University Hospitals of North Midlands NHS Trust

DIGITAL TRANSFORMATION STRATEGY
2019 - 2023

BUILDING ON "RESPONDING TO THE INFORMATION AGE 2014-19"

PROGRESSING CLINICAL DIGITAL MATURITY & HEALTH MANAGEMENT

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January 2019

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INTRODUCTION

In the time since the publication of the "Responding to the Information Age – Information Communication Technology Strategy, there have been significant changes in the wider NHS context, including:

- The NHS Five Year Forward View (5YFV) which has set a radically different direction for the NHS based around the development of locality based Sustainability and Transformation Partnerships
- The Wachter Review, which has set out an overall direction for developing IM&T capabilities to support clinical transformation in the NHS.
- The Carter Review, which has identified a range of opportunities for efficiency savings across the NHS including technology-enabled improvements in administration, pathology and radiology.
- GDPR and the uncertainty over the implications of the new regulations for the NHS.

This document concentrates on Clinical Systems / Services digitalisation, and the move towards Population Health management. There are a number of areas of strategic development that are not integral to this document, that are covered by the preceding iteration of the IM&T Strategy (Responding to the Information Age 2014),, or will be covered by a subsequent Infrastructure specific Strategy.

These areas include:-

- Infrastructure & Licencing
- Mobile and Fixed Devices
- Networking (LAN, WAN, WiFi)
- Cyber Defence
- Modals of Technical support

IMPORTANT NOTE:

This document is delivered in three discreet sections:-

1. **Section One considers the considerable progress made against the preceding strategy "Responding to the Information Age 2014-2019" and examines some of the legislative environmental and systemic changes that create the current NHS**
2. **Section 2 puts forward immediate the strategic IM&T priorities for the Trust.**
3. **Section three puts forward a progression to a proactive Population Health Management environment for the Trust, with indicative examples of application, cost, deployment time line, and resources required to augment.**
    - **This section is concerned with emerging technologies that are changing the way that healthcare is delivered across the world.**
    - **It is very important to recognise that whilst the Trust could be a significant beneficiary of these technologies, the benefits would be limited if they were not implemented in full collaboration with health and social care providers across Staffordshire.**
    - **Most of these technologies could not be effectively deployed without significant process re-design**

1. DIGITAL TRANSFORMATION CONTEXT: A CHANGING LANDSCAPE

1.1 About the Trust

The University Hospitals of North Midlands NHS Trust (UHNM) was created on 1 November 2014 following the integration of University Hospital of North Staffordshire NHS Trust (UHNS) with Stafford Hospital from the Mid Staffordshire NHS Foundation Trust (MSFT). Key points of note are:

There are two main hospital sites[1]:

- Royal Stoke University Hospital with 1157 beds, a PFI new build fully opened in 2012
- County Hospital in Stafford with 350 beds opened in 1983 and currently undergoing improvement works.

- The 1,508 beds consist of 1,380 general and acute beds, 97 critical care beds and 91 maternity beds
- UHNM employs around 11,000 WTEs, including 1,100 medical and 2,800 nursing staff
- 17 medical specialities including 8 providing tertiary level care
- Annual turnover in the region of £750M
- Member of the Staffordshire and Stoke-on-Trent STP, known locally as 'Together we're Better'
- Geographically midway between major conurbations of Birmingham and Manchester with significant patient flows out in both directions
- University teaching hospital trust with strong links with Keele University and Stafford University

The UHNM 2025 Vision and Strategy recognises that to fill the NHS-wide funding gap from demand which is growing at 2-3% per annum and with costs increasing by 3-4% per annual requires continuing improvements in productivity through investing in IT and changing working practices. Investing in IT and changing working practices requires capital investment, but can deliver significant financial and non-financial benefits, both recurring and non-recurring.

1.2 Current Status of IM&T Services

This section reports progress against the IM&T Strategy and the current position state of delivery.

Overview

IM&T have had a challenging task over the past 4 years delivering Trust integration and maintaining existing services and while also progressing implementation of the UHNS IT Strategy 2014-19.

Foundations have been laid and key enablers for the strategy have been put in place. This is reflected in the Trusts self-assessment against the Clinical Digital Maturity Index where The Trust have progressed over the past 3 years from 119th to 34th out of 239 Acute Trusts, with a total score of 225, averaging 75% across Readiness (82%), Capabilities (54%) and Infrastructure (89%). This reflects good progress with Infrastructure and Readiness to enable and exploit IM&T.

Current Position and Issues for the IM&T Strategy

See Table 1 below.

Table 1. Current position and issues impacting on Digital Transformation strategy

Level	Current position	Issues
Management	• IT functions of MSFT and UHNS have been merged into a centralised UHNM IM&T Function, including the successful exiting from the MSFT Health Informatics Services (HIS) contract. • Centralisation of Divisional IT Teams for Pathology, Radiology and Pharmacy completed.	• Support hours may need to be extended to support 7 day services and/or 24/7 support as new clinical systems come on stream.
Foundation	• Desktop estate of over 7,000 devices refreshed, now primarily Windows 7 with Windows 10 devices being piloted as part of Digitisation. • Server infrastructure refreshed, now primarily virtualised. • Deployment of a unified resilient Trust email system. • Patient and guest Wi-Fi made available across the Trust. • Refreshed infrastructure proven resilient, as demonstrated by maintaining services through the recent Wannacry Cybersecurity incident. • Single Master Patient Index shared across both Hospital Sites • SystemC Medway PAS upgraded to version 4.8. • EDMS implementation completed. • Video conferencing installed between sites to facilitate Virtual meetings. • Single Sign On Smartcards solution being deployed to 3,000 staff across both sites. Needs to be extended to all 6,000 Clinical staff.	• Desktop estate is ageing, some devices are 5+ years old. Need to refresh approx. 25% every year at annual cost of approx. £1.45m. • Device estate expected to increase significantly as digitisation progresses and workforce becomes more agile. • Corresponding impact on network bandwidth. • Replace N3 network and Wide Area Network between sites before 2019/20, noting loss of N3 subsidy. • Wi-Fi and Mobile Phone connectively significantly restricted at Royal Stoke Hospital due to the reinforced concrete construction of the majority of the building. • Infrastructure software approaching sunset/contract end date • Digitisation, increasing demand for mobile working, and potential loss of NHS Microsoft licencing bringing pressure to upgrade to Office365. • Replace existing Front End BI reporting tool (Dundas BI) to enable more flexible analytics by end users. • Reliance on 24/7 available and resilient Infrastructure set to increase as digitisation drives adoption of clinical systems. • The fixed Wi-Fi and VOIP telecommunications network infrastructure at Royal Stoke Hospital is managed by a 3rd party as part of the 30 year PFI contract.

Level	Current position	Issues
Enabling	• Clinical Information Systems centralised around an internally developed Clinical Portal – iPortal. • Departmental Systems rationalised and unified across hospital sites, including Radiology, Pathology, Pharmacy, A&E and Maternity. • Patient Data Management System (PDMS) implemented in Critical Care, a strategic objective outlined in the UHNM 2025 Vision. This enables information to be automatically recorded from bedside patient monitoring equipment and infusion pumps, and displays the information on bedside terminals. • SystemC contract recently extended to cover EPR Phase 2 clinical modules • Digitisation of Outpatients and Inpatients in progress, to remove the need for the paper case notes over time. • MediSec eDischarge system implemented to get letters to GPs with 48 hrs. • Digital Dictation (Winscribe) introduced across both Hospitals.	• iPortal is an in-house development and support required will increase as the number of clinical systems to be integrated grows with the EPR program. iPortal request list greater than the current resource capacity can deliver. In time this may become unsustainable. • Many core Clinical Information systems need routine replacement. These include LIMS, CRIS, PACS, Theatres, and Order Comms.
Exploiting	• Clinical Information Systems deployed, including • Voice Recognition • Vitalpac – Electronic Observations • NerveCentre to support out of hours Nursing and Clinical handover and escalation • CareCentric, to enable A&E access to GP patient records across STP • Saviance patient self-service kiosks • iPortal access given to GPs to enable access to UHNM patient records. • SystemC contract recently extended to cover EPR Phase 2 additional clinical modules. • £1.7m funding has been secured from the NHS Estates and Technology Transformation Fund (ETTF) to progress the delivery of an Integrated Care Record to support the Digital Workstream of the STP.	• Increasing levels of Clinical systems adoption will require a strengthened Clinical Informatics function. •

1.3 The Evolving Strategic Content

In the years since the publication of the "Responding to the Information Age – Information Communication Technology Strategy" there have been significant changes in the wider NHS context. The following aspects are the principal drivers, and the implications of each are covered in more detail in the subsequent sections:

- The NHS Five Year Forward View (5YFV) which has set a radically different direction for the NHS based around the development of locality based Sustainability and Transformation Partnerships
- The Wachter Review, which has set out an overall direction for developing IM&T capabilities to support clinical transformation in the NHS
- The Carter Review, which has identified a range of opportunities for efficiency savings across the NHS including technology-enabled improvements in administration, pathology and radiology
- GDPR and the uncertainty over the implications of the new regulations for the NHS
- NHS England and NHS Digital guidance on developing digital services.

1.3.1 The Five Year Forward View

The NHS Five Year Forward View (2015) set out a vision of how NHS services need to change to meet the needs of the population. It argued that the NHS should place a far greater emphasis on prevention, integration of services, and putting patients and communities in control of their health.

Some services currently delivered from hospital, such as outpatient clinics, diagnostics and management of long-term conditions are moving into community hospitals, homes and other settings as people receive care much more locally

1.3.2 The Wachter Report

The Wachter Repor[2] (2016) set out recommendations and principles for digitising acute care in the NHS. The report effectively subsumed a number of previous policy documents published in the wake of the cancellation of NPfIT, including the 'Information Revolution' and Paperless 2020. Among the principles are:

- The need to ensure Trusts digitise for the correct reasons, in particular ensuring digitisation supports the wider sustainability and transformation agenda. This is being achieved through the development and implementation of local digital roadmaps.
- It is better to get digitisation right than to do it quickly
- Interoperability should be built in from the start – which also implies the need for a clear technical architecture against which solutions should be deployed.

Wachter also recommended the linking of national funding to a viable local implementation/ improvement plans, defining four categories in which Trusts could be placed and recommending support for a number of 'Global Digital Exemplars (GDE). NHS England has identified and awarded funding to an initial 16 digitally advanced acute trusts[3], through funding and international partnership opportunities. The intention is for GDEs to be part of a new procurement framework with their IT suppliers to sell their solutions to non-GDE Trusts. Thus ending the need at a national level for multiple competitive procurements by Trusts.

The Acute Global Digital Exemplars are now partnered with fast followers – trusts who will support the spread of best practice and innovation. A total of 18 fast followers were awarded up to £5M in 2017. Both GDE and fast follower funding must be match funded by the Trust.

The shift to GDEs presents a significant challenge for the Trust, as most central funding for IM&T has now been channelled into the GDE Trusts leaving others, like UHNM, having to fund IM&T improvements on their own. There is some possibility that the Trust could apply for funding in a subsequent round of fast followers although the conditions for this and funding involved are uncertain at this stage.

1.3.4 Carter Report

Lord Carter's report for the Department of Health titled "Operational productivity and performance in English NHS acute hospitals" identified a number of unwarranted variations in costs and made 15 recommendations designed to tackle this variation and help trusts improve their performance to match the best. There are a number which are directly linked to IM&T.

1.3.4 Population Health Management

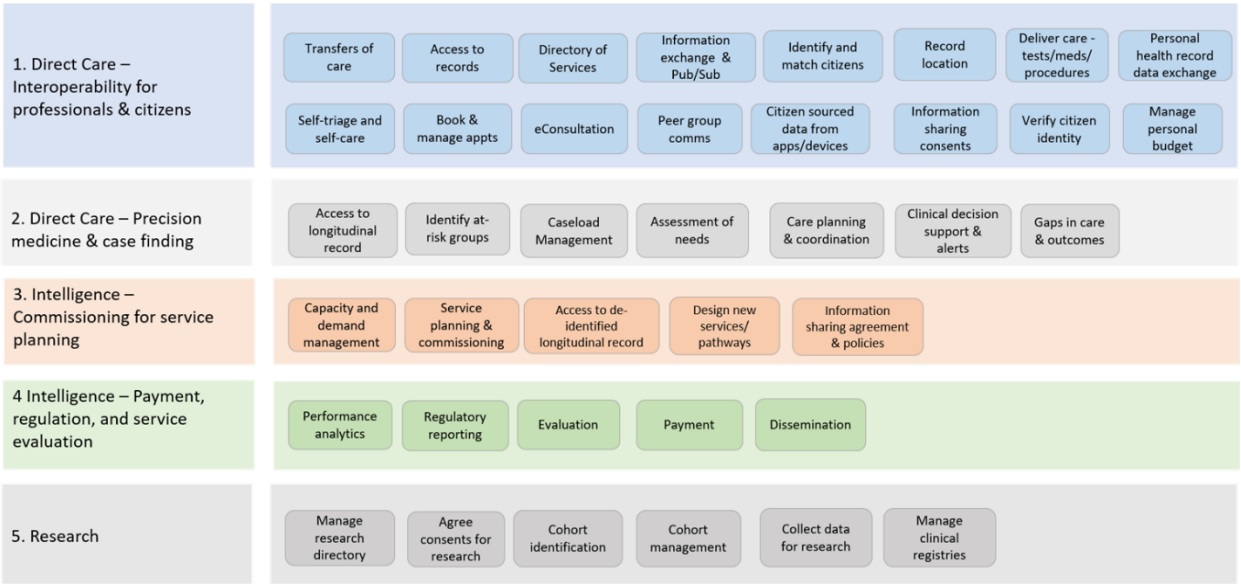
One of the most significant aspects of the Five Year Forward View is the development of new care models aimed at improving services provided to whole populations. Primary and Acute Care Systems (PACS), Multispecialty Community Providers (MCPs), Enhanced Health in Care Homes (EHCHs) and Acute Care Collaborations (ACCs) all focus on the Triple Aim of improving the health and wellbeing of local communities, providing a better experience of care for patients, and delivering lower per capita cost for the taxpayer.

