the Covid-19 VW.

Importantly staff commented on the opportunity to work with patients on rehabilitation and self-management that can result from early discharge but recognised that this would require additional home visits.

Some staff shared perceptions that the VW model in its inception could have built further on good practices and services already supporting patients in the community, including components such as the Advice Line that were already operational.

4.6.4.3   Other considerations

Staff also raised the following considerations around implementation:

- **Staff recruitment**

  Both SWHHCP and CLCH staff explained recruitment challenges had impacted staff work and wellbeing, with a resolution seen as vital to enable expansion of the VW.

- **Technology**

  Several staff mentioned equipment complications during early implementation and suggested it was important patients and staff had confidence in troubleshooting. Patients' ability to cope with the technology was seen as variable, with some needing additional support or work-arounds.

- **Referrals**
  Staff identified a small number of instances of patients being inappropriately referred and admitted to the VW, involving high-risk patients with a severe condition or complex needs, and low-risk patients who were stable and not needing high levels of clinical interaction.

- **Complex discharges**
  Referred patients have a comprehensive discharge assessment including of their social care needs.

- **Access to information and support.**
  Also described as a system challenge, access was seen as an ongoing challenge to implementation. Additionally, staff and patients gave examples of difficulty in accessing West Herts Service Desk support.

4.6.5 Staff satisfaction and recommendations

Overall, staff feedback on their experiences of the VW model were positive. They were committed to the COPD VW and expressed a keenness to be involved in helping to inform improvements.

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Staff acknowledged the approach needs to be adapted depending on both patient need and the level of support they have at home.

The referral process and ensuring the right care on the ground were two aspects of the model staff identified for further consideration. Other suggestions and recommendations were also made.

- Improved guidance and information for patients, such as providing a leaflet to clearly set out expectations, details of what to do and who to contact in different situations such as health issues or technical issues.

- Improved information for staff on the pathway, processes and contact details for support.

- Patient and Public Involvement to facilitate understanding of what patients would like and to allow service improvement that starts with what works well.

- Adaptations to the technology provided to support face-to-face virtual communication more routinely rather than only in an emergency.

- Planning for the sustainability of the VW that uses the feedback from the evaluation to keep moving forward and refining the model.

- Reviewing referral criteria and processes.

- Reviewing the SOP, touch points with patients and resourcing, potentially making better use and more cost-effective use of specific staff roles.

- Reviewing the staff/management structure for the VW and how that works alongside the clinical pathway and the wider system.

4.7 Indicative cost-benefit of the COPD Virtual Ward

4.7.1 Overview

This section explores the indicative cost-benefit of the COPD VW in terms of immediate and long-term impact on healthcare utilisation.

To calculate the fiscal value of the VW, and whether it represents a cost-effective and sustainable model of care, both the cost and benefit inputs into the economic model have been converted to monetary values.

For costs, these figures have been sourced directly from SWHHCP partners based on actual expenditure incurred throughout the duration of the evaluation. This includes

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staffing resources including medical time, nursing time and other non-clinical support, as well as technology such as the remote monitoring devices and other materials like printing and stationery.

The two benefit streams incorporated both relate to the impact of the VW on reducing overall healthcare utilisation and improving appropriate, timely care for patients.

The first, a reduction in length of stay at initial inpatient admission, anticipated to reduce due to earlier supported discharge, has been monetised using the recognised standard NHS bed day cost of £400 per day.

The second, a reduction in re-admission events within 90 days of discharge, due to proactive, continuous patient monitoring in the community setting, has been monetised using bespoke values for WHTH taken from NHS Digital Patient Level Activity and Costing[15] and any admitted patient events under the category "*Diseases of the respiratory system*".

4.7.2 Optimism bias

These values have then been adjusted to account for optimism bias, the recognised psychological tendency as part of project appraisal and evaluation to systematically over-estimate benefits realised and under-estimate the costs of a new initiative.

To account for this bias, it is recognised best-practice to include an adjustment in the cost-benefit calculation to deflate the benefits and inflate the costs in line with the quality of the evidence used to inform each side of the equation. This is known as optimism bias correction (OBC).

Each input into the model has therefore been assessed against several criteria, including the age of the data, the known error, the population of interest and the evidence base, to determine the appropriate level of OBC to apply.

For clarity, all outputs are quoted with OBC both included and excluded, providing two estimates for the fiscal value of the VW model with an upper and lower bound scenario.

4.7.3 Results

- The overall benefit-cost ratio in-year for the VW is estimated at £1.12:1, suggesting that for every pound invested a financial benefit of £1.12 is created, this is when compared to the counterfactual scenario of all patients treated through the MDT-only pathway.

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15 NHS Digital's Patient Level Activity & Costing (2020-21)

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- The net-present value is the difference once the total value of the benefits has been subtracted from the cost, seen as reflective of the net savings produced by the VW, this is estimated at £6,370 per annum.

- If OBC is excluded, these figures increase to £1.45:1 and £24,400 respectively.

This positive return is created both by a proportion of bed days avoided due to a reduction in LoS from earlier discharge on initial admission.

It equates to approximately £46,500 over the duration of the evaluation period with OBC included, or £62,000 if excluded, accounting for 76.5% of the total benefit value.

The remainder, or 23.5% of the overall benefit, relates to a modest reduction in the number of readmission events, arising from a lower rate of repeat readmissions in the VW cohort compared to the MDT-only cohort.

This equates to £14,300 with OBC included or £16,800 if excluded.

Divided crudely by the number of unique admissions to the VW, at 50 events across 46 individual patients, these figures can be used to derive an indicative "per patient per VW episode net benefit" value.

This quantifies the difference between the additional investment needed to operate the VW model and the benefits realised for each new patient onboarded.

With OBC excluded this equates to a net financial benefit of £128 per patient per VW episode in the lower scenario, and £488 per patient in the upper scenario.

Table 9 summarises these outputs under each modelling scenario

Table 9: Cost-benefit analysis outputs per lower and upper estimates, all-costs included for duration of the evaluation period

Metric	With OBC (Lower Scenario)	Without OBC (Upper Scenario)
Total Fiscal Value	£60,800	£78,840
Benefit-Cost Ratio	£1.12:1	£1.45:1
Net Present Value	£6,370	£24,400
Per Patient Net Benefit	£128	£488

Several costs included in the model can be considered one-off initial investments required for the set-up and early establishment of the VW and not required on an ongoing basis. This includes upfront technology investment and a proportion of printing and stationery costs.

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It is important to consider cost-benefit metrics once these cost items are excluded, to determine the likely ongoing financial position based on recurring costs alone. This provides the most accurate reflection of the likely fiscal benefit once the VW continues to deliver at-scale as part of business-as-usual operations.

Table 10 summarises each of the key cost-benefit metrics under the lower and upper scenario, with initial one-off expenditure now excluded and with both costs and benefits apportioned over 12 months, extrapolated from the evaluation period.

Table 10: cost-benefit analysis outputs per lower and upper estimates, recurring costs only, per annum

Metric	With OBC (Lower Scenario)	Without OBC (Upper Scenario)
Total Fiscal Value	£145,950	£189,210
Benefit-Cost Ratio	£1.25:1	£1.62:1
Net Present Value	£28,930	£72,200
Per Patient Net Benefit	£263	£656

5 Conclusions

5.1 Summary

5.1.1 Timeframe

South and West Hertfordshire Health and Care Partnership (SWHHCP) implemented its chronic obstructive pulmonary disease (COPD) Virtual Ward (VW) in December 2021.

It aimed to support Watford General Hospital (WGH) in winter pressures management and enable patients to receive the consultant-led care they required safely at home.

The VW onboarded 50 patient cases between December 2021 and early June 2022.

