iNSW Report

Information Communications and Technology Infrastructure Requirements for the Health Sector: A BT Point of View

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1.   EXECUTIVE SUMMARY

The New South Wales public health sector, like health sectors globally, is facing increasing challenges to deliver high quality and cost-effective care against a backdrop of ever increasing demand for healthcare services, limited capital availability and tight operational expenditure budgets. As with other industries undergoing fundamental transformation - information, communications and technology (ICT) are a critical enabler that can help unlock the traditional dependency of healthcare on financial constraints.

Health is the last of the information-intensive sectors to undergo an ICT-enabled transformation process. ICT in other industries is known to have a disruptive and cathartic role to play in the radical transformation in the way that services are delivered to more efficiently meet demand and this in turn will have a profound effect on the physical infrastructure required to support delivery.

In 2008, Deloitte prepared a report for the Commonwealth, titled the National eHealth Strategy that was agreed by COAG 2009.
Deloitte identified that National action should be focused in four key areas:

- Implementing the national 'health information highway' infrastructure and rules to allow information to be seamlessly accessed and shared across the Australian health care system
- Stimulating investment in high priority computer systems and tools that will deliver tangible benefits to consumers, care providers and health care managers
- Encouraging health sector participants to adopt and use high priority systems and tools as they become available
- Establishing an E-Health governance regime to enable effective coordination and oversight of national E-Health activities.

Summary of their Recommendations were as follows:

R-1 Implement a set of national E-Health foundations to provide a platform for health information exchange across geographic and health sector boundaries.

R-1.1 Design and implement a national solution to enable the unique identification and authentication of Australian consumers and care providers.

R-1.2 Design and implement a consistent national legislative framework for information protection, privacy and consent.

R-1.3 Design and implement national E-Health information standards for data and message structures, coding and terminologies and information display.

R-1.4 Establish mechanisms to encourage care providers to invest in the implementation and maintenance of an acceptable baseline of computing infrastructure.

R-1.5 Coordinate the rollout of appropriate national broadband services to all care providers.

R-2 Foster and accelerate the delivery of high priority E-Health solutions by vendors and care provider organisations in a nationally aligned manner.

R-2.1 Establish a national fund to encourage investment in the development and deployment of high priority, standards compliant and scalable E-health solutions.

R-2.2 Establish a national compliance function to test and certify that E-Health solutions comply with national E-Health standards, rules and protocols.

R-2.3 Adopt a nationally coordinated approach to the development of consumer and care provider health information portals and an electronic prescriptions service.

R-2.4 Adopt an incremental and distributed approach to development of national individual electronic health records (IEHRs).

R-3 Encourage health care participants to adopt and use high priority E-Health solutions and modify their work practices to support these solutions.

R-3.1 Design and implement national awareness campaigns that focus on communicating the scope and benefits of high priority solutions to consumers and care providers.

R-3.2 Establish financial incentive programs, targeted primarily at key private provider segments, to encourage the adoption and use of high priority E-Health solutions.

R-3.3 Facilitate changes to national care provider accreditation regimes to make the adoption and use of E-Health solutions a core accreditation requirement.

R-3.4 Implement changes to vocational and tertiary training programs to increase the number of skilled, nationally available E-Health practitioners.

R-3.5 Establish national E-Health stakeholder reference forums and working groups with cross sectoral representation and clearly defined objectives and goals.

R-4 Develop a governance regime which allows strong coordination, visibility and oversight of national E-Health work program activities.

R-4.1 Establish a national E-Health governing board that reports to AHMC, has an independent chair and has a breadth of cross sectoral stakeholder representation.

R-4.2 Establish an independent national E-Health regulation function to implement and enforce national E-Health regulatory frameworks.

R-4.3 Establish a national E-Health entity incorporating strategy, investment management, work program execution, standards development and compliance functions.

R-4.4 Leverage NEHTA to establish the new entity and undertake a transition process to address changes to accountabilities, brand, culture, resources and operating model.

We have used these recommendations in the development of this paper.In particular, we have referenced the recommendations in the Case Studies provided.

The National eHealth Strategy also identified that The World Health Organisation defines E-Health as 'the combined use of electronic communication and information technology in the health sector.' In more practical terms, E-Health is the means of ensuring that the right health information is provided to the right person at the right place and time in a secure, electronic form for the purpose of optimising the quality and efficiency of health care delivery.

Many countries are progressing primary investment in ICT infrastructure to underpin and support radical transformation of the way healthcare operates. In those countries where the basic ICT infrastructure estate is already fully or partially in place, we see investment priority areas are now focusing on ICT-enabled transformation of the actual processes of purchasing and provision of care.

Infrastructure New South Wales has the opportunity to chart a path for new ways of financing an infrastructure that supports healthcare reform and delivery for the next twenty years. As healthcare requires significant reconfiguration to improve operational efficiency, this paper outlines the impact of ICT infrastructure on operational efficiency (section 1). Recommendations are made for improving operational efficiency by taking action in the following areas:

- Improving Organisational Efficiency & Increasing the productivity of people,
- Connecting Care and
- Delivering a better patient experience

Trends in health infrastructure across several countries have helped identify recommendations such as using ICT to transform ways of working, not simply create electronic records without fundamental process reform. NSW may also wish to embrace a trend of decentralising hospital care out into smaller scale community hospitals and specialist community centres to better meet community needs.

Electronic patient records supported by new clinical pathways and practices present new opportunities to localise care and should impact the locations of services, including infrastructure for aged care. This has significant opportunity to reduce cost due to clinical pathway inefficiencies and improve patient outcomes. In fact it is believed that new clinical pathways implemented to improve the delivery of healthcare should be implemented with haste, as they are central to unlocking the problem of meeting the ageing population demand of capital intensive hospital buildings in a capital constrained environment.

The focus on ICT as enabling process changes in this paper reflects the benefits of increased service delivery agility delivered by ICT investment. It is recommended that to derive the best benefit from ICT infrastructure, that it be decoupled from capital expenditure from traditional physical infrastructure projects. It is recommended that ICT be acquired through outsourced facility services contracts, not as part of a facilities management or infrastructure build contract.

Supporting the recommendations are case studies that indicate a way forward for NSW through demonstration of the art of the possible (Appendix A).

Finally this paper is concluded with BT's future vision of health care; to enable better value for money by utilising more cost efficient, focused ways of working. BT's vision is described in section 5, grouped under 4 headings:

1. The management of chronic diseases.
2. patient co-production.
3. Care integration.
4. Procurement and provision of managed ICT and infrastructure services.

BT's vision includes:

- Support for wide spread change in patient quality and duration of life expectations and associated demand coupled with the opportunity to help change behaviours for self-care and wellbeing,

- Ubiquitous access to health information (pharma, health provider, patient) driving improved quality of care and improved patient outcomes, whilst driving an intelligent use of healthcare services and reducing dependencies on physical facilities,

- New business models of healthcare enabling the provision of care to be more independent of physical buildings infrastructure. This is likely to result in a spread of health care infrastructure from today's focus on large hospital infrastructure to a graduated mix of smaller provider care units and virtual care services based on local population profiles and needs.

In conclusion, the disruptive nature of ICT offers the opportunity for transformation in healthcare that should challenge the status quo, and offer new possibilities that impact the requirements for physical healthcare infrastructure in the future.

2. HEALTH ICT AND OPERATIONAL EFFICIENCY

The nature of the health system today reflects the long history of healthcare as a government responsibility, hospital institutions as the central provider, and an ever increasing community demand for a wide array of public and private providers and services. Operational efficiency is highly dependent on the physical environment and working practices. Common to all areas of operation, information sharing and alternative infrastructure and technology solutions can make a significant impact on traditional hospital-centric healthcare, and in turn, influence future physical infrastructure demand, design and usage.

We describe the role of ICT in operational efficiency against four key themes:

Improving organisational efficiency

Increasing the productivity of people

Connecting care

Delivering a better patient experience

Key to tables below:

$ Cost savings, improved income

Improving quality of care

Improving productivity

Meeting targets

Improved satisfaction

2.1.   Improving organisational efficiency

How do I improve organisational efficiency to achieve savings while still delivering a better patient experience? How do I reduce costs? What role can ICT play in delivering savings? How do I rationalise my organisation post-merger or following organisational change?

Operational efficiency	Description	Example technologies
Accelerate discharge of patients from hospital	Discharge patients faster from hospital enabling increased throughput	• Audio conferencing for community-based multidisciplinary teams and to coordinate care in the community. • Telehealth to assist supported earlier discharge.
Manage resources for productivity and cost savings	Help save money and improve working efficiency through enabling better management of resources and assets	• RFID asset tracking of high value assets freeing up 10% of inventory costs. • RFID asset tracking of case notes to increase their availability and free up staff time finding them.
Save through consolidating infrastructure	Consolidate networks, virtualise data centres, and unify communications to save money and the overhead of managing multiple contracts.	• Virtualisation of data centres. • Network consolidation. • Unified communications. • Cloud services.
Free up estate and buildings	Free up the office space required to run healthcare organisations enabling asset release or expansion for investment areas.	• Reduce office provision by 20% through mobile/agile working. As below there are other important benefits and outcomes of mobilising the workforce. • Reduce paper storage through scanning and Electronic Document Management solutions.
Outsource management of applications and infrastructure	IT outsourcing or managed services enabling providers to focus on the business of delivering healthcare whilst leveraging lower cost solutions.	• IT outsourcing. • IT managed services for infrastructure, network and applications.
Drive business change through intelligence	Transform business operations through the effective use of information and process redesign.	• IT outsourcing modern data centres with virtualization. • Business intelligence solutions. • Cloud-based ecosystems for informatics and analytics.
Meet the green challenge	Meet targets for sustainability and climate change through reduced carbon footprints and moving to digital by default.	• IT outsourcing to modern data centres with virtualisation. • Audio conferencing, Videoconferencing, Unified Communications, Telehealth and other services enabling the replacement of face-to-face with digital by default.

