Connected care
Enabling Personalised Care and Empowering Care Teams
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A new, but common, set of pressures is coming to bear on governments worldwide. Populations are not just rising globally, but ageing and taking on a different shape from previous generations – ever more mobile and increasingly more transient.

Whilst administrations are inevitably subject to financial constraints, public expectations around service provision and access to medical advances grow ever higher, due to the normalisation of digital technologies in everyday life and a global news media sharing the digital dream.

Meeting these challenges will be hard, but public administrations can harness the new opportunities digital technologies offer to redesign and transform models of public service and healthcare, improving both efficiency and the lives of the people they serve.

Governments can cultivate a greater ambition in developing a holistic connected continuum of care, based on three pillars: healthcare, care in the home and public housing - putting people at the heart of service design and taking a holistic view to meeting their needs.

Such initiatives can make big contributions to the public good in their own right, but there is a financial imperative to getting this right too.

From telemedicine to telecare and the use of IoT, from big data, artificial intelligence and machine learning to advances in mixed reality, the cost of devices and technologies is falling, bringing exciting opportunities within reach of all governments.

But perhaps more importantly, Microsoft has a wide range of incredible partners worldwide, specialised in specific technologies and with a deep understanding of public service issues, that are working around the globe to add their own innovative thinking to the technology tools.

This vision paper comes from a series of interviews and insights with colleagues, partners and customers around the globe - my thanks to them all for their valuable time and input. It outlines the innovation and the trends that we are seeing today, but acknowledges that our vision does not have an end point – rather it will continue to evolve as do new technologies. But there are already enough examples of real achievement to show that the connected continuum of care can be an international force for public good.

I hope that you will enjoy this paper and find elements of use in your own digital transformation journeys. And I look forward to sharing future innovations and successes with you in the drive to deliver a connected continuum of care.
A new set of pressures is coming to bear on governments worldwide. Populations are growing globally and taking on a different shape from previous generations, administrations continue to be subject to financial constraints yet public expectations around service provision grow ever higher due to the normalisation of digital technologies in everyday life. By rising to these challenges public administrations can harness the new opportunities digital technologies offer to redesign models of public service and health, improving both efficiency and the lives of the people they serve.

Of course the global picture is not uniform. The dynamics vary between countries, as do the structures for delivering services: in some the responsibilities are heavily focused on central government, while in others there is a much larger role for regions, cities, counties or localities. The mix varies on the political culture and administrative tradition of the individual states.

Commonalities in the challenge

But there are commonalities. Administrations in most countries face similar types of demands, want to see similar outcomes for their populations and can find similar opportunities in how they can use technology. They are working with academia and the private sector to develop new digital solutions to deal with societal challenges, and exploring the potential in emerging technologies such as the internet of things (IoT) artificial intelligence (AI) and augmented reality.

This is developing into a vision for a ‘connected continuum of care’, in which governments and their partners are able to use technology in providing cost effective and enhanced support for those in need at every stage of life. It goes from new approaches to healthcare for mothers and babies, to protecting children at risk, offering good quality housing for families, providing care for the elderly and vulnerable, shifting healthcare from hospitals to communities and homes, and supporting people with special needs. It also extends into using data to support the allocation of resources in healthcare, housing, infrastructure and social care.

Citizens at the heart of service design

At its best the vision connects and underpins the different services, ensuring that officials working in acute and primary healthcare, care in the home and housing can communicate and share crucial information in responding to the needs of families and individuals - putting people at the heart of what they do and taking a holistic view.

It provides a degree of integration that helps officials to identify how factors in one sector influence the needs in another, align the services better and provide more effective support for communities. It can help governments to deal more effectively with societal challenges, reduce the financial pressures and find approaches that are sustainable over the long-term.

This paper looks at the common pressures and points to innovative technology solutions that are providing the foundations of this emerging continuum of care.
Societal demands on government vary across the globe. For example, a major factor in Western Europe and North America is an ageing population that is increasing the pressure on health and home care systems, with a resultant pressure on national finances. The healthcare systems in these countries also have to deal with problems around rising trends in obesity and chronic disease, driving momentum for a shift in care and monitoring away from hospitals and into communities and people’s homes.