To achieve these aims, the Trust in collaboration with the STP needs to use data to understand the needs and experiences of the population, to target preventive care and other initiatives most efficiently, and to monitor improvements.

To use data in these ways there is a need to invest in new resources such as patient-level population datasets and capacity command centres. This will require skills and expertise that have traditionally been found on the commissioning, rather than the provider, side of the health service – skills such as actuarial analysis, predictive modelling, population health analytics and cost accounting.

For the Trust, this will require sharing of patient level information for both direct care and case finding / risk stratification, as well as operational information shared with partners to enable the most effective deployment of resources.

NHS England is developing a national technical architecture to support the sharing and use of information envisaged in the 5YFV. The architecture defined 5 levels of information use as illustrated below.



NHSE is also developing a design guide which outlines options for achieving the proposed levels of information sharing. While this principally applies to information sharing at an STP or regional level, the concepts are equally applicable to acute hospitals

In addition, data analytics is typically based on an archive architecture to avoid analysis impacting on operational ICT performance, and with a degree of anonymization (aggregation) and pseudonymisation to protect patient confidentiality. Population health will involve establishing shared access to data to enable a range of applications including risk stratification.

1.3.5 Staffordshire and Stoke-on-Trent STP

The Staffordshire and Stoke-on-Trent STP, marketed under the “Together We’re Better” branding, is “designed around Clinical Priorities, Driven by Patient Benefits” and through collaboration, co-production and collective ownership across partners has engendered a sense of “The Whole is Greater than the Sum of its Parts”, and a commitment to delivering new models of care across existing organisational boundaries.

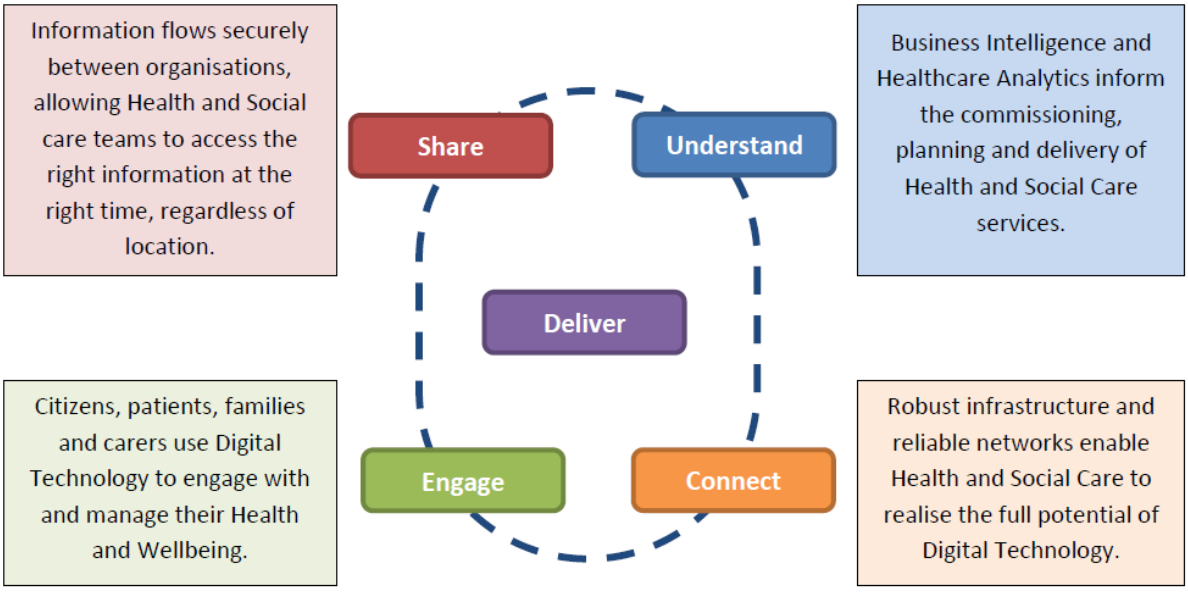
Digital Technology is a key-enabler of this transformation programme, and through the better use of data the STP aims to:

- Support individuals to live healthier lives, manage their own health and well-being
- Reduce the demand on local services.
- Transform the quality and cost of Health and Social Care
- Close the finance and efficiency gap

- Improve patient experience

1.36 The STP Local Digital Roadmap

The LDR sets out the overall plan for sharing and using information across the STP and covers 4 following core components, underpinned by 'Delivery':



The 'Delivery' component of the LDR vision includes a Digital Workstream covering 4 core delivery programmes and 5 Enabler Workstreams. These are based around delivering 10 Universal Capabilities grouped into 4 themes linked to enabling digital capabilities including an STP wide Integrated Care Record:

2. BUILDING ON THE FOUNDATIONS – PROGRESSING CLINICAL DIGITAL MATURITY

Delivery of the Trust preceding strategy has delivered a digital platform for the Trust that is a combination of Foundation Infrastructure and enabling Administration systems, technical innovation and clinical decision support systems. This section puts forward immediate the strategic IM&T priorities for the Trust to further enhance the clinical digital maturity of the organisation, to support clinical productivity, patient safety, quality of care value for money and financial return on investment..

2.1 Digitalising Clinical Notes

The current approach to digitising clinical notes is based on a federated architecture with a 'Core EPR with to 'best of breed' departmental systems and point clinical decision support applications. These are currently brought together into a single clinical view through a portal solution (iPortal).

The core EPR and PAS solution is the Medway solution from System C, who are a participating Supplier in NHS England's Global Digital Exemplar programme. The System C Medway PAS contract was originally due to expire in March 2020, and has recently been extended until 2022 to include delivery of the following modules:

- PAS
- A&E
- Theatres, replacing Ormis with BlueSpier
- ePMA - Electronic Prescribing and Medicines Administration module.
- CareFlow e-observation model (previously Vitalpac) to be integrated with the Ward Information System (WIS) for real time escalation of MEWS and integration into iPortal..
- Clinical Communications via CareFlow Connect
- Ward Order Communications and Results Reporting
- Integration with the national Patient Demographics Service (PDS) and Electronic Referrals Service (ERS)

Indicative milestones for IM&T programme, including EPR Phase 2:

Project	Solution	Milestone
Outpatients Digitisation		April 2018
Inpatients Digitisation		April 2019
Ward based Order Communications and Results Reporting (WOCRR)	Medway WOCRR	April 2019
Theatres (Requires CSC Ormis contract extension beyond April 2018)	Medway Bluespier	Nov 2018
Electronic Observations (eObs)	SystemC eObs	June 2018
Electronic Prescribing and Medicines Administration (EPMA)	Medway EPMA	TBC
Patient Demographic Service (PDS)	Medway PDS	2018/19
iPortal Replacement		2021/22
ED (A&E)	Ideagen PatientFirst	Nov 2017

While SystemC is not yet a fully integrated enterprise EPR solution, it is being developed as part of the GDE programme by University Hospitals Bristol and the Whittington Hospital has recently been awarded Fast Follower Status.

The GDE solution is intended to include a full suite of integrated mobile, tablet and desktop clinical applications for use in hospital and across care communities. Functions include clinical noting, assessments, orders, results, prescribing and decision support as well as access to shared care records, multi-disciplinary care plans, patient portal, population health, remote patient management and new models of care. These new models of care applications transform the way services are provided, using patient portals and wearable devices to connect patients with clinicians and to help Trusts manage patients remotely.

2.2 Pathology

The Carter recommendations on Pathology had three main themes:

- Improve quality and patient safety
- Improve efficiency
- Identify mechanisms for delivering change.

The key method for realising these aims was identified as service consolidation through establishing NHS Pathology Networks to reduce variation in quality and cost. Within the region UHNM is the 'hub' Pathology site with Mid Cheshire and East Cheshire acting as 'spokes' within the locally established pathology network.

2.2.1 Laboratory Information System (LIMS) refresh

A LIMS is a Laboratory and Information Management System with features that support a modern laboratory's operations. Key features include, but are not limited to, workflow and data tracking support, flexible architecture, and data exchange interfaces, which support its use in regulated environments. The features and uses of a LIMS have evolved over the years from simple sample tracking to an enterprise resource planning tool that manages multiple aspects of laboratory informatics.

The Pathology department need a new LIMS system as the current system (Clinisys Labcenter) is approaching end of life. It is 15+ years old. In addition it is no longer meeting the needs of the organisation. The legacy platform is no longer fit for purpose across a range of areas .From 2021 the vendor will look to significantly reduce the support options.

A new LIMS will realise quality and efficiency gains, reduce lead times, increase capacity, maximize economies of scale as well as enable new capabilities. For example there is an increasing need to share results between laboratories within the network and with other specialist laboratories. A new LIMS would also support enhanced electronic results sharing with the electronic patient record and with GPs.

The LIMS replacement project is in the current work pipeline and the Trust are actively looking to secure funding. The project would be undertaken in collaboration with Mid Cheshire (also using the legacy Clinisys platform) and as such would act as an enabler for broader network consolidation.

Strategic Direction

A new LIMS system directly supports the strategic direction of the Pathology department. It will increase capacity of the laboratory, reduce lead times, over time reduce the cost of performing diagnostics and enable more streamlined results reporting. Specifically further automation of manual order and results workflow will enable better tracking of samples and improve results reporting. This will also increase laboratory capacity and maximise economies of scale by eradicating manual receipt and allowing results to be better reported electronically with clinician e-receipt acknowledgement. All these benefits will in addition make the department better equipped to respond to, and succeed with, tenders.

Fit against Trust Strategic Objectives

Provide safe, effective, caring and responsive services – additional automation and better tracking will result in improved quality and responsiveness. If services can be consolidated across the two sites then staffing resilience will be greatly enhanced.

Lead strategic change within Staffordshire and beyond – implementing a new and modern LIMS systems will allow the Trust to be a leading light in Pathology automation and further network consolidation goals through the deployment of a single solution for UHNM and Mid Cheshire.

Ensure efficient use of resources – a new LIMS will reduce the unit cost of performing diagnostics through elimination of manual workflow.

Fit against IM&T Strategic Objectives

Objective	Met?	How
Safety	Yes	Further automation of manual workflow resulting in less errors.
Quality	Yes	Further automation of manual workflow resulting in less errors.
Productivity	Yes	A reduction in the unit cost of performing diagnostics through enhanced workflow. If services can be consolidated across the two sites then staffing resilience will be greatly enhanced.
ROI	Yes	Will reduce the unit cost of performing diagnostics and allow UHNM to compete more successfully through the tender process.

Priority

Replacing the current LIMS system is a very high and strategic priority for the Pathology department.. Integration with the Integrated Care Record should be a phase 2 consideration. Very early estimates have indicated that the cost for just a new LIMS (software and hardware) would be in the region of around £2.0M.

The Trust will require the implementation of the new Medway Order Comms solution before deploying a new LIMS to avoid having to re-develop key integrations and change workflow between the two systems.

2.2.2 Digital Pathology

Digital pathology is an image-based set of technologies that enables the management of information generated from a digital slide. Digital pathology is enabled in part by virtual microscopy, which is the practice of converting glass slides into digital slides that can be viewed, managed, shared and analysed on a computer monitor. With the advent of Whole-Slide Imaging, the field of digital pathology has expanded rapidly and is currently regarded as one of the most promising avenues of diagnostic medicine in order to achieve even better, faster and cheaper diagnosis, prognosis and prediction of cancer and other important diseases.

Strategic Direction

Digital pathology supports the strategic aims of reducing lead time, reducing cost and providing a higher quality service.

Fit against Trust Strategic Objectives:-

Provide safe, effective, caring and responsive services – digital pathology provides better, faster and cheaper diagnosis, prognosis and prediction of cancer and other important diseases. Treatment costs could also be avoided due to improvements in the accuracy of cancer diagnosis among non-subspecialty pathologists. If there is a shortage of consultant pathologists to review and approve reports against tissue samples then reviews can be, in theory, performed from any location. Increasing staffing resilience.

Lead strategic change within Staffordshire and beyond – implementing a new and modern digital pathology system will allow the Trust to be a leading light in Pathology automation.

