The Technology Enabled Care Revolution

The Way Forward for Integrated Health and Social Care

Contents

Transforming Health Through Technology

Advances in technology are delivering the potential to transform the way in which we lead our lives through good health and during periods of sickness. This is providing the ability to revolutionise the health and social care system with citizens being empowered to manage their well-being at home and subsequently live independently in good health for longer.

The adoption of technology in the health and social care environment has been patchy and often not properly integrated with underlying systems. This has significantly limited the benefits that could be achieved by a more holistic approach to exploiting the capabilities of the digital revolution in technology.

There are a number of pressures on the health and social care system ranging from an ageing population that is living longer but with more long-term conditions, pressures on funding in both the NHS and local government services and patient expectations to have more control over their health and social care.

The digital revolution and the development of the internet of things presents a massive opportunity for digital transformation that can be achieved by utilising the potential of the explosion of digitally enabled devices available for use in institutions and homes.

The range of technology enabled care solutions includes wearables, virtual assistants, sensors, remote monitoring devices, portals and apps. However this can also extend to better tools for workforce mobility and real-time access to data and updates for care workers outside the traditional hospital environment.

Benefits associated with adopting technology enabled care

- Improved workforce efficiency through mobility solutions and updates to records whilst visiting patients
- Improved patient outcomes via promoting patient self-management and monitoring
- Better decision support through real-time access to integrated healthand social care records
- Improving the flow of patients through health and social care, reducing delays and providing support for integrated care pathways and joint care plans

This digital revolution does not, however, come without issues. There is a need for a truly platform based approach to integrating systems and devices across different care providers and devices in the home to avoid trapping data in proprietary solutions. Data captured in individual systems must be integrated and made meaningful to consumers. Inclusivity and patient choice must also be respected as not all patients are able or willing to use technology at home or trust that their data will not be misused.

Compliance with data protection regulations and security requirements can also be challenging when federating and integrating personal information across systems and devices. Moving to a technology enabled care world will also require significant business change across services if it is to deliver the full set of benefits as work practices will change to make use of new solutions. A national infrastructure for internet access is also required along the lines of the 5G initiatives underway to ensure that citizens and staff can make best use of new technologies to transform how health and social care is managed.

Current Issues In Health And Social Care

Challenges

The NHS is facing a number of challenges associated with a wide range of social, medical, financial and political factors. Healthcare needs are changing including a greater incidence of obesity and diabetes and problems with antibiotic resistance as well as increasing years of healthcare dependency due to an ageing population.

Within society, there also remain significant inequalities based on social class and geography and there has been a lack of progress in addressing preventable illnesses as a result of lifestyle choices. Patients have also found that there is reduced access at a local level with the centralisation of certain specialist treatments and A&E departments. There are also pressures and challenges from a financial and political perspective:

- Patient and citizen expectations as consumers of digital technology in other areas eg banking and shopping and increasing use of personal health monitors
- The cost of innovations in treatments including medications, diagnostic tests and therapies (eg Proton Beam)
- Financial pressures in health and local government affecting the provision of health and social care
- Political challenges including Brexit and the impending exit from the European Union, together with successive re-organisations across public health, the NHS and local government services
- Problems in meeting targets in terms of waiting lists and waiting times and access to services
- Poor integration both from a technical and organisational perspective across Primary, Acute, Community and Social Care services

Policy Initiatives

In 2014 the NHS issued the NHS 5 Year Forward View which set out priorities in:

- Focusing on public health and prevention
- Engaging with the wider community across carers, local authorities and health providers
- Patient empowerment and access
- Support for local initiatives and flexibility around local networks of care
- New care models for areas including multispecialty community providers, primary and acute care systems, urgent and emergency care, viable smaller hospitals, maternity and care homes.

The extended Long Term plan issued in January 2019 has additional emphasis on areas such as integrated care systems and upgrading technology to support digitally enabled care.