Developing countries currently have younger populations and stronger networks of informal care for the elderly, but they face problems in other areas. A lack of decent housing and public sanitation in rapidly growing cities is a major issue in Africa, India and South America. The spread of HIV/AIDS around Africa remains a big issue for public health and there is a challenge in delivering care to remote areas with little infrastructure. In addition, public services in these regions often run on lower resources and have less extensive structures than in developed countries.

Ageing populations

However, the world’s population is ageing. According to the United Nations, the number of older people globally is expected to reach nearly 2.1 billion by 2050. Not only are older people increasing in number but they make up a growing share of the population in virtually every country – “with implications for nearly all sectors of society, including labour and financial markets, the demand for goods and services such as housing, transportation and social protection, as well as family structures and inter-generational ties.”

Society’s challenges

This ageing population, however, is not the only common societal challenge impacting public health and care services. Other challenges at the centre of many political agendas include:

Changing demographics, as populations rise and the average age increases, the ratio of retired to working people is shifting towards the former, leading to fewer taxes to pay for services.

Ever rising expectations of high quality healthcare, and access to medical advances, whether that be financed and provided by the state or the private sector.

Social inclusion, with a desire to ensure that people are not excluded from accessing public services, or wider society, due to age, disability, race, ethnic or religious background.

Digital inclusion; the shift towards online services from public and private sectors is creating a recognised risk of leaving a significant number of people behind, especially among the elderly, the disabled and the poor.

Loneliness is an increasing problem for older people in western societies as traditional family structures break down when members move to follow work, study or...
take other opportunities. Communities have also been changing in a way that can eliminate social contact with others with a mobile population and a trend to online services.

**Access to quality housing**, the status of public housing varies globally, but this key bedrock to maintaining good health provides the best hope for decent quality homes for many.

**Migration**, with many people moving from the developing world to escape conflict or persecution, sometimes climate change, or in pursuit of better employment opportunities, the demands on public services and housing inevitably increase.

A whole report could be written alone on the plethora of statistics that indicate the extent of these issues. This is not the purpose of this document; however some quick reference points include: the United Nations reported that in 2016, 65 million people had been forcibly displaced from their homes across the globe. The UN also confirms the world’s ageing population - expected to reach nearly 2.1 billion by 2050. The UN Enable programme has said that 650 million people, about 10% of the world’s population, live with a disability. The International Labour Organisation has reported that 4 billion, over half the people in the world, are without social protection. In the UK alone, according to Age UK, 3.6 million older people live alone, and 1.9 million say they often feel invisible.

**Financial strain**

Governments of all countries have to maintain a balance in their finances, and many have suffered crises in recent years that have undermined public spending and left needs unmet. In many countries the informal networks for social support have been weakened due to many changes. For example, families being geographically scattered, women spending more time at work, the change in balance between older and younger people. All can sharply increase the demand for support, adding to the financial strain and creating social and political tensions.

The challenges in the developing world are more focused on the delivery of healthcare and maintaining public health standards through the management of urban development and provision of proper sanitation.

Water and energy supplies are big issues, and there is a need to ensure that resources are directed at areas with expanding populations and where serious issues of infant mortality and the spread of diseases have been identified.

**Public good**

The priorities for these countries may be different, but it comes back to the common ambition of supporting the public good by making life for better for individuals – and governments are working with companies, charities and international organisations to harness technology to the cause.

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**Integrating the eco system:** The EU-funded Smart-Service-Power project in Germany is exploring how to support the elderly and those with chronic diseases in their everyday lives with the goal of helping people to stay autonomous and self-determined in their familiar home environment for longer. The project is targeting the whole eco-system – from nursing services to municipalities, religious institutions, health insurance providers, insurance companies, real estate and housing organisation, pharmacies and other SMEs offering or coordinating services in the neighbourhood. It brings together housing, care and health and connects people, companies and organisations through technology-based collaboration platforms and processes. [More information...](#)
Over the past 20 years governments worldwide have seen that much can be achieved through the exchange of data between different agencies and the integration of IT systems that support services. Microsoft technologies have been at the core of this work, helping to create conditions for interoperability and innovation, and grappling with the data governance issues that can complicate the sharing of information.

Recognition of the role of technology as one of the fundamental building blocks in providing more effective, more efficient public health services continues to grow. And this potential is not static. Technology is advancing at a rapid pace, offering new potential and opportunities for fresh thinking in service delivery.