Ensure efficient use of resources – digital pathology will reduce the unit cost of performing diagnostics through elimination of manual processes. Reads can be performed remotely which in theory could reduce the physical space of laboratories over time.

Fit against IM&T Strategic Objectives

Objective	Met?	How
Safety	Yes	Better prognosis and prediction of cancer and other important diseases.
Quality	Yes	Improvements in the accuracy of cancer diagnosis among non-subspecialty pathologists.

Productivity	Yes	A reduction in the unit cost of performing diagnostics through enhanced workflow. Staffing resilience from ability to perform remote reviews and reporting.
ROI	Yes	Will reduce the unit cost of performing diagnostics and allow UHNM to compete more successfully through the tender process. Reduction of physical space.

2.3 Radiology

The Carter review found that costs for diagnostic imaging varied significantly across trusts. Following this a set of set of radiology departmental benchmarks that trusts should aim to achieve are being developed. As well as reducing and standardizing the cost of diagnostic imaging measures are being introduced for radiology department efficiency.

The Stoke imaging service operates diagnostic imaging services on behalf of the Trust and other organisations. Establishing the radiology department as a specialist hub provider of imaging services and investing in modern capabilities would support the overall UHNM 2025 strategy through the realisation of economies of scale. This will extend to the use of equipment (there is for example a wide variation in the mean time between scans for each scanner, suggesting there is an opportunity to optimise their use) and the activity of technical and clinical staff.

2.4 PACS & Radiology Information System (RIS)

The Trust have just gone live with a new PACS system (Sectra). The project to implement this has gone well and there is a broader ambition to use this to consolidate the PACS in use across the Trust and the region.

The contract for the existing RIS system is part of the Estates & Facilities Directors Portfolio as an integral part of the Trust PFI contract. It is understood that the contract is being reviewed and a business case is being put together for replacing it in the future.

A Radiological Information System (RIS) is the core system for the electronic management of imaging departments. The major functions of the RIS can include patient scheduling, resource management, examination performance tracking, examination interpretation, results distribution, and procedure billing. RIS complements PACS and is critical to efficient workflow to radiology practices.

Strategic Direction

The new PACS system will further the goals of efficiency through a number of new capabilities. Including, but not limited to, embedded clinical tools on a single PACS workstation, the adoption of technology standards such as xDS to support the sharing of images across the region and nationally, sharing a common workflow (but allowing for the system to be utilized on a regional basis).

Fit against Trust Strategic Objectives

Provide safe, effective, caring and responsive services – The new more modern PACS system will provide better, faster and cheaper diagnosis, prognosis and prediction of cancer and other important diseases.

Lead strategic change within Staffordshire and beyond – implementing a new and modern PACS system will allow the Trust to be a leading light in radiology automation, scaling it out to other hospitals in the region thereby establishing a single record of patient imaging.

Ensure efficient use of resources – a new PACS system will reduce the unit cost of performing diagnostics through further elimination of manual processes. Reads can be performed remotely which in theory could reduce physical space over time. A new RIS system will enhance the automation of the Radiology department's workflow and provide much tighter integration with the Medway EPR. Artificial Intelligence (AI), and computer aided diagnostics can be used to perform routine reads reducing the time to perform reads significantly.

Fit against IM&T Strategic Objectives

Objective	Met?	How
Safety	Yes	Better prognosis and prediction of cancer and other important diseases.
Quality	Yes	Improvements in the accuracy of cancer and other diagnosis.
Productivity	Yes	A reduction in the unit cost of performing diagnostics through enhanced workflow and tighter integration with other systems such as the Medway EPR. AI and computer aided diagnostics can be used to automate more routine reads.
ROI	Yes	Will reduce the unit cost of performing diagnostics.

2.5 Pharmacy

The UHNM 2025 Vision and Strategy includes the following planning priorities:.

- Implementation of UHNM Pharmacy Transformation Plan and trust-wide medicines optimisation strategy (2017-2020
- Implementation of a major trust-wide IT project to improve electronic Prescribing and Administration of Medicines (ePMA).

These priorities are interrelated. Implementation of a trust-wide ePMA IT system would support the trust-wide medicines optimisation strategy.

Supporting IM&T capabilities

- Implement Electronic Prescribing and Medicines Administration (ePMA)

In general terms, ePMA supports hospitals to manage the prescribing and dosage of drugs to patients. ePMA systems have the potential to support the whole medicines use process, enabling medications (and other prescribed therapies) to be managed electronically at every stage, from prescribing through to supply and administration. Electronic systems are already used in a small but growing number of other Trusts across the UK.

Current paper based prescription charts have been used for prescribing and administration of medicines within the Trust for over forty years. In the long term a paper-based system will not meet the required standards of a modern health care service- particularly regarding “paperless systems” and associated reporting.

The Trust will be implementing the Medway ePMA because of the EPR integration benefits and ability to utilize an existing contract.

Fit against Trust Strategic Objectives

Provide safe, effective, caring and responsive services – quality and safety are key drivers as an ePMA supports initiatives to reduce medication errors. It also provides immediate decision support for interactions and recorded allergies and better / quicker searching by patient and / or medication. The system will be easier to audit through electronic recording of all transactions and system usage and can provide better information to GPs on allergies and to take out drugs (TTOs). Integrating with the Medway EPR will enable dose and contradiction alerts. Automation of medication information onto the discharge letter will reduce the chance of errors occurring once the patient is back in primary care.

Lead strategic change within Staffordshire and beyond – Successfully implementing a new ePMA system will allow the Trust to be a leader in prescribing automation across the region.

Ensure efficient use of resources –Complete and accurate information for prescribers and nurses and remote viewing and prescribing will provide a more seamless process that is more efficient and cheaper. Broader use of ward based prescribing will also speed up the time it takes to fill prescriptions. Automation of medication information onto the discharge letter (integration with Medisec) will remove the need to manually enter medications onto the letter.

Fit against IM&T Strategic Objectives

Objective	Met?	How
Safety	Yes	Reduction of medication errors.
Quality	Yes	Ability to easily audit and an overall reduction of errors.
Productivity	Yes	Automation of manual workflow for example the addition of medication information automatically to the discharge letter.
ROI	…	TBD

Integration

A new ePMA system will need to be integrated with the PAS system to retrieve demographics, CIS for pathology results (results reporting) and Medisec e-discharge to improve information provided to GPs in the discharge letter. Medisec needs to be running on version 10 of its software for this integration to work (currently it is on version 6). The new system will also need to be integrated with the organisational drug catalogue.

2.6 Speech Recognition Software (SR)

Use of an EPR often places a considerable data entry burden upon the physician. Speech Recognition systems (SR) have been proven to mitigate some of this burden by removing the need to type up the encounter in real time or in between consults.

Fit against Trust Strategic Objectives

Provide safe, effective, caring and responsive services – SR allows doctors to interact with patients and then later dictate their notes. This means that the patient can benefit from a genuine face-to-face interaction as opposed to a doctor who is multitasking with typing, listening and trying to talk with the patient.

Ensure efficient use of resources - SR solutions can improve the speed and efficiency of managing patient encounters, allowing physicians to see more patients, more quickly. A recent study concluded that the use of SR versus typed data entry did not appear to alter the amount of time physicians spend charting or performing direct patient care in an A&E setting. However, a lower number of workflow interruptions were observed when using SR technology.

For the most effective adoption of this technology, there is a requirement to integrate the technology directly into the existing electronic letter generation and discharge system. This will reduce process overheads, reduce costs and significantly improve the eDischarge turnaround time, which would be practically instantaneous from the point of clinical authorisation..

Fit against IM&T Strategic Objectives

Objective	Met?	How
Safety	Yes	Less distractions for the Physician.
Quality	No	There is a risk of errors being introduced into the patient record.
Productivity	Yes	Allows for more patients to be seen more quickly.
ROI	Yes	Reduction of existing administrative processes/transcription costs, and improved communication time.

2.7 Replace the Current Acute Order Comms and Results Reporting Solution

UHNM need to implement a new acute Order Comms solution. The contract for the legacy platform (ICM) is old technology, end of life and expires in 2019.

Order comms systems were designed to enable clinicians to request a variety of services from other departments within an acute care setting and receive updates on their progress. This includes diagnostic imaging procedures and pathology diagnostics. They replaced the need for conventional paper based systems. They enable bidirectional communication of patient information, clinical and diagnostic decision making and the progress of the procedure and image / pathology report status between the referring clinician and the diagnostic department.

Integration with the PAS is usually needed to pass on patient demographics and patient registrations and updates and merges are usually handled through bidirectional HL7 messaging. A common user interface between the order comms, RIS, LIMS and EPR systems is often required to enable both the referrer and imaging / pathology staff to access relevant prior imaging / testing history, including reports and images, with relevant pathology results.

Increasingly order comms functionality is being delivered within the EPR and often accessed from the context of the patient record or from other clinical workflows. The ability of referring clinicians and others to view results is crucial and should be available within the EPR

The project to replace the legacy acute Order Comms solution (ICM) with the built in Order Comms solution that is part of the Medway EPR, began in April 2018.

Strategic Direction

The Trust need to standardise order comms across the Trust. The existing system is no longer meeting the needs of the Trust and is end of life technology. The current system is being used to refer to over 100 different departments including radiology, pathology and also for therapies, cardiology and respiratory. A new system is needed to address the following gaps:

- Integration with primary care and A&E
- Personal order sets
- Printing and labelling
- Advanced and pending orders
- Results being shared with patients via the iPortal
- PAS HL7 integration.

Fit against Trust Strategic Objectives

Provide safe, effective, caring and responsive services – quicker and more comprehensive results reporting and the ability for both GPs and Patients to easily see results.

Ensure efficient use of resources – standardized order comms solutions across the region will result in savings through economies of scale. Tighter integration with labs and referrers will result in a reduction of inefficient manual processes.

Fit against IM&T Strategic Objectives

Objective	Met?	How
Safety	Yes	Positive impact on safety due to results and related information being available at the point of care.
Quality	Yes	More comprehensive results reporting.
Productivity	Yes	Automation of manual workflow and tighter system integration.
ROI	…	TBD

Priority

The Trust will need to implement the new Medway Order Comms solution before deploying a new LIMS to avoid having to re-develop key integrations and change workflow between the two systems. The work is a top priority for 2018/19 given the contract for the existing solution expires in 2019.

2.8 Implement Point of Care Workflow and Digital Asset Tracking More Broadly

There are many use cases for digital asset tracking using barcodes and RFID tags including laboratory sample tracking, surgical instrument tracking, the tracking of patients for supporting real time bed management, and positive patient identification. Typically a unique number is generated by a the Trusts EPR system (Medway) and this is used to generate barcode labels and RFID tags from specialised printing equipment.

Poor laboratory inventory management can lead to mistakes that create the need for samples to be retaken and re-evaluated, wasting time. Standard barcoding at source using GS1 compliant barcodes reduces this risk significantly and also enables automation and process improvement across the end to end sample management workflow.

Only a handful of GPs are using GS1 compliant barcodes at source. Elsewhere a predominantly manual workflow persists. Introducing barcoding at source across the Trust, will enable the introduction of digital workflows within the Laboratory including a hopper to receive and sort samples and a bulk import module to queue samples. Increased use of barcoding and a digitalised workflow will increase capacity, maximise economies of scale and enable efficiencies.

Strategic Direction

Standardised barcoding at source directly supports the strategic direction of the Pathology department. It will increase capacity of the laboratory, reduce lead times and reduce the cost of performing diagnostics.

Fit against Trust Strategic Objectives

Provide safe, effective, caring and responsive services – better tracking will result in improved quality and responsiveness, reducing the chance of costly mistakes such as mixing up samples. Instrument tracking can ensure the instruments and trays are not accidently used for the wrong patient / operations and that instruments are always sterilized before use. Positive patient identification can ensure that the right procedures are carried out on the right patient.

Ensure efficient use of resources – barcoding will reduce the unit cost of performing diagnostics through the elimination of manual workflow. Patient tracking can enhance the optimisation of bed management. Installation of new equipment that is enabled such as hoppers and bulk import modules would further reduce turnaround and enable savings.

Fit against IM&T Strategic Objectives

Objective	Met?	How
Safety	Yes	Instrument tracking can ensure the instruments and trays are not accidently used for the wrong patient / operations and that instruments are always sterilized before use. Positive patient identification can ensure that the right procedures are carried out on the right patient.
Quality	Yes	Reduces the occurrence of mistakes.
Productivity	Yes	Will introduce significant automation to manual workflows and enable enhancements within pathology such as being able to use hoppers and bulk import modules.
ROI	Yes	Cost avoidance through a reduction in costly mistakes that need to be reversed. Will reduce the unit cost of performing diagnostics through the elimination of manual workflow.

Environmental

GS1 barcodes have been used for over 40 years in retail – saving the industry billions of pounds every year. Healthcare is now adopting GS1 barcodes globally to improve patient safety, enhance clinical effectiveness and drive operational efficiencies. It is mandatory to comply with GS1 standards across all NHS contracts.

Positive Patient ID technology is currently being used at the Trust for blood transfusions within UHNM. The transfusion system is using barcodes that are being generated from the Medway EPR.

