

## Beneficial Changes Network Case Study: Remote Monitoring



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## Background and project summary

In June 2021, Eastern AHSN was asked by the NHS England/Improvement East of England regional team to complete a rapid review of remote monitoring solutions and virtual ward implementation.

The use of at home remote monitoring has accelerated rapidly during the Covid-19 pandemic, with dedicated funding and 'how to' guidance made available for Covid-19 virtual wards using pulse oximetry at home. Integrated Care Systems are now looking at where virtual wards can be used to safely support patients with a range of conditions to avoid hospital (re)admissions and to support early discharge from hospital.

In response to this request, Eastern AHSN developed an implementation support pack that aimed to provide:

- 1) An overview of the evidence for remote monitoring across three clinical pathways: heart failure, respiratory (COPD & pneumonia) and pre-elective and post-operative care;**
- 2) Learning from implementation of remote monitoring pathways in the East of England and;**
- 3) A summary of remote monitoring devices.**

ARC East of England played a key role in reviewing the rapid evidence review conducted by the AHSN and providing valuable feedback regarding how it could be strengthened.

The support pack was launched at a regional workshop in September 2021, which brought together national and regional policy-makers as well as those with expertise in implementing remote monitoring across the region. The workshop was facilitated by the AHSN and attended by a wide range of stakeholders across the region, including ARC East of England colleagues.

This work served as the precursor to the collaborative AHSN/ARC National Insights Prioritisation Programme (NIPP) project, which seeks to evaluate the impact of various remote monitoring pathways across four ICSs. The NIPP project proposal received the highest level of approval from the reviewing panel, which would not have been possible without this work.

This work was funded by the National Institute of Health Research and supported by NHS England as part of the Beneficial Changes Network programme.

## What we did and project results

### Evidence review

We focused on reviewing the most recent reviews, systematic reviews and meta-analyses in relation to heart failure, COPD, pneumonia and surgery. While some studies reflect on the Covid-19 context, others were conducted prior to the pandemic, and therefore recommendations did not always take into account the increased need for remote care.

The implementation support pack sets out further detail on the search strategy and the papers reviewed in each area. Below we set out the headline findings.

# Heart failure (HF)

## Remote monitoring for patients with HF mainly consists of:

- Non-invasive monitoring of pre-specified parameters, such as daily weight, blood pressure, ECG, pulse oximetry, subjective assessment of HF symptoms or depression levels and medication adherence.
- Structured telephone support.
- Invasive monitoring by implanted devices with the sole function of remote patient monitoring (measuring proxies of left ventricular filling pressures, such as right ventricular pressure, pulmonary artery pressure and left atrial pressure).
- Invasive monitoring by cardiovascular implantable electronic devices (CIEDs), such as ICDs or cardiac resynchronisation devices (CRT-D) (see Planinc, Milicic and Cikes, 2020).

Remote monitoring for HF shows promise. There is an abundance of clinical evidence, some of which shows that remote monitoring can reduce HF-related hospitalisations and mortality (see, for example, Bekfani et al., 2020). However, not all results are positive. Much of this may be down to the wide range of parameters and devices that can be used to monitor HF – therefore leading to wide variation in trial design (Planinc, Milicic and Cikes, 2020).

The European Society of Cardiology (ESC) provided limited recommendations for monitoring in its 2016 guidelines for the diagnosis and treatment of acute and chronic HF. Monitoring of pulmonary artery pressure (PAP) using a wireless implantable haemodynamic monitoring system in symptomatic patients with reduced or preserved ejection fraction (EF) and a previous HF hospitalisation was recommended for the risk reduction of recurrent HF hospitalisations (see Planinc, Milicic and Cikes, 2020).

Multiparameter monitoring by ICD for improvement of clinical outcomes in symptomatic patients with left ventricular EF (LVEF)  $\leq 35\%$  was also recommended (see Planinc, Milicic and Cikes, 2020).

All other monitoring methods were considered to lack sufficient evidence to support recommendation, based on different clinical trial results and lack of uniformity (see Planinc, Milicic and Cikes, 2020).