The Digital Revolution And The Internet Of Things

By 2020, 30 billion things will be connected to the Internet[1]. The Internet of Things (IoT) is a computing paradigm which is quickly becoming the dominant reality of our interconnected world. The paradigm of IoT proposes that everyday objects would be capable of both disseminating information to a network and responding to information from the network—increasingly independent of human intervention. IoT is permeating all industries and, accompanied with the broad technology trends of social media, mobility, analytics and cloud computing, is supporting the digital transformation of industries.

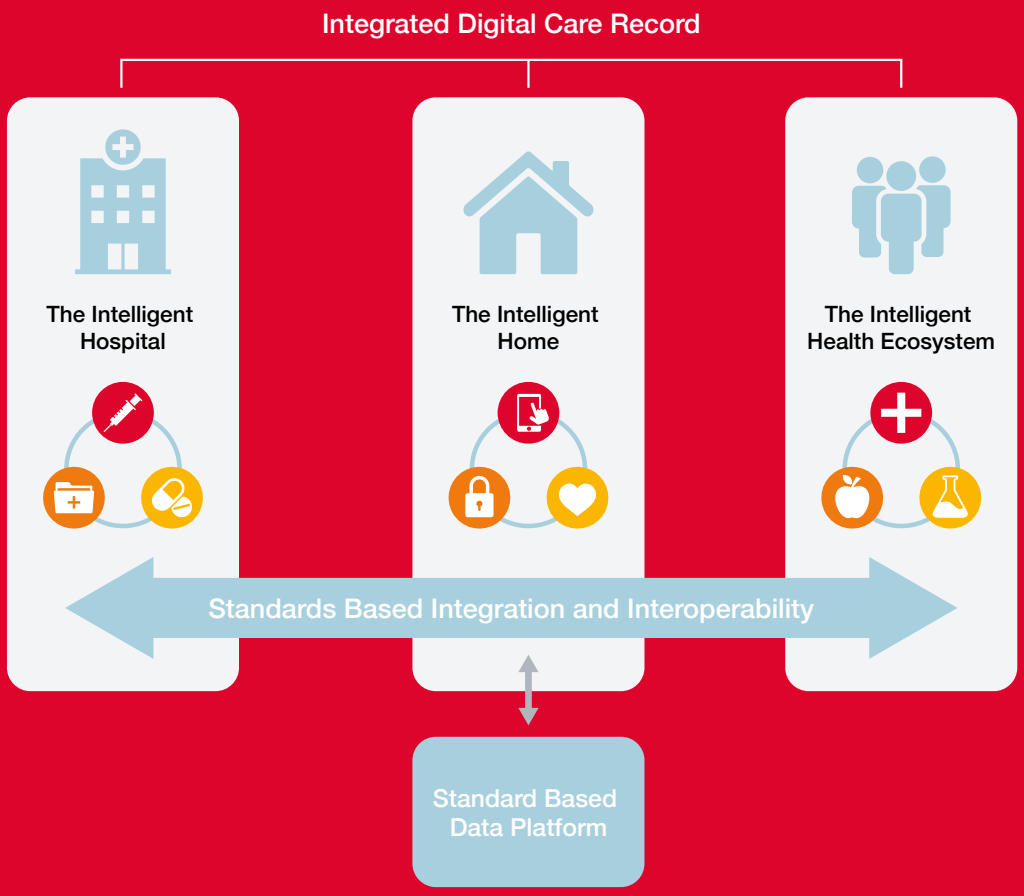
In the context of health, IoT is enabling new business paradigms, such as interacting with patients through wearable or embedded devices. Moreover, IoT is enabling the digital transformation of a hospital or patient's home.

Acute care institutions are already the most complex buildings that people use. Hospitals are populated with thousands of systems—building systems, medical equipment, clinical and administrative systems and now increasingly patients with wireless or embedded devices. These systems have traditionally been standalone, but a distributed network of smart healthcare devices, machines and systems is now able to be connected into an orchestrated Internet of Health Things (IoHT).

[1] (https://www.statista.com/statistics/471264/iot-number-of-connected-devices-worldwide/)

The same principles can be applied to patient homes or care homes where a variety of devices and sensors can be connected to an integrated digital care record accessible to patients, carers and staff to help support the digital transformation of health and social care.