One encouraging development is that in all societies, even though those with weaknesses in their infrastructure, people are becoming increasingly comfortable with digital technologies and the low cost access routes this offers public services. This consumerisation of digital technology has made billions of people more assured and confident in using devices and has changed their behaviour in a way that makes them ever more open to taking up innovations in service delivery.

It has also blurred the traditionally siloed lines between public services and private lives in areas such as health. Many are not just willing, but keen, to wear devices and share their data to help both them and their care providers to monitor their health and wellbeing.

Mobility

This has become most apparent in the ubiquitous use of mobile technology, which is already seen as a staple in the provision of good public services.

Mobile technologies enable government professionals to tap into information sources, access and update crucial data, collaborate with colleagues and make requests for assistance while out in the field. For several years this has provided the basis for advances in telemedicine – with healthcare workers at remote sites able to draw on the expertise of clinicians in major hospitals via Skype and a mobile phone – and is becoming more prominent in the form of telecare, providing the scope to support older people in their homes and daily life.

It can also enable social workers and other officials to quickly assess, record and share crucial information on vulnerable people, and field workers to monitor the state of public housing and manage maintenance work away from their offices.

Mobile devices with security features have become a crucial element of public service delivery in most countries, and as the infrastructure improves with the spread of 5G networks its role will inevitably expand.
Also crucial is the increasing adoption of cloud systems and collaborative working platforms. Microsoft's Office 365 in the cloud helps to enable government officials to be productive, efficient and connected to the information they need to do their work.

Cloud technology is also providing public authorities with a cost-effective means of running their digital systems, and more agility in adapting to changes in demand and new solutions. Cloud platforms such as Microsoft Azure are enabling them to pick up advanced technologies for new services - enabling them to take advantage of commoditised applications without the need for heavy investment or a long-term commitment.

Platforms such as Microsoft Dynamics 365 and Office 365 provide the foundations for increasingly sophisticated approaches to collecting, processing and analysing data, collaborating, managing case work and interacting with citizens.

It should be noted that many governments and authorities globally are exploring a pragmatic hybrid approach to cloud adoption, combining the use of cloud with in-house systems and data storage. With the new EU privacy regulations coming into force (EU General Data Protection Regulation) the EU has established clear guidelines around the impact on privacy and handling of sensitive data. The direction is clear: cloud offers governments globally the key to a digital future.
Internet of Things (IoT)

Alongside this the rapid development of new technologies, such as wearable devices, in-home sensors, machine learning, artificial intelligence, and data analytics in the cloud, is opening up a range of possibilities for new methods of social support.

Microsoft’s IoT platform and Azure IoT capabilities have been powering developments in this sector and offer a platform for collating and analysing the vast streams of data that are now coming online.

National, regional and city administrations are making increasing use of internet of things technology, with a range of sensors and devices to provide streams of real time data. This can be integrated into systems that control functions such as monitoring public safety, providing remote care, and facilitating predictive maintenance in housing.

Safehouse in the UK: The Safehouse Liverpool project in the UK fitted 2,000 ‘Safehouse’ devices in council and housing association homes to help make it easier for tenants to live independently for longer and make it possible to discharge people earlier from hospital. InformedAction’s solution uses unique sensory technology - temperature, sound, humidity and electricity - linked to a city-wide LoRa network. Algorithms then use the data collected to provide preemptive actions to improve living conditions and health and social care provision. More information...

Data

Microsoft’s data analytics platform makes it possible for administrations to identify groups of people with similar needs, and forecast the demands on public health services – laying the ground for delivery optimisation and better outcomes for citizens. Data can also support the effort to detect and prevent fraud against the public purse, a major element of ensuring the financial sustainability of services.

The field of big data is extending rapidly with advances in software and platforms making it possible to take in datasets from a multitude of sources on a previously unimaginable scale. Microsoft Azure Analytics can turn data into actionable insight. It can be used in predictive or user behaviour analytics to spot trends and relationships between different factors that have previously been undetectable. It can provide the evidence for short-term action and long-term planning in areas such as protecting public safety, identifying the rise of environmental problems, and preventing the spread of disease.

Governments in developed countries are gradually exploring and exploiting the potential of big data, and while it may currently be beyond the resources of many in the developing world, the case for investing in the specialist systems and expertise will grow as the use cases prove their value.