5.1.2 Demography

Patient demographics, including ethnicity and gender, were similar between patients onboarded to the VW compared to the MDT-only and historic control cohorts.

This suggests the service was accessible and provided equitable care and that patients on the VW were representative of those accessing acute care.

A key distinction was the age of patients being admitted to the VW, which was slightly higher with a third of all patients aged between 80 and 84.

5.1.3 Referrals and admissions

More than three quarters of patients admitted to the VW were referred directly from the hospital ward. An additional 10% were referred from the accident and emergency department (A&E).

COPD or bronchitis were the most common reasons for admission to the VW (52%), with all forms of respiratory disease accounting for 82% of total admissions.

5.1.4 Design

The SWHHCP team designed clinical and technical support measures for the VW to enable safe care for patients of a higher acuity who would typically be managed within an acute bed.

This utilised continuous monitoring to provide timely biometric readings and rapidly identify patients who may require escalation.

Around 40% of patients upon admission had a DECAF score, a measure of hospital mortality risk, of between 2 and 3, demonstrating a higher degree of acuity than is common for most VW models.

A small proportion of patients (6%) were considered high risk, with a DECAF score of 3.

This remote monitoring model requires hub nurses to call patients four times a day (or an alternative agreed number of calls) to record patient readings and populate a NEWS2 chart. Omitting or reducing the number of calls made to patients for readings and receiving more patient observations through constant monitoring could lead to time savings.

Additionally, calls being made by hub nurses to record readings can be considered costly. Alternatively, call for data collection may be conducted by administrative staff, such adjustments to the remote monitoring model could lead to significant cost savings.

5.1.5 Length-of-stay and discharge

Based on the standard operating procedure (SOP), patients were intended to be supported on the VW for up to 14 days from the point of being onboarded.

On average, patients stayed a total of 7 days on the VW, with the majority (86%) staying for ten days or fewer.

A limited number of exceptions exceeded the 14-day recommendation, with the longest VW length of stay (LoS) recorded at 22 days for a single patient.

About two thirds of patients were discharged for ongoing care supported by CLCH (66%), with the remainder discharged with no further action, re-discussed by the MDT or re-admitted to a physical bed.

Across most of the measures considered in this evaluation, the VW has demonstrated a positive impact on patient care. By comparing average LoS between the three cohorts, we observed a likely reduction in LoS upon initial inpatient admission due to earlier supported discharge into the community for ongoing care.

On average, VW patients experienced an inpatient stay that was approximately 3 days shorter when compared to the MDT-only cohort and slightly shorter than the historic control cohort. It is not possible to determine whether this conclusion carries statistical significance due to the size of the VW cohort.

However, this conclusion is supported by staff and patient experience identified though qualitative engagement, with staff in particular highlighting how the VW has contributed to strengthening clinical confidence at the point of discharge.

5.1.6 Readmission

Although excluded from the analysis, both the VH and MDT re-admission rates were significantly lower than the 2019 historic control.

The likelihood that a patient will be readmitted within 90 days of discharge from hospital was moderately higher for VW patients compared to the MDT-only cohort. Just over half (54%) of VW patients were readmitted at least once for all-causes, compared to just under half (48%) of the MDT-only cohort.

The trend is consistent when focusing specifically on COPD-causes, where 30% of VW patients were readmitted compared to 23% of the MDT-only cohort.

This can be accounted for by the identification of unmet needs of patients at risk of deterioration in the community who are then appropriately escalated back into an acute setting.

Such readmissions, which occurred within less than a day following VW discharge and where the patient's reason for VW discharge was readmission to a hospital bed, account for 15% of all readmission events for the VW cohort. When these occurrences are removed, readmission rates are broadly comparable between the two groups.

A lower proportion of repeat readmissions within 90 days was observed among VW patients compared to the MDT cohort, at 0.78 versus 0.87 average events per patient respectively.

This suggests that although the likelihood of at least one readmission is greater for a VW patient, the total number of readmission events per patient is lower.

These subtle, non-significant differences between the VH and MDT group need to be interpreted with caution. All COPD patients benefit with improved healthcare outcomes when services transform with MDT-driven pathways which include a technology-enabled virtual hospital.

5.2 Staff and patient feedback

5.2.1 Overview

Feedback from staff and patients support the positive quantitative outcomes and suggest that the VW model was perceived as an effective, safe and beneficial model of care for COPD patients.

Patients reported a positive experience on the COPD VW, describing it as enabling them to feel safe and cared for whilst feeling relaxed in their own home. The majority of respondents (92%) felt prepared and confident about using the equipment.

All respondents to the patient survey reported being satisfied with the way concerns were answered, that they were given adequate information about risks, and they had had the equipment explained and been involved in decisions about their treatment.

5.2.2 Challenges and benefits

A small number of patients identified challenges or areas for improvement, which included difficulties downloading and using the technology, having access to advice out of hours, wanting fuller information and guidance about what to expect and who to contact, and better communication between different actors involved in their care.

Staff acknowledged providing tablets with the application pre-loaded, a step taken during the initial implementation phases, was a solution to some of the challenges patients experienced with technology.

Similarly, staff feedback suggested that their experience overall was positive. Staff described several benefits of the VW model including increased clinical interaction for patients and reduced LoS, a view that is supported by the quantitative data.

Staff also said they thought that the model was safe. Feedback and insights from staff suggested consensus that there was organisational readiness to implement the COPD VW.

5.2.3 Organisational readiness

The rigorous planning and robust SOP, including detailed guidance on inclusion and exclusion criteria for referral to the VW and escalation routes, were acknowledged as key to successful implementation.

In addition, the approach to apply learning from early delivery to adapt the model and improve practice was highlighted as important and meant that many of the challenges staff identified were recognised as now resolved.

For example, measures put in place to ensure all patients could easily access the technology, to agree the number of calls patients received, to ensure inclusion and exclusion criteria were applied appropriately, and to ensure staff had access to discharge summaries and patient information.

Insights gained from the staff and patient feedback also highlighted several factors that acted as facilitators or challenges to the implementation of the VW model. For example, the commitment of staff involved in the design and delivery were identified as a critical factor to successful VW implementation.

This included the new role of hub nurse and the role of community staff, specialist respiratory nurses, consultants and liaison GPs along with executive support.

5.3 Cost-benefit

We analysed whether the VW represents a cost-beneficial model of care for patients with acute respiratory conditions. Based on two key benefit streams, the impact on reducing LoS and the number of repeat readmissions within 90 days of discharge, the VW model demonstrated a positive benefit-cost ratio and has a compelling economic case for further investment.

This financial return increases once initial one-off set-up costs are removed from the equation, with an estimated recurring annual net benefit of between £263 and £656 per patient onboarded to the VW.

This demonstrates that the impact of the VW on reducing subsequent healthcare utilisation is sufficient to offset the additional staffing and technology costs required to deliver the technology-enabled pathway.

While a larger sample followed over a longer period is required to determine whether these observed differences are significant, it is evident from this evaluation that the SWHHCP COPD VW delivered safe care for patients in the community that, overall, improved patient outcomes, reduced avoidable acute demand and had a high degree of both user and staff satisfaction.

Technology-enabled VW models therefore can provide an effective alternative to hospital bed care that can release critical inpatient capacity while ensuring patients continue to receive safe, timely care in their own homes.

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6 Limitations and recommendations

6.1 Summary

This report represents one of the first independent service evaluations of a post-covid technology-enabled virtual ward. It supports the continued development of this emerging evidence base, combining comparator, patient-level quantitative analysis with multi-strand qualitative engagement with patients and staff members.

Together with economic analysis, this provides critical evidence for those involved in setting national policy and in the local adoption of these transformative models of care.