The overall connectivity between the internet of health things in hospitals and homes can help to support a connected intelligent health ecosystem:



Types Of Technology Enabled Care

Personal Devices

Personal devices such as smart phones, tablets, laptops and wearables have now become ubiquitous and both staff and patients are becoming more adept at using the variety of features available on them. A range of home monitoring devices are also now increasingly available to support patients at home whilst informing care teams of results.

The number of personal health apps available on personal devices is growing all the time though there is a need for regulation to avoid patients being given incorrect or misleading information. To help support this process NHS Digital has set up the NHS Apps Library (https://apps.beta.nhs.uk/) to help promote apps that have been evaluated for approved use in the NHS.

Increasing levels of adoption mean that it is now more realistic to provision intelligent care services on these platforms. However it must be recognised that adoption and usage is not universal and that provision must be made for patients and citizens either unable or unwilling to use personal devices for communications or personal health management.

Workforce Mobility

One of the advantages of the technological improvements in both communications and applications has been the ability to better support a mobile workforce. This is particularly important for staff visiting patients at home and is a key enabler for more out of hospital care.

Workforce mobility solutions have the ability to dynamically schedule visits for teams to optimise efficiency. The best workforce mobility solutions should also integrate with acute, community and social care systems to receive appointment details and patient information and provide the ability to:

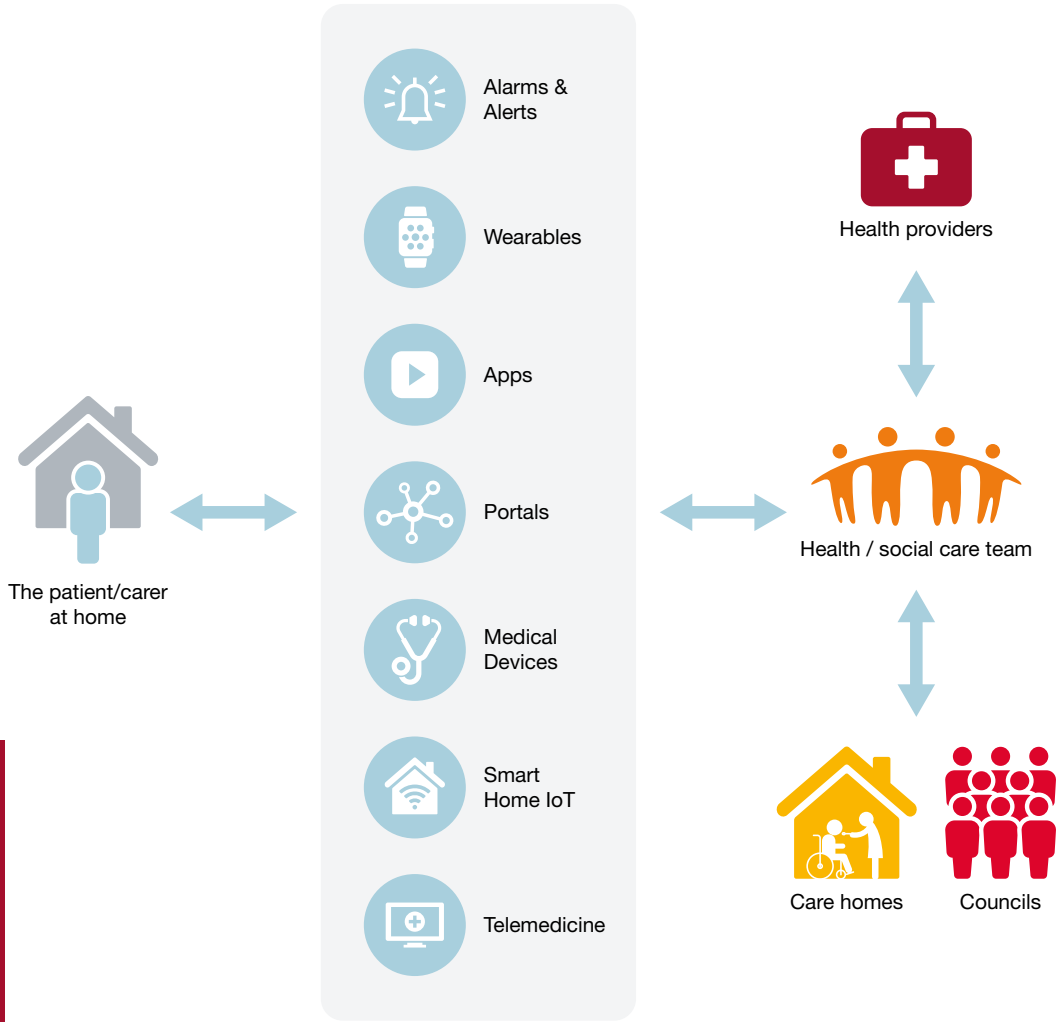
- Check in and out when visiting patients
- Look up key information and alerts about patients
- Carry out on-line assessments and clinical notes during visits
- Capture photographs, images and patient signatures and integrate these with the integrated digital care record
- Update underlying systems with key information