Artificial Intelligence, machine learning and bots

The biggest change, however, could come from the development of robots and solutions powered by machine learning and artificial intelligence (AI). These give machines the ability to mimic the cognitive functions in the human brain, learn and solve problems.

Machine learning uses algorithms within the software that learn from the data it collects and can adjust its actions accordingly. It is effective when focused on a specific task and can be used for more proactive purposes such as identifying people at risk and handling legal processes.

Artificial Intelligence goes further in having the ability to understand its environment and contextualise information. This gives it capabilities resembling those of humans, such as the ability to reason, plan and understand the intricacies of language. Azure’s Cognitive.
Connected care

**Services** capabilities include image processing algorithms, natural language processing and conversion of audio into text, powering software into the realms of problem solving and sophisticated support in decision-making. It is early days with this technology, but at a basic level government and public sector pioneers are already beginning to prove the potential of bots in dealing with citizen contact, automating some of the tasks in care, supporting assisted learning, and even developing care avatars or small robots. This can do a lot to assess the needs of individuals and programme systems, robots or avatars to respond accordingly; and given the financial pressures on administrations its ability to automate processes - and to do it more quickly - will do a lot to promote its adoption.

It is also being used in information systems to process data much more quickly than any human can manage and provide people with insights to support the allocation of resources and decisions affecting individuals.

There are of course ethical considerations in this technology’s use. Governments will have to assess these new considerations and create robust frameworks for the use of AI, setting boundaries around how humans will engage AI in making decisions. This is going to be one of the major issues in the adoption of technology over the next decade.

**Espoo harnesses data for health and social care:** The Finnish City of Espoo has been working with Tieto on using artificial intelligence to bring together a huge amount of health and social care data on every one of its residents. The data has been analysed and grouped using AI to understand people’s service needs and provide more individualised services, aimed at reducing problems such as social exclusion. Thomas Lehtinen, from the Mayor’s Office of the City of Espoo said: “We hope to find out whether artificial intelligence will enable us to identify residents who will need services at an earlier stage than we can now, while protecting the identities of individuals. In the future, it may be possible to allocate the city’s resources more efficiently while improving the quality of life of individual residents, as they are offered preventive support.”

**Machine learning improves chronic disease management:** Singapore’s Fullerton Health Group joined up with Microsoft to achieve higher quality of care and lower healthcare costs. With operational analytics and machine learning, Fullerton developed a chronic disease management programme with the goal of more effectively managing patients with chronic heart disease and diabetes, helping to result in fewer trips to the hospital and less missed days of work. The 200+ facilities and medical centres owned by the health group now have data immediately after the patient receives it and have a best course of action for each patient informed by real-time evidence. The programme reduced the number of chronic disease patients by 60%.

**An intelligent network for eyecare:** Not-for-profit L V Prasad Eye Institute in India has teamed up with Microsoft to launch Microsoft Intelligent Network for Eyecare (MINE) – a project using artificial intelligence with the goal of eliminating avoidable blindness and help increase efficiency in the delivery of eyecare worldwide. There are currently 285 million people visually impaired, of which 55 million reside in India. Partner organisations, including global experts, will collaborate and work on diverse datasets of patients to come up with machine learning predictive models for vision impairment and eye disease. The Cortana Intelligence Suite will be deployed for advanced analytics and machine learning to build artificial intelligence models for eyecare.

More information...
Mixed reality

Visualising the outcomes from AI and analytics through the use of mixed reality offers exciting opportunities. Essentially a step forward from augmented reality – which augments the surrounding environment with relevant data through a connected medical device – mixed reality provides a layer of virtual objects that creates a 3D virtual image, hologram placed in the space. It is on the way to changing processes on a significant scale, enabling surgeons to see real time scans superimposed over the heart on which they are operating on, or linking expert surgeons with remote hospitals to share expertise in the theatre for unprecedented collaboration.

There are currently two main types of devices that deliver the experience: holographic devices with see-through lenses such as the Microsoft HoloLens; and immersive devices with opaque displays that are not see-through. It is the HoloLens that is generating great excitement in public health and care environments because of the augmented reality approach and capabilities.