Due to the rapid nature of this evaluation and delivery within a real-world, uncontrolled environment, four notable limitations emerged during our engagement and analysis that should be highlighted.

6.1.1 Cohort size

The size of the VW cohort is relatively small at 46 individual patients, constituting 50 VW admissions.

Although the historic and MDT-only cohorts are much larger, the limited scale of the VW group has restricted our ability to draw statistically significant conclusions, particularly related to the impact of the VW on measures of healthcare utilisation including readmissions and length of stay.

As such, while the case mix of the MDT-only cohort is comparable to the VW cohort and both groups were observed over the same period, we are unable to clearly determine the degree of attribution of these changes to the introduction of the VW model compared to other contextual shifts that may have occurred at the same time, and the extent to which any findings may be replicable over time or in another similar area.

More data would need to be obtained from a greater number of patients to understand whether differences in outcomes and utilisation are significant and could be reproduced at scale across other sites.

6.1.2 Survey responses

The limitation in sample size is reflected in the patient experience survey, which has captured the views of around a third of all patients onboarded to the VW. Any future evaluation should consider broadening this coverage to fully reflect the diversity of patient experience.

Partly, the degree of patient engagement may have been due to the distribution method of the survey, with some patients receiving it retrospectively, post-discharge from the VW and often with some time elapsed after discharge.

While this approach ensured all patients had the opportunity to contribute the evaluation, it may have impacted on how representative the sample of respondents is. Patients who completed the survey are likely to already have a higher level of activation and engagement in their care.

Every effort was made to combat this bias, including providing alternative options for how the survey could be completed such as on paper or via telephone. We are unable to determine how representative these respondents are of the wider VW cohort because survey returns were designed to be fully anonymous, supporting openness and transparency in patient responses.

6.1.3 Implementation phases

Discharge systems across the country including in West Hertfordshire have changed significantly, due in part to the Covid-19 pandemic, with a greater emphasis on community and primary care.

Due to time limitations for this evaluation, whilst some engagement did occur through the practitioner interviews, it has not been a focus within this evaluation to consider in detail the impact of the VW model on other settings of care, such as primary care in particular, or to understand the views of staff providing support for the VW in those areas.

Subsequent analysis of the effects of the VW on an integrated care system (ICS) would benefit from further exploration of this aspect.

In reviewing the data and pathway it is important to recognise the three phases of implementation, and to understand the contextual factors that may influence the delivery of the model and may help to explore some of the quantitative findings.

A more detailed understanding of how the staffing model may be refined and resourced to match work activity with appropriate healthcare professionals is critical to ensure a cost-effective and sustainable model. Suggestions for improvement described by staff (section 4.6) and patients (section 4.5) provide useful insights for further improvement of the VW model.

6.1.4 Other factors

Any future evaluation should consider exploring in greater detail the impact of the VW model on the wider social support network for patients, in particular the role of family members and carers whilst patients are managed in the community.

Such work may also consider different forms of economic analysis which expand on this consideration of patient quality of life, such as cost-effectiveness or recognised cost-utility measures.

6.2 Staff recommendations

6.2.1 Overview

In addition to these recommendations identified through the course of our evaluation, several factors were identified by staff members as to how the VW model could continue to be adapted to continually improve the model of implementation.

The SWHHCP team have already considered or are implementing many of these factors:

- Developing information and guidance for patients and staff on the VW model, including expectations of what to do or who to contact and written material for dissemination.

- Further development of the technology provided to support face-to-face virtual communication routinely.

- Review and refine the VW model and pathway including referral processes and criteria, the number of touch points with patients, and the staffing model to continue providing a cost-effective use of specific staff roles and to plan for sustainability.

- While telephone-based interventions are more inclusive for people who lack internet access or digital literacy, it may be effective to co-design remote interventions with patient groups to reduce the staff resources.

Reducing the number of calls made to patients may free up staff time and the cost attached to this, as well as alleviating pressure on staff such changes could lead to a reduction on the overall ROI.

6.2.2 Recognising exemplary performance

West Hertfordshire Teaching Hospitals NHS Trust's respiratory team is recognised nationally as a leader in service-led continuous improvement and clinical innovation.[16]

As such, it is important to note that the operating model within the team, recognised as exemplary in terms of leadership, teamwork and responsiveness to change and identified as a critical enabler to the success of the VW, as noted by the qualitative aspects of this evaluation, may not be fully reflected in other areas.

Overall, despite these limitations and the rapid nature of this evaluation, it is evident from all three aspects of quantitative, qualitative and economic analysis that the VW model represents a safe, effective alternative to inpatient care that improves outcomes, positively impacts patient experience, and delivers cost efficiencies when compared to traditional care pathways.

We recommend the SWHHCP team continues delivery of the VW and explores further expansion of the model into other care pathways outside of COPD and heart failure, considering our suggestions above for further future improvements and learning from this initial implementation.

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[16]Team recognised by the British Medical Journal (BMJ) as "Respiratory Team of the Year"