2.9 Continue to Migrate Electronic Referrals to the Medway

E-referrals is an electronic platform that enables the seamless transfer of patient information from a GP to the hospital's EPR. Electronic referrals can result in considerable benefits for service providers. Firstly at the patient level, e-referrals ensure significant improvements to follow-up care coordination by the creation of accurate and timely referrals. Medical decisions are enhanced as each provider involved has the full patient information available to them. Duplicate tests are eliminated as patient information is being shared from one provider to another. The speed of communication is improved by removing delays related to paper-based transmission, ensuring a faster response rate. Transmission of referral information is secured, upholding patient privacy.

Benefits can also be seen beyond the patient level, e-referrals can improve practice productivity. Documentation quality is improved by removing the use of illegible handwriting as well as poor quality faxed documentation. E-referrals create a logical and standardised referral template. Auto-population (Using Robotic Process Automation), of clinical information ensures referrals are more clinically complete. There are also significant long term operational cost savings between electronic and paper based referrals.

The Trust have been replacing the legacy e-referrals platform that is integrated with the Medway EPR (ERS) by migrating over time to the clinical portal.

Fit against Trust Strategic Objectives

Provide safe, effective, caring and responsive services – ensures the accuracy and quality of follow up care coordination through accurate referrals. Medical decisions are enhanced as each provider involved has the full patient information available to them. Documentation quality is improved by removing the use of illegible handwriting as well as poor quality faxed documentation. Digital referrals are more secure than paper ones.

Achieve NHS constitutional patient access standards - reduces the time of follow up care coordination through timely referrals.

Lead strategic change within Staffordshire and beyond - benefits not just the Trust but also GPs in the community.

Ensure efficient use of resources – duplicate tests are eliminated as patient information is being shared from one provider to another. The speed of communication is improved by removing delays related to paper-based transmission, ensuring a faster response rate. E-referrals can improve practice productivity. Finally only GP referrals received electronically will be reimbursed.

Fit against IM&T Strategic Objectives

Objective	Met?	How
Safety	Yes	Medical decisions are enhanced as each provider involved has the full patient information available to them.
Quality	Yes	Ensures the accuracy and quality of follow up care coordination through accurate referrals. Documentation quality is improved by removing the use of illegible handwriting as well as poor quality faxed documentation.
Productivity	Yes	Duplicate tests are eliminated as patient information is being shared from one provider to another. The speed of communication is improved by removing delays related to paper-based transmission, ensuring a faster response rate. E-referrals can improve practice productivity.
ROI	Yes	Will increase reimbursement rates and increase productivity.

Environmental

The clinical portal is already in place and UHNM have been working for some time to migrate all referrals over to this new platform.

2.10 Virtual Consultations

Virtual consultations through email, phone or video involve patients visiting with a Physician remotely from their home or place of work. Virtual care has been delivered in rural parts of the world for many years. Telehealth is the primary vehicle for this where a remote patient visits a primary care or smaller secondary care facility and connects with a Doctor within a larger and remote hospital using high end and expensive video codecs and cameras supplied by vendors such as Cisco and Polycom. The appointment is facilitated by a local nurse or physician's assistant.

However, the advent of video capable smart phones and reasonably priced home internet access is changing the way that virtual consultations are delivered. The popularity of apps such as Teladoc, AmriDoc, Zipnosis, Ringadoc and Medoc are demonstrating that the technology and demand exists for secure, accessible, fast and reliable virtual consultations between Physician and patient.

The Trust will explore if a technology enabled virtual consultation service could broaden the appointment options available to patients for example offering them a remote visit in just 2 weeks-time as opposed to waiting 8 for in person. This is enabled by allowing both the patient and physician to engage at a time that is convenient and suitable.

Fit against Trust Strategic Objectives

Virtual consultations have many benefits for patients. It reduces travel expenses and the need to take time off from work for example to have an appointment. It allows them to receive care when it is convenient therefore providing additional motivation and encouragement to own their health outcomes. It also realises efficiency gains within the hospital, freeing up the need for physical space, overcrowding, wait times and allows the consulting Physician to optimize their schedule, performing remote reads either off site or onsite during dedicated time.

Provide safe, effective, caring and responsive services – virtual consults enable patients to receive care in the community who otherwise might choose not to make an appointment or who struggle in general making it into the hospital. Studies have demonstrated improved health outcomes through the use of virtual care. Staffing resilience is increased through the ability to provide consults from outside the Trust and in different regions of the country.

Achieve NHS constitutional patient access standards – enables additional support for the patient when they have been discharged and enhances overall patient pathways.

Lead strategic change within Staffordshire and beyond – the Trust could be a regional exempla on how to use consumer / digital technology to advance health outcomes.

Ensure efficient use of resources – Physicians schedules can be optimised, and patients can be seen more quickly and efficiently. Reduces the cost of providing care within the hospital setting.

Fit against IM&T Strategic Objectives

Objective	Met?	How
Safety	Yes	Follow up virtual consults can ensure that patients are following their discharge instructions, adhering to medications etc.
Quality	Yes	Improves the quality of care delivered to patients and health outcomes. Increases resiliency of staffing.
Productivity	Yes	Physician's schedules can be optimised, and patients can be seen more quickly and efficiently.
ROI	Yes	Regular virtual consults have proven to reduce the number of readmissions.

The Trust will need to partner with other care provides and commissioners regarding the implementation of Virtual Consultations with regard specifically to the :

- Standardisation of technology
- Implementation planning
- Clinical governance
- The agreement of consultation tariffs

2.11 Implement an Integrated Care Record

The NHS Five Year Forward View requires the development of services that meet the needs of population health management. These will include:

- Shared patient information across health and social care
- Shared data to enable risk stratification and case finding to target interventions

Consideration of a shared patient portal or personal health record to provide patients with a holistic view of their care from across the various providers they encounter.

An integrated care record, is the longitudinal aggregation of patient health information into a single record that can be shared across different health care settings such as between hospitals and between hospitals and GPs. Records are shared through enterprise-wide integration technologies or Health Information Exchange platforms.

Integrated care records capture the state of a patient across time. They eliminate the need to track down a patient's previous paper medical records and assist in ensuring data is accurate and legible. It can reduce risk of data replication as there is only one modifiable file, which means the file is more likely up to date, and decreases risk of lost paperwork. Due to the digital information being searchable and in a single file, ICRs are more effective when extracting medical data for the examination of possible trends and long term changes in a patient. Population-based studies of medical records may also be facilitated by the widespread adoption of integrated care records.

Fit against Trust Strategic Objectives

Provide safe, effective, caring and responsive services – an integrated care record ensures that a complete history of a patient's medical history is available when they are admitted into the hospital and when they are discharged back to the care of a GP. Thereby avoiding potential errors and inappropriate treatment. Quicker access to allergy and a patient's medication history can avoid expensive and dangerous mistakes.

Achieve NHS constitutional patient access standards – patient pathways into and out of the hospital are significantly enhanced through the ability to share health records electronically between providers. In addition most platforms provide patient portals for patients to get access to their records.

Achieve excellence in employment, education, development and research – information from longitudinal records of patient care have significant implications for research on the efficacy and safety of different treatments and medications on specific patient cohorts. Drug companies are particularly interested in collaborating with healthcare providers on utilising this data to improve health outcomes.

Lead strategic change within Staffordshire and beyond – the implementation of an integrated care record within the region is a critical step in improving overall population health outcomes and driving network collaboration.

Ensure efficient use of resources – reduction of manual processes and paperwork will result in a cheaper and more efficient set of processes.

Fit against IM&T Strategic Objectives

Objective	Met?	How
Safety	Yes	An integrated care record ensures that a complete history of a patient's medical history is available when they are admitted into the hospital and when they are discharged back to the care of a GP. Thereby avoiding potential errors and inappropriate treatment. Quicker access to allergy and a patient's medication history can avoid expensive and dangerous mistakes.
Quality	Yes	Access to a patients longitudinal care record will enable better levels of care and better health outcomes.
Productivity	Yes	Reduction of manual processes and paperwork will result in a cheaper and more efficient set of processes.
ROI	…	TBD

2.12 Digitalisation

Strategic Aim

To reduce the establishment of the Royal Stoke Health Records department through the provision of historical paper notes to outpatient clinics, to remove the generation of paper in clinics, to provide electronic data capture, to integrate electronic solutions via electronic clinic noting in the Trust portal iPortal.

Background

The EDMS business case was approved in 2013 to deliver revenue savings against the Health Records budget in 2018/2019 through the removal of paper notes in outpatient clinics at the Royal Stoke site. The acquisition of MSFT and the subsequent technology programme to consolidate IT systems (including the Patient Administration System (PAS)) and undertake significant improvement to the County site infrastructure resulted in an 18 month delay to the project. However, the original timescale of savings in 2018/2019 continues to be planned and scheduled. Implementation timescale is significantly reduced due to the project delays and therefore Trust leadership and clinical engagement is critical to ensuring that the timescale can be achieved.

The project will utilise the internally developed clinical portal (iPortal) to create electronic clinical noting for nursing staff, clinicians and other health professionals in an outpatient setting. This functionality is already in place, further development will include specific structured noting and deployment of supportive technology to facilitate improved accessibility to clinical information.

In the absence of an integrated electronic GP referral solution and to avoid the barriers of CAB (clinician difficulties in accessing referrals via CAB), all referrals (paper and CAB), will be made available electronically through uploading into iPortal.

All clinical correspondence will remain accessible via iPortal (utilising Medisec) and historical County letters will be uploaded into iPortal to improve access to historical information at the County site.

The Trust's digital dictation solution, Winscribe, has been upgraded (March 17) to introduce mobile licenses and facilitate digital dictation in different settings.

Savings:

- £1.6m pay savings Health Records Department Apr 18 - Mar 19.
- Further unquantified savings in administrative staff through the removal of paper health records - outpatients preparation staffing, medical secretaries, receptionists.

2.13 Electronic Enablement of Clinic Letter Distribution / Removal of Paper Clinic Letters to GPs

Strategic Aim

Following the removal of paper discharge letters historically and in line with the contractual requirement for all clinical correspondence to be delivered electronically to GPs by Oct 18.

Background

Electronic discharge was introduced at UHNM in 2009 and discharge letters have been distributed electronically since this date, this includes to GPs within Stoke on Trent and Staffordshire. Discharge letters that are being sent out of the local area or for which there is no GP registered on the system are printed within the IM&T directorate and posted.

To facilitate the electronic distribution of clinic letters, a transformation change in the workflow of outpatient letters is required to remove local printing by medical secretaries and administrative areas, ensuring that clinicians have a clear workflow process to approve the dictation of the letter within an agreed timescale. This will include a requirement for the development of reporting metrics by Information Services and an agreed monitoring framework for compliance. Once local printing of clinic letters has been removed, the IM&T Directorate will enable each GP Practice to receive letters electronically and remove the ability for paper copies to be received.

There is an interdependency between this project and the digitalisation project as during the progression towards digitalisation, some specialties have been utilising the electronic correspondence solution as a repository for

clinicians electronic notes and this must also be validated with an alternative repository / solution required to prevent inappropriate correspondence from being distributed to GPs. This is currently underway.

The project will reduce the cost of printing clinic letters (paper savings only), but will facilitate a workforce review of efficiency savings achieved through the removal of printing and posting of clinic letters by medical secretaries.

Business process mapping and Redesign

The overall objective is to define processes that minimise operational impact and maximise patient safety, allowing clinicians and staff access to relevant information when and where it is required in a timely and intuitive way.

The As-Is and To-Be process definition activity will define business processes that fulfil the business needs of the staff impacted by the change and maximise the opportunities provided by the current systems available and define other developments and new processes required to support the change.

This is a critical aspect of the Business Change process and it is essential that clinical and operational staff are released and participate in this activity. The final outputs will be a set of processes that define the future State and highlights how and who are impacted through the implementation of the digitalisation programme. Stakeholders with relevant knowledge and authority to influence change are critical to the successful definition of 'to be' processes.

The process maps will be developed through a series of clinical area observations and process design task and finish groups for each clinical area with key staff including health record staff, operational, nursing and support staff and clinicians and members of the multi-disciplinary teams. Key staff in these areas will become champions as detailed in section 2.2.

It will also take into account other information generated on paper or viewed in other systems and any clinical or business process which may be specialty specific and any documentation that will need to remain on paper and why to ensure a "complete view" of the patients record.

As part of this process the degree of change for each process step will be identified and this, in turn, will feed into a gap analysis and operational impact assessments if required. These will be used to identify those process steps that will require the most support during the Preparation for Change and training stages and any risks that need to be managed as part of the implementation. The operational impact assessment will be presented to the steering group who will review and approve the mitigations to any impacts or identify alternative mitigations where required. Associated actions will be given a clinical or operational lead who will be responsible for completing the mitigating actions.

The key Business Process Redesign steps that will be employed are set out as follows:

OBJECTIVES

Each clinic area will be supported for the period of a month. The 'plan, do, check, act' principles will be applied for each clinic area and the roll out of the clinic areas is detailed in appendix 2. One month prior to the business change process starting in the clinics, training will provided to the clinicians on iportal first. This will ensure that clinicians are fully briefed on what information is already available electronically and what functionality is already available to record information electronically. The business change process will then commence and deliver the key objectives detailed below.