However, the updated 2021 guidelines state that non-invasive home-telemonitoring may be considered for patients with HF in order to reduce the risk of recurrent cardiovascular and HF hospitalisations and cardiovascular death (McDonagh et al., 2021). This is in line with a recent systematic review, which found that although there is inconsistency in the reported effects of non-invasive remote monitoring strategies on all-cause mortality, all-cause hospitalization, and HF-related hospitalizations, the overall combined results demonstrated a small beneficial effect on the overall survival, HF-related hospitalizations, and adherence to the guideline-recommended pharmacological therapy (Veenis et al., 2021). The authors conclude that due to its simplicity, non-invasive nature, and relatively low costs, non-invasive remote monitoring is desirable and to be recommended in lower risk or less symptomatic chronic HF patients (Veenis et al., 2021).

This is supported by another Cochrane review that found both non-invasive remote monitoring and structured telephone support were shown to reduce all-cause mortality (Inglis et al., 2015).

Monitoring using multiple parameters has generally shown the most positive results (Senarath et al., 2021).

## **The following points should be carefully considered ahead of implementation, as these questions remain unanswered by current evidence (see Bekfani et al., 2020):**

- 1) Which patients should be monitored?
- 2) Should monitoring be invasive or non-invasive? Invasive is more effective but it is more costly and not without risk.
- 3) Which parameters should be used? Using multiple parameters is more effective.

- 4) When should monitoring be done? Should it be at onset of HF or after an episode of decompensation? Cost should be weighed against risk.
- 5) How long should monitoring be done for? Should it only be in high-risk periods or life long? Again, cost should be weighed against risk.
- 6) Who is responsible for reviewing results? There are some concerns about increasing workload. Reviewing results must be appropriately built into roles and responsibilities. It is also important to ensure there are protocols in place for data to be acted upon – translating remote monitoring into remote management.
- 7) How should patients be engaged? Implementing mechanisms that both monitor and encourage daily measurement along with staff enthusiasm toward using the system can help improve adherence. Lack of patient engagement may lead to missing data or inaccurate results.
- 8) How often should measurements be taken?
- 9) Who will cover the additional costs? Efficiency savings may accrue to acute settings, although a system-wide approach (for example through ICSs) may be appropriate. Efficiency savings may differ depending on whether a block contract or payment by results is in place.

## Chronic Obstructive Pulmonary Disease (COPD)

**Remote monitoring in COPD has been applied to prevent exacerbations, establish a self-management program, improve physical activity, provide education, and deliver pulmonary rehabilitation (see Barbosa et al., 2020).**

Frequently, telemonitoring devices are used to collect parameters such as vital signs, symptoms, oxygen saturation, electrocardiography (ECG) and/or lung function tests and transmit them to online devices.

Wearables have also been used to try to increase physical activity in people with COPD (see Pericleous et al., 2019).

Studies show some positive results for remote monitoring for COPD – including in reducing A&E attendances and hospital admissions (see, for example, Barbosa et al., 2020; Hong and Lee, 2019). But clinical trials vary significantly in design and there is very little conclusive evidence on the benefits (particularly in a pre-Covid context). In general, results are very mixed and evidence on cost-effectiveness is lacking (Barbosa et al., 2020).

NICE guidance for diagnosing and managing COPD in over 16s recommends not using routine telehealth monitoring of physiological status as part of management for stable COPD. This is because they found telehealth monitoring does not improve quality of life or reduce hospitalisations for people with COPD, and it leads to higher costs. However, the committee did not want to prevent telehealth monitoring being used for specific reasons that were not covered in the evidence they reviewed, such as short-term monitoring following hospital discharge.<sup>1</sup>

**The following implementation points should be considered:**

- Evidence on the benefits of remote monitoring for COPD patients is not conclusive and therefore any implementation needs to be considered carefully, with particular attention given to the risks.
- COPD patients are a very heterogeneous population with variable baselines and different phenotypes. Exacerbations are also highly variable. This can make accurate monitoring difficult (Barbosa et al., 2020). One paper suggested future research could use predictive algorithms to account for individual differences – with an aim to reduce false-alerts, patient anxiety and lack of compliance (Buekers et al., 2018, referenced in Barbosa et al., 2020).