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Appendices

Appendix 1: COPD VW on-boarding Standard Operating Policy

Standard Operating Policy

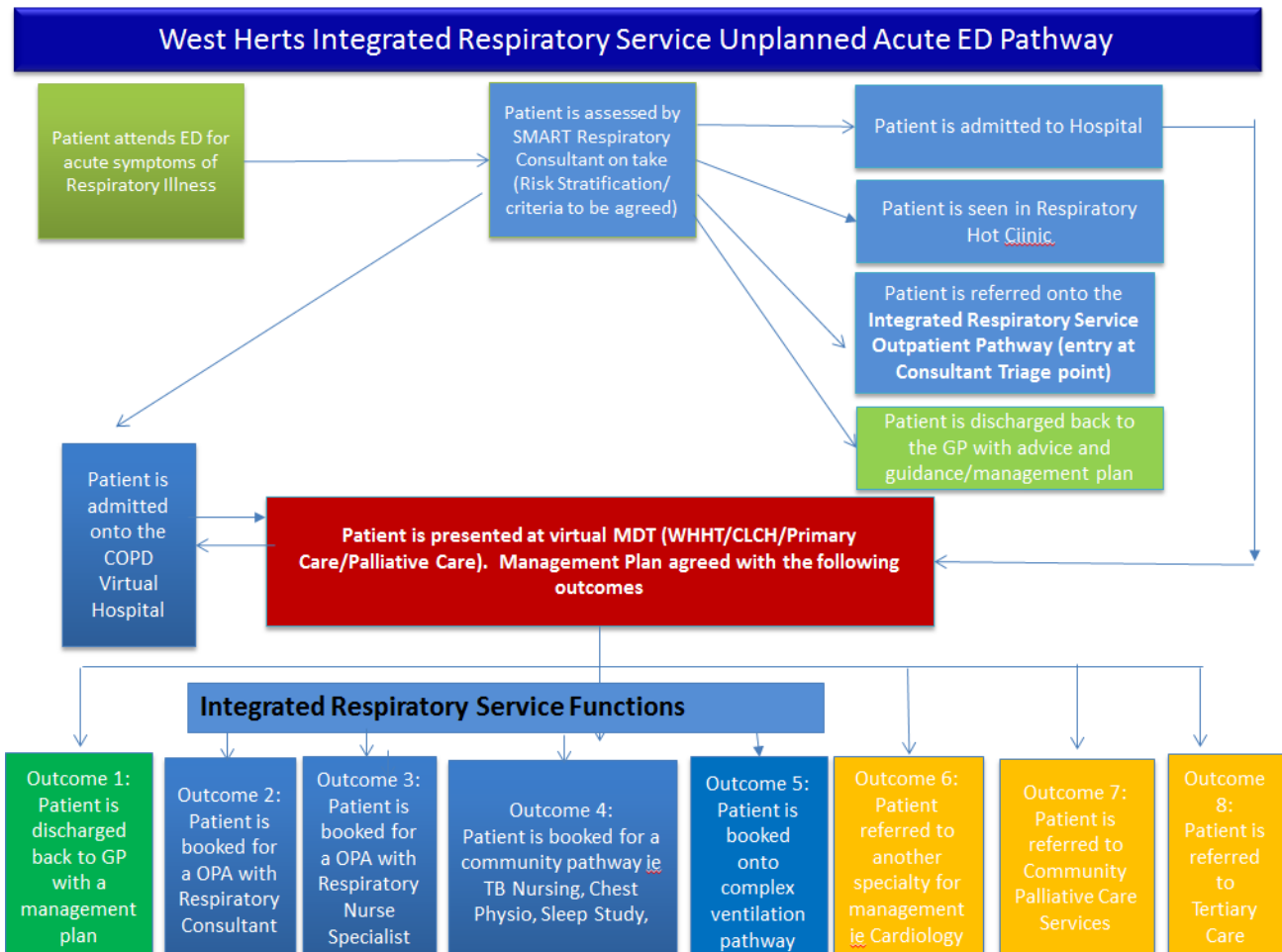**Integrated Airways Disease Service:**

The ABC MDT and the COPD Virtual Ward on-boarding principles

Introduction:

The department of respiratory medicine at West Hertfordshire Teaching Hospitals NHS Trust, CLCH and wider system partners recognise the need to adapt to the new demands posed by COVID-19. In response to restrictions placed on patient movement, staff availability and growing waiting lists for elective care and diagnostics, the need to create new platforms to deliver high quality efficient care are very high priority.

This policy places the patients' needs at the centre. It embraces the principle of matching work activity with the appropriate healthcare professionals. It aligns with the principles of integrated care in the newly formed integrated care partnership. It also builds on the success of virtual platforms demonstrated by the West Herts Covid Virtual Ward. It will allow a new focus on supporting primary care colleagues and ultimately, raising standards of education and care in this sector.

This policy covers the new ABC MDT and aligns with the agreed process map for COPD patients requiring unscheduled care:

West Herts Integrated Respiratory Service Unplanned Acute ED Pathway

ABC MDT, an integrated care partnership:

- West Hertfordshire Teaching Hospitals NHS Trust
- Central London Community Healthcare NHS Trust
- Palliative Care
- Primary Care
- Herts Valleys CCG
- West Herts & Essex ICP

WHTH NHST Airways disease MDT leads: Dr Rahul Mogal, Dr Andrew Barlow, Dr Ajitha Jayaratnam
CLCH leads: Maria Buxton
Palliative Care: Dr Sharron Chadwick
HVCCG commissioning lead for Respiratory Medicine: Dr Corina Ciobanu
MDT Coordinator: Caroline Daly

Which patients does this SOP relate to?

All patients regardless of their care setting with asthma, bronchiectasis or COPD (hence 'ABC')

Operational phases:

Initially the MDTs will manage all admitted patients with airways disease, but once established will blend in referrals from CLCH nurses and then lastly new referrals from GPs (upon completion of the 'work-up')

How will we measure the success of this programme?

- Number of acute admissions with exacerbation of COPD, asthma
- Number of re-admissions exacerbation of COPD, asthma
- Average LOS for exacerbations of COPD, asthma
- Adherence to agreed treatment frameworks as defined by GOLD/SIGN guidelines
- Wider adherence to general health and wellbeing advice inc. smoking cessation
- Pulmonary rehabilitation enrolment
- National audit programmes [NACAP]
- Patient feedback
- Quality of end-of-life management and engagement with palliative care services

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West Hertfordshire COPD Virtual Ward

Standard Operational Policy

Description:

The COPD VW is designed to provide high quality care in the patient's home and facilitate both early discharge (for patients who require an initial period of in-patient care) and admission avoidance (to prevent unnecessary use of acute in-patient facilities where equivalent care can be delivered in the patient's own home).

It builds on and enhances the existing community supported discharge programmes. It incorporates all the principles laid out in the recent RCP documentation on Modern Ward Rounds.

Proposed phasing:

Phase 1: November 2021   Facilitated discharge
Phase 2: February 2022   Admission avoidance
Phase 3: June 2022   Direct community on-boarding

Pathways:

High risk, (all facilitated discharges and DECAF 2, 3 admission avoidance): 7/7 with daily consultant review, continuous monitoring, regular input (at home from community specialist nurse/physiotherapy team)
Monitoring: Masimo continuous pulse oximetry

Low risk, DECAF 0, 1 admission avoidance patients from ED/community
Monitoring: standard pulse oximeter

Admission into the COPD VW: this is arranged directly from the ABC MDT (facilitated discharges and community admission avoidance patients) and when running, from ED following Respiratory (V)SMART post-take WR or nominated/trained acute physician post-take WR.

How is the 'admission' organised/monitored? InfoFlex referral form and InfoFlex-based pathway shared across all clinicians

On-boarding Team:
This will vary dependent on the time of day.
Respiratory SMART, when it restarts, will provide Respiratory PTWR consultant until 2100 7/7. Until then:

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M-F/0900-1700: In-patient specialist nurse, NIV consultant, physiologist, resp. SpR
M-F/1700-2100: PTWR consultant, NIV consultant, take juniors, resp. SpR (if on call)
Weekend/0900-1300: PTWR consultant, resp. ward consultant, physiologist
Weekend/1300-2100: PTWR consultant, NIV consultant, physiologist

Care Partnerships:

- WHTH NHST: consultant respiratory physicians will provide the ward rounds
- CLCH FT: will provide the community-based nurse input (both virtual and real visits into the home)
- palliative care consultants/nurses

Complex discharges/on-boarding into the high-risk pathway of the VW

FACILITATED DISCHARGE/HIGH RISK PATH COPD VW REFERRAL
Purpose and background

COPD patients suitable for early facilitated discharge will be identified at the ABC MDT

The aim of this document is to clarify who would benefit from early discharge with temporary oxygen support

Inclusion criteria

- Patients <85
- No additional complex social/physical requirements
- Clearly demonstrating a positive clinical trajectory
- DECAF 3 or more on admission
- Receiving O2 via NC at no more than 4l/min, with resting SpO2 maintained 88-92%
- Willing to be discharged with O2
- No contraindications to Rx O2 at home
- May require NIV in addition to O2 supplementation
- New O2 discharges: referral phoned through to CLCH nurse on call for the day and HOOF/consent completed by ward team
- Admission to the COPD VW requires full completion of the InfoFlex referral tool and ABC MDT agreement either before (facilitated discharge/community on-boarding) or at the next available MDT if admission prevention
- Patients discharged with oximeter/COPD VW advice pack
- Ambulant/self-caring
- EOL patients can be considered following ABC MDT discussion

Exclusion criteria

- Complex medical needs over and above the O2 requirements
- Clinically unstable
- Confusion/impaired cognitive ability
- Complex social arrangements
- Not discussed at ABC MDT

Scope

The scope of this SOP is to ensure that the correct patients are identified for safe discharge into the community

Operating Procedure

COPD VW: DISCHARGE WITH OXYGEN/NIV	Inclusion Criteria (ALL REQUIRED to Qualify)	Exclusion Criteria	Exclusion Criteria (If any category applies – Patient NOT appropriate)
Confirmed diagnosis of COPD with positive clinical trajectory, beginning to mobilise (or back to baseline). May require additional O2 to prevent significant desaturation (<88%), or NIV support			
Patient for D/C with Ambulatory +/- temporary LTOT Oxygen – <u>agreed with respiratory consultants at ABC MDT</u> • Planned D/C for 'tomorrow' = BOC Next Day Order (24 hrs) – order immediately for delivery 'tomorrow' • D/C 'today' = BOC Emergency Order (4 hrs)		Patients NOT discussed at ABC MDT	
Clinically stable x 24 hours minimum and improving clinical trajectory (NEWS, clinical judgement)			