- Complete As-Is processes and agree standard To-Be processes in clinical areas for the
  - Flow and movement of the patients notes.
  - Clinicians and the MDT for viewing and capturing data electronically
  - Other departments that have clinical systems that are generating paper which is being filed in the case notes
- Documentation of all the core changes in processes and the staff affected by the change
- Produce operational impact assessments
- Generate standard operation procedures
- Complete action plans for change

During this process analysis will be completed during the month and then action plans developed for each clinician and clinic area where relevant for moving them to removal of the notes and digital data entry.

2.1.5 IS and TO BE processes mapping

1. Flow ovement of patient notes

Current ‘AS IS’ processes in all the clinics locations will be reviewed to determine the flow and movement of the patients’ notes, from pulling and preparation of notes, the generation of patient information during clinic and by whom, and the journey of the notes at the end of clinic.

Key processes in areas in clinics will be reviewed for impact of removal of the notes including:

- The E referral / paper referral processes
- Insertion of clinic outcome forms in the notes
- The use of notes as triggers
- Which notes are used in clinics or returned
- Where do notes go after clinic and why

TO BE processes will then be established which will streamline clinic processes and procedures when individual case notes are not sent to clinic and clinic packs are introduced.

Standard operational procedures will be created detailing the core processes which will be communicated to staff through the champions’ network and will ensure that all staff are aware of the processes and core changes.

ii. **Clinicians and MDT capturing and viewing patient information electronically**

Key AS IS processes with clinicians and the MDTs will be reviewed for current ways that patient information is currently recorded and will include:

- What are the notes used for and what is being accessed in the notes
- What paper is generated and added to the notes
- What other ways is information being recorded and where
- Identify information that cannot be digitalised and why
- Locations in which information is accessed

New TO BE processes will then be agreed incorporating options for recording information using electronic methods and will including

- Accessing information that is already available electronically
- Identify what other information can be made electronic i.e. digital dictation, free text noting structured noting, voice recognition
- Whether alternative solutions need to be developed i.e. structured notes and speciation’s for the requirements completed
- Where other systems are required to access or record information.

Action plans will then be drawn up detailing the digitalisation approach and steps required to achieve the new to be processes. Any operational impacts will be identified based on the removal of the notes and associated mitigations agreed.

iii. **AS IS and TO BE processes – departmental clinical systems**

Key AS IS processes will be reviewed where departments are generating paper from other IT and departmental systems. Key processes in areas in clinics will be reviewed for impact of removal of the notes and this paper and will include.

- Identify how the information is generated and made available to the clinician and the requirement to access this information.

New TO BE processes will then be established which will based on how this information can be made electronic and Divisions and system owners will be responsible for identifying and agreeing the digitalisation approach for this information and remove the generation of paper. It will establish one of the following options:

- If the information can be viewed electronically at source or
- If the information needs to be uploaded into iportal electronically or
- Confirm that the paper record generated can be scanned and uploaded into iportal at source.

2.14 Electronic Observations

Background

The introduction of VitalPAC at the Trust is in line with the Trusts IM&T Strategy developments in clinical decision support. It also satisfies a number of recommendations made in the Frances report.

Use of this solution will transform the Trust’s ability to collect vitals and other assessments, such as nutrition and fluid balance digitally, and at the bedside, in order to provide a more consistent, safer and timely level of care.

It will proactively monitor for deteriorating patients, by determining early warning scores, sepsis, acute kidney injury events and Venous thromboembolism risk and will push escalations to clinical teams in an effective and timely manner.

The objective of this case is to implement an electronic observations and monitoring system to improve the capture of real time data on the physiology of patients, and use this data to assess and detect the deteriorating patient. The use of the technology will support a robust escalation of clinical care through automatic track and trigger.

The implementation of an electronic observations and monitoring system is in line with the IM&T Strategy to improve clinical decision support through the provision of value, quality and patient safety. Electronic Observations is at the forefront of patient care to provide a higher quality of service provision for clinicians and provide a greater degree of patient safety whilst giving a potential benefit in terms of reduced administration overheads.

Introduction

Vitalpac is a mobile clinical system that monitors and analyses patients' vital signs giving clinicians accurate, real-time information for the safest possible patient care. Vitalpac Core consists of six applications – Nurse, Doctor, Clinical, Ward, Performance and Administrator.

The system enables safer and more efficient care 24/7 and particularly improves night time and weekend care, through mobile task management. This enables safer management, better prioritisation, safer resourcing and improved transparency and governance.

Benefits

This proposal will allow the Trust to introduce technology systems that will track vital signs and guide the clinician to an appropriate escalation, in order to initiate appropriate interventions in accordance with the NICE Guidance. Other benefits include:-

- Reduces error and oversight by enabling continuous and shared digital handover within and between care teams with additional patient tagging and smart list management.

- Provides safer, easier and more reliable communication through secure mobile messaging, integrated with the patient record, including secure picture messaging and video conferencing, and enables structured and audited opinions and patient referrals between teams.

- Enables push notifications to teams of any electronic patient events, including admissions and discharges against specific conditions or alerts to enable earlier response and rapid care coordination, enabling safer care and improved outcomes.

- Facilitates the sharing of all electronically captured information across the health economy, with a number of organisations across Staffordshire already having access to and use of the UHNM clinical portal. These include GPs across North Staffordshire, SSOTP, Combined Healthcare and a plan in flight to provide the UHNM clinical portal embedded within the GP EMIS systems.

- Use of this solution will transform the Trust’s ability to collect vitals and other assessments, such as nutrition and fluid balance, digitally and at the bedside in order to provide a more consistent, safer and timely level of care.

- Proactively monitor for deteriorating patients, by determining early warning scores, sepsis, acute kidney injury events and Venous thromboembolism risk and will push escalations to clinical teams in an effective manner.

- Enables safer and more efficient care 24/7 and particularly improves night time and weekend care, through mobile task management. This enables safer management, better prioritisation, safer resourcing and improved transparency and governance.

2.15 Robotic Process Automation

Robotic Process Automation (RPA) gives the enablement to create a digital 'workforce' to drive greater efficiency. RPA can eliminate manual data-driven activity, where 'software robots' (comprised of powerful and dynamic process flows), automate the tasks that humans would otherwise perform.

These software robots mimic specific actions that humans take while working on a computer. This can include actions taken when interacting with an clinical/corporate application, website, web portal, legacy system, or desktop applications including email, Microsoft Office systems etc.

Incorporating the ability to access and process data from multiple data sources, robotic process automation doesn't require re-engineering of old processes, or replacing existing IT systems. It is complementary to traditional business process management (BPM) and case management, where robots are used at various steps within a larger set of processes, helping further eliminate manual steps in operational processes E.G Finance, HR Procurement, Clinical Administration.

Benefits of Robotic Process Automation

Easily Integrate Information

Automatically acquire and integrate data from websites, portals, and applications into systems for easier processing.

Return Time to a Busy Workforce

Free staff from repetitive tasks so they can apply their skills to other work.

Achieve Greater Operational Efficiency

Cost avoidance by automaiting existing manual processes incorporating speed, business intelligence, efficiency into business processes.

Eliminate Human Error

Complete processes the same way, every time – resulting in constantly accurate and reliable outcomes.

Match the Speed of Business

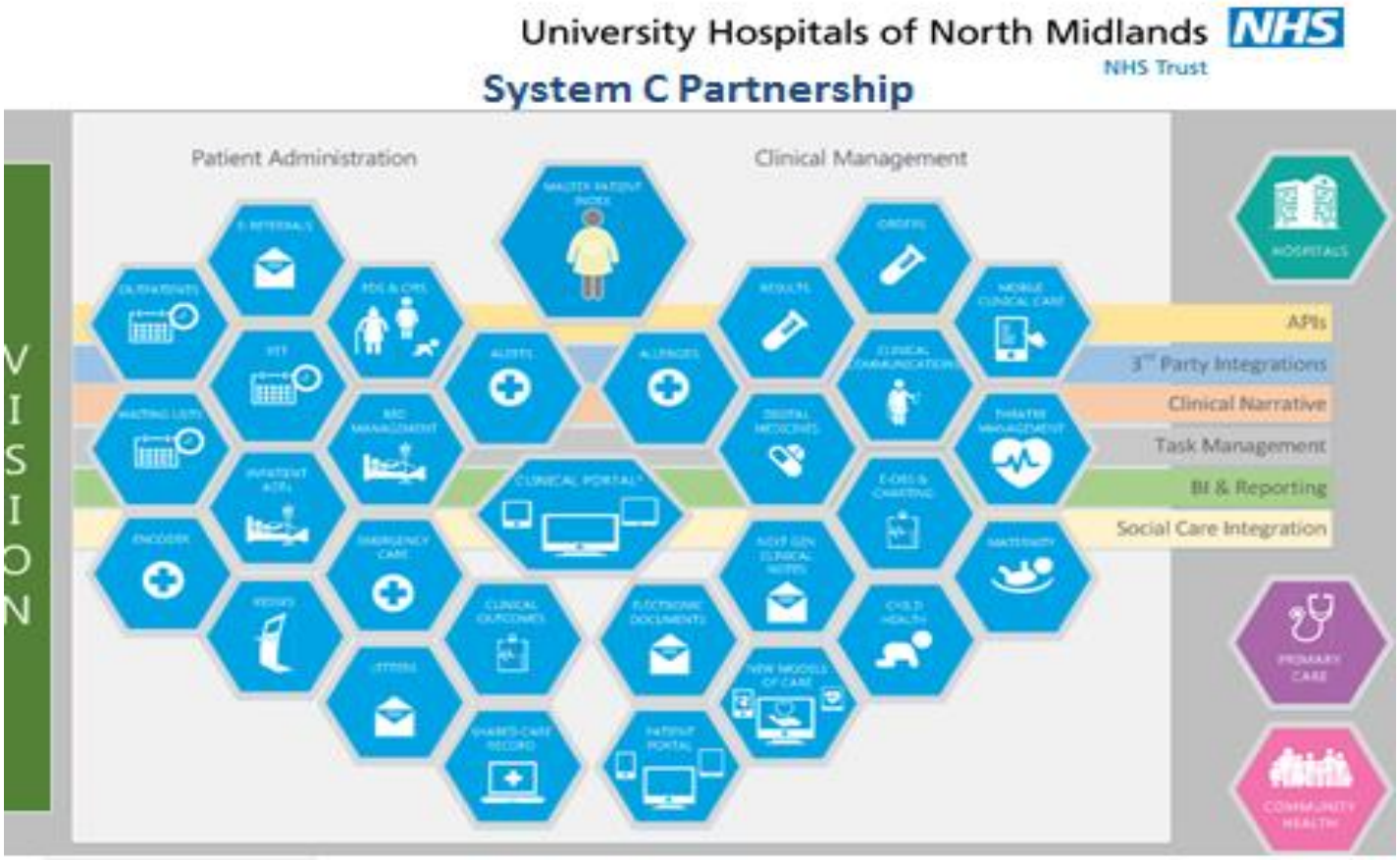
Deploy software robots to new process activities as needs and priorities change without months of development, using the ability to develop processes quickly

2.16 System C EPR Partnership Roadmap

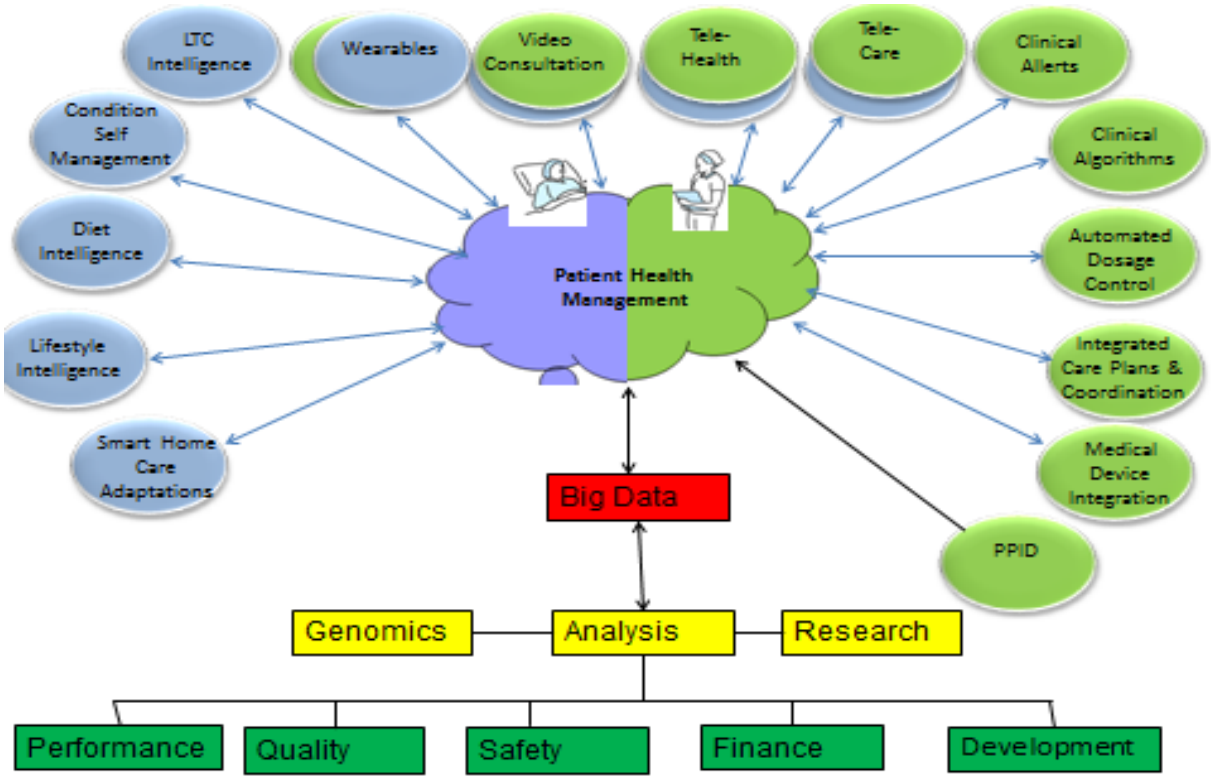
The Trust will continue to work closely with System C on a strategic partnership and under the national GDE trajectory. System C will continue to work with the Trust to build upon the Core EPR, to increase integrated clinical decision support functionality. This continues to be a mutually beneficial partnership where the Trust is able to influence national direction, benefit from effective early adoption of clinical decision support technology, and evolve its clinical systems through a shared roadmap.