2.2.   Increasing the productivity of people

How do I increase the productivity of your people while still ensuring that patients receive the best care possible? How do I maximise the time my clinical staff spend with patients? How do I redesign service models and working practices to drive productivity gains? What role can ICT play in transforming productivity? How do I manage with fewer management staff?

Operational efficiency	Description	Example technologies
Deliver clinical best practice	Incremental implementation of EPR functionality and associated clinical portals and analytics services required to maximise effectiveness in delivering best practice cost-effective healthcare.	• Electronic Patient Record (EPR) systems implemented against roadmaps such as HIMSS EMR Adoption Model. • Electronic Document Management (EDM) solutions ensuring clinicians have access to all relevant letters and information. • Clinical portals to join up data across the care system and enable workflow between systems assisting delivery of best practice.
Free up staff time	Free up staff time to work in other areas where demand is greatest or where new opportunities exist to change care models, whilst increasing the quality of care provided.	• Medical Transcription saving medical secretary time and improved accuracy. • Flexible working and conferencing services to work smarter reducing time to travel and prepare. Including audio conferencing, videoconferencing, and web meetings. • Managed service mobility solutions to support agile, mobile and office workers including secure remote access solutions. • Electronic Patient Record and clinician/ patient portal service systems to speed access to information.
Mobilise the workforce	Through agile and mobile working boost people's productivity by 40%, improve staff quality of life, whilst delivering better patient care and trimming office costs by 20%.	• Managed service mobility solutions to support agile, mobile and office workers including secure remote access solutions. • Lone worker to help keep staff safe. • Mobilising EPR and Medical Imaging applications onto mobile solutions. • Bring Your Own Device to leverage existing infrastructure.
Educate the workforce	Manage staff training against regulatory and business requirements.	Learning solutions to deliver educational content, including professional services.
Secure services for rapid and safe access	Manage security services to facilitate timely staff access to services and support for mobile devices.	• Single Sign On. • Connection to national or regional security services. • Mobile device security solutions.

2.3. Connecting care

How can better communications help you transform the patient experience and the delivery of healthcare? How do I improve interoperability across my local health economy? What role can ICT play in closer collaboration between mental health, community health, social care and GPs? How do I provide care closer to home?

Operational efficiency	Description	Example technologies
Enable integrated team working 💰 📊 🕐 ◎ ☺	Connect care networks and teams to support smarter ways of working to free up time and deliver better integrated services for patients. • Care networks (e.g. cancer) supporting multi-disciplinary teams to deliver safe, evidence-based care across large geographical areas and care settings. • Virtual ward rounds in the community supporting primary and community teams to manage high risk patients in the community. • Community team meetings enabling single, multi-disciplinary or integrated teams to achieve effective communication, facilitates team working without the need to travel, saving time and money. • Enabling dispersed national health teams, such as public call centres or transfusion service, to meet without the need to travel.	• Audio conferencing, videoconferencing, and web meetings. • Clinical portals to share access to common patient information and to manage workflow. • Interoperability services to share documents and workflow between organisations for key events like referrals, appointment scheduling and booking, discharge and outpatient letters, and prescriptions. • Medical Imaging vendor neutral archives for common access to medical images.
Enable redesigned interface services (across tertiary/ acute/primary/comm unity/social care) 💰 📊 🕐 ◎ ☺	Leverage specialist care services to remotely manage patients in the community and at home with co-benefit of up-skilling care professionals • Virtual outpatients from acute care to family doctor surgeries streamlines community work up, reducing the need to travel and triages which patients need a face to face consultation or surgery. • Virtual outpatient/ therapy/ rehabilitation services to a community setting or patient's home, enables post discharge support and on-going therapy at a distance without the need to travel, supporting re-enablement and post discharge/ acute event recovery. • Virtual out of hours care enabling effective clinical decisions without the need for the patients or care professionals to travel.	• Audio conferencing, videoconferencing, and web meetings. • Telehealth services to remotely monitor and manage patients at home.
Enable faster clinical decision making 💰 📊 🕐 ◎ ☺	Connect critical information with empowered care professionals to assist rapid clinical decision making to radically improve patient outcomes and 'save lives'	Telemedicine services utilising videoconferencing for remote assessment combined with vendor neutral archives (VNA) for common access to medical images e.g. Telestroke and rapid decision making for thrombolysis.

2.4. Delivering a better patient experience

How do you deliver a better patient experience when there is so much pressure on resources? What role can ICT play in this? How do I provide care closer to home? How do I transform the way long term conditions are managed?

Operational efficiency	Description	Example technologies
Connect with patients	Transform relationships with patients and their affinity to provider organisations. Deliver patient-centric services to suit patients' needs or preferences.	- Customer Relationship Management solutions. - Patient self-service terminals to improve efficiency and user experience. - Patient portals and electronic personal health systems for utility services and access to medical records. - Mobile phone queue management to free up waiting room space and enable patients to wait where they want to. - Automated language translation services.
Give patients with long term conditions better care every day	Maintain patients at home through supported remote care to keep people well and maintain quality of life, whilst reducing healthcare utilisation such as reducing hospital admissions and outpatient attendances.	- Telehealth services to remotely monitor and manage patients at home. - Conferencing services including secure communications with patients. - Telecare services for the frail and elderly. - RFID medication management solutions e.g. for care homes.
Support specialist community care interventions	Support and enable the delivery of specialist community services - Support end of life care maximising chance of patient dying with dignity in the place of their choice. - Support cost-effective care delivery for specialist services such as paediatric care or chemotherapy.	- Telehealth services to remotely monitor and manage patients at home. - Conferencing services including secure communications with patients.
Support re-enablement of patients post hospital discharge	Deliver supportive services post discharge for patients to deliver a better experience, support re-enablement and reduce subsequent healthcare utilisation.	- Telehealth services to remotely monitor and manage patients at home. - Conferencing services including break out to public IP addresses. - Telecare services for the frail and elderly

3. HEALTH ICT RECOMMENDATIONS

For iNSW there are some clear recommendations for the next stage of the journey of healthcare transformation. These initial short-term recommendations also incorporate planning suggestions for the medium- to long-term. They build on BT Health's experience in implementing technology in a number of countries to help our customers lay the foundations for transformation of healthcare services.

3.1. Improving organisational efficiency and increasing the productivity of people

1. Setting an overall plan and framework for the next 20 years, as iNSW is currently doing is an appropriate initial priority. This plan should take into account the eHealth strategy for NSW and include key objectives such as improvement targets in clinical outcomes, productivity gains and cost reduction across the health economy as a whole through a focus on the interplay and synergies between care models, ICT and infrastructure. A particular focus should be the freeing up of funds at each stage for reinvestment in the next stage.

2. Infrastructure and ICT refresh lifecycles are fundamentally different, so where ICT is bundled in with capital projects, provision should be made to ensure that contractual provisions do not prevent flexible evolution of ICT implementation in response to innovation and changing needs.

3. Where ICT is not bundled into capital projects, future ICT requirements should be taken into account from the beginning of infrastructure design.

4. All new builds should be conceived and designed with evolving care models and ICT requirements at the forefront. Existing hospitals and major community health buildings should be reviewed to evaluate the cost-effectiveness of implementation of Wi-Fi networks to lay the foundations for asset tracking, agile working in the built environment and enhanced patient services (e.g. internet and television access).

5. Current ICT facilities should be audited and reviewed to identify short-term opportunities for consolidation and streamlining, e.g. through consolidation of data centres and networks, virtualisation of applications and server estates, unified communications.

6. Initial steps should be taken to engage key health stakeholders in the development of thinking around an ecosystem for informatics and analytics to establish heavy lifting data services and provide easy access to data and tools for patients, clinicians and researchers. Such data will support performance management, service improvement and research.

7. Guidelines, tools, training and consultancy support should be put in place to develop capability in technology-enabled service transformation and to encourage innovation and best practice. This would help providers and commissioners to optimise use of in-house/outsource/managed service/PPP and PAYG models and promote best practice in change and programme management and clinical engagement.

8. Existing policy around information transparency should be reviewed and updated to allow greater public engagement in healthcare, so that patients and taxpayers are more able to hold the health system to account, and more information is available to speed up clinical research and pharma and life science investment.