Obs: NEWS2 score <3 [Apyrexial, RR < 20 (rest), HR < 100, BP: Systolic < 160, Diastolic < 100]			
JUST O2: Type 1 Resp. Failure O2 plus NIV: Type 2 Resp. Failure (see separate guideline for domiciliary NIV)	Agreed at ABC MDT NIV set up on ward prior to discharge		
Cognitive ability – able to follow commands, understand treatment rationale and dexterity to use the equipment			
Non-smoker, and NO family member who smoke living at property			
Oxygen ordering via BOC Portal – family member to be at home to receive supply before patient discharged			
If patient requires CLCH same day visit (as vulnerable): - order oxygen by 12.00PM on Emergency HOOF A on BOC Portal - Patient needs to be home by 3PM			
Oxygen BOC Order to be completed by WHTH using BOC Portal: Use this link https://www.bochealthcare.co.uk/hop/ • New staff will need to register • HOOF A required • Next Day Order (24 hours) preferable for planned D/Cs for tomorrow • Emergency (4hrs) only for today			

• Consent and Risk Forms to be printed, completed and filed • HOOF A to be printed, and filed once sent • BOC will email confirmation to individual email of staff who ordered Oxygen to be installed prior to patient leaving hospital			
Oxygen Prescription should be: Standard Flow and Standard Hours • 1 x Concentrator (always includes a backup cylinder) • Flow =? l/min (max of 4) • Hrs / day –(suggest minimum 14hrs a day or more if ambulatory, otherwise 24hrs)			
Refer to CLCH – • Call Mobile 07944 960825 • email COPD VW referral form (automated) and DC summary to clcht.respiratoryrms@nhs.net			

Escalation:

The dignity and quality of care given to the patient will be maintained throughout the discharge.

Monitoring Structure:

1. All breaches of this procedure will be reported via Datix.
2. Patient complaints will be monitored and reviewed by the head of nursing
3. iReporter to capture data on patients transferred
4. Monitor any adverse issues via Serious Incident Reporting

All learning from incidents and complaints will be used to review and amend this procedure as required.

ADMISSION PREVENTION COPD VW REFERRAL

Purpose and background

COPD patients suitable for admission prevention will be identified at the post-take ward round by respiratory consultants +/- acute physicians who have completed the COPD VW training module

The aim of this document is to clarify who would benefit

Inclusion criteria

- Patients <85
- No additional complex social/physical requirements
- NEWS 3 or less
- DECAF 0/1/2 at assessment
- Not requiring a new oxygen prescription (patients stable on pre-existing home O2-Respiratory consultant decision only)
- Willing to be discharged into COPD VW
- InfoFlex COPD VW referral completed
- Inpatient specialist airways disease nurse contacted or resp. SpR
- Patients discharged with oximeter/COPD VW advice pack
- Ambulant/self-caring

Exclusion criteria

- Complex medical needs over and above the O2 requirements
- Clinically unstable
- Confusion/impaired cognitive ability
- Refusal to give consent

Scope

The scope of this SOP is to ensure that the correct patients are identified for admission prevention

Operating Procedure

COPD VW: Admission prevention	Comments
Confirmed diagnosis of COPD, mobilising (or on baseline) NEWS< 3 DECAF SCORE: 0,1 (low risk path) DECAF SCORE: 2,3 (High risk path)	- All trained consultant decision-makers - Respiratory consultant ONLY

Process: 0900-1700 Monday-Friday	- Identify suitable patient in ED/post-take (consultant) - Contact WH in-patient specialist respiratory nurse - If not post-take, then requires resp. consultant PTWR - If PTWR completed, specialist nurse escalates to NIV consultant on call. If suitable candidate, - complete InfoFlex referral (junior doctor/specialist nurse) - DECAF 2,3 patients will require resp. consultant review and on-boarding assistance including Masimo safety-net monitoring - Provide COPD VW grab bag (ED team/specialist nurse) (Oximeter/advice leaflets/safety-netting)
1700-2100 Monday-Friday and weekends	- Identify suitable patient in ED/post-take (consultant) - If 1700-2100, discuss with NIV consultant on call. - If Weekend 0900-1700, discuss with resp. consultant on call for wards. If suitable candidate, - Complete InfoFlex referral (junior doctor) - Provide COPD VW grab bag (ED team) (Oximeter/advice leaflets/safety-netting) All patients on-boarded to COPD VW low risk pathway will be discussed at the next available MDT (MDT coordinator)

Escalation:

The dignity and quality of care given to the patient will be maintained throughout the discharge.

Monitoring Structure:

1. All breaches of this procedure will be reported via Datix.

2. Patient complaints will be monitored and reviewed by the head of nursing
3. iReporter to capture data on patients transferred
4. Monitor any adverse issues via Serious Incident Reporting

All learning from incidents and complaints will be used to review and amend this procedure as required.

COPD VW referral form (InfoFlex)

Examination findings

Bilateral BS	Y - Yes	Wheeze	Y - Yes	Crepitations	Y - Yes	
Tracheal central	N - No	Signs of thoracic surgery	N - No	Crepitations - if yes, zone	R - Right	

Oxygen saturation

COPD with known hypoxia	1	Not known hypoxic at baseline	6
On LTOT/Oxygen at discharge	Y - Yes		
Saturation > 92%	Y - Yes	ABG Done ✔	pH 0.7
Respiratory rate	34	Consciousness score	1 - Alert
Systolic BP	120	Temperature	38.0
Pulse	40		

Exercise tolerance on the flat (at time of assessment) - BORG score: 1 - 1

Baseline breathing - best in last 3 months: 2 - Needs assistance with ADLS

Is there an acute deterioration in any other medication condition: Y - Yes   (eg CCF, Diabetes)

Bloods

Hb	12.8	WCC total	134.0	Eosinophils	122.00
CRP	12	Creatinine	13.0	Urea	14.0

Is this pt a current/recent smoker: Y - Yes   (stopped last 3 months = smoker)

ECG findings: 1 - Sinus normal   ECG findings - other: other ecg findings

Can the patient use their inhaler: Y - Yes

Weight	55.0 kg	Height	1.65 m	BMI	20.2

Risk Scores

Total DECAF Score	3
Total NEWS Score	3
Initial Virtual Hospital Risk Level	H - High

Most recent activity tracker details

WB Current Risk Level	H - High
WB Review method	1 - Telephone
WB Current Status	A - Alive

Name	Date ↓	File Name
	No Results Found	

⊕ Add New Tracker

Review Date	Daily review comments	Daily Tracker Risk Level	Review method	Discharge Destination/Outcome	Entered by
01/06/2021	daily review comments	High	Telephone		surreyc

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Standard Operating Policy

Integrated Airways Disease Service:

The ABC MDT and the COPD Virtual Ward.

Monitoring for the Virtual Ward

Overview:

The monitoring hub will be established to support both the cardiology and respiratory VW platforms, supported by Masimo monitoring technology. Masimo provides continuous physiologic data to ICU-standards for up to 14 days. Whilst the monitoring hub will only be staffed 0800-1800, all data will be reviewed for alerts every morning. When on-boarded the patient will be provided with the monitoring equipment, which will include, if necessary, a trust-provided smartphone to facilitate the Bluetooth link and instructions on what to do. Further support for the VW patients will be provided by the monitoring hub administrator possibly enhanced by voluntary sector input. In concept, this care pathway should not be viewed as a light-touch version of a real admission. Monitoring standards will be as high as those provided on standard wards, with inputs from a diverse multi-professional team including specialists nurses (hospital based and community), senior consultants, physiologists, NIV specialists, palliative care consultants, GPs and where necessary sign-posting to care services.