The System C functionality map is displayed below. The Trust will continue to assess the strategic fit and (if appropriate), deployment of this functionality, as an integral part of the annual business planning process.

The UHNM/System C functionality map



3. POPULATION HEALTH MANAGEMENT



An abstract view of PHM support

The purpose of this section is to highlight the 'art of the possible' for innovative patient health technology for both delivering care and enabling patient directed care.

The challenge of an ageing and growing population coupled with increasingly stretched financial budgets is being felt across health and social care services. To meet these challenges, providers are turning to patient health management technology advances to reduce costs and improve quality of care.

This section aspires to review the suitability of technologies (some emergent and some identified earlier for their Trust specific strategic fit), that may collaboratively create a Population Health Management enabled environment, and the Trusts vision of investing in technology to improve health and care and reduce long-term costs of care provision. The technologies described fit into broad capabilities:

- Remote consultations
- Telecare
- Telehealth & Self Care
- Patient Data Integration & Analysis
- Genomic Medicine
- Care Management.
- Data Analytics and Artificial Intelligence

A brief overview the technology is presented, alongside real-world examples of how it has been implemented. High level estimations of costs are shown as a general indication of level of spend required based on the examples observed elsewhere in the healthcare sector.

A list of 'enablers' for each specific technology is included, where a skillset or capability may be needed that falls outside of 'business as usual' roles and responsibilities. Where there are 'core enablers' that underpin many of the technologies, these are summarised at the end of this section.

To give a broad indication of implementation timeframes a three-year horizon map is presented with examples of technologies that could be packaged up together for implementation and a logical deployment sequence. This is followed by a summary table of indicative high-level costs.

3.1 Remove/Virtual Consultations (see section 2 for fuller description)

Remote consultations refer to appointments between clinicians and patients that are delivered 'virtually'. That is, delivered in different locations. Virtual care has been delivered in rural parts of the world for many years but is still not a mainstream mode of contact for care delivery. Improvements in camera phone technology and the almost universal integration of webcams into laptops is increasing the accessibility and appeal of remote consultations.

Remote consultations include:

- Email – putting patients in direct contact with their health providers without needing to speak with them or wait on hold.
- Telephone – speaking with a clinician when needed without needing to attend an appointment.
- Smart phone – using in-built camera technology to virtually 'see' a clinician.
- Videoconferencing – using traditional videoconferencing technologies such as a high-end Cisco / Polycom solutions and lower-tech tools including a webcam, headset and mic.

Case Example 1: Improving the accessibility of GP consultations by using Skype

Cavendish Health Centre have been offering GP Consultations by Skype since 2014. They piloted the use of Skype with patients and found good patient and clinician satisfaction. As the technological literacy of the population grows, so too will the demand for appointments over video.

Case Example 2: Making psychological therapy accessible through e-counselling, anytime, anywhere

BetterHelp is the world's largest e-counselling platform to support people struggling with their mental health. Users can easily create a profile by answering simple questions that they are guided through by a chat bot. They can select the type of therapy they would like, respond to questions about the things they are struggling with. Users are matched to a therapist within 24 hours. Users pay a weekly subscription fee for unlimited access to their counsellor. This means that people can contact their counsellor by exchanging messages, live chatting, speaking over the telephone, or video conferencing. They are not restricted by a certain number of sessions per week or month.

Benefits to UHNM

- Improved attendance at appointments – because appointments are delivered in such a flexible way, DNA rates and cancellations are reduced, saving the Trust money.
- Better utilisation of clinical and administrative resources – clinicians can see more patients in a day if they do not need to travel between locations, and administrative time is not taken by needing to 'sign in' patients as they arrive at a clinic.
- Reduced service costs – remote consultations reduce the need for travel overheads.
- Clinician satisfaction – improved flexibility for clinicians means that they can deliver appointments in a location that works for them, reducing their need to travel between sites.
- Patient satisfaction – improved flexibility means that patients do not need to take time off work to attend appointments.
- Reduced burden on NHS facilities – NHS buildings will be quieter as fewer patients need to attend in person.
- Improved accessibility of healthcare provision – patient groups who may struggle to access traditional care are able to do so, such as patients living with chronic pain.

Approximate Costs

To implement a teleConsult model at Catholic Health Initiatives (CHI) in the US, there was an estimated annual cost of £28,000 based on 28 offices being equipped with teleconferencing facilities.

Remote Consultation Specific Enablers

- Clinical leadership – to ensure that clinical standards are maintained despite the change in modes of contact.
- Clinical engagement – clinicians will need to be fully on board with the purpose and value of remote consultations.
- Video infrastructure – a Trust would need to invest in video cameras, codecs and supporting infrastructure if they wanted to achieve a reliable, service for teleConsults. If consumer grade is acceptable then laptops can be used with an industry standard video solution such as Skype, Jabber etc.

3.2 Telecare

Description

Telecare refers to the use of technology to enable patients to access care when they need it. A common example of a telecare solution is the use of personal alarms in patients' homes. Personal alarms can be used by patients to alert a health professional or relative that they may need assistance. Telecare can be contrasted with telehealth, where technology is used more actively, for example the continuous monitoring of a patient's health status.

Although telecare technology has been around for some 30 years the successful adoption and implementation of telecare solutions has been slow. To ensure that telecare solutions are effective and return sufficient benefits to warrant investment a key part of implementation needs to be the training and engagement of clinical teams.

More recently, traditional telecare systems have been complimented by the growth of technologies related to the 'Internet of Things' (IoT). IoT enables the collection of information from all manner of physical devices and infrastructure, as well as intelligent control and use of infrastructure via smart management systems. IoT technology holds particular benefits for people who need additional support with activities of daily living, such as those with learning disabilities or dementia.

Other Telecare technology includes:

- Personal alarms – can be activated by patients when needed.
- Motion sensors to detect the lack of normal activity – are activated automatically.
- Voice activated technology – activated by voice command or preprogramed to provide support at allocated times.
- Epilepsy detectors
- Fall detectors
- Remote monitoring
- Dementia Support

Case Example 3: Improving quality of life through 'smarter environments' at home

Argenti is a consortium of organisations that have successfully implemented telecare solutions across several local authorities. For example, Argenti is currently delivering telecare services to the residents of Hampshire and its borders on behalf of Hampshire County Council. Argenti Telecare is a 24 hour personal emergency monitoring service, which helps residents to continue to live independently in their own homes.

Residents can call for help by pressing a personal trigger (often known as a pendant), which can be worn on the wrist, around the neck or clipped to clothing. Once the trigger is pressed, residents are linked to a telecare monitoring centre where a team will explore what kind of help is required and take appropriate action. This could be contacting a family member or emergency services.

Personal sensors can also be added to the pendants (usually worn on the wrist). These sensors are individually calibrated and automatically raise an alert if it senses that the wearer has fallen.

Case Example 4: Improving independence through voice activated technology

Hampshire County Council is piloting the use of Amazon Echo ('Alexa') in social care. The aim is to explore how the technology can support 50 people to live independently in their own homes for longer and to reduce isolation.

The technology will be able to be programmed to remind people to take their medication. Linked to a pill dispenser through the Internet of Things, Alexa will verbally remind a person to take their tablets and track when they have not done so, sending an alert to a carer. This technology could also enable automated dose control to minimise the risk of accidental overdose.

Benefits to UHNM

- Cost effectiveness – independent evaluation of Argenti has found approximately 70% return on investment.
- Patient satisfaction – 92% of Argenti users are very happy with their telecare services overall.
- Increased independence – patients live independently in their own home for longer.
- Reduced use of emergency services – as alarm calls are triaged through the experienced telecare monitoring team, emergency services are only called when required.
- More efficient hospital discharge and fewer readmissions – patients can be discharged with a care plan that includes telecare.
- Health and care practitioner satisfaction – practitioners can focus their time on the patients who really need their support. 9/10 social workers reported that Argenti is 'good' or 'very good' at achieving desired user outcomes.

Approximate Costs

To ensure successful adoption, telecare technology roll out requires comprehensive programme management to engage all part of the health and social care system. To effectively deploy telecare to 4,600 residents Hampshire County Council committed £4.2m to the telecare programme – 1.2% of their annual spend on providing social care to vulnerable adults.

An Amazon Echo unit is available for £49. However, to roll out a trial of Amazon Echo across 50 residents in Hampshire cost approximately £100,000. This includes wraparound support with all aspects of delivering telecare, such as; programme management, engagement of stakeholders across health and social care, and evaluation of resident and clinician satisfaction.

Telecare Specific Enablers

- Technology help desk for patients – patients and their families will need access to prompt support for questions or queries about their technology. They also need to quickly and easily report faults / technical difficulties in their telecare technology.
- Remote monitoring centre – to act as a 'command centre' to manage any alerts raised from fall sensors and personal alarms.

3.3 Telehealth

Telehealth is a broad term that refers to the virtual assessment and delivery of health and care away from typical care settings. There is a growing body of research into the benefits of telehealth for patients and providers alike. Most research focuses on the application of telehealth for the treatment of chronic conditions such as diabetes, COPD, or hypertension. Underpinning telehealth is the idea of constant remote patient monitoring through wearable technologies. Advances in technology including miniaturization, enhanced connectivity, improved usability, reduced cost, increased reliability and battery life explain why wearable technology is expected to be ubiquitous in the healthcare sector.

Due to the breadth of applications of telehealth technologies, it can be helpful to consider telehealth from two angles: prevention and intervention.

Telehealth technology includes:

- Wearable devices – technology that can be worn on the body or attached to clothes that monitors health vital signs.
- Continuous limb sensors that assess movement – devices are attached to a particular limb and provide specific monitoring body movements.
- Video streaming – cameras that can record on loop for continued observation.

3.4 Telehealth and **Prevention**

Description

Wearable technology includes smartwatches (such as Apple Watches), sports watches (such as Fitbits), and medical devices (such as glucometers). All of which can be used to prevent health and mental health problems. Wearable technologies can act as a 'digital coach', equipping people with insight into their wellbeing. Armed with this insight, the digital coach can motivate and 'nudge' people to take steps to maintain wellbeing and prevent illness.

Case Example 5 – Incentivising health behaviours to prevent illness

Vitality Health operates a health insurance scheme that rewards physical activity of its members. Vitality provides an Apple smart watch (Apple Watch Series 3 GPS or Apple Watch Nike+ GPS) to members who join their 'Vitality Active Rewards Programme'. Members do not have to make any monthly payments toward the watch if they meet certain minimum criteria, such as walking a certain number of steps per month. Additional incentives are also available if individuals attain weekly physical activity goals. In a secondary healthcare service, this might approach might prove effective at keeping individuals with chronic conditions such as Type 2 Diabetes well and avoid unnecessary visits to the hospital.

Case Example 6 – Early Telehealth adopters

In the U.S., many early adopters have seen the benefits of Telehealth materialise. The Veterans Administration, for example, has found that remote monitoring of chronic conditions has reduced hospital admissions by 63% and emergency room (ER) visits by 40%. Centura in Colorado has reduced the number of required home visits for chronic heart failure (CHF) patients to 3.5 a month, from 6-8.

In the UK, too, telehealth (along with telecare) is seen as playing an important role in helping the NHS deliver more and better services without any increase in funding. This promise has been confirmed by the Department of Health's Whole System Demonstrator (WSD) programme, the largest randomised control trial of telehealth and telecare in the world. It involved 6191 patients, 238 GP practices across three sites Newham, Kent and Cornwall

Benefits to UHNM

- Reduced burden of chronic conditions – by working preventatively, more patients will remain healthier for longer, reducing the cost of caring for people with chronic conditions.
- Reduced cost of care – harness the trend for patients to take increasing accountability for their own health and care meaning that more people are kept out of hospitals and clinics.