9. Healthcare budgets and tariffs should be reviewed with a view to aligning payment incentives with initiatives such as remote consultation and monitoring so that commissioning and payment arrangements support new technology-enabled models of care as recommended in the Deloitte National eHealth Strategy (Recommendation R-3.2)

10. Introduce a programme of specific healthcare initiatives in different local health areas to demonstrate the NSW vision for health care, and improve policy settings and procedures before subsequent broader adoption. There are many areas where ICT infrastructure services will enable new capabilities, and much can be learned from overseas experience of simple and more complex deployments, some which had very short payback as well as very significant improvements in patient outcomes such as:

    a) Post discharge patient management.

    b) Chronic disease, in-home and in-community monitoring management.

    c) Management of in-home health (vital signs, and interventions).

11. Existing EPR systems should be consolidated and extended with a view to supporting integrated care plans, decision support, pathways and interoperability in the medium- to long-term. All such implementations should be benchmarked against an appropriate adoption model such as the HIMSS Asia Pac EMR Adoption Model, leveraging use of electronic patient records to drive improved data quality, collaboration, productivity and clinical outcomes.

12. Over time, EMR will influence the physical landscape of the provision of care, and trigger points should be identified (and monitored) that will indicate the potential for adoption of new physical asset options. It will take some time for attainment of certain EMR Adoption stages by all providers, particularly with regard to interoperability.

13. Optimisation of EPR and associated technologies should be used to underpin the gradual introduction of standardised approaches for managing integrated care plans for patients with chronic diseases, and growing integration with mental health and social care.

14. Operating costs can be taken out of the hospital system by operational efficiency improvements, freeing cash for further investment. Operating efficiency improvements occur through a reduction in referrals, improved staff efficiency, reduction in hospital bed days, better patient outcomes.

15. Encourage ICT suppliers to develop and deliver centralised application service models for non-clinical and clinical services that take advantage of new ICT infrastructure such as electronic patient records, faster broadband and data centre services such as cloud.

3.2.   Connecting care

1. Audio and video conferencing should be evaluated as a potential quick win to reduce unnecessary travel, release time to care, improve collaboration and enhance patient experience. Adoption of such comparatively simple solutions will raise the profile of technology as an enabler and stimulate the adoption of more complex technologies, such as Telehealth, in the future.

2. The roll-out of agile/mobile working solutions to support delivery of services in the community should be continued and accelerated in areas such as community nursing and health visiting where the clinical and organisational need is greatest. Particular attention should be paid to ensuring that such initiatives generate the anticipated productivity and cash benefits, e.g. through release of time to care and estate rationalisation. In order to achieve this, working practices will have to evolve significantly. Particular thought will need to be given to effective working in areas of poor signal coverage.

3. Reduce patient service costs by in home or community intervention by reducing hospital visits through the deployment of simple commodity communications technologies that enable video assessments or in-home telephone (audio conferencing) discharge follow ups.

3.3.   Delivering a better patient experience

1. Initial steps should be taken to implement patient co-production e.g. through the introduction of basic utility services such as electronic booking and repeat prescription services. Such initial involvement of patients will help to pave the way for medium- to long-term innovations such as patient access to health records and patient portals, patient feedback and social networking mechanisms.

2. Current Telehealth/Telecare trials should be evaluated for clinical effectiveness and cost/benefits in order to identify priority areas and to develop plans for implementation at scale. Crucial for scale roll-out will be alignment of commissioning and payment arrangements to incentivise such implementations. The initial focus will inevitably be on complex chronic diseases and the facilitation of acute discharge, but thought should be given to the future role of Telehealth in management of early stage conditions, prevention and wellbeing programmes. Medium – to long-term plans should leverage the opportunities offered by pervasive monitoring and smart home facilities combining existing and consumer infrastructures.

4. TRENDS IN HEALTH INFRASTRUCTURE

The interaction of healthcare services, technologies and built infrastructures is complex. Changes in one element can lead to unpredictable or highly lagged effects on the others.

Models of healthcare delivery and care pathways are institution-based and generally hard to change; **acute hospital care** still dominates the system in all developed countries. Care pathways tend to be highly standardized, aiming to provide services at optimum speed and minimum cost. However, in time the pressure to reduce dependency on expensive hospital models will force change. This will be reinforced by the desire of patients to have access to a wider range of higher quality healthcare services closer to where they live and work, rather than where it suits the system to provide them. In an increasing number of countries there are consistent policy statements about taking services out of larger hospitals and **delivering them in the community**. For hospital organisations, decentralising services to satellite settings also has the potential advantage of helping to reduce fixed costs in expensive acute hospitals, while at the same time maintaining a revenue flow.

Technology, in its broadest sense, is also playing an important part in decentralising services. The introduction of progressively less invasive clinical treatments and clinically administered diagnostic procedures means that doctors need not necessarily work in settings where there is access to multi specialist teams and high technology equipment. Developments in facilities technology is making it increasingly safe and acceptable for diagnostic tests and acute clinical treatments to be delivered in settings beyond large hospitals, including on a mobile basis. The digitalisation of pathology and imaging mean that patients need not travel to hospitals for the majority of their diagnostic tests and the results can be read and interpreted anywhere.

So what will **future healthcare infrastructure** look like? Care pathways will be increasingly reconfigured to allow the majority of care to take place in the community. Such healthcare will be delivered by community-based healthcare staff and patients themselves, who self-manage their own conditions. The current shift of services out of large acute hospitals will therefore accelerate. This presents an opportunity to rethink how to use scarce resources more effectively and at the same time create more responsive and accessible services for all. However, it also raises some important questions about the future built infrastructure for healthcare. Traditional general hospitals will in time be reconfigured to best meet the range of services they are best able to meet.

Remote care – Telecare/Telehealth – needs to be designed into proposals for modernising or replacing healthcare built infrastructure from the outset. Redesign of services around remote care will need to embrace primary and secondary care, as well as social and housing services. Greater use of remote care suggests that the design of new or existing hospitals that are being refurbished should not only consider ways of optimizing their internal functions and processes to meet changing health care practices and needs; it will also need to consider how best to integrate remote care models and how these can open-up possible new forms for care delivery.

New **community hospitals** – smaller scale and more widely distributed than large district general hospitals – could provide opportunities to explore and introduce new care and infrastructure models which embrace remote care. Their role should be as facilities for local, more accessible health services such as testing, imaging, minor injuries treatment, day case procedures coupled with responsive, flexible intermediate care and community rehabilitation services, with remote care providing better support after discharge. Remote care would also extend to the home monitoring and support of chronic conditions.

Another area where infrastructure needs to change to accommodate new healthcare models – increased self-management and community-based rehabilitation – is the home itself. It is clear that the **mainstream housing stock** will become an increasingly significant part of the care delivery system, but this needs to be 'fit for purpose'. A greater proportion of the population cared for in their own homes may well mean there is a need for measures to improve the physical quality of housing, such as improvements to disabled access or thermal efficiency, in order to make it suitable for frailer, older people.

In the long term we need to challenge preconceived notions of what type of housing provision is appropriate for people's varying needs. Existing sheltered housing and nursing home models will need to adapt. This is because of the way remote care potentially creates new care pathways, for example slowing the point at which people require nursing home placements and allowing them to remain in their own home or sheltered accommodation. This is turn may result in

different types of resident – perhaps with higher levels of need – being accommodated in the sheltered housing and nursing home sectors than is currently the case.

ICT has a significant role to play in integrating facilities management services within a hospital or other health services environment and also integrating these to clinical services. ICT infrastructure is very different to physical infrastructure in that it has a short currency (2-5 years), costs decrease over time for the same capability, and more capability becomes available daily.

The ICT industry also differs from physical infrastructure building companies and facility management companies as they have a willingness to build services and charge on a consumption basis, assuming minimum volume commitments or equivalent commercial terms. This will reduce capital requirements and delivery risk for the State. Some ICT companies may also be willing to invest in Public Private Partnerships (PPP) or similar models.

There are new 'smart PPP' models, where the envelope around the contract is more widely drawn than just the physical infrastructure and its maintenance, i.e. also embracing non-FM/infrastructure services and possibly even elements of clinical care, as in examples in Spain, Portugal and Finland. The Fiona Stanley hospital model, addressed below, is one variant of this model.

There is a strong trend in the delivery of ICT services towards procurement of services, rather than the traditional Design, Build, Finance and Operate (DBFO) view of ICT. In the private and public sectors, suppliers are accepting the commercial opportunity to build the ICT infrastructure to provide services for one or multiple clients, based around a commercial rate of return and client commitment to the service. The upfront investment in bespoke services often carries more complexity and technology-currency risk for the supplier, than say an electricity plant or road, and this differentiates this model from the commercial engineering of a user-pays approach for infrastructure projects.

Given the different characteristics of ICT infrastructure, to achieve the expected benefits, the managed introduction of change is paramount. Looking abroad to where success has been achieved, the UK can point to many successes based on introduction of change at the local area authorities' level. There are many case studies demonstrating success and benefits in the following section.