Key supporting personnel:

- ABC MDT coordinator
- Respiratory physiologist
- Monitoring team
- NIV practitioner
- CLCH nursing team

Monitoring team

- Administration staff: 1 band 4 [available 7/7, 0900-1800]
- Nursing staff: 1 band 6 [available 7/7, 0800-1700]
- Respiratory consultants: 1 available am 7/7 [as per VW rota]

Monitoring nurse duties:

- Review all the continuous data logs for VW patients overnight and prioritise the consultant WR order accordingly [analogous to board rounds pre consultant WR on standard wards]
- Respond to individual patients should rapid escalation be appropriate or where patients have requested call backs
- In priority order (and before the consultant ward round), attain the first observation data set
- Perform data accrual: heart rate, respiratory rate, temperature, BP, weight, peripheral perfusion index (quality indicator) and EDI (measure of intravascular fill/pre-load). Using the Masimo platform, the nurse will then populate a complete NEWS2 chart for that time point and record in InfoFlex
- Three further time points during the day will be formally recorded in this way onto the InfoFlex VW platform [indicative times: 0830, 1130, 1430, 1700]

Respiratory consultant:

- Perform consultant ward round on every respiratory patient in the VW
- As part of that round, all key areas need to be reviewed including:
  o Symptom update
  o Feedback on observations
  o Review of medication
  o Identification of new issues both medical or social
  o Identification of additional in-pathway diagnostics

CLCH community respiratory nurse:

All patients will be reviewed by the allocated CLCH nurse according to the assigned pathway (see below). Via weblink/VPN access, CLCH nurses will update the patient's record on the VW InfoFlex platform. Any required escalations can be made after the patient review.
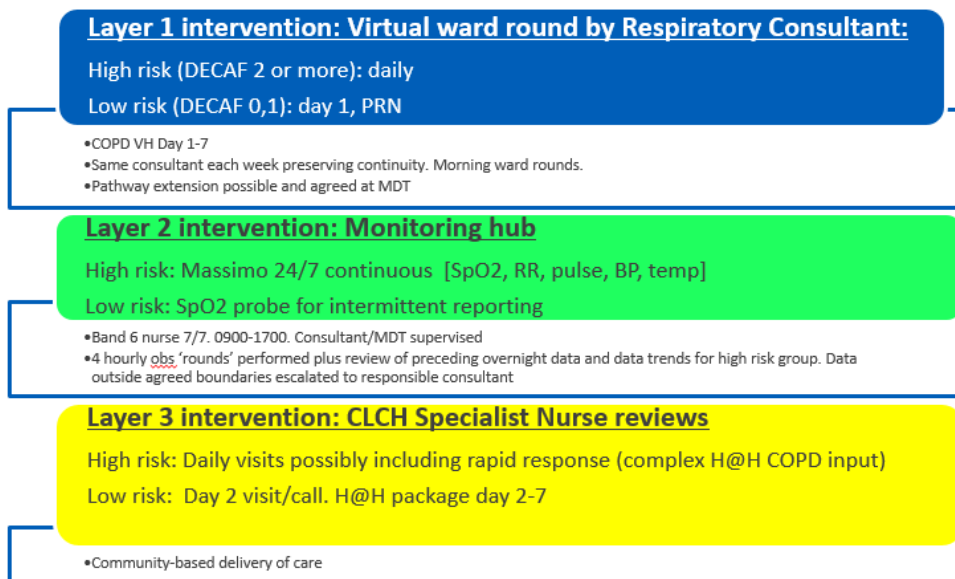
Interaction with ABC MDT

A section of the ABC MDT will be dedicated to VW patient updates, allowing both CLCH nurses, hub nurses and respiratory consultants an opportunity to raise important issues

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(should that be required). All patients on the VW will need to be formally reviewed by the ABC at least once, at the conclusion of their stay.

Escalation pathways:

The VW will provide 3 separate layers of regular clinical intervention/review as described below.

Layers of escalation/governance

Layer 1 intervention: Virtual ward round by Respiratory Consultant:

High risk (DECAF 2 or more): daily

Low risk (DECAF 0,1): day 1, PRN

- COPD VH Day 1-7
- Same consultant each week preserving continuity. Morning ward rounds.
- Pathway extension possible and agreed at MDT

Layer 2 intervention: Monitoring hub

High risk: Massimo 24/7 continuous [SpO2, RR, pulse, BP, temp]

Low risk: SpO2 probe for intermittent reporting

- Band 6 nurse 7/7. 0900-1700. Consultant/MDT supervised
- 4 hourly obs 'rounds' performed plus review of preceding overnight data and data trends for high risk group. Data outside agreed boundaries escalated to responsible consultant

Layer 3 intervention: CLCH Specialist Nurse reviews

High risk: Daily visits possibly including rapid response (complex H@H COPD input)

Low risk: Day 2 visit/call. H@H package day 2-7

- Community-based delivery of care

Clinical escalation:

Patient triggered escalation can occur directly with the respiratory consultant (during the ward round), the CLCH nurse (either during their independent review or using the on-call CLCH nurse call line) or the hub team. The Patient Information Leaflet will describe who/how and when. We will encourage the patient to use to use the available routes of escalation in the following order:

- 0800-1800: VW monitoring hub (number to be confirmed)
- 1800-2000: CLCH nurse on call (number to be confirmed)
- 2000-0800: **Non-urgent**-VW hub (answerphone)

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- 2000-0800: **Urgent**-111 or EoE ambulance service depending on clinical need

Where calls come in direct to either the hub or to the community nurse on call, further senior advice is directly available as shown. For example, at 1400 on weekdays, they can escalate to the VW consultant (who would have spoken to the patient directly, thereby retaining continuity of care). At 1900, the same senior advice can be sought from the NIV consultant on call. The NIV rota is well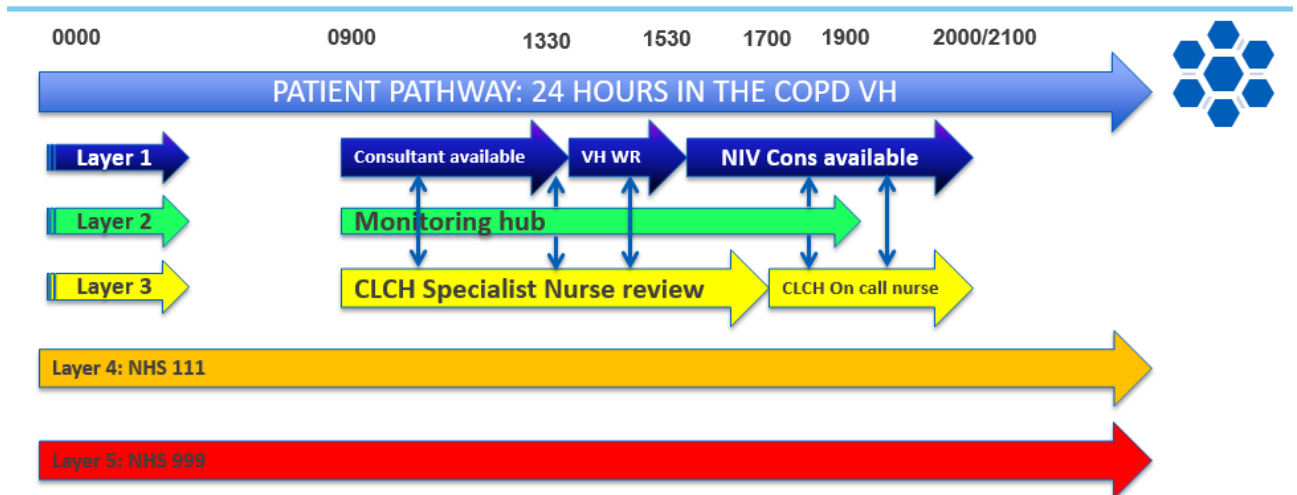 established with a consultant allocated every day of the year. Weekdays and weekends look slightly different, but there is always a consultant available for advice up to 2100.