Smart Homes

There is considerable innovation currently going on in terms of designing digitally enabled smart homes. Some of this innovation is related to energy and utility optimisation but there is an increasing awareness of using similar technologies to better support patients at home through the use of the internet of things. Examples of smart home technologies that have the potential to deliver technology enabled care include fall monitors, bed sensors, key safes, door sensors, home alarms and medication dispensers.

The use of digitally enabled devices in the home can help patients to stay at home longer and potentially reduce the need to spend time in hospitals and care homes. This is, however, dependent on the devices being integrated into a wider integrated digital care record so that any alerts or warnings issued by the technology are appropriately routed to the relevant stakeholders for swift action and response.

The Intelligent Home



The Intelligent Hospital / Facility

Some steps have been taken to improve the use of technology in care facilities using kiosks, asset tracking or calling screens though the full potential of using the internet of things has yet to be realised.

The key concepts associated with technology enabled care in a complex environment such as a hospital where a vast array of digitally enabled systems and devices can be connected are:

- **Situational Awareness** – situational awareness relates to understanding what is happening in a particular place at a particular time based on geographically targeted access to information from devices and applications.
- **Actionable Insights** – with the high volume of data available from connected devices and systems a process of filtering this out into actionable insights is required to support clinical staff prioritise their work in real-time.

How the hospital of the future could make better use of connected technologies

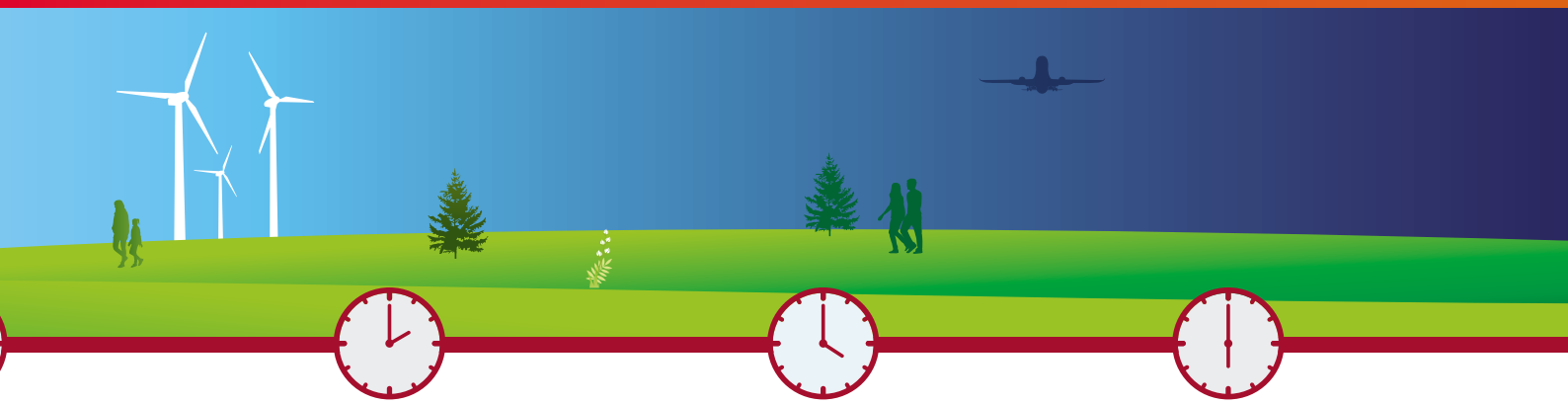
A patient is expected back on the ward having been to a diagnostic test in a different department but has failed to return. The nurse checks the current location of the patient based on tracking the RFID enabled patient wristband. The nurse can then issue an urgent portering request via her tablet which is picked up on a portering worklist. The porter collects the patient from the canteen, brings her back to the ward and marks the request as complete.