1-3 years	4-10 years	10-20 years
The current emphasis on traditional hospital infrastructure, both new and re-furbished hospitals will continue to meet existing government obligations.	The trend towards managing older people in their homes will continue, as a necessity, given limited types of accommodations and low availability of appropriate accommodations for treatment and convalescence. Governments will view in home care as a preferred option, given long lead times and affordability issues.	Governments and private providers of sheltered housing and nursing homes will need to adapt and build accommodations to cater for a broad range of in situ medical treatments.
In remote communities trials of Telecare and Telehealth will begin, enabled by new broadband deployment.	Standard Telecare and Telehealth services will be adopted for a limited range of services, limited by the number of appropriate community facilities for videoconferencing. Whilst the emphasis may be to service more remote communities, there will be a growing expectation of similar services in urban communities.	A range of community care centres will become expected by local communities, in the same manner as general practices and hospitals are expected today.
Local councils may offer video conference services to their community for various purposes including remote care sessions.	New community hospitals of smaller scale and with a more limited scope of services may be in the planning and early delivery phase.	There will be a graduated range of public and private care facilities, catering for specific community needs and addressing the constraints of the rapidly increasing demands of the ageing population, and unaffordable linear expansion of traditional hospital models.

A new approach to health infrastructure is proposed, building on capability today, with new types of facilities and services that address the increasing demand for healthcare and in-affordability of traditional hospital infrastructure and existing care pathways. Underlying this approach is the enabling capability provided by electronic patient records and required changes in clinical pathways and practices. Projects for new and refurbished health infrastructure should take advantage of the National and State investment in electronic patient records, network and data centre infrastructure that can transform the traditional healthcare cost structures.

5. HEALTH INFRASTRUCTURE RECOMMENDATIONS

Recommendations

1. Over coming years, small scale community hospitals and specialist community centres with specific scopes of service are recommended to reduce the dependence on general hospitals and to better meet local community needs. Their role should be to facilitate local, more accessible health services such as testing, imaging, minor injuries treatment, day case procedures coupled with responsive, flexible intermediate care and community rehabilitation services, with remote care providing better support after discharge.

2. To significantly reduce the cost per bed, ICT infrastructure such as electronic patient records supported by new clinical pathways and practices will help define efficient operating models for these hospitals.

3. As new smaller community based facilities are built, today's general hospitals can be re-configured to address acute and emergency services as new clinical pathways and community hospitals remove some of the burden of existing services. Consequently the average sickness acuity of patients will increase in such facilities and they will need new ways of operating with higher staff to patient ratios.

4. New aged care facilities, including respite care should also be encouraged to adopt an operating model based on electronic patient records supported by new clinical pathways and practices. This will reduce cost due to clinical pathway inefficiencies and improve patient outcomes.

5. New clinical pathways to improve the delivery of healthcare should be implemented with haste, as they are central to unlocking the problem of meeting the ageing population demand of capital intensive hospital buildings in a capital constrained environment.

6. Increase service delivery agility and reduce capital requirements by decoupling ICT infrastructure investment from physical infrastructure projects. It is recommended that ICT be acquired through outsourced facility services contracts, not as part of a facilities management or infrastructure build contract.

7. Reduce less efficient on site ICT support and budgets in favour of outsourced ICT services procured on a central operating budget on a pay per use model.

6. BT'S VISION FOR HEALTHCARE

6.1. Introduction

Healthcare is changing as never before. New models of care, that is a shift to greater community and home based care, and less early hospital engagement; as well as changing patient and societal expectations are creating demand for radical changes in the way healthcare is managed and delivered.

Demand levels continue to rise due to growth in ageing populations with increasingly complex long-term co morbidities.

Supply is ever-challenged through constraints in workforce, the limited change capacity within health organisations, and global competition for healthcare and informatics professionals.

In the long term, socio economics dictate that, 'business as usual' – or a slightly adapted form – will not be an option. Fundamental and lasting solutions will require significant system redesign, involving new combinations of technology, services, infrastructure and care delivery models. In optimising outcomes, these combinations may involve difficult implementation challenges, not least the need to accommodate multiple stakeholders from across health and social care systems, and wider public and political constituencies.

Technology is one of the very few mechanisms to address this supply-demand mismatch. Technology is already evolving in response to these healthcare requirements, enabling vast changes; from new drug personalisation, in-home patient monitoring, collaborative care provision, to greater patient information sharing and the opportunities to be unlocked through the transparency of health data and information.

6.2. The 'Shift Left' opportunity

In many countries with mature healthcare systems, there is increasing pressure (and desire) to shift care to lower cost care environments and to earlier phases of disease lifecycles. Intel helpfully described this as 'Shift Left' in reference to lowering the cost of healthcare; from acute care, to residential/community/ambulatory care to home care and proactive health and wellness[1].

This shift highlights the opportunity to transition care provision, from expensive hospital environments to lower cost community and home services. The focus of care becomes the patient, not the institution, by increasingly promoting healthy living, prevention and early detection/intervention, moving – where possible – out of the formal healthcare system as people take increasing responsibility for their own health. This can help rationalise the demand for hospital services and could lead to

- Merger and consolidation of existing hospital-based services.
- Reduction in capex demand for new buildings
- Reduction in capex needed to renovate existing estate
- Increasing income through selling existing estate
- Reduction in opex by reducing maintenance costs of estate management

ICT has a key role in enabling health care to Shift Left but to deliver the benefits research shows that this must be accompanied by a wider reform including:

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[1] http://www.ehtel.org/activities/event-documentation/report-ehtel-intel-workshop-ehealth-2020

- Alignment of health and other public sector care budgets and tariffs to support integrated care around an individual.

- Move away from activity-based payment models that can drive perverse incentives to outcomes-focussed and patient-centric payment mechanisms.

- Health promotion clinicians and other professionals playing an increasingly advisory role, as patients become increasingly more health educated and empowered to make care decisions and change their behaviours.

- Flexibility of the provider landscape, either through competition or collaboration, to be better responsive to patient needs and changes in demand, and achieve efficiencies required across the care system including the re-balancing of care between specialist and community based services. Capturing, analysing and sharing of information focused on measuring improved outcomes and costs.

- Improving communication and collaboration across sectors to avoid hospital admissions and support community and home based care.

- Supporting change management in a politicised domain with entrenched interests and views.

- Co-production of policy, where consumers are included as partners in service innovation and managerial decision- making so they are active participants in the Shift left.

6.3. ICT

Enabling this reform is ICT. Some technologies are critical underpinnings that have to be in place, such as broadband infrastructure, security and identity management, convergence of communications or electronic patient record systems (EPRs) to digitise care; but to enable care transformation, it is what we do with them that counts. Examples include Telehealth which sits on

broadband, requires aspects of security, identify and communications so that offers a disruption to the usual the care interface. Information derived from Electronic Patient Records can identify and enforce best practice processes driving higher quality outcomes in care provision.

BT's approach is to work with the business of healthcare and assists health boards, management and clinical teams to transform the very nature of their healthcare business. This is in contrast to working with health customers to perpetuate old ways of working – contrary to the computerisation of outdated procedures, which is all too often the approach taken in the market. This is not the opportunity that ICT offers and it is not the value proposition for the health system.

Getting the approach right will enable health systems to become sustainable. Getting this wrong will have dire consequences for the affordability of, and access to, healthcare services for patients. This paper identifies our vision of healthcare enabled by ICT and changes in the built environment as a guide to helping make the right decisions today to enable the healthcare system of the future.

6.4. Societal and environmental factors accelerating demand for healthcare reform

Public participation in health service design and provision is likely to grow in the medium term. This is partly the result of the communications revolution and explosion in use of social media, as well as the increasing ubiquity of the accessibility to information via the Internet. Increasingly health policy around the world is emphasising the 'co-production' of health services and self-care with the public to try to share the growing burden on health budgets. In part this involves the public being encouraged and incentivised to take more responsibility for its own health to try to reduce demand on the formal health and care systems.

Another trend is the changing relationship between doctors and patients, with decision making about care shifting towards a more democratized model, with decisions carried out in conjunction with or by patients rather than healthcare

professionals. This move towards patients as 'knowledgeable consumers' of healthcare is being reinforced by the Internet as well as the policy goals which seek to enable patients to proactively plan their own healthcare.

It is unclear to what extent environmental sustainability, both as a social and a political trend, will influence future healthcare models. There is concern over the environmental impact of healthcare in relation to the environmental and energy costs of existing built infrastructure, as well as the impact of patient and staff journeys to and from care facilities, and the waste produced by healthcare processes. This could stimulate moves towards innovative designs for infrastructure and speed the introduction of remote care (Telehealth/Telecare) models. On the other hand, a prolonged economic downturn may dampen enthusiasm for environmental initiatives, particularly if their introduction carries higher short-term costs.

6.5.   Factors inhibiting healthcare reform

Healthcare is a complex environment. There are many stakeholders and organisations each with their own sets of interests, professional and funding silos and agendas, and complex payment and reimbursement arrangements. the impact of new interventions can be unpredictable and unintentionally perverse. These characteristics have a knock-on effect on organisational and management culture. Changing deep-rooted cultures that have developed over many decades, under conditions of tight budget control and a rigid hierarchy of decision-making is extremely hard.

Healthcare tends to be highly politicised. Seemingly rational innovations or reforms can rapidly become the subject of populist disquiet, unsettling local politicians. Yet policy shifts are perceived by many in healthcare as commonplace, with repeated attempts by governments at organisational reforms resulting in 'change fatigue' and unwillingness to embrace new ideas.

There are problems in planning and coordinating innovation and change across the different interdependent parts of the health system. The pace of change varies in the built infrastructure, health services, technology, and the wider policy environment. Managing investment in new innovations in this context is difficult. At and which organisations should do this?