**HoloLens brings virtual heart into reality:** Polish telemedicine specialist MedApp has found a unique use for Microsoft’s HoloLens technology that helps doctors and patients save time and effort. Using the augmented ‘mixed reality’ that HoloLens provides, MedApp’s CarnaLife app helps cardiologists to “visualise an individual patient’s heart as it beats in their chest in real time,” according to MedApp’s Ralf Saykiewicz. “We utilise the HoloLens system, which gives cardiologists the ability to see the heart before they open your chest. This diminishes the time needed to perform open heart surgery.”

This is just one of the innovative features of MedApp’s CarnaLife app, an extensive telemedicine system that uses smartphones, medical wearables and the HoloLens to connect doctors and patients. MedApp’s mobile apps, which are hosted on Microsoft Azure, feature artificial intelligence algorithms that can help detect life threatening events. More information...
Digital identity

The successful organisation and delivery of services around the individual will depend heavily on the use of robust digital identities, providing organisations with the assurance that they are providing the right service for the right person – regardless of the delivery channel. Many governments worldwide are using Microsoft’s Azure Active Directory B2C to deliver personalised services to citizens whilst protecting their identities. But not all countries have the infrastructure to create and manage citizens’ identities – an estimated 1.1 billion currently living without an officially recognised identity. To help address this, Microsoft is a founding member of ID2020, an alliance committed to improving lives through digital identity. We have donated funding, resources and expertise to help develop a secure, portable form of digital identity that will be recognised globally.

Developers around the world are now collaborating on an open source, self-sovereign, blockchain-based identity system that allows people, products, apps and services to interoperable across blockchains, cloud providers and organisations. Blockchain, the distributed ledger, is the basis of bitcoin currency. It involves the use of records linked and secured by a cryptographic hash of the previous record – or block – along with a timestamp and transaction data. This makes it resistant to modification and is seen as an efficient and verifiable approach to recording transactions and, potentially, identities.

Cyber security, trust & privacy

Along with the use of digital identities and citizen data for the public good comes the responsibility to ensure the security of that data and respect the privacy of individuals.

Microsoft invests heavily in cyber security and the resilience of its platforms. This is essential if we are to help governments not just deliver innovative and efficient services but to also help prevent the abuse of public sector digital systems from fraud and cyber attack.

In order to build and maintain trust with their citizens, security has to run right through the organisation’s technology foundations, protecting systems from the ever growing number of threats in our digital world. Governments and public service organisations world-wide must ensure that they have the appropriate technology in place, along with the protocols, practices and mindset among their staff that makes cyber hygiene a central element of their organisation’s culture.

Meanwhile the new era in privacy regulation which started in May 2018 with the European General Data Protection Regulation (GDPR) imposes new rules on companies, government agencies, non-profits, and other organisations that offer goods and services to people in the European Union (EU), or that collect and analyse data tied to EU residents. For governments dealing with their citizens GDPR may not apply outside the EU, but it has become the current ‘Gold Standard’ in privacy law.

Microsoft has extensive expertise in protecting data, championing privacy, and complying with complex regulations, and is committed to GDPR compliance for its cloud services. You can learn more about Microsoft and GDPR here.
Some of this technology is already being applied across the world, in many cases explored and implemented to fulfil urgent local needs. The combination of mobile networks and cloud services provide the basic foundations in many cases, but these are increasingly combined with the emerging technologies to respond to challenges in key areas.

Telemedicine

Telemedicine is one of the areas where considerable progress has already been made, but in which new technologies are creating exciting possibilities. It is removing the physical boundaries and taking scarce healthcare resources and skills beyond the confines of geography.

It can take a basic yet incredibly effective form, as in the eMamta programme in Gujarat, India, where a mobile application is used to feed a digital repository of information that health workers use to identify mothers and young children and ensure they follow the recommended immunisation and care at different stages in childhood.

But it goes beyond this. It has provided support for doctors and nurses travelling around remote areas – for example, those evolving out of the ‘flying doctor’ service in parts of Africa and Medapp’s cardiac telemedicine solution – enabling them to tap into expertise in city hospitals and research centres through remote consultations. This can support prescribing or even minor operations. Or they can learn which services and drugs are available at specific centres, or interrogate knowledge banks to support their own diagnosis.

This provides big advantages in giving patients access to care they would otherwise not receive, and doing so at a manageable cost. It can also reduce the number of cases in which patients need to be transported for emergency care.