Week day escalation routes
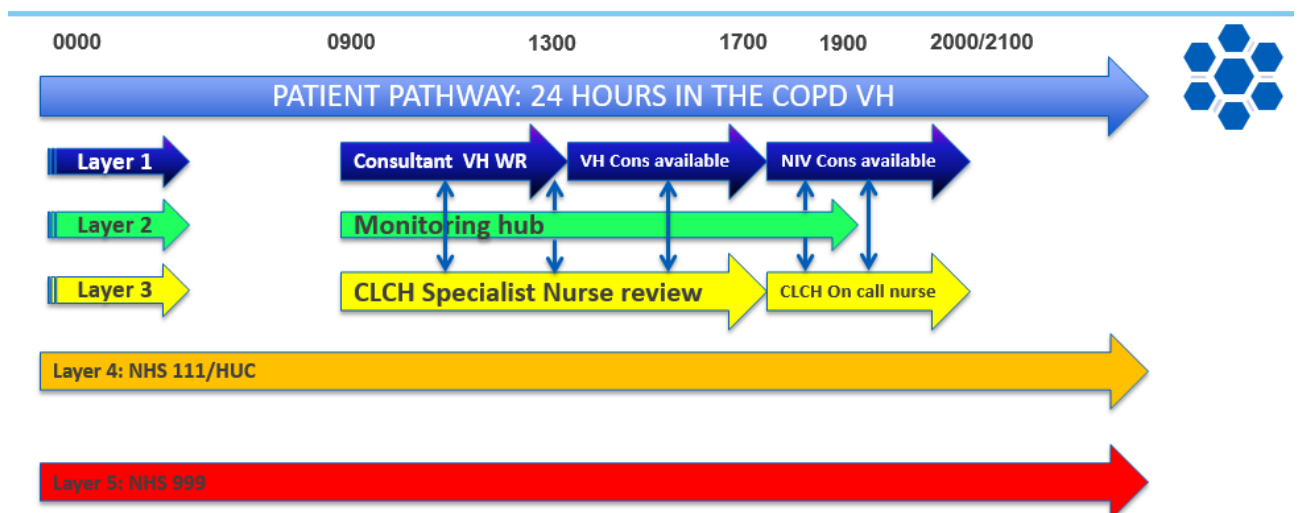
West Hertfordshire Teaching Hospitals NHS Trust

| | 0000 | 0900 | 1300 | 1700 | 1900 | 2000/2100 |

PATIENT PATHWAY: 24 HOURS IN THE COPD VH

Layer 1 — Consultant VH WR — VH Cons available — NIV Cons available

Layer 2 — Monitoring hub

Layer 3 — CLCH Specialist Nurse review — CLCH On call nurse

Layer 4: NHS 111/HUC

Layer 5: NHS 999

- Escalation routes will vary dependent on the time of day
- The monitoring hub will review all patients observations according to risk status and also provide 0900-1900 telephone advice to patients
- Nurses can escalate to available consultant and vice versa
- Patients can contact monitoring hub 0900-1900
- At 'risk patients' need agreed escalation plans in place by 1700 every day available to emergency teams

Weekend escalation routes

PATIENT PATHWAY: 24 HOURS IN THE COPD VH

0000   0900   1330   1530   1700   1900   2000/2100

Layer 1 — Consultant available — VH WR — NIV Cons available

Layer 2 — Monitoring hub

Layer 3 — CLCH Specialist Nurse review — CLCH On call nurse

Layer 4: NHS 111

Layer 5: NHS 999

- Escalation routes will vary dependent on the time of day
- The monitoring hub will review all patients observations according to risk status and also provide 0900-1900 telephone advice to patients
- Nurses can escalate to available consultant and vice versa
- Patients can contact monitoring hub 0900-1900

Masimo-triggered escalation:

At set up (and this will be tailored according to the unique needs and background of each and every patient), thresholds will be established for all the physiological parameters. Direct alerts from the system to the monitoring platform will occur. If between 0800-1800, this will prompt a clinical response from the hub team. If outside hours, then this will be reviewed the next day.

- The monitoring hub nurse will review the continuous data at 0800 every day
- 0800: All patients with data falling out-with agreed thresholds will be WR-prioritised and prompt rapid call back for review of the clinical position. The patient will then receive a priority call from the VW consultant
- 1300-1800 (and after the consultant WR): threshold breaches will trigger a call to the patient by the hub nurse. If no contact possible, then continuous monitoring will inform next step. Discussion with covering consultant is mandated in this circumstance. The opportunity for a community visit will be explored. Other actions will be determined by the real time data, but could include escalating to EoEAS.
- 1800-0800: Reliance on patient directed actions is key here and described above. Clear safety-netting advice will be provided.

- Case reflection and review may prompt adjustments of the thresholds where repeated triggering without consequence occurs.

Patient interaction with the Masimo platform:

The patient will be prompted to complete a 'quality of life' questionnaire at the start and on completion of the VW stay. There is also a patient portal provided by Masimo with a 24-hour help line, mainly directed towards solving technical issues with their equipment.

Appendix 3: patient survey

Eastern **AHSN**

West Hertfordshire Hospitals Trust COPD Virtual Hospital Evaluation

Eastern **AHSN**   **NHS**

Feedback Survey for Patients on the South and West Hertfordshire Health and Care Partnership (SWHHCP) COPD Virtual Hospital

As a patient on the COPD Virtual Hospital you are invited to complete this feedback survey. It is important for us to gather information so we understand more about your experience on the virtual ward. This will help us to understand how effectively the virtual ward has been delivered, and if it has achieved the aims of improving patient care. The information and insights collected through the survey will help us to make recommendations to support wider adoption of the virtual ward model.

Completing the survey should take no more than 10 minutes of your time. Staff overseeing your discharge from the virtual ward will support you to complete the survey. Before you complete the survey, it is important that you understand why this study is being done and what it involves. Please read the Participant Information Sheet on the next page carefully. Completing the survey means that you have consented to participating in the survey.

Participant Information Sheet

As a patient on the SWHHCP COPD virtual hospital ward you are invited to complete this feedback survey. Your views and experiences are important for us to help understand the pathway and impacts for patients. Before you decide whether or not to take part, it is important for you to understand why this study is being done and what it will involve. Please read the following information carefully. Please contact us if you have any questions or want more information.

The purpose of this study is to gather evidence to help understand whether the virtual hospital ward has successfully delivered its intended objectives of improving patients care, clinical outcomes, and staff capacity, with a view to supporting wider adoption or the virtual hospital model. This survey is part of an evaluation study to understand clinical outcomes, staff and patient satisfaction and challenges and facilitators to implementation of the virtual ward.

This part of the evaluation is being conducted by Eastern Academic Health Science Network.

We are inviting all patients on the virtual ward to complete this survey. Taking part is entirely voluntary. If you agree to taking part you will be asked to provide consent to show that you understand and agree to all aspects of the study and that you are happy to participate. Please note that if you do decide to take part you are free to withdraw at any time without giving a reason, up until the point of data analysis - at which point your de-identified data will be pooled with that of other

participants. Deciding not to take part or withdrawing will not affect you in any way. You can withdraw by contacting the evaluators at the email address provided below.