 'Innovation' is often seen as part of the problem in healthcare, rather than a solution. This is related to its economic characteristics.

Healthcare innovation may not necessarily be cost reducing. Innovation in drugs or surgery may expand the market, allowing more people to be treated, even if unit costs are reduced. So the paradox is that the more we innovate and the better healthcare becomes, the more expensive it can be for taxpayers, patients or governments.

In healthcare systems the payment and reimbursement arrangements can be convoluted, with unpredictable economic spill-overs. The return on investment, risks and benefits of a change may be spread unevenly across the system. Investment in innovations that require significant up-front expenditure or involve a contribution from budgets in different parts of the system can be hard to achieve.

In order to overcome these inhibitors, it is essential to have good leadership and change management in place. Where service reconfiguration is required, the case for change must be compelling, and the implementation plan must set realistic but timely milestones to avoid losing momentum – a minimum of 2 years is often required. Clinical and managerial leadership is needed at all levels in the organisation – approaches which are purely top-down or bottom-up will not work. Scale implementation will often require intervention at regional as well as organisational level. Funding needs to be robust to ensure that the right resources are in place to address the key issues.

6.6.   Healthcare ICT opportunities and physical infrastructure consequences

BT characterises the key domains of trends and ICT enabled opportunities and infrastructure in the coming 20 years into four areas:

1.   Management of chronic diseases,

2.   Patient co-production,

3.   Care integration and

4.   Procurement and provision of managed ICT and infrastructure services.

These areas are described in the following sections - references to short-term should be taken to mean 1-3 years, medium-term 4-10 years and long-term 11-20 years.

Management of chronic diseases

As identified in above key changes for sustainable healthcare are the role of the patient in their health and wellbeing , and the opportunity to shift care left The following table identifies these changes over time and opportunities that can be achieved.

1-3 years	4-10 years	10-20 years
Focus on patients with complex chronic diseases generating a reduction in emergency admissions and outpatient appointments, and supporting end of life care to enable people to die with dignity in a place of their choice	Focus prevention for patients with chronic diseases risk as programmes reach critical mass with more appropriate use of health care facilities by patients as more care is delivered in the community or at home.	Patients and citizens are more responsible for their health and wellbeing, making active choices, seeking advice from care professionals, and care programmes are integrated with primary prevention/ wellbeing.
Introducing standardised approaches for managing integrated care plans for patients with chronic diseases	Focussed on behaviour change of patients and clinicians with experimentation and delivery against outcomes	

ICT-enabled opportunities

1.   Telehealth supporting chronic disease management programmes, ranging from simple Telehealth services that enable videoconferencing between care professionals and patients, through to more complex Telehealth solutions that measure patients' physiological variables to Mobile Health (mHealth) or home health hubs with remote clinical triage for clinical decision support.

2.   Already there is a move to pervasive monitoring so that patients are not tethered to their home environments with proactive identification of problems. This may be coupled with digital health coaches that help look after people's health and wellbeing as they age. For some age ranges and health conditions the use of Avatars is emerging that can help provide an effective informative interface between patients and care professionals for care interactions.

3.   Provisioning of cost-effective behaviour change and wellbeing programmes online and through consumer-based technologies and social networking media will reduce the consumption of care professional time, improve outcomes and increase patient responsibility.

4. Advancing ubiquitous and standardised data collection with analytics will enable better predictive modelling based on health, social care and other data, facilitating more personalised risk stratification and intervention targeting to potentially change risk behaviour.

5. There will be a drive towards technologies that can support integrated care as detailed below.

Physical infrastructure implications

1. There will be a shift in care provision in hospital facilities to monitoring at home and response being orchestrated through algorhythmic escalation to central call centres and local response community teams, enabling a reduction in outpatient clinic settings.

2. It is expected that there will be a reduced admissions for emergency facilities to support acute exacerbations of chronic diseases with bed capacity freed up.

3. The centralisation of specialist services in regional centres of clinical excellence is expected, as is the development of graduated step-down models to minimise hospital length of stay by moving patients back home or to care homes (e.g. following surgery that requires a post-operative therapy period - hip replacement).

4. Homes and home based devices will become smarter with infrastructure that could be leveraged to support health care needs e.g. TVs, fridges. The merger of technologies for videoconferencing, the merger of Telecare and Telehealth devices, and so on provides an opportunity to leverage existing and consumer purchased infrastructure.

5. Increasing support of mobile technologies in the patient's own home, residential and nursing homes and other settings enable remote monitoring and the exchange of clinical information to facilitate end of life care and maximise the opportunity for people to die with dignity in the place of their choosing.

Patient co-production

People themselves are perhaps the largest untapped resource in health care. The opportunity is to engage and empower them in their own care leveraging a desire for better healthcare interactions and the role of informal carers in helping others. The following table identifies likely key trends and opportunities.

1-3 years	4-10 years	10-20 years
Move to information transparency as a mechanism to catalyse change in healthcare through better engagement of patients in being a shared partner in their healthcare, to enable patient choice, and for the public to hold the health system to account.	With much of the basic information in place, the move will be to converting information into knowledge to drive evidenced based change in health system processes of care. Information is a care service in its own right.	As health matures in its generation and use of high quality information, and patients are activated in managing their health and wellbeing, so we will move to a culture of shared decision making where patients and clinicians manage shared records and shared decisions.
Start of co-production of health with patients acquiring access to their healthcare records, having better interactions through utility services, and continuous engagement through patient feedback and social networking.	Building on basic engagement in healthcare transactions has started to build a trust relationship with patients that enables patient activation to change behaviours. The maturing of relationships with care professionals and others such as patient support groups and voluntary sector, together with information, will enable patients to be co-productive in their health and wellbeing.	Early movers may be offering patient membership of community based care models. Social contracts may exist with citizens willing to share their data for clinical research as well as their care in order that the community itself continuously learns and reapplies its knowledge to its members.

ICT enabled opportunities

1. There is an opportunity to enable an ecosystem for the secondary use of information, where small to large companies are playing a pivotal role in interpreting the information that is made available to help direct patient care, to help reconfigure health care processes against an evidence base. There is also a risk that putting in place data-information-knowledge-wisdom cycle is a cultural challenge to the way that clinicians and others are trained and maintain their practice. It is well known that it takes some 17 years for clinical trial information to result in large scale change, whereas identified best practice in many other sectors is rolled out the very next day.

2. A market ecosystem may be formed around "heavy lifting" data services with data models to join data and capture once or use in multiple data marts. There is a flip side risk that every healthcare organisation and supplier creates thousands of data warehouses and wastes innovation money and effort on data infrastructure rather than focusing on the value-added informatics services.

3. There are opportunities to encourage electronic patient records vendors to open their technology to patient input through access to care records, with appropriate identity management controls, and an ability to interact for basic utility services such as electronic booking services and electronic repeat prescription services. This can be built upon over time to enable patients to be active contributors to their care records and help manage the access to other care professionals they encounter.

4. Opportunities exist for consumer-directed ICT such as patient portals and utilisation of electronic personal health record systems. This includes an opportunity for patient relationship management in a similar way that we have seen commercial companies build customer relationships management systems to better understand their customers. Patients can engage in virtual consultations and e-clinics, contribute to care records, and providers can better understand how to target their services to patient segments.

5. New clinical decision support processes can be achieved through moving to tools that facilitate shared decision making with individuals. The enablers will be clinical functionality that is built into Electronic Patient Record systems, analytics tools that are built into chronic disease management programmes, consumer-directed ICT services such as Telehealth and wellbeing programmes, and genetic records database growth. Data will build exponentially quickly leading to the ability to match patients in country, regions or globally. This combination can support outcomes driven healthcare decisions or present new opportunities for clinical research.

6. ICT will enable increased collaboration between health care, Pharma and life sciences, bringing investment for clinical research. eHealth protocols for patient identification in electronic health records are already being created in Europe. Interested patients will be able to more easily participate in clinical research.

Physical infrastructure implications

1. Engaging patients in co-production and helping them become more intelligent consumers of health care will impact on the places and services they seek out for help and advice. The physical infrastructure opportunity is to respond to patients with the delivery of services in places that are convenient for patients. We will see an increase in consumption of information services available in consumer settings, and retail pharmacy outlets and new providers expanding to health services.

2. Expansion in information services will have consequences on the need for data platforms with expansion in data warehouse capability and storage with the potential to centralise or federate to manage costs and flex according to the different requirements of stakeholders. Complex computing power will become increasingly important as the size and complexity of health care data and information expands. This will drive requirements for sustainable, secure advanced hosting facilities with appropriate access controls.

3. There will be an increase in call centre requirements for clinical triage and patient relationship management services. For example this will include requirements for rule-based tools for the management of escalations. These call centres may be co-located with other call centres for efficiencies and scale rather than being setup with individual organisations.

4.   There will be a move to virtual interactions through patient contact with care professionals over email, videoconferencing and other mechanisms requiring changes to the configurations of healthcare facilities and consulting rooms and devices to support this interaction.

Care integration

The opportunity to 'shift left' to lower cost care delivery models and the need to move to provide seamless integrated care journeys for patients requires the integration of care across care settings. The following table identifies likely key trends and opportunities.