- Patient engagement is particularly important where patients are taking and reporting their own measurements. Patients' age, education, experience in technological devices, cognitive, motor and visual abilities or deficits, and their families and home environment should all be taken into account (Barbosa et al., 2020).
- As with heart failure, consideration needs to be given to who will review the results – particularly given concerns about increasing workload – and this should be built into roles and responsibilities. Again, protocols should enable active management. In the future, there is potential for monitoring parameters to be adjusted remotely, allowing for individualised care (see Kruse et al., 2019).
- Particular consideration needs to be given to who will cover the costs of monitoring for COPD, given the lack of evidence around cost-effectiveness (see Kruse et al., 2019).

<sup>1</sup>Chronic obstructive pulmonary disease in over 16s: diagnosis and management NICE guideline [NG115]Published: 05 December 2018 Last updated: 26 July 2019

## Pneumonia

**Our review revealed one systematic review about remote monitoring specifically for Covid-19, rather than pneumonia more generally. All of our findings are from that review (Vindrola-Padros et al., 2021).**

The review highlighted some positive outcomes including low mortality rates and high patient satisfaction.

One article presented findings on reduction in length of stay, calculated at 5 days fewer per patient.

But the review could not reach conclusions in relation to patient safety and the degree to which remote home monitoring models can conclusively identify cases of deterioration at an earlier stage in the disease trajectory. Much of this was due to lack of standardised reporting and not using comparators.

The review found remote home monitoring needed to be seen as an approach to maintain patients safely in the right setting rather than as an admission avoidance model.

### **The review highlighted the following implementation considerations:**

- It is important to consider remote home monitoring models as an approach to maintain patients safely in the right setting.
- The use of apps for monitoring allowed the follow-up of a higher number of patients (compared to paper-based models), but some of the studies indicated that models based on telephone calls were more inclusive (i.e. including patients without internet access or technological literacy).
- Patient/carer training was identified as a key determining factor of the success of these models.
- Coordination between primary and secondary care facilitated implementation.
- Primary care led models were considered, in some cases, as more adaptable to evolving patient and system needs, and easier to replicate in contexts with limited secondary care access and capacity.
- A few models integrated mental health and social care support during and after the monitoring intervention.
- Issues with using pulse oximetry were also highlighted such as: patient physiological measures needed to be recorded several times a day to correctly identify cases of deterioration and pulse oximetry readings were made less accurate by a range of factors including nail polish, severe anaemia and poor cardiac output.

## Remote monitoring in surgery

### **In the literature we reviewed, the majority of evidence relating to telemedicine applications in surgery did not concern continuous remote monitoring.**

In orthopaedics, the literature often related to patient examinations, interpretation of imaging, post-operative care provision, diagnosis, and patient-reported outcomes follow-up.

In other areas of surgery, much of what we reviewed related to virtual consultations.

However, there are some examples of remote monitoring being used to monitor physical activity pre- and post-intervention and to support post-intervention care more generally – such as enabling remote monitoring of surgical wounds via images taken by digital cameras (see, for example, Ajibade et al., 2020).

The literature we identified was diverse and related to different specialties, procedures and monitoring approaches, making it difficult to draw out key themes. It may be that this topic is too broad for the approach and search strategy we adopted.

One paper particularly highlighted the potential of physical activity monitoring pre and post-orthopaedic surgery to provide clinicians with a fuller picture of the patient's status and to support patients to achieve their physical activity targets (Sliepen et al., 2020).

And another found combinations of regular virtual consultations and remote monitoring of clinical parameters are feasible for cardiac surgery patients and would be useful to assess and triage before surgery. Remote monitoring could also be particularly useful in managing postoperative complications, to help reduce ambulatory visits and rehospitalizations for vascular surgery patients (Ajibade et al., 2020).

#### **Implementation considerations we identified were:**

- When deploying remote monitoring to monitor physical activity it is important to identify the desired parameters and choose sensors that can measure them with a high level of precision. Wear location, data analysis skills and tools, customer support, battery life and the evidence for the sensor should all be considered (see Sliepen et al., 2020).
- Studies suggest that mobile phone apps, online surveys, or online materials for consent are some of the best ways to improve perioperative patient communication and patient education (see Kolcun et al., 2020).
- It is important to consider the approach in order that it is useful and inclusive. Some studies have asked for text message follow-ups from patients and others have used telephone calls. As above, physical activity monitoring can draw on sensors (Sliepen et al., 2020).