As seen in the previous section, there is exciting use of augmented reality and AI aligned to cloud systems to support remote medical care, such as MedApp’s use in Poland of HoloLens, Azure and machine learning to provide a detailed visualisation of a patient’s heart for cardiologists.

e-Mamta in India: The e-Mamta programme, run by the Health and Family Welfare Department of the Government of Gujarat, is based on research showing that small and affordable measures can significantly reduce the health risks that women face when they become pregnant. Health workers go door-to-door collecting information on pregnant women and sending it via their mobile phones to the State Rural Health Mission, which collates it into a central repository. The data is then used to alert health workers to reach out to pregnant women to support delivery of antenatal care, childbirth, postnatal care, immunisation, nutrition and adolescent services, and help to identify any children who have not been covered. More information...
Telecare

Another significant contribution turning health care outside the hospital environment from a reactive to a proactive and predictive paradigm is telecare.

The increasing sophistication of IoT wearable technology and devices enables medics, carers and patients to continuously monitor and keep track of vital signs such as blood pressure and heart rate at home. Combined with a strong broadband infrastructure this provides a remote flow of information to clinical specialists who can monitor a patient’s condition and advise action if they see signs for concern.

This is being harnessed and enhanced with AI, particularly in supporting the elderly, those with chronic diseases and disabilities to stay well, safe and independent at home for longer.

Internet-connected devices not only monitor crucial elements of behaviour – and deviations from the expected norm - but can also send alerts to family, friends or care teams in urgent or emergency situations. This can involve a range of wearable technology, triggering alarms notifying carers of falls or accidents, and in-home sensors providing indications of whether someone is active at home.

UK’s NHS treats stroke patients via Skype: Treating stroke patients relies heavily on treatment being administered as swiftly as possible to ensure the best chance of recovery. Brighton & Sussex University Hospitals NHS Trust (BSUH) in the UK recognised that telemedicine was the answer to enable patients to be assessed by a consultant out of hours. Working with Microsoft they introduced Skype for Business as a user friendly, easy to support and cost-effective solution that has been welcomed by staff and patients. Consultants are now able to assess stroke patients over Skype and can undertake assessments even when they’re off-site or out of normal working hours. The clarity of the pictures ensures that consultants are able to make faster diagnoses, and may give patients a better chance at a recovery. Patients are also reassured that the consultant is taking an active part in their treatment even when that are not able to be physically present. More information...

Preventing falls in the elderly: In the UK one in three adults aged 65 and over fall every year, and half of those over 85 who fracture a hip will die within 12 months. Falls wreak a terrible toll on our elderly and in the UK cost the NHS £2.3bn every year. But 85% of these falls are preventable. The East Midlands Academic Health Science Network is trialling technology in its region to reduce these injuries. Its Falls Prevention and Monitoring demonstrator identifies and monitors those at risk of falling and provides preventative measures based on IoT, analytics and a user-friendly app - enabling older people to age well, maintain independence and support self-care and self-management. The app assesses risk, provides information and support, and enables patients to create an online support community of family, friends and services. More information...
Smart housing

The use of home sensors is being explored extensively in development of smart houses and smart buildings. Sensors can monitor vital signs of the state of a building and the surrounding environment, such as humidity levels and air quality. This can be run through analytics programmes to identify potential detrimental impacts on health, structural and maintenance problems and provide the basis for predictive maintenance. In the smart house of the future not only will the environment be maintained at the optimum for its inhabitants’ wellbeing but maintenance work will be done before problems arise.

This vision is in its early days in both Liverpool and York in the UK, but could become a major factor in the care continuum: maintaining public or private housing and improving the quality of life for residents – which in turn supports public health and social wellbeing.

There are other applications in housing, with initiatives beginning to harness the potential of machine learning and AI for a more efficient approach to management of government projects. There are examples of organisations beginning to use the technologies to get a more accurate view of priorities for planning and the needs of individual families, and they are drawing on the insights to support the allocation of properties.

Among those on this path are Paris Habitat – a social housing organisation for the French capital – which has used its Microsoft Dynamics CRM system as the basis for information on applications and reports of problems. It has been able to link this with other digital tools that can be used by its residents for interactions, and is trialing the use of chatbots to assist tenants with self-service.