1-3 years	4-10 years	10-20 years
Increased integration between primary care settings with secondary care providers and out of hours and out of hospital support services. Integration across boundary interfaces will be predominately based on performance targets or dealing with bottlenecks in the care journey. This will include provision of step down care at home or in care home facilities.	Integrated care models start to develop within the healthcare system supported by tariffs for sharing information and enabling reimbursement of telemedicine (already in-place for GPS). Integration within local health economies will start to develop driven through integrated care planning by payers or through mergers of healthcare providers. Activity based payment systems may predominate but with incentives for integration.	Integrated care providers mature in the landscape providing end to end services for patients. Payment systems have matured so that payers offer integrated care tariffs for patients and real or virtual provider networks form, incentivising prevention as well as paying for appropriate treatment.
	Integration with social care and mental health will rise as the increase in demand comes from patients with mental health problems. Workplace wellbeing for productivity is of increased importance.	Health services are really focused on mental health and mental wellbeing and these are heavily integrated with primary care and the workplace.

ICT-enabled opportunities

1.   The expansion and mainstreaming of technologies that enable the delivery of integrated care is expected. Healthcare is an information-intensive sector with many more information and communication transactions occurring than drug and treatment transactions.

2.   There is a clear opportunity for mainstreaming into the health setting, common communication services such as audio conferencing, videoconferencing and unified communications to reduce the need for face to face consultations. This shift will avoid the need for patients and clinicians to travel, improving clinician productivity whilst offering the potential to deliver co-benefits such as up-skilling of primary care physicians, and consolidation of specialist expertise (e.g. regional stroke consultants supported through Telestroke ICT services). This common technology will also mobilise specialists from a national and indeed global marketplace into primary care and directly to patients – a key requirement for managing patients with chronic diseases well in the community.

3.   There is further opportunity for information sharing between electronic patient record systems, departmental systems, and patient held records. This speeds safe and effective provision of care, and the technologies involved enable care processes to be computerised and orchestrated across multidisciplinary teams spread across multiple physical sites.

4.   Electronic patient records and other clinical information systems will need to evolve to support integrated care planning with increasing ability to transmit computable processes between applications, devices and care settings. The short to medium term will see hospitals and other services consolidating and leveraging their use of

electronic patient records to drive improved data quality, collaboration, performance and clinical outcomes. Security and identity requirements will become key.

5. To reduce the administrative burden on clinicians, better utilisation of assets, providers will consolidate their IT system implementations of key functionality such as patient administration, order communications and diagnostic reporting, letters generated with coding, scheduling of assets (tests, beds etc.) and e-prescribing. The value of these core capabilities in provider systems will be in integrating technologies such as remote access, speech recognition, electronic data management, medical imaging, bar coding and asset tracking, closed loop medication administration and interoperability. To achieve the highest levels of clinical support and integration, providers will move through the various stages of adoption models such as HIMSS EMR Adoption Model.

6. There is an opportunity for clinician and patient portals to access electronic health records containing longitudinal patient data from multiple care providers to help ensure clinicians and patients have access to up to date information and to avoid the need to repeat laboratory and other investigations.

7. Care professionals are increasingly mobile within facilities and outside of the built environment to deliver care, requiring agile and mobile working solutions that are connected to information systems to enable point of care decisions to be made and acted upon.

8. There are opportunities to create vendor neutral archives for the central storage of medical images to be accessible across multiple care organisations supporting the management of complex patients requiring services across multiple specialist care providers.

9. Core clinical informatics services are required to facilitate the unique identification of patients and secure identity brokerage for clinicians and patients.

10. Opportunities exist for core patient information such as emergency care record summaries to be held once and made available across the health care system for safe delivery of emergency care.

11. Opportunities also exist to support utility transactions across the health care system to support timely and safe delivery of care, such as electronic bookings between primary and secondary care, electronic transfer of prescriptions from care providers and retail pharmacies.

Physical infrastructure implications

1. There will be different demands on integrated care providers with physical infrastructure requirements to support delivery of virtual clinical services to other care providers or patients at home or on the move. This will demand flexibility in the physical design of buildings.

2. Care provision will increasingly centre on the patient and the care professional and their mobility. The need for the physical infrastructure to dictate where and how people meet will diminish and the built environment will need to respond to support delivery of virtual care interactions or focus on those aspects of care where people do need to physically meet such as surgical interventions.

3. Opportunity to provide a consistency of care experience across the built environment to match patient needs and their individual journeys. To date, infrastructure design has led to decisions to create the best hospital design, or care home design, or smart home design with little or no regard for the transition of patients between these environments. There is an opportunity, for example, to consider how patients can be better supported at home with technology to connect patients to social networks and the healthcare system, but then to replicate this support in residential care homes. This shift will not delay the onset and need for residential care but will help to ensure a seamless social and medical support experience between these environments.

6.7.   Procurement and provision of managed ICT and infrastructure services

The health care sector will look to the ICT industry and others to innovate and support new ways of working for health ICT and informatics services. The following table identifies likely key trends and opportunities.

1-3 years	4-10 years	10-20 years
Largely capex-based procurement of ICT will still predominate with suppliers paid mainly on their inputs or outputs but not their outcomes.	More mainstream adoption of ICT managed services with health care applications being delivered in health clouds as the default mechanism. Much less demand for local infrastructure within health care organisations.	Some health systems may have matured to patient held and controlled personal budgets and this will include patients' decisions to purchase ICT-enabled services such as Telehealth more directly as a part of determining their integrated care package.
Emergence of new ICT delivered as managed services with novel business models such as 'pay as you go' enabling faster deployment of services, lower total cost of ownership and opportunity to more rapidly scale innovation across the health market.	'Pay as you go' models where industry pays for upfront investment are much more common place. Transactions are driven through tariffs for interventions such as telemedicine and Telehealth.	Care providers will have matured to being intelligent customers with retained skill sets for effective management of outsourced activities, with a likely internal focus on developing informatics skills to maximise ability to leverage the power of data to transform care.
Health care organisations experiment with which ICT services they should outsource or retain in house.	The health market is clearer on what services are better outsourced versus retained in house. Outsource contracts are second or third generation with much learning having been achieved.	
	Likely increase in consumer based ICT services such as Telehealth and Telecare from clinical service providers	
PPP models exist in the market to outsource the building and maintenance of health care facilities with ICT mainly a bolt on consideration.	PPP models have matured where ICT is considered in detail from the outset and influences the design of facilities, perhaps with PPP arrangements dedicated to ICT.	PPP models for ICT may have matured to purchase on the basis of committed partners delivering against outcomes with the onus on the ICT partner to deliver and proactively maintain and innovate up-to-date solutions.

ICT-enabled opportunities

1. There will be opportunities to move to secure health cloud provision of services with novel business models such as 'pay as you go' to more rapidly enable and support new models of care and accelerate the dissemination of innovation across the marketplace

2. The virtualisation and consolidation of ICT infrastructure presents opportunities starting with the consolidation of data centres, to virtualise applications and server estates and move to managed service ICT providers.

3. Agile and mobile working solutions enable productivity and the ability for care to be delivered in more flexible ways within work environments or out into the community and patients' homes.

4. Hospitals and other care providers will utilise ICT to maximise their efficiency and throughput. Asset management of high value assets will reduce inventory stock of assets like wheelchairs and crutches. In many cases today, large quantities of stock are being lost. However the greater cost is in the time taken for staff to track equipment down or arrange alternative solutions.

5. Mobile phone queuing systems (e.g. SMS) will reduce waiting rooms and enable patients to relax in alternative environments. Other technologies, such as avatars, will facilitate navigation and interactions with patients and take advantages of automatic language translation services.

6. ICT and other technology requirements will be integrated into the design of the built environment from the outset, e.g. integration of energy, lighting, security, voice, video and data networks over one simplified, flexible, and scalable IP network.

7. Hospital IT infrastructure will require good wireless infrastructure with dense coverage to support the plethora of healthcare transactions and application requirements. The advancement towards the "internet of things" will also enable intelligence in supply chains.

8. There will be increasing provision of patient services such as phone, internet and television access to enhance the patient experience and generate new income streams.

Physical infrastructure implications

1. Hospitals and other health care buildings of the future will have to be designed and built in the knowledge that the way they will be used in 5, 10 or 20 years down the line may be substantially different to the original usage as conceived in the beginning. Hospitals will be increasingly built with flexibility in mind so that the environment is configurable for multiple purposes. Some hospitals are already being built that are flexible with the ability to change wall dividers and reconfigure the care workplaces without the need to rebuild the facility.

2. ICT enables care to become independent of building location and configuration, driving the freeing up of buildings and the need to reconfigure remaining estate.

3. In some cases, existing hospitals and medical centres may be shut down or repurposed to support the long-term reconfiguration of the service and to release cash for onward investment in service transformation.

4. Hospitals will no longer need their own data centres and regional data centres that are 'state of the art' will provide ICT services to the organisation.

5. Removal of paper through scanning paper record backlogs and moving to electronic patient record and document management systems enables hospitals and other care provider facilities to become paper light, freeing up vast amounts of space previously dedicated to the storage of paper records

6. Consideration will be increasingly given to the control of environmental factors (noise, music, lighting, decoration) to create an atmosphere conducive to promoting healing and convalescence.