A doctor walks on to a ward. Her smartphone knows her location based on situational awareness and immediately brings up an actionable insights worklist of the patients requiring attention based on significant new diagnostic test results or deteriorating MEWS scores. She can review the results on her phone whilst with the patient and mark the actions and reviews as complete whilst on the ward.

A Day In The Life Of A Technology Enabled Hea

Team			
Care Coordinator Manish	• Manish dynamically schedules the home visits for the team using the workforce mobility solution ensuring that all the relevant care records are available on-line	• Manish is notified that Josh has phoned in sick and dynamically reschedules Josh's home visits to other care members	• Manish sets up the patien Doris on the patient app t access • Manish is notified electron Doreen Jacobs is in hosp ablement service review is discharge care planning
Care Worker Bill	• The team gathers together to check on the day's activities including viewing the schedule and checking patient details	• Bill arrives at the client – he can access the key code to gain entry and logs that he has arrived on his personal tablet. He is presented with the latest updates from his client's health and social care record	• Bill checks the observatio Doris and explains the res through a self-assessmen with Doris and takes phot help with planning a stair
Patient John Mary Edward Stan Doris	• John receives a reminder via Alexa to take medications and do daily exercises	• Mary is reminded to take blood pressure and pulse readings via a message on her smart phone • Doris has a home visit from her care team. She works with Linda in filling out a questionnaire on the tablet and is shown how to access her own care plan on-line using a tablet. She is also put in touch with support groups in the neighborhood via their website • John follows the video exercises on his tablet and updates his patient app to confirm completed and his assessment about progress • John's electronic pill dispenser records that the medicines have been retrieved	• Stan's bed sensor alerts t got out of bed that morni an alert to the nominated member
Family member / Carer William Pauline Bernie		• Doreen Jacob's son William is notified that Doreen has attended A&E and has been admitted for exacerbated COPD • Mary's carer is notified on a visit for the next day	• Stan's daughter Pauline re message to say that Stan bed
GP Dr Prakesh		• Dr Prakesh is notified that patient Doreen Jacobs has attended A&E and has been admitted for exacerbated COPD with an estimated discharge date	
Hospital Team			• The hospital accesses the for Doreen Jacobs
Care Team Manager Sharon	• Sharon checks the roster for home visits and scans emails and messages for any changes logged by patients or staff	• Josh has phoned in sick so the rota for today's visits is amended	• Sharon adds an orthotics a home visit based on rea from the district nurse