A number of organisations are also in the early stages of harnessing Azure Machine Learning to support public housing, in terms of identifying the needs of families in to ensure appropriate housing allocation, and to analyse reports of problems and environmental factors in the maintenance of properties. Machine learning can take in not just inspectors’ reports, but also tenant complaints, social media feeds and historical data to provide the basis for predictive maintenance – helping to fix problems before they occur and maintaining a safe and healthy environment for tenants.

These are examples of how new technology is being used in the development of smart housing, and helping to target the effort at people who are most in need of access to and support in decent quality accommodation.

City-wide LoRa network supports social housing in UK: City of York Council in the UK is using a LoRa wide area network to support the use of IoT technology in social housing. Collecting data from sensors installed in homes across the city is helping the council spot potential issues at properties – from damp and moisture detection, to issues with air quality. This will help the council take more preventative action and improve future housing. Head of ICT Roy Grant said: “We’ve got particular problems, because York is in a bowl, with damp, asthma and other conditions, and need to get into preventative action,” Grant said. “Then we want to learn from it for the development of new housing stock, so they will be almost IoT smart houses as we go forward.”

Paris Habitat transforms services for tenants: Paris Habitat is responsible for the management and rental of 125,000 social housing units in the French Paris region. Founded in 1914 it is France’s largest public utility social housing company. The organisation is using Dynamics CRM and Office 365 to optimise the customer relationship and simplify access and accelerate the case management and to enhance digital support for its often vulnerable or disadvantaged tenants. The vision for the future looks to harness AI, chatbots and the power of data to identify the right homes for the right tenants, provide enhanced support and report into formulation of the city’s social policy.
Predicting & protecting

One of the most beneficial areas will be in helping administrations to identify people in urgent need of support. Pulling data together from several sources – not just health and social care records, but housing, education, law enforcement – can help officials to spot the signs that will raise the alert that action needs to be taken.

This can apply in areas such as child protection. The example of the system built by EY points to the use of algorithms to spot relationships between different data fields to produce risk alerts and uses predictive analytics to recommend specific responses to keep children safe.

Equally this can work in helping authorities to identify older or handicapped people who are becoming isolated or may be struggling to live independently. And it can highlight those who are at risk of becoming homeless, or the groups who may need special support in healthcare – enabling action to be taken on a pre-emptive basis.

In Barcelona, Bismart collaborated with the city to create a big data solution in the cloud, with the aim of bringing together data from its different agencies, third parties and social media in order to gain new insights and predictions into the services that people need to maintain quality of life.

The big advance in this area has been the development of both the cloud capabilities to handle massive amounts of data and the algorithms that provide insights into the links between different factors - alerting public officials of problems that are yet to become visible. It helps them to anticipate risks and problems and take preventative action, to the benefit of the individual and often reducing the long term costs for the organisation.

Citizen Intelligence Platform: EY’s Citizen Intelligence analytics platform – based on Microsoft technologies including Azure, Bing Maps, HD Insight and Power BI – combines information from multiple agencies. It includes a real time AI chatbot, called Pip, that can interpret questions and responds accordingly, combined with blockchain technology for service provider and carer qualification, verification and compliance checks. Meanwhile geospatial analytics provides locational intelligence, and graph database technology enables users to look at links between different people within families and communities. It can turn unstructured data such as court reports into a structured format that makes it easier to examine. Its ability to identify a risk in advance gives it potential applications in the field of public health and dealing with homelessness. More information...

Eccovia Community Care Programme: Prevention is widely recognised as an important step in dealing with public health issues, but healthcare services are generally playing catch-up with people who have developed chronic conditions. In the USA Eccovia Solutions has worked with the Community Health Partnership (CHP) of Colorado Springs to develop a prevention model. The CHP team looked at where money was being spent and found that most dollars were going toward pharmaceuticals, with very little spent on preventing medical problems. In response, it and Eccovia aimed to build an infrastructure to collect data at the ground level, bring it together as information and then apply analytics to provide knowledge to a broad healthcare community. They used Eccovia’s ClientTrack Care Coordination platform, powered by the Microsoft Azure Government cloud, to manage patient care with multiple agencies. More information...
Augmented decision making

Algorithms and AI are also becoming important in helping public officials make sensitive decisions affecting individuals in areas such as child welfare and supporting people with special needs.