A   APPENDIX: SUPPORTING CASE STUDIES

Operational Efficiency Area	Description
Organisational efficiency: Asset management & work practices	The following examples show how intelligent use of infrastructure, technologies and clinically-driven change can help healthcare organisations to achieve major organisational efficiencies.(R-2)
	The construction, operation and maintenance of new hospitals and other large healthcare-focussed buildings can be made more cost-effective by: • Implementation of a single flexible, and scalable IP network supporting voice, video and data, heating, ventilation, air conditioning (HVAC), security and access, energy, lighting, fire and safety to drive down costs and lay the foundations for integration of building and clinical systems. • Provision of a wireless infrastructure to support mobile working, asset tracking and bedside access to clinical data. • Provision of rooms and conferencing facilities to support teleconferencing and Telehealth.
	Northern Lincolnshire Local Health Community is anticipating monthly savings of £450,000 a month based on the potential to reduce referrals and admissions once their BT mobile working solution is fully implemented across all 1,000 clinicians within the trust. This is based on the ability to have full access to patient records at all times (subject to connectivity), so that clinicians can make informed decisions on treatment and risk wherever they happen to be, and remain in contact with colleagues and care partners. Case study reference *British Telecommunications plc 2009: BT Case Study: "Northern Lincolnshire NHS Case Study – Improving Patient Service at the Point of Delivery".*
	Worcestershire Health ICT Services (WHICTS) in England have some 6,000 items of mobile equipment valued at tens of millions of pounds in use across the three main hospital sites. These range from specialist beds to scanners and defibrillators. They have implemented a public-private partnership for a wired/wireless infrastructure at all Worcestershire Acute Hospitals NHS Trust sites, and an RFID asset tracking solution. The trust estimates that they will be able to reduce overall inventory by 5-10% through optimum asset utilisation, and rental costs of specialist beds by 20-30% through optimum bed utilisation. Return on investment is expected within 2 years, and the infrastructure which has been put in place will of course support many other improvement initiatives within the trust, such as accessing results at the patient's bedside. Asset tracking could be extended to track the movements of staff and patients, e.g. porters and babies, with significant logistical benefits and other efficiencies. Case study reference *British Telecommunications plc 2011: BT Case Study: "Worcestershire Health ICT Services: Improved utilisation of assets releases cash for hospitals", 02/11.*

Operational Efficiency Area	Description
	Worcestershire Health Community (comprising Acute, Primary and Mental Health trusts) has implemented a unified communications vision comprising LAN, WAN, mobile communications and flexible working. The implementation of IP telephony has enabled the trust to reduce the number of mobile phones by around 25% and call charges by £400k pa. The use of BT MeetMe audio conferencing allowed the trust to coordinate services during the swine flu pandemic, allowing them to set up a contact centre from scratch in 24 hours. Audio and video conferencing facilities are expected to reduce travel costs by up to 20%. Case study reference *British Telecommunications plc 2010: BT Case Study: "Worcestershire Health Community UC-Unified Communications Improves Healthcare Efficiency " PHME 60172/05/10.*
	Just a few years ago, it took the US Social Security Administration on average three months just to access the records needed to review benefits for patients. Now, because of better health IT, it takes seconds. In the private sector, Connecticut's Hartford Hospital increased its early discharge rate, a metric hospitals use to manage bed utilisation, nearly three-fold (from 9.5 to 25.6 percent) in seven months through the use of business intelligence dashboards. Article Reference: "Is Better Technology *Still The Future Of Healthcare?*" Forbes, 16/05/2012
Emerging alternate models of care	Emerging alternate models of care affect the net health system costs as the trend continues to increase in-home and in-community care infrastructure, which in time will reduce pressure on increasing hospital infrastructure. The health workers and patient services required can make significant net savings to existing practices.(R-2.1)
	The potential impact of ICT enabled care delivery has been modelled in the UK for different conditions (stroke, heart failure, general frail elderly) across the care system, focusing on patient flows through different parts of the system (hospital, nursing homes, primary care etc) and distribution of costs and benefits. For example, modelling the impact of telestroke networks suggests that there could be a saving of c20% in hospital bed days and a 5% decline in demand for residential care home places. When combined with ICT-supported systems to allow earlier scanning and thrombolysis, the long term benefits could be even greater. The Whole System Demonstrator Programme in the UK examined the impact of technology as a remote intervention and has produced headline figures showing reductions in emergency admissions and treatment costs of 20% and 8% respectively, underpinning a startling 45% reduction in mortality rates in the patient pool of 6,191. Work is underway to refine the data, but the WSD findings, along with the modelling work described above and numerous case studies of pilot schemes, suggest that when fully-deployed, remote care models could have a significant impact on reducing demand for beds in healthcare facilities. Peter Bower, Martin Cartwright *et al, "A comprehensive evaluation of the impact of telemonitoring in patients with long-term conditions and social care needs: protocol for the whole systems demonstrator cluster randomised trial." BMC Health Services Research 2011, 11:184.*
	BT's own Telehealth case study (NHS Wakefield District) shows how remote monitoring technology can pick up on early signs of deterioration in health and flag it up to community nurses

Operational Efficiency Area	Description
	so that they can respond quickly. Telehealth allows community nurses to manage larger caseloads whilst receiving daily updates on vital signs for each of their patients. It means that they can focus their efforts wherever they are needed most at any point in time, optimising the use of valuable clinical time and skills.
	Case study reference
	British Telecommunications plc 2011: BT Case Study: "NHS Wakefield District: Promising Prognosis for BT Telehealth Trial", PHME 61679/02/11.
Outsource management of ICT as a service, not as part of a capital project	New technologies and commercial arrangements are driving improved efficiency and effectiveness of public sector infrastructure provision through less capital intensive service delivery, through outsourcing, managed services and Pay As You Go (PAYG) models.(R-4)
	In a BT case study, Derbyshire Community Health Services is using BT MeetMe for a wide range of conferences, averaging 100 calls a month, giving an annualised saving of £115,000 on travel costs, and travel avoidance equating to 3,000 hours in travel time and 20 tonnes of carbon last year. Apart from the immediate return on investment, the trust is reporting more punctual attendance on calls. The value and flexibility of conference calling was demonstrated when heavy snow in December 2010 made travel especially difficult. During that month over 190 calls were made. Due to its low monthly PAYG cost model, audio conferencing can very quickly deliver a return on investment without the need for major capex investment
	Case study reference
	British Telecommunications plc 2011: BT Case Study: "Improving care and communication in the community.", PHME 61707/02/11.
	Worcestershire Health ICT Services (WHICTS) in England have implemented a public-private partnership for a wired/wireless infrastructure at all 4 Worcestershire Acute Hospitals NHS Trust sites, and an RFID asset tracking solution. The trust estimates that they will be able to reduce overall inventory by 5-10% through optimum utilisation, and rental costs of specialist beds by 20-30%. Return on investment is expected within 2 years, and the infrastructure which has been put in place will of course support many other improvement initiatives within the trust, such as accessing results at the patient's bedside. Due to these early cash savings, RFID asset tracking can very quickly pay back the up-front cost.
	Case study reference
	British Telecommunications plc 2011: BT Case Study: "Worcestershire Health ICT Services: Improved utilisation of assets releases cash for hospitals", 02/11.
	The outsourcing of ICT, as demonstrated in the Fiona Stanley Hospital, should reduce the net capital for each project, and shift the burden of technology risk and service outcomes to the ICT provider.

Operational Efficiency Area	Description
	St Antonius is one of the top 5 teaching hospitals in the Netherlands. Already one of the most efficient IT departments in the Dutch healthcare sector it needed to replace an offsite data centre which could no longer meet regulatory requirements. The cost of self-build proved prohibitive, and after an options evaluation the hospital opted for a BT Compute Telehousing solution. The hospital now benefits from virtually zero downtime, improved business continuity through mirroring of hardware and software, provision for increasing storage requirements and records access within 2 minutes, plus a reduced environmental footprint due to use of a highly energy-efficient installation. This has been achieved at a fraction of the cost of a self-build. Case study references *British Telecommunications plc 2012: BT Case Study: "St Antonius Hospital Case Study: BT Telehousing ensures healthy information flows for leading Dutch teaching hospital" .*
	NHS Lanarkshire conducted a 3-month pilot of flexible working at two localities with significant accommodation problems. The evaluation after three months showed some very significant achievements: • 66% reduction in time taken to write up patient notes. • 33% less sick leave. • 22% improvement in work-life balance. • 21% increase in time spent with patients. • 12% fewer technical constraints. • 11% decrease in business miles. "Flexible working will deliver significant capital savings with every new build. For example, in any new builds, rather than building accommodation for 50, we will provide 20 desk facilities and 50 laptops". (Craig Cunningham, Locality General Manager, East Kilbride). Case study reference *British Telecommunications plc 2009: BT Case Study "NHS Lanarkshire Case Study: Making a real difference to service delivery".*
Health care worker efficiency	Many health care workers are frustrated by time consuming tasks such as looking for equipment, contacting others to progress a patients treatment or management through the hospital, processing or waiting for paperwork to arrive.There are various solutions that can help address practical issues with demonstrated benefits. (R-3)
	The West London Cancer Network is a group of nine hospitals. Historically, the integration of information on local cancer care required couriers to transfer CD-ROMs containing patient data, or doctors carrying notes around in taxis. Now, using the N3 network, the West London Cancer Network videoconferencing solution enables simultaneous transmission of video images, voice, and data. The Network has found that over 5,500 hours of consultant time and 10,000 or more hours of general NHS staff time each year are saved by using videoconferencing. . ("Broadband heralds a healthier planet", BT case study). Case study reference