lth Economy



t profile for o enable on-line ically that ital and the re- s initiated for post	• Manish uses the system to produce stats for the previous month including metrics on visits and interventions	• Manish adds the urgent home visit to the schedule for tomorrow	• Manish checks that all the visits have been updated on the system and that actions have been assigned to different team workers
ns recorded by sults. He works t questionnaire os of the stairs to lift	• Bill notices that Doris is feeling anxious and sends a message to Doris's son Bernie to suggest a visit	• Bill moves on to visit Shakar and helps set up the home monitoring equipment. He also puts Shakar in touch with a local community support group who will provide day care	• Bill checks that all the data has been synchronised with the main systems. He reviews the schedule for tomorrow and suggests that a physio accompany him to visit Jane
hat he has not ng which sends carer / family	• Mary receives a second reminder via smart phone • Edward interacts with his home screen well-being module to record he is feeling anxious and depressed	• Mary's monitoring readings are received electronically and trigger an alert to the care team which schedules a home visit for the next day • Edward's care worker phones him to check his well-being and provides advice and reassurance	• Mary is contacted with the suggested appointment and asked to confirm this is ok
eceives a has not left his	• Doris's son Bernie receives a message to advise that Doris seems quite anxious	• Pauline updates the patient app to confirm that Stan is up and about and feeling better	
			• Dr Prakesh receives an alert from the care team about Mary's changing symptoms and a medication review is initiated • The GP interacts with Mary using the GP booking app to arrange the appointment
e on-line records	• The hospital initiates an electronic transfer of care assessment referral for Doreen Jacobs for social care support post hospital		
assessment to l-time updates		• Sharon reviews the performance metrics for the month using the inbuilt reporting tools	

Patient Wearables and Remote Monitoring

Wearable devices have been available for some time particularly for specific conditions such as diabetes monitoring. There has also been an explosion of the use of personal fitness devices such as Smartphones, Fitbits or smart watches to monitor daily activities including exercise as well as more sophisticated observation recording devices for key clinical indicators including temperature and blood pressure. Personal pendant alarms have also been used for a number of years which typically initiate a call back response when activated. This has helped to promote a culture of personal health management and health improvement amongst some but not all of the population.

Typically however these devices are not connected to the wider integrated digital care record with patients only able to interact with proprietary apps. This has limited the use of these devices in supporting the joined up care pathway across the whole health economy including alerting carers, GPs, social care teams or community nurses.

There have also been issues with ensuring that the apps and devices comply with safety legislation and adhere to standards for the exchange of data.

There is huge potential for the wider use of home monitoring for patients once these issues are addressed.

Remote Consultations

Telemedicine has been available for a while with a number of vendor solutions available on the market. Telemedicine can be used to support remote consultations at home or at a local GP practice to avoid the need to travel to hospital which could be a significant journey if for specialist treatment.

Again the need here is for the remote consultation to be integrated into the wider digital record with the session recorded for audit purposes and all participants able to view relevant and pertinent contextual information both before and during the session.

Remote consultations can also be used for multi-disciplinary team meetings where a geographically dispersed set of stakeholders can review and record information with or without a patient being present.

Virtual Assistants

Virtual assistants or chatbots are increasingly being used as part of general interactions with the internet of things. Many people are starting to use Apple Siri, Google Assistant or Amazon Alexa to interact with smart phones. Developers are also starting to look at how these can be used to better support patients. Some examples as to how this might evolve include issuing reminders to patients to take observations, do their exercises or take medications, providing guidance on how to exercises or take measurements and directing patients to appropriate support.

Virtual assistants can also play an important role in supporting care-givers by providing access to knowledge bases.

Benefits Through Digital Transformation

There are multiple benefits that can be realised through the adoption of integrated technology enabled care solutions for all stakeholders involved in health and social care.

The benefits can relate to patients, users but also deliver improved safety outcomes, improve efficiency and therefore deliver financial savings.

Benefits for Patients

The main objective for patients is to be able to live independently for longer. The other associated benefits derived from the better use of technology include:

- Fewer trips to hospital
- Better information about conditions and underlying health through routine self-monitoring
- Better access to personal information through the availability of an integrated digital care record
- On-line access to community support and condition based services
- Improved confidence in the service – knowing that different care teams have access to information previously supplied without having to answer the same questions repeatedly

Benefits for Families and Carers

Families and carers are often out of the loop in terms of access to information and being made aware of significant events. This often means that support that could be delivered by families and carers is often provided by care teams. This includes supporting patients with self-monitoring, medications or exercise routines. Adopting a technology enabled care approach can help with:

- Informing families and carers of significant events – including failure to take medications, actions from home sensors or attendances at A&E
- Providing on-line information to support patients with self-monitoring and exercise routines
- Directing families and carers to helpful information and support networks

Benefits for Health and Social Care Professionals

There are numerous potential benefits for health and social care professionals that cover:

- Providing real-time access to important information to support decision-making and improving patient safety and outcomes
- Reducing the duplication of data on paper forms and across multiple systems through electronic data capture and integration
- Supporting better coordination of activities across multi-disciplinary teams through the sharing of information and targeted referrals and promoting out of hospital care
- Providing the right tools for the right jobs including access to information and workflow across smart phones, tablets and other devices to avoid data duplication and entry across systems
- Supporting the flow of patients through acute services including reducing delayed transfers of care and non-elective work including A&E attendances or emergency admissions

Benefits for the Health and Social Care Economy

There are many benefits for the overall health and social care economy that reflect many of the benefits delivered to patients and care professionals such as:

- Supporting more care in the community and reducing the number of GP appointments, hospital appointments or admissions or A&E attendances
- Supporting clinical and operational efficiencies through workforce mobility, improved patient flow, reduced duplicate data capture and entry and improved data sharing between multi-disciplinary teams
- Providing actionable insights from the data collected via an integrated digital care record to identify patients most likely to require intervention
- Supporting public health initiatives including patient empowerment and self-monitoring to help reduce the demands on the service
- Improving patient outcomes and quality of life through patient support networks, access to information and targeted interventions based on clinical need rather than routine scheduling

Issues And Challenges And How To Overcome These

The adoption of a technology enabled care approach comes with several important challenges that need to be addressed as part of the overall solution.

National Infrastructure

There are still many areas in the UK that suffer from poor connectivity or limited bandwidth. Improving the national infrastructure and backbone via 5G is a critical step towards delivering technology enabled care.

Security and information governance

The exponential growth of personally identifiable data collected in healthcare means that careful attention must be given to data security and information governance particularly with regard to General Data Protection Regulations (GDPR). Any solutions that are designed and implemented must be based on:

- A privacy first approach
- Support for patient preferences around consent and access
- Support for the identification and control of legitimate relationships between users of data and patients
- Audit
- Processes for incident management in the event of data breaches
- Supporting GDPR principles in terms of patient preferences, right to delete and access to digital records

Safety

There are a number of safety hazards associated with the collection, management and use of clinical data through technology enabled care. This is particularly pertinent to any medical devices that are connected to the internet of healthcare things and used to support both patient and clinician decision support. A robust safety management approach is essential to ensure that devices and solutions comply with medical device management regulations and safety standards.

Integration and Interoperability

Currently many solutions used in healthcare have poor support for integration and interoperability. This is particularly true of remote monitoring apps and equipment and home based devices. There is also a current lack of integration between GP, Acute, Community and Social care systems. This is preventing many of the benefits associated with integrated health and social care from being realised including a reduction in data duplication and data entry, real-time access to an integrated digital care record and support for population health analytics. The NHS is actively trying to improve the situation through support for new standards for interoperability eg the CareConnect approach using FHIR and via industry liaison initiatives such as InterOpen.

Platform approach

The best approach to realising the benefits of technology enabled care is to adopt an open standards platform approach to integrating devices, apps, clinical systems and workforce mobility solutions. This ensures that data can be:

- managed around a single patient master index
- securely and safely exchanged between connected devices and systems in real-time
- additional functionality can be provided on top of the platform including alerting, reporting and notifications
- supplemented with additional functionality that can be aggregated for population health analytics
- presented as an integrated digital care record for all stakeholders including patients with appropriate access and security management
- captured to enhance the information held about patients and citizens
- shared in meaningful ways across health economies for example if a patient moves to a new location

One of the most important deliverables of a platform approach is the ability to transform and store data using standard definitions to support semantic interoperability and ensure that the data is meaningful for all stakeholders. A great example of this is the OpenEHR platform which allows communities of clinicians to define clinical data and store this in a fully interoperable platform that can be populated via interfaces and exposed via APIs to support the ecosystem of technology enabled care solutions.

CGI are actively working with OpenEHR solutions to provide regional health economy solutions that provide a better platform for integrated health and social care solutions than traditional megasuite solutions.