Approximate Costs

A smart watch is priced at approximately £350 per unit.

Approximate costs for Vitality health insurance that includes the Smart Watch is between £55 - £68 per month (depending on activity during the month).

A traditional remote patient monitoring programme can cost in the region of £3,000 per patient per year.

3.5 Telehealth and **Intervention**

Description

Moving from prevention to intervention, technology can be used as more actively in the treatment of health conditions. For example, Monica Health have developed a wireless foetal heart monitor that can be given to pregnant women who would otherwise need to remain in hospital for monitoring. Telehealth such as this can enable new models of care and clinical pathways can be re-designed to include telehealth as a treatment. Using the foetal heart monitor example, healthcare providers would need to identify who would monitor the data generated and how any potential issues would be approached – for example, a nurse triage might triage potential risks and refer to a physician when needed.

Case Example 7 – Using a skin patch to monitor vital health signs

PA Consulting's technology team developed a low-cost, body-worn sensor. The Healthcare Patch can be used to remotely monitor a patient's critical health indicators and to check if they have taken their medication. This information can be securely sent via the internet to a physician or caregiver and can enable better monitoring, improved quality of care and, importantly, reduced costs.

Case Example 8 – Turning camera into a fall prevention alert system

People with a diagnosis of dementia often experience confusion during the night when they are in hospital. This might cause them to try and get out of bed without support, which might result in a fall and a longer length of stay. To mitigate this, nurses often have spend substantial amounts of their time 'checking in' on patients. Computer Vision is a new technology that would allow 24/7 monitoring of patients through a camera. An algorithm can be built into the live video stream that analyses movement. If the algorithm notices sudden changes in noise or motion then the system can alert a nurse who can then go and check on the patient. This means that nurse time is not wasted on check-ups that aren't needed.

Case Example 9 – Using an app to streamline clinical information

Google Deep Mind developed Streams in partnership with the Royal Free Hospital NHS Foundation Trust. Streams is a secure mobile phone app that aims to address what clinicians call "failure to rescue" – when the right nurse or doctor doesn't get to the right patient in time. Each year, many thousands of people in UK hospitals die from preventable conditions like sepsis and acute kidney injury. A major reason for this is that the warning signs aren't picked up and acted on in time.

The Streams app integrates important medical information, like patients' blood test results. This allows clinicians to spot serious issues while on the move. If one is found, Streams can send an urgent secure smartphone alert to the right clinician to help, just like the 'breaking news' alert on a mobile phone. The alert is presented along with information about previous conditions so clinicians can make an immediate diagnosis. Clinicians can also review their patients' vital signs – like heart rate and blood pressure – through Streams. And they can record these observations straight into the app. To make all of this possible, Streams integrates different types of data and test results from a range of existing IT systems used by the hospital.

Benefits to UHNM

- Improved medication adherence – reducing the cost of medication waste and improved patient outcomes through correct dosing of medication.
- Improved early detection of patient health difficulties.
- Reduced need for routine follow up – remote monitoring means that patients are only seen for follow up if their health symptoms suggest that it is needed.
- Enabling clinicians to work at the top of their band – re-designed clinical pathways with a focus on triaging patients based on their health data means that clinicians can only see patients that they need to see.

Approximate Costs

The Royal Free's partnership with Google's Deep Mind is reported to be free (Business Insider, 2017). However, the Royal Free must pay DeepMind a 'service fee' if DeepMind ends up providing more than £15,000 in support per month.

Telehealth Specific Enablers

- Risk management – careful oversight of new clinical pathways will be required and a comprehensive assessment of how these risks can be negated or mitigated.
- Commercial leadership – an innovative partnership similar to the one highlighted in the Vitality Health example would need to be led with experience of establishing commercial partnerships.
-
- Patient engagement – active and continuous patient engagement would be needed to ensure that prevention efforts are having an impact on the groups that most need it, rather than just the 'worried well'.
- Equipment setup and support – deploying technology into patients' homes typically requires nurses to install equipment and train the user on how to operate it effectively. Technology support needs to be available as and when the patient needs it.

3.6 Technology and Healthcare

Description

Technology can be increasingly used to provide care at a distance, It can also be used to support patients to better care for themselves. In addition to 'one directional' self-care advice available through websites, a wide market of healthcare apps is now available. These provide a much more interactive and tailored self-care advice. Although the apps are currently unregulated in the quality of their advice and many are not evaluated in terms of the effectiveness, NHS Digital highlights the apps that provide 'trusted' advice.

Self-care technologies include:

- Smartphone applications – 'apps' that can be downloaded to a smart phone.
- Interactive websites – websites that can be accessed by a laptop, computer or mobile phone and allow patients to add information about their health, activity, wellbeing, or diet.
- Online chat bots – online assistants that can be programmed to respond to a range of common frequently asked questions (eg the best treatments for the common cold).
- Personal health record portal – an online portal where patients can log in to see information about their medical history, test results and future appointments. Patients can use this information to manage their own conditions.

Case Example 10: Providing practical coping strategies when people need them most

Calm Harm is an app that aims to help people resist or deal with the urge to self-harm. It has lots of practical coping strategies that people can choose from, and users can select the type of coping strategy that they prefer. For example, relaxation or distraction.

Case Example 11: Supporting patients to map out their health and manage their diabetes

Map My Diabetes is an online self-management support program for patients in the UK with Type 2 Diabetes. It contains information and education modules about managing diabetes. Users can add information about their levels of exercise and their diet. This information can be shared with GPs to enhance the quality of face to face appointments by providing clinicians with accurate diet intelligence and physical activity information that can drive care planning decisions.

Case Example 12: Creating an online platform that clinicians and patients can share to manage their COPD

myCOPD is an app to help patients living with Chronic Obstructive Pulmonary Disease to manage their health and wellbeing. Users have access to a dashboard full of self-care tools and educational resources, including inhaler videos, breathing exercises, a medication diary, and symptom tracker. Clinicians can also use myCOPD to check in with their patients remotely, monitor their condition, update their medication and improve their care. myCOPD has been shown to correct 98% of inhaler errors without any other clinical intervention.

Benefits to UHNM

- Empowering patients – by equipping patients with technology that can enable them to look after themselves more effectively, helping them to increase their sense of confidence that they can manage their health needs.
- Reducing reliance on health conditions – by sharing trusted advice through applications, patients do not need to make appointments with their healthcare providers to get the information they need to look after themselves.
- Enabling more effective use of clinician resources – as patients can find basic information, clinicians are freed up to spend more time with more complex patients.

Approximate Costs

Most healthcare applications are freely available on Apple and Android devices and tablets. As such, there is no concrete cost to encouraging more patients to make better use to technology for self-care purposes.

There would be a cost implication in the development and facilitation of training for clinicians in the Apps that they might want to recommend for patients. Clinical pathways could also be extended to include the sharing of information about relevant Apps. For example, each time a new patient is diagnosed with diabetes they might get an email (or letter) about the App that might best help them to manage their condition and stay well. Commercial partnerships between App developers and NHS Trusts could prove to be a cost effective approach to improving well-being.

Technology and Self Care Specific Enablers

- Training for clinicians – specific training material and / or sessions will be needed to ensure that clinicians are able to confidently and accurately share information about suitable apps.
- Patient engagement – in addition to hearing about suitable self care apps through their clinician, target patient populations could receive direct communication about apps they might be interested in to manage their condition.

3.7 Patient Data Integration

Description

Technology needs centre on providing the information that clinicians need, when they need it. There must be interoperability between the technology used by health and care organisations so that patients receive smooth transitions of care from home to hospital and back again. Patients also frequently require access to their own health records. This is frequently achieved through the use of a patient portal that exposes data either from a Trust's or GP's EPR or from a longitudinal record of care enabled through technologies such as Integrated Care Record (ICR).

Another facet of integrating patient data is gathering clinical data from devices owned and operated by patients. This is referred to as 'Clinical Device Integration'.

Internet networks are faster and more reliable than ever which means that bandwidth and connectivity issues for example are less of a concern than they used to.

Case Example 13: Integrating personal data from telehealth with electronic patient records

In 2017, Salford Royal NHS Foundation Trust partnered with Validic, a data connectivity platform. The partnership will enable the integration of patient-generated health data from in-home medical devices, wearable technology and consumer health apps into the Electronic Health Record. Through this partnership with Validic, Salford Royal will start integrating fitness and sleep data to pilot its use and value within the EHR. Long term, this partnership will enable the Trust to bring in the full spectrum of clinical, fitness, biometric, lab, and lifestyle data available via Validic's 400 device and application connections.

Data will also be aggregated into a data warehouse, which clinicians and researchers can use to identify trends, correlations, and causations. For example, researchers will be able to correlate sleep and heart rate data to identify new care methods for weight and diabetes management – enabling patients greater control to self-manage their condition and offering doctors insight into how a patient's lifestyle impacts their health and disease state. This dynamic, in which patients receive their data back contextualised and doctors have an opportunity to treat patients holistically, creates an accountable care model.

Case Example 14: Integrating data across primary care, secondary care, mental health and social care and making it available for patients to view through a portal

Health and social care organisations across Bradford and Airedale distract have created a single, integrated, digital care record programme. They used TPP's SystmOne to create a 'pooled record' such that a patient's medical record is accessible by organisations across all care settings, including A&E, community services and GP practices. SystmOne allows patients to log on to their online portal and view their own electronic medical record.

Benefits to UHNM

- Innovative partnership opportunities – potential to partner with Universities can provide additional revenue streams and further knowledge about the management of complex health conditions.
- Improved patient and clinician experience – the integration of personal data means that valuable appointment time is saved because clinicians already have information about their vital health signs and activity levels. And patients do not need to repeat their story to different care professionals.

Approximate Cost

Funding for Salford Royal's partnership with Validic came from an award of £10m for their work as a centre of global digital excellence. The Trust has not stated how much of this award will fund the partnership with Validic.

Bradford and Airedale's development of an Integrated Digital Care Record cost approximately £3m.

Patient Data Integration Specific Enablers

- System wide engagement – successful integration of systems relies on the successful alignment of leaders across different sectors. Engaging key stakeholders with the goal of integrated care records and the system-wide value will be important.
- Patient engagement – members of the public can feel, understandably, cautious about consenting to their information being shared. Careful patient engagement will be needed to clearly and concisely articulate what it is and why it would help improve the care they receive.

3.8 Genomic Medicine

Description

The likelihood of an individual experiencing a particular health problem is partly attributable to their genetic makeup. It is understood with increasing clarity that genetic make up also plays a role in responsiveness to treatment. Genomic medicine refers to the use of genome sequencing to customise medical care to a patient's unique genetic makeup. For example, genomic medicine could guide the dosage of drugs that are given to each patients, a field of practice that is called 'pharmacogenomics'.

Genomics has the potential to transform medical care across the world and improve patient outcomes. Genomics has already led to advances in diagnosis and new treatments, especially in the fields of cancer and rare diseases.

The UK Government has already invested heavily in Genomic research. The NHS is leading the way in researching the relationship between genomes, health conditions, and treatment outcomes. It is likely that the appetite for genomic research and practice will continue to grow and there have been recent calls for the Government to increase the level of funding for genomic research.

Case Example 16: Using genomic medicine to reduce prescription costs

US company, GeneSight, evaluated multiple genetic variations that influence how people respond to antidepressant and antipsychotic medications. They found that of 13,000 behavioural-health patients, those who were tested received fewer drugs, and they saved an average of £795 in annual prescription costs compared to non-tested patients. The tested patients were also 17% more likely to keep taking their medications as prescribed.

Benefits to UHNM

- Improved diagnosis – genomic medicine can lead to accurate and efficient diagnosis, some of which may not have been possible without genomic sequencing.
- Improved outcomes – exploring an individual's genetic makeup will enable personalised treatment plans that are tailored to each individual patient.
- Minimising adverse effects – just as genomic medicine can point toward optimal treatment it can also flag treatments that may result in adverse effects.

Approximate Cost

Genome sequencing costs approximately £600 per genome (Genomics and Genome Editing in the NHS, 2018).

Genomic Medicine Specific Enablers

- Digital infrastructure – significant digital infrastructure will be required to store and make the most of the data generated by genomic sequencing.
- Training of staff in genomics – engagement in 'The Genomic Education Programme'.
- Patient engagement – ensuring that patients understand the purpose, rationale, and benefits of genomic medicine will be important to encourage their consent and participation in genomic research and treatments.

3.9 Data Analytics and Artificial Intelligence

Description

Use of technologies such as telehealth and virtual consultations generates a wealth of patient data. This data could be used to generate insight and inform population health management programmes. Population health management programmes are targeted workstreams that aim to improve the health of groups of patients with similar health needs.

Computer algorithms or artificial intelligence (AI) can be used to analyse vast amounts of patient data, including data from new technology (such as wearables) with the clinical data already generated within organisations such as electronic patient records. Computer algorithms are sets of mathematical rules that can be used to analyse data and make predictions about likely outcomes. Armed with this information, recommendations can be made about interventions. For example, a recent study found that electronic health record data could be analysed and used to accurately predict in-hospital mortality, 30-day unplanned readmission, and prolonged length of stay.