Operational Efficiency Area	Description
	British Telecommunications plc 2010: BT Case Study: "NHS+N3 Sustainability Case Study Final: Broadband heralds a healthier planet", 2010.
	As a result of a service transformation programme, in which an implementation of BT Mobile Health Worker solution played a key role, Locala Community Partnerships in Yorkshire, England, were able to improve district nurse productivity by 40% and increase patient visits whilst going through significant staff reductions. The total contribution to Locala of the programme is calculated at more than £3.25 million (combined increase in patient contact value and headcount cost savings) over a three-year period. ("Enabling a local healthcare provider to deliver more productive community services and better patient care", BT case study). Case study reference *British Telecommunications plc 2012: BT Case Study: "Locala community Partnerships: Enabling a local healthcare provider to deliver more productive community services and better patient care", PHME 64136/04/12.*
	North East Lincolnshire Care Trust Plus has responsibility for commissioning health and adult social care services in North East Lincolnshire. The first of its type in the country, the partnership with North East Lincolnshire Council enables greater integration between health and social care and provides more opportunity to address wider determinants of health and wellbeing, such as education, employment, housing and lifestyle. Using BT Workstyle Managed Services they were able to equip their workforce with an Agile programme portal and laptops, allowing them to achieve £444k of savings by April 2012. By being able to work from any location, staff are working more effectively. For example finance staff are able to visit GP practices to review financial issues, rather than asking the GP to come to the head office. There is evidence that short-term sickness and carer-related absences are reduced and that generally work/life balance has been positively affected. Case study reference *British Telecommunications plc 2012: BT Case Study: "NE Lincolnshire NHS Case Study: Flexible working supports integrated service delivery and reduces costs for NHS Care Trust Plus".*
	South Essex Partnership University NHS Foundation Trust chose BT Workstyle Managed Services to implement a programme of flexible working for its staff, allowing them to choose one of five different work styles characterised by work base and degree of mobility. The trust expects to be able to reduce overall office provision by 20%, delivering significant financial savings, less building carbon emissions and less staff travel. The fact that staff are now able to access the corporate network from home means that they can meet their 24-hour target for completing reports following patient home visits much more consistently. In addition they find they are generally more productive and have more time for vulnerable patients. Case study reference *British Telecommunications plc 2010: BT Case Study: " "Flexible working drives efficiencies for high performing NHS Trust".* It is estimated that remote access over the N3 network currently saves the NHS 150,000 days of

Operational Efficiency Area	Description
	commuting a year and 1,250 tons of CO2. If video conferencing were fully embedded into the NHS, it is estimated that it would save the service over 2.3 million in travel hours, over £160 million in travel costs (both staff time and fares), and nearly 9,000 tonnes of CO2. Case study reference *British Telecommunications plc 2010: BT Case Study: "NHS+N3 Sustainability Case Study Final: Broadband heralds a healthier planet", 2010.* As a result of a service transformation programme, in which an implementation of BT Mobile Health Worker solution played a key role, Locala Community Partnerships in Yorkshire, England, were able to improve district nurse productivity by 40% and increase patient visits whilst going through significant staff reductions. The total contribution to Locala of the programme is calculated at more than £3.25 million (combined increase in patient contact value and headcount cost savings) over a three-year period.
	Case study reference *British Telecommunications plc 2012: BT Case Study: "Locala community Partnerships: Enabling a local healthcare provider to deliver more productive community services and better patient care", PHME 64136/04/12*
Connecting care delivery	It is becoming increasingly accepted that the flow of electronic information within and between different organisations and patients supports the delivery of better clinical outcomes, increased productivity and improved patient experience. (R-3)
	The Whittington Hospital NHS Trust in London have implemented a simple audio conferencing solution to reduce bed days by 830 over two years, saving the trust approximately AUD$575,000 (£307,000). Using this simple Pay As You Go solution, they were able to coordinate discharge planning and intermediate care between two hospitals, social care and community services to reduce bed days. Given the fact that the monthly rental for conferencing is lower than the cost of a single bed day, they were able to start generating cost savings from day one. Case study reference *British Telecommunications plc 2011: BT Case Study: "Whittington Health: Daily audio conference call means patients return home happier and more swiftly" PHME 63270/11/11.* The Greater Midlands Cancer Network (GMCN) cares for patients across a sizeable territory stretching from Shropshire, Staffordshire, and the Black Country to parts of Powys. This includes eight primary care trusts, a Welsh local health board, seven acute trusts, and six hospices. Several times a week, teams of oncologists, radiologists, surgeons, and pathologists meet. They look over patients' cases together, exchanging information and collaboratively planning the best possible treatments. These multidisciplinary team meetings (MDTs for short) are part of the collective approach to patient care at the heart of the Improving Outcomes Strategy (DoH, 2011). BT helped them to implement a video conferencing system to allow them to share scans, X-rays, and medical images as well as discussing things face to face, but without leaving their workplaces. The Network estimates that it is currently saving £400k a year on travelling expenses and productivity gains already, even though it is using only 10% of the conferencing capacity available

Operational Efficiency Area	Description
	from its 16 video points across the sites. Case study reference *British Telecommunications plc 2012: BT Case Study: "NHS Greater Mids Cancer Network Case Study: Putting Cancer Specialists in the picture" 03/2012.*
	Berkshire Healthcare NHS Foundation Trust wished to invest in a video conferencing facility to support multi-disciplinary team working for people with mental health and learning disability issues. Due to the high cost of the equipment and the large number of localities, traditional video conferencing would not have been viable. Then BT proposed Cisco WebEx, a web conferencing product that offers enterprise-level features such as integrated security and high quality video, all at a fraction of the cost of a traditional video conferencing system. Around one in five MDTs now take place over WebEx. And the Trust is hoping to boost that level to 50 per cent. Each WebEx session only costs about £10 compared to the huge time and cost of travelling to meetings, so this is another example of another immediate return on investment. Case study reference *British Telecommunications plc 2011: BT Case Study: " "Easy and inexpensive web-based multidisciplinary team meetings make for better care". PHME 64017 02/12*
Improving patient outcomes and the patient experience	A focus on the patient outcomes includes the patient experience. Putting the focus on outcomes rather than activity is likely to achieve a better result for patients. For example streamlining clinical pathways can reduce referrals and reduce health worker administration, and also result in more efficient handling of the patients' needs.(R-1)
	Feedback from BT's Telehealth trial at Wakefield suggests that patients feel more in control of their condition. One patient said: "The confidence I have in this system means I don't worry about my health like I used to. I sleep better and don't have the panic attacks. I've started to walk small distances again. I'd go as far as saying it's given me a new lease of life." Case study reference *British Telecommunications plc 2011: BT Case Study: "NHS Wakefield District: Promising Prognosis for BT Telehealth Trial", PHME 61679 02/1.* NHS Surrey A&E (ED) department has implemented a video conferencing solution running over a Community of Interest Network (COIN) to rapidly assess patients with suspected strokes. Making a quick and accurate assessment is critical, as a rapid response is essential, and giving the wrong drug could aggravate the patient's condition. The trust estimates that it is generating savings of £540k a year on average care costs of £60k over 10 years. However perhaps even more impressive are the implications for the patient experience. "I can review scans and test results online, see and talk with the patient over the HD video link, and speak face-to-face with the onsite medical team and worried family members – all without leaving my home office," says Adrian Blight, Clinical Director Surrey Telestroke, Royal Surrey County Hospital. "Many conditions masquerade as a stroke. Being able to thoroughly assess patients more rapidly and prescribe the right treatment saves lives and improves the chance of a full recovery.

Operational Efficiency Area	Description
	Case study reference *British Telecommunications plc 2012: BT Case Study: "NHS Surrey Case Study: Remote diagnosis using video conferencing is literally a lifesaver" PHME 64136 03/12.*
Improving patient outcomes and the patient experience	A focus on the patient outcomes includes the patient experience. Putting the focus on outcomes rather than activity is likely to achieve a better result for patients. For example streamlining clinical pathways can reduce referrals and reduce health worker administration, and also result in more efficient handling of the patient's needs.(R-1)
	The Kent Cardiovascular Network uses the N3 broadband network to link local facilities with main centres of expertise in London. They send angiograms to specialists in London which previously had to be sent as CD-ROMs via the post our courier. Now they can be shared in real time. Invasive cardiac procedures can now be conducted locally with the knowledge that remote experts are on hand. In the last year alone nearly 400 angioplasty procedures were safely carried out in Kent. Prior to the existence of the Kent Cardiovascular Network, all patients had to travel to London for those procedures. This is saving a huge amount of patient inconvenience and travel. It is estimated that 30,000 miles of patient travel has been eliminated in the last year alone, making a huge reduction in the NHS carbon footprint in the county. Case study reference *British Telecommunications plc 2010: BT Case Study: "NHS+N3 Sustainability Case Study Final: Broadband heralds a healthier planet", 2010.*