## Lessons from implementation in the Eastern region

Significant progress has been made in the East of England to implement non-Covid virtual wards across a range of clinical pathways, including heart failure, respiratory, pre- and post-operative surgery, palliative care, oncology and stroke medicine.

Eastern AHSN carried out a deep dive with implementation leads in Hertfordshire & West Essex, Norfolk & Waveney and Suffolk & North East Essex, to understand the process they have been through to establish virtual wards, and the key lessons from implementation.

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### Hertfordshire Community NHS Trust

Across Hertfordshire and West Essex Integrated Care Partnership, a Virtual Hospital Operational Group has been established, with distinct task and finish groups for each clinical pathway reporting into it. There is representation from across the system including primary, secondary and community care, and the voluntary sector. This builds on the Covid-19 virtual ward which went live in February 2021.

The pathways that have been developed are for heart failure, respiratory (COPD and pneumonia), infections (recurrent UTI and cellulitis) and pre- and post-surgery. Data for bed-days, readmissions and length of stay has been analysed and discussions with lead clinicians have determined which patients could benefit most from remote monitoring. As an example, data for readmissions of patients with recurrent UTI was analysed showing 24 patients accumulated 326 bed days over 12 months. Remote monitoring at home could enable these patients to avoid readmissions by monitoring hydration, frequency of urination, urine colour and body temperature, and checking in with patients virtually.

An opportunity for pre-op support identified as a result of mapping the 'as is' pathway against a 'future state', is for those requiring a pre-op orthopaedic assessment. Better patient information and self-assessment resources, alongside remote monitoring for up to six weeks before surgery, could significantly reduce cancelled surgeries.

The heart failure pathway will accept referrals from primary care, community services, secondary care and from patients, where a) they are previously known to the service, b) they are experiencing an exacerbation of their conditions, c) the service is named on their self-management action plan, and d) the re-referral is within 6 months of discharge from the service.

Two suppliers have been procured to support the remote monitoring pathways (Doccla and Masimo) including providing the devices, onboarding patients and providing a dashboard for clinicians to monitor patient data and admissions & discharge data for the virtual ward.

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### Top Tips

*Ensure buy-in from across your system by mapping which organisations need to be involved, and getting sign off for attendance at key planning and implementation meetings.*

*Appoint a clinical lead and dedicated manager for each workstream or pathway.*

*Include operational staff from the outset (e.g. those managing waiting lists, theatre time, discharge and targets). They are key to identifying any obstacles and driving forward pathway change.*

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## East Suffolk and North Essex NHS Foundation Trust

Pathway development began before the Covid-19 pandemic, and by February 2021 was running in parallel with setting up Covid oximetry @home. A transformation lead worked with the multidisciplinary, dedicated admissions avoidance team to look at options to manage patients safely at home to reduce hospital admissions, and save travel time to and from patients (monitoring could be 2-3 times per day per patient across large rural areas).

ESNEFT provides both acute and community services which helped facilitate setting up virtual wards across different community pathways. West Suffolk had already procured the remote monitoring solution Current Health and shared positive feedback, so this was adopted by ESNEFT. The admissions avoidance team also had good links with other community nursing teams.

Virtual wards have been set up for respiratory, particularly those patients having exacerbations and who require monitoring of response to antibiotics or oxygen weaning; heart failure, for patients that require up-titration and optimisation, and to enable quick decisions if patients are deteriorating; and admissions avoidance which tends to support elderly and frail patients who require close observation.

Referrals can be made by GPs, out of hours, ambulance, discharge team, 111, social care and patients, carers or relatives to a care coordination centre, which then alerts the clinical team that an assessment for remote monitoring is needed.

All 3 pathways have been live since June 2021. Clinical teams have been set up on the virtual dashboard for patient monitoring, nurse training with Current Health has been completed and remote monitoring devices have been issued. There is an easy to use tablet for patients to contact clinicians, and a small wearable device for continuous monitoring of respiratory rate, heart rate, movement, and saturations. The wearable can also connect to various other devices via Bluetooth such as weighing scales and a blood pressure cuff.