One AI approach is known as "machine learning". This is where a computer system is modelled on the human brain. Machine learning programmes involve multilevel probabilistic analysis. Another AI variant is "deep learning", where software learns to recognise patterns in distinct layers. One practical use for deep learning in healthcare is in accurate diagnosis based on scanned images because deep learning could separate layers of information such as colour, shape, and size. Services can add more patient data and increase the accuracy of the model. For example, information about patient history, familial history, or genomic sequencing. As deep learning programmes process more data, they refine their assumptions and interpretation of the information, providing increasingly useful feedback. Together, this capability can help deliver the goals of personalised medicine.

Data analysis and artificial intelligence is being used for:

- Identifying cohorts of patients – to understand the needs of distinct groups of patients.
- Risk stratification – to identify groups of patients that are most in need of support and treatment.
- Diagnosis – to better identify disease or health problems by processing patient scan results.
- Epidemiology – to evaluate and better understand the causes of local health issues. For example, in the US AI found a link between paediatric asthma rates and living proximity to major roads.
- Treatment recommendations – synthesising patient information to suggest treatments that are most likely to be helpful.

Case Example 17: Treatment planning for head and neck cancers

DeepMind has partnered with University College London Hospitals NHS Foundation Trust (UCLH) to explore the use of AI in planning treatments for patients diagnosed with head and neck cancers. To do this, UCLH has supplied DeepMind with permission to access a set of up to 700 scans from former patients who have consented to their data being used for medical research.

Their goal is to use the latest AI technology to analyse CT and MRI scans from UCLH patients with cancer of the head and neck to improve the efficiency of the complex process of planning treatment, called segmentation. Segmentation is a highly detailed process that involves delineating exactly where radiation needs to be applied to minimise damage to healthy tissue. This can take up to 4 hours per task, and we want to reduce this to 1 hour with the assistance of machine learning.

Case Example 18: Improving treatment decisions for heart attacks

Royal Liverpool and Broadgreen University Hospitals NHS Trust has partnered with Deontics to use AI to improve treatment decisions for patients who have had a heart attack. This will enable doctors on the Trust's acute cardiac unit to access AI-driven evidence-based clinical treatment recommendations that are tailored to a patient's individual needs. Deontics will encode the appropriate guidelines from the National Institute of Health and Care Excellence (NICE) and other bodies, and make these specific to a patient's risk factors, which will help doctors avoid medication that could increase risks of bleeding and recurrent heart attack.

Case Example 19: Identifying early signs of eye disease

DeepMind has partnered with Moorfields Eye Hospital NHS Foundation Trust to investigate whether AI could help to identify early signs of a variety of eye conditions. The ambition is to use the technology to improve the speed and accuracy of analysis of over 3,000 eye scans that Moorfields carries out each week. Over the past two years AI has been trained to make the correct referral decision for over 50 eye diseases with 94% accuracy. This is as accurate as world leading eye experts.

Benefits to UHNM

- Improved efficiency – care pathways can be designed optimally based on data-driven insights.
- Improved outcomes – as data can inform decision making about clinical best practice and support the personalised medicine agenda.
- Improved quality of care and reduced mortality.
- Improved speed of diagnosis and better utilisation of clinician time – AI has been found to be as effective as expert clinicians in diagnosing problems. Using AI for diagnosis will enable clinicians to spend more time on treatment.
- Greater compliance with clinical standards as these can be encoded into AI programmes and guide recommendations.

Approximate Costs

Costs of implementing AI at UCLH and Royal Liverpool have not been released. However, it has been reported that Moorfields received £110,000 from DeepMind to use AI to evaluate medical eye scans. DeepMind have stated that this fee compensates Moorfields for the cost of the programme (Business Insider, 2017).

Data Analytics & Artificial Intelligence Specific Enablers

- Commercial leadership – establishing and manage the relationship with an AI provider, such as DeepMind, will require strong commercial leadership.

3.10 Care Management

Description

Care management refers to the way that patient health management pathways are designed and operated across health and social care providers. Technology provides the opportunity to improve care management and care co-ordination. Patients who are most in need of a care plan can be highlighted through data analysis. Once a patient has a care plan in place, their care can be more readily co-ordinated because clinicians can access all necessary health information about their patients whenever and wherever they need it.

Case Example 20: Integrated digital care record that enables improved care planning and co-ordination

As described earlier, Bradford and Airedale have developed a shared digital care record across the region. Using the range of communication methods available through GP systems, health and care professionals can use it as a powerful resource for care planning and co-ordination. For example, GPs have access to patient management plans, future scheduled investigations, outpatient appointments, and blood tests to help them provide better continuity of care.

Case Example 21: An online platform that aligns data and resources
In the US, Casenet offers healthcare providers a platform for care managers to analyse trends in their patient population and highlight opportunities to develop preventative care plans. The system allows care managers to see a complete view of a patient's history and previous treatments so that care co-ordination can be tailored.

Benefits to UHNM

- Better use of clinical time – clinicians will need to spend less time chasing referrals or requesting test results, they will have immediate access to them as soon as they are actioned.
- Better continuity of care – patients will receive joined up care and are less likely to 'fall between the gaps' of different services.
- Confidence in clinical pathways – as pathways are based on data that is integrated across an area.

Approximate Cost

Bradford and Airedale's development of an Integrated Digital Care Record cost approximately £3m. An implementation of the Casenet care management solution can cost as much as £10M to £20M.

Care Management Specific Enablers

- Clinical engagement – using integrated technology and patient data to design new care pathways must be done in collaboration with clinicians. Clinicians will be following new pathways and co-ordinating care so their engagement is essential.

4 DEVELOPING CORE ENABLERS (FOR POPULATION HEALTH MANAGEMENT IMPLEMENTATION)

Getting the right people with the right skills in the right place is important for the successful delivery of patient health technologies. Several key enablers underpin all the capabilities described above.

Partnerships Management
New partnerships will be needed to source and implement the technology outline above. A Partnerships Manager would be needed to:

- Manage the legal aspects of commercial agreements
- Ensure that licences for new technology are appropriate
- Manage the information governance of new technologies
  - Patient data storage approaches are appropriate
  - Patient data management is secure
  - Patients understand what it means to give consent for their data to be shared.

Change & Programme Management
The change management programme that wraps around a digital change is essential if users (clinicians and patients) are going to make best use of the opportunity that new technology provides. Change Managers will be needed to:

- Develop accurate, specific project plans that ensure projects are completed on time and on budget
- Maintain regular and effective communications about project progress both to Directors and to the whole organisation
- Drive a continuous improvement culture where feedback from users can be integrated quickly
- Support the creation and adoption of new operating procedures for the new technology
- Disseminate best practice in technology use internally and externally
- Act as 'brokers of change' across the whole STP – bringing key people together from different organisations and uniting them for the same cause.

Data scientists
The move to 'big data' will require a step change in the amount of analysis required. Data scientists will be needed to:

- Map high levels of patient data
- Complete sophisticated analyses such as risk stratification
- Support the implementation of AI programmes
- Create written protocols for data analysis.

Researchers
There is an evidence base for all of the capabilities described above. However, some of the technologies are in their infancy and will require ongoing research and evaluation to ensure their effectiveness and efficacy. Researchers will be needed to:

- Design evaluation procedures and protocols
- Test hypotheses about the effectiveness of new technologies
- Evaluate the health economic advantages and disadvantages of new technologies
- Manage qualitative evaluations to integrate patient feedback in the continuous improvement cycle.

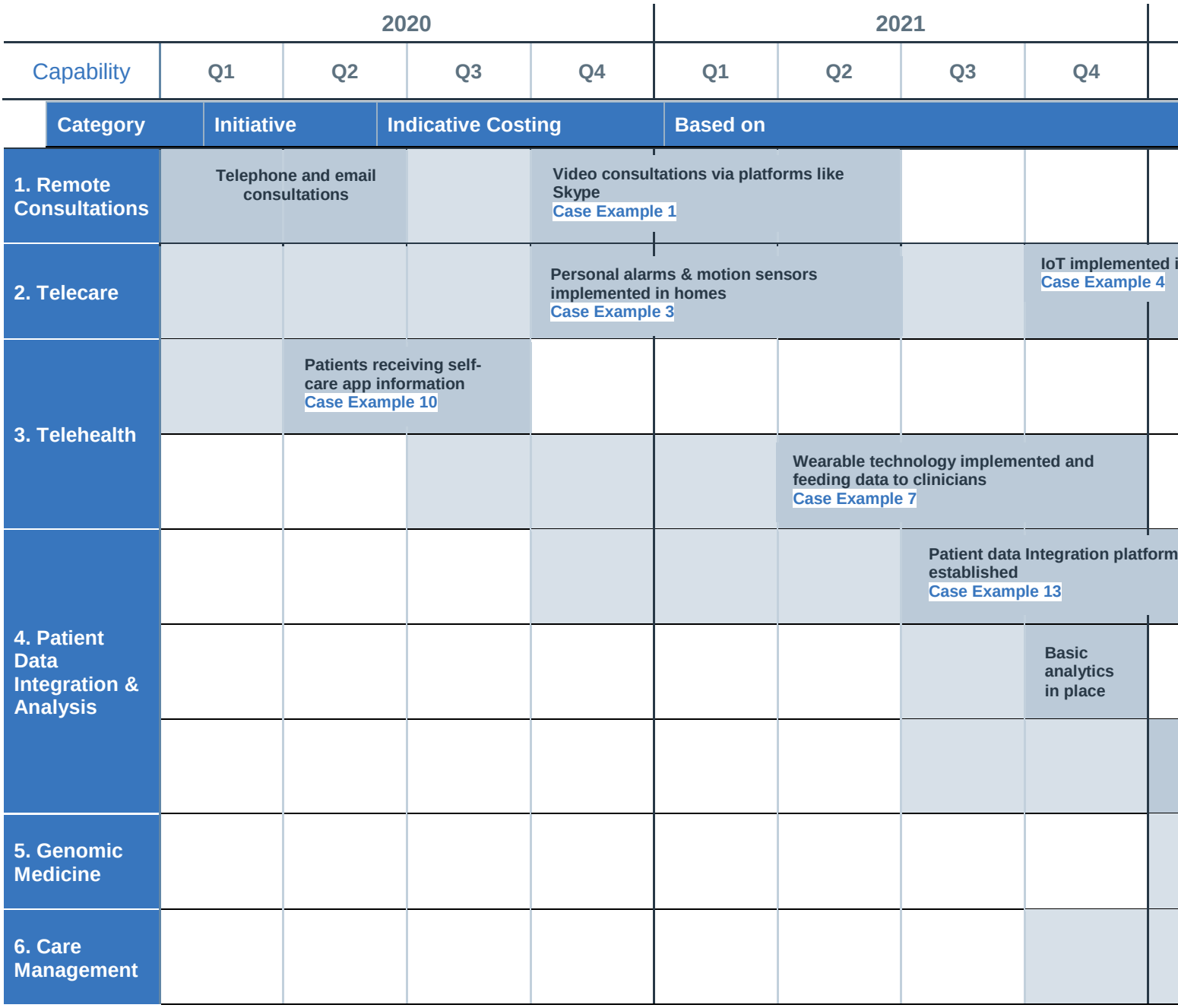
Training
To manage the technical components of digital change programmes, training officers will be needed to:

- Facilitate workshops to support clinical and administrative staff in making best use of new technologies
- Producing user guides, trouble shooting, and FAQ reference documents
- Support patients and carers to learn how to use the technology, as appropriate
- Deliver comprehensive training to all new starters in the use of technology driven care.

4.1 Example Timeline for Deployment of Population Health Technologies

The patient health capabilities and technologies presented in this section would take time to deploy within the Trust. And be dependent on collaboration from across the STP. An Outline Business Case would need to be developed as an immediate next step to explore further which technologies to invest in and what the actual business case for the Trust might be. Below is an example potential three-year timeline for deploying the technology discussed and indicate how solutions can logically be deployed as packaged capabilities potentially from a single (or narrow set of) vendor/s.

Time Horizon: Three-year example timeline



4. 11 EXAMPLE COSTS

To get an idea of the likely level of investment into PHM technology, some very high-level example costs below. This is a guide only. To fully understand the likely cost of deploying these capabilities the Trust would need to perform an Outline Business Case that compares one off and on-going costs to the benefit realised over time.

Remote Consultations	Tele-consultations	£20,000 to £50,000 per annum	28 rooms / offices equipped with teleconferencing faciliti
Remote Consultations	Clinicians available online	£150,000 to establish and trial	Based on 1,000 patients actively using these services
Telecare	Internet of Things: Amazon Echo	£100,000 to trial	50 residents in need of adult social care
Patient Data Integration	Patient Data Hub	£3m to roll out across the system	System to integrate different types of patient generated a device data
Data Analysis & Artificial Intelligence	Artificial Intelligence for diagnosis	£100k to £150k to trial	Based on an estimate of 1 million patient scans
Genomic Medicine	Genome sequencing to inform treatment	Circa. £5.5m for genome sequencing tests	Genome sequencing of 10% of patients at UHNM
Care Management	Casenet	£5M to £15M to implement and end to end care management solution	For all patients within the Trust who would benefit from f management