The Integrated Digital Care Record

The integrated digital care record is the main deliverable from a platform based approach to technology enabled care and supports:

- Longitudinal patient records with data sourced from:

- Applications used in care settings
- Remote monitoring devices
- Patient apps and portals
- Clinician apps and portals

- Patient and nominated user access to personal information
- Support for workflows for different stakeholders
- Standards based interoperability across all applications, devices and systems used in the health economy
- Platform based storage for clinical information
- Reporting and analytics to support operational management and long-term planning

The integrated digital care record forms the main user interface for stakeholders and can be embedded into existing applications with patient, user and activity context.

A number of solutions are available that support many of these key concepts but there is still work to do to support open standards based platforms and greater interoperability with devices and point solutions eg mobile apps.

Inclusivity

Although the adoption of technology is growing exponentially it is important to ensure that patients, carers and staff who are either unable or unwilling to use devices, apps or portals are not excluded or disadvantaged. Many joined up health authorities are already undertaking surveys of patients and staff as to their preferences for using various technologies as part of the care process.

There are many examples of user research linking the most appropriate technologies to different care pathways and this should feed into the planning of an overall approach to technology enabled care. For example patients with dementia will have a different set of needs and capabilities to patients undergoing rehabilitation for a common surgical procedure.

It should also be noted that for many patients social interaction with health and social care teams is an extremely important aspect of well-being and that any technology enabled care solution should not totally remove personal contacts between patients and staff.

Personalisation

The concept of personalisation is linked to inclusivity. Each patient will have a set of individual needs and goals. Although patients maybe on standard care pathways any solution must provide the ability to tailor technology enabled care to fit the individual circumstances of the patient for example:

- Taking account of comorbidities
- Taking account of personal circumstances eg living arrangements
- Respecting patient preferences
- Reviewing the individual patient social network of family and carers
- Addressing the patient familiarity and willingness to embrace technology

Adoption

As with all IT projects in health and social care, adoption and business change are as important as the technology itself. Engagement with staff and stakeholders is critical to the success of realising the benefits of innovation. This can only be achieved through ongoing dialogue with teams about the goals and benefits of the project for both staff and patients, potential issues arising from the adoption of the technology and full support through training and mentoring.

Principal adoption concerns

- Concerns about workforce mobility solutions – constant monitoring of where staff are and what they are doing, removing the ability for team huddles at the start and end of each working day and using computers when interacting with patients.
- Concerns about use of new technology – unfamiliarity around use of tablets, smart phone apps, setting up and checking remote monitoring devices, use of virtual assistants. Concerns around removing the human interaction and engagement between staff and patients.
- Concerns about personalisation and inclusion – clinical staff have rightly emphasised this as an important issue in the use of technology to support care and is a key element of configuring and adopting any solution.

Business Continuity

With an increasing reliance on technology to deliver care steps must be taken to ensure that appropriate business continuity measures are in place to deliver:

- High availability platforms so that a single point of failure does not disrupt the ability to care for patients
- Workarounds for staff in the event of system unavailability

Conclusions

There are massive opportunities for the better use of technology to support care givers and provide the tools for patients and carers to manage conditions at home or in assisted care homes. The issues associated with technology enabled care are significant and can be managed and mitigated through consultation with staff, patients and system vendors and adherence to standards already published by UK Gov and the NHS.

CGI are at the heart of designing, scoping and building solutions with partners that can facilitate this digital transformation and provide truly integrated, intelligent health and social care for the 21st Century.

CGI works in partnership with Trusts to deliver a full spectrum of digital solutions, in areas including e-Prescribing, intelligent health and care, mobile apps and secure content sharing. These provide both care professionals and patients with the right information at the right time, to make informed decisions about care.

Through increased collaboration between organisations and within communities, we help local governments and NHS Trusts ensure a joined-up approach across health, social care and local citizen services.

CGI

Experience the commitment®

www.cgi-group.co.uk/health
enquiry.uk@cgi.com

Follow us on Twitter
@CGI_UKNEWS

Connect with us on LinkedIn
CGI

Find us on YouTube
Youtube/CGIgroup

Find us on Facebook
Facebook.com/CGI.uk