The tablet can be used to message or video call the patient and offer surveys or questions about their daily wellbeing. The devices are monitored (not necessarily in real time) by the relevant community teams and will also alert a clinician if the reported observations start to fall outside of set parameters.

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### Top Tips

*Keep pathway development simple, involving a small number of clinicians for each pathway and keeping documentation to a minimum.*

*Identify a senior operational lead to bring community nursing teams on board and champion the project.*

*Ensure that your medical devices governance team is aware of the project and has early sight of the remote monitoring system you are planning to procure.*

*Where applicable, factor in staff travel time saved as part of your business case.*

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# Norfolk and Norwich University Hospitals NHS Foundation Trust

In February 2021 a Covid-19 virtual ward began admitting NNUH patients by establishing a clinical team to mirror a hospital ward. Staff who were shielding or unable to work in the physical hospital were quickly engaged in setting up the virtual ward pathways. As well as providing capacity from experienced professionals, this approach had the added benefit of supporting staff mental health and wellbeing. The service is located within the Digital Health arm of the trust.

The company Current Health was procured to provide the remote monitoring devices, tablet for communication with patients, and clinical dashboard with clinical alerts depending on the parameters set by clinicians at the outset. The clinical pathways are gastroenterology, hot gall bladder, awaiting cardiology treatment, pregnant patients with confirmed Covid-19, palliative care, and awaiting treatment or diagnostics at other centres.

The service offered by the NNUH is a fully staffed virtual ward offering 24/7 monitoring of observations and daily video calls to patients. There is pharmacy and medicines support, a daily medical review and coordination of care with community services. Home intravenous therapy can also be offered.

Individual specialties can identify anyone they think might be suitable for the virtual ward, using the Standard Operating Procedure for inclusion and exclusion criteria. The model has enough leeway to allow for a range of different specialties. The Senior Matron or deputy will speak to the patient and clinician before accepting the referral, and can flex the package of support available. The remote monitoring kit is set up ready for the patient on transfer from the hospital to the virtual ward. The lead clinician will set individual parameters for each patient so that any issues are flagged at the right time via the remote monitoring alert system. Patients remain under the care of the consultant and are therefore not discharged but transferred to the virtual ward.

The trust has set up its own dashboard via BI Analytics to draw together the number of patients on each clinical pathway, bed days saved and patient satisfaction data.

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## Top Tips

*Make sure your definition of a virtual ward is clear for all partners along with which patient groups can be cared for remotely.*

*Address accountability at the outset through clinical safety mechanisms and clear delineation of roles and responsibilities.*

*Use a provider that offers technical support for patients to avoid overloading your service desk.*

*Engage community services to improve your value proposition.*

*Winning over hearts and minds is likely to be more of a challenge than establishing the operational process.*

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## Remote monitoring solutions

The following table summarises a selection of the remote monitoring solutions on the market that are applicable to clinical pathways for heart failure, respiratory (COPD or pneumonia) and pre- and post-surgery.

In most cases, the company has approached one of the 15 AHSNs in England to ask for advice or to plan for implementation. Doccla, Masimo and Current Health are companies whose services have already been procured by trusts in the Eastern region.

In May 2021, the Department for International Trade (DIT) published 'The First 100' Digital Health Playbook which lists 100 UK digital health companies with expertise in a range of areas, including remote monitoring, self-care, triage and pre-assessment, screening and diagnostics, and data analysis.

Company	Product	Website
Doccla	Multiple	<a href="http://www.doccla.com">www.doccla.com</a>
Masimo	Multiple	<a href="http://www.masimo.com">www.masimo.com</a>
Current Health	The Universal Patient Management Platform	<a href="http://www.currenthealth.com">www.currenthealth.com</a>
Dignio	Dignio Connected Care	<a href="https://dignio.com/en/">https://dignio.com/en/</a>
Solcom Ltd	Whzan	<a href="http://www.whzan.uk">www.whzan.uk</a>
Rinicare	PRIME	<a href="https://rinicare.com/solutions/remote-monitoring">https://rinicare.com/solutions/remote-monitoring</a>
Isansys Lifecare	The Patient Status Engine	<a href="http://www.isansys.com/en/Patient-Status-Engine">www.isansys.com/en/Patient-Status-Engine</a>
InHealthcare Ltd	Multiple	<a href="http://www.inhealthcare.co.uk">www.inhealthcare.co.uk</a>
Spirit Digital Ltd	CliniTouch Vie	<a href="http://www.spirit-digital.co.uk">www.spirit-digital.co.uk</a>
Qardio Inc	Multiple	<a href="http://www.qardio.com/qardiomd-remote-monitoring-devices">www.qardio.com/qardiomd-remote-monitoring-devices</a>