There is no risk in taking part, other than your time to complete the survey. The benefits of taking part is that your feedback will help us to improve and inform wider adoption of the virtual hospital model.

All the data obtained through the survey will be stored securely on Eastern AHSN servers and deleted after analysis and publication of the findings. All participants will be anonymous, no personal details are gathered through the survey. Please do not add any details in the survey responses that would identify you or give details of your health conditions. All data will be handled in accordance with the General Data Protection Regulations of 2018 and Eastern AHSN's privacy policy (https://www.easternahsn.org/privacy-policy/).

Findings from this survey will be reported to the NHSx, Health Innovation Manchester and West Hertfordshire Hospitals Trust, who have commissioned this evaluation.

If you have a concern about any aspect of this study, or if you would like more information about the study please contact Judith Fynn on the evaluation team - (mailto:judith.fynn@eahsn.org?
subject=COPD%20Virtual%20Hospital%20Evaluation)judith.fynn@eahsn.org
(mailto:judith.fynn@eahsn.org) (mailto:judith.fynn@eahsn.org?
subject=COPD%20Virtual%20Hospital%20Evaluation)

If you have further concerns, or wish to make a formal complaint please contact Sarah Robinson, Director of Delivery at Eastern AHSN - sarah.robinson@eahsn.org (mailto:sarah.robinson@eahsn.org)

Thank you for taking the time to read this information sheet.

---

*I confirm I have read the Participant Information Sheet and agree to Eastern AHSN capturing data in this survey.

◯ I confirm I have read the Participant Information Sheet and consent to participating in the survey

◯ I do not consent to participating in the survey

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Feedback survey questions

*How long have you been on the virtual hospital ward?

[   ]

*Where were you admitted on the the virtual hospital ward from? (please select the answer that applies)

○ Admitted from a hospital ward   ○ Admitted from A & E   ○ Admitted from home or community care

*Did you feel adequately prepared during admission for your time on the virtual ward?

○ Yes, fully prepared   ○ Yes, to some extent   ○ No, I felt unprepared

*Did a member of staff explain the purpose of the equipment supplied to you as part of the virtual ward?

○ Yes, completely   ○ Yes, to some extent   ○ No

*Do you feel you were given adequate information about risks and what to do if you had any concerns?

○ Yes, completely   ○ Yes, to some extent   ○ No

*How confident did you feel about using the equipment?

○ Yes, completely confident   ○ Yes, to some extent   ○ No, not confident

*Do you feel you were involved in decisions about your treatment and care on the virtual hospital ward?

○ Yes, definitely   ○ Yes, to some extent   ○ No

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*Did you ever feel that you could not find someone to talk to about concerns whilst on the virtual ward?

○ Yes, definitely   ○ Yes, to some extent   ○ No

If you had any fears or concerns about your treatment and care, what was the staff role of the person who answered your questions?

○ On-call Nurse   ○ Specialist Nurse   ○ Respiratory Consultant

○ The Monitoring Team

[   ]

*When you had questions to ask healthcare staff, were you satisfied with the way your concerns were answered?

○ Yes, completely   ○ Yes, to some extent   ○ No

*If your family or carer, or someone close to you whilst on the virtual ward wanted to talk to a member of the healthcare staff, did they have enough opportunity to do that?

○ Yes, definitely   ○ Yes, to some extent   ○ No

○ NA, no family or carer
   were involved

*Did you feel confident that help was available when needed?

○ Yes, definitely   ○ Yes, to some extent   ○ No

*Overall, did you feel that you were treated with dignity and respect while you were on the virtual ward?

○ Yes, definitely   ○ Yes, to some extent   ○ No

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What did you like most about being on the virtual ward?

What did you like least about being on the virtual ward?

If at any time you did not follow the treatment and monitoring plan, what were the reasons for this?

How would you describe the benefits to you, if any, of being on the virtual ward?

How would you describe the challenges, if any, you experienced whilst on the virtual ward?

Do you have any suggestions about how your experience of being on the virtual ward could have been improved?

Appendix 4: Staff interview questions

Interview questions for staff of VW:

Introduction

1. Please can you tell me about your role in the delivery of the Virtual Ward?

Process of the Virtual Ward

2. How would you describe the key features of the Virtual Ward?
   a. What do you see as the value of this approach?
3. Please can you describe your experience of how the pathway works?
   a. How does the referral/admission process for the Virtual Ward work?
   b. Any challenges?
4. How are key personnel working together to deliver the Virtual Ward?

Impact on staff

5. What changes in staff roles, practices or processes were required to deliver the Virtual Ward?
   a. What knowledge or support is needed to use the technology?
   b. Did you receive additional training or support?
   c. Were you satisfied with the training and support you received for implementing the Virtual Ward?
   d. What further training or support for staff do you feel would be useful?
   e. Were there any changes to accountability?

Role of patients

6. What is expected of the patients?
   a. Were there any issues related to patient compliance or confidence?
   b. How were patients' families or carers involved in decisions or in supporting patients on the Virtual Ward?
7. From your experience, do you have any thoughts about the patient characteristics or patient groups that the Virtual Ward is appropriate for, (or not appropriate for)?
   a. Are the right/most appropriate patients being admitted and/or agreeing to be admitted?

Organisational readiness and implementation

8. How ready do you feel the organisation was to deliver the Virtual Ward?
   a. Prompts: support & training for the innovation, ability to adapt, new staff roles, documentation and communication of SOPs, guidance etc.
9. What were/are the challenges or barriers to delivery of the Virtual Ward?
10. What were/are the things that have helped/enabled delivery of the Virtual Ward?
11. Is the service being delivered in line with the delivery plan?

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12. Have you been able to adapt the technology or the delivery of the Virtual Ward over time?
     a. For example, to improve reach, usability or outcomes for patients, carers/families and/or staff?
     b. If not, would you be able to if needed? What would that involve?
13. What would you identify as the benefits of the Virtual Ward compared to standard care/practice?
     a. For patients, and for staff.
14. What would you identify as the risks of the Virtual Ward compared to standard care/practice?
     a. For patients and for staff
15. What features of the Virtual Ward would you identify as key to its success?

Monitoring, evaluation and improvements

16. Have you been able to use monitoring data and other forms of routinely collected data to inform/improve treatment or the care provided?
17. How were success criteria agreed and monitored?
18. What are the success criteria for the Virtual Ward?
19. Do you have any suggestions or recommendations to improve the Virtual Ward?

Concluding questions

20. Is there anything else you feel I have not asked, that you would like to tell me about?

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Appendix 5: Qualitative data collected in person level dataset

Patient Demographic	Admissions Data	UEC Attendance	Outpatient Attendance	VW stay
Five-year age group	Patient ID (consistent across datasets)	Patient ID (consistent across datasets)	Patient ID (consistent across datasets)	Patient ID (consistent across datasets)
Gender	Admission reason (HRG)	Attendance reason (HRG)	Outpatient attendance date	Date of admission to VW
Ethnicity	Diagnosis on admission (ICD-10)	Diagnosis on admission (ICD-10)	Outpatient attendance type	Duration of stay on VW
Patient weight / BMI (VW only)	Admission date	Attendance date	HRG code	Referral source
DECAF score	Discharge date	Discharge date	Speciality	Number of telephone calls to patient while on VW
Patient LSOA (Lower Layer Super Output Areas)	Discharge destination	Discharge destination	-	Number of virtual calls to patient while on VW
Registered GP practice	Length of stay	Length of stay	-	Number of F2F visits to patient while on VW
-	Treatment / intervention / procedures (OPCS)	Treatment / intervention / procedures (OPCS)	-	Discharge destination from VW
-	Readmission flag (within 30 / 60 / 90 days)	-	-	Onboarded to pulmonary rehab

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