Augmented decision making can be seen in, for example, its use to support decisions on foster care of children for adoption in the USA. It has processed data on key factors in the child’s background and behaviour, and matched this with the backgrounds and capabilities of families to ensure the best possible homes for the children. Similar possibilities are emerging in the care of vulnerable adults and the elderly. Humans can identify and assess the most obvious information about their circumstances and capabilities, but AI can interrogate and spot the relevant points in a much wider range of data, and assist the evaluation of how the factors stack up against each other.

These automated systems can provide evidence and guidance, but humans will always make the final decision.

Foster Care Technologies in the USA: Foster Care Technologies has developed the ECAP (Every Child A Priority) solution for helping to place children with the right foster carers. It runs on the Microsoft Azure Government cloud and draws on algorithms to help agencies make the right match between families and children. This produces some long-term benefits for the agencies by helping to ensure that their children are placed with the best available homes.

ECAP has demonstrated that improving placement matches in this way can lead to fewer placement disruptions, less time elapsed before the children reach permanent living situations, and the lower operating costs for agencies that result from these improved outcomes.

ECAP’s performance has been validated by researchers from the School of Social Welfare at the University of Kansas who found that children whose placements were guided by ECAP experienced a 22% improvement in placement stability and reached permanency 12% sooner than children placed without ECAP. These improved outcomes led to savings of over $3.5 million dollars per year for an agency with about 2,200 children in care.

More information...
These initiatives can make big contributions to the public good in their own right, but there is a financial imperative to getting this right. Governments can cultivate a greater ambition in developing an holistic connected continuum of care, based on three pillars: healthcare, care in the home and public housing – delivering ‘more for less’ and better outcomes for their citizens.

It involves a series of connections between the different services, integrating information flows and ensuring the interoperability of technologies to maximise positive outcomes. It can eliminate many of the pressure points that arise currently through a lack of coordination between these sectors, reduce the overall load on public and government services and help to strengthen a public sense of wellbeing.

The continuum would apply to care from pregnancy to early childhood, school age, youth, working age and old age. It would involve a more effectively integrated approach to services focused on the individual, but delivered locally through a range of organisations, including hospitals, schools, public housing, pensions authorities, local authorities, etc. This can reduce economic, societal and human costs and provide better care at all levels. But most importantly it will improve immeasurably the lives of citizens.

For example, in the early years it can focus on child health, protecting children from abuse and diverting them from crime or drug abuse. As they grow older it can direct them towards education, sustainable skills and employment opportunities, reducing future need to rely on the state. And as they age it can provide the right type of housing, health and social care, with a focus on helping them to live well, safely and independently in their own homes for as long as possible.

There has already been significant progress in many countries towards the integration of healthcare and care in the home. However the end-to-end connections between these and housing are still an aspiration for most, and a lot of work remains to be done on how to bring together the information from the technologies used and harness it to improve people’s lives. But policy makers are identifying the relationships between decent housing and issues around public health and social outcomes, and in some societies there is an early momentum to find solutions. Digital technology is set to play an important role.

This is particularly important for less developed societies, where millions of people live in ramshackle housing with poor sanitation and infrastructure, leading to a plethora of health and social problems. But it is also where the biggest opportunities lie – there is much to gain from...
harnessing information systems, big data and AI to target investments in decent homes, health and care to tackle these problems at source.

Building the connected continuum is a major demand, but the development of technology within the Microsoft stack makes it achievable. Commodity cloud platforms such as Microsoft Azure, Office 365 and Dynamics 365 provide the foundations for an unlimited range of flexible solutions, bolstered by the capabilities of offerings such as Power BI, machine learning, bot frameworks, cognitive services, HoloLens and AI to provide the stepping stones to fresh thinking and innovative solutions.

But perhaps more importantly, Microsoft has a wide range of incredible partners, specialised in specific technologies or public service issues, that are working with public administrations around the globe to add their own thinking and innovation to the technology.

This is not a journey that has an end point – rather it is a vision that will evolve as the potential of new technologies become clear. But there are already enough examples of real achievement to show that the connected continuum of care can be an international force for good. This will make a great contribution to improving the quality of care, making an efficient use of resources, supporting governments’ financial sustainability, providing people with dignity and helping them to live healthy lives.