## How did we involve people?

Conducting and finalising the evidence review was a collaborative effort between the ARC and the AHSN. The AHSN devised the search strategy; ran the searches; reviewed the literature and identified key points.

Then, academics and academic clinicians with significant expertise and experience with remote monitoring solutions in the ARC reviewed the learning points from a clinical and academic perspective. They then suggested further literature to review and a range of ways to strengthen the evidence review.

In carrying out the deep dives, Eastern AHSN spoke to a range of people involved with implementing the remote monitoring pathways at the sites in question. This involved in-depth interviews to understand what exactly had been done to implement the pathways and the transferrable learning for other sites looking to implement remote monitoring.

Finally, the regional workshop was particularly collaborative. We asked the Deputy Director of Digital Health at NHSx to outline the national vision for remote monitoring and the support available for systems looking to implement remote monitoring. Next, we asked for NHS England to give an overview of the NHS@home programme and how it is using and evaluating remote monitoring solutions, before hearing from those with experience of implementing remote monitoring solutions in the Eastern region.

The event was attended by over 50 stakeholders across the region.

## What did we learn?

We identified several key lessons in reflecting on the project.

Firstly, one of the reasons the event was so successful is because it tapped into current national and regional policy and placed our work in the context of the wider policy landscape. Ensuring senior representatives from NHSx and NHS England/Improvement gave presentations on their work and how it is anticipated to evolve provided really helpful insight to attendees with regard to future planning and applying the learning from our implementation support pack.

Secondly, the event and slide pack were particularly timely, given the increased focus on remote care during the Covid pandemic. Whilst this meant the work was particularly useful much of the literature did not reflect the Covid context and the majority related to remote monitoring solutions more broadly, rather than virtual wards specifically. Although this was not a problem in this case, it is important to bear in mind the limitations of literature reviews when working at the cutting edge of innovation and new developments in healthcare services.

Thirdly, this work was one of the first examples of project collaboration between the ARC and the AHSN in the Eastern region. The process of engaging with ARC colleagues and gaining their expert review of the materials we produced worked very well. It helped us build excellent relationships and set the foundations for fruitful collaborations. This work provided the basis for the ARC and the AHSN to develop a complex evaluation of remote monitoring pathways across 4 ICSs as part of the NHS Insights Prioritisation Programme. We are also formalising partnership working between the ARC and the AHSN with a number of joint roles, and we are looking to build on this work by developing a clear and transparent process for collaboration across all areas of ARC and AHSN activity. Having this project to demonstrate the skills in both organisations and how we can work together to support project delivery helped us to build relationships and foster goodwill at the early stages of the change process.

## What next?

As noted above, this project laid the groundwork for the joint AHSN/ARC submission to the NHS Insights Prioritisation Programme (NIPP) which seeks to evaluate remote monitoring pathways in 4 Integrated Care Systems (ICSs). These are:

- Pre and post operative pathways for hip and knee replacements in Hertfordshire
- An asthma virtual ward at Northampton General Hospital NHS Trust
- A respiratory pathway at Cambridgeshire Community Services NHS Trust
- A heart palpitations pathway at Mid and South Essex NHS Foundation Trust

This project started in November 2021 and will complete in March 2023, with the production and dissemination of practical, accessible and evidence-based guidance about how to make best use of remote monitoring.

## Find out More

You can find out more about the NHS Insights Prioritisation Programme and our work evaluating remote monitoring pathways at the links below.

<https://www.arc-eoe.nihr.ac.uk/news-insights/news-latest/project-award-improve-remote-monitoring-healthcare>

<https://www.easternahsn.org/about-us/our-projects/remote-monitoring-ics-nipp/>

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## **COPD**

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