Technology for our Ageing Population: TAPPI INQUIRY

Submission of Written Evidence

The TAPPI Inquiry seeks evidence on the Terms of Reference set out in the template below for submission of written evidence to the TAPPI Inquiry. Please expand the sections if required and attach any additional materials as required.

Market intelligence

Evidence from the Economic and Social Research Council funded Sustainable Care: connecting people and systems programme, Grant reference: ES/P009255/1, 2017-21, Principal Investigator Professor Sue Yeandle, University of Sheffield, specifically the Achieving sustainability in care systems: the potential of technology project, led by Dr Kate Hamblin.

What are the needs and challenges faced by people with care and support needs, and (at an organisational level) by providers and commissioners, which could be mitigated or transformed by effective use of contemporary digital and technology solutions?
Written evidence: 1. For providers and commissioners, there is an issue of workforce capacity, and technologies can be used to address some of these issues- we have a case study of a local authority which used technology to reduce the need for 15-minute care visits to monitor medication compliance (attached). 2. Some commissioners have used technology to mitigate issues related to the digital divide- for example installing 5G mesh networks, LoRaWAN or Narrowband networks to support digital/ IoT devices in care settings. 3. Technologies can contribute to independence for people with care and support needs where their aspirations and outcomes are at the forefront of commissioning and decision-making. In our consultations, users of services highlighted how they had used their personal budgets to fund technologies that enhanced their independence, but did report challenges related to persuading local authorities that any technologies outside of telecare / AT devices were an acceptable way to spend their PBs.

What are the likely future trends and possible aspirations of the next generation of older people (in their late 40s / 50s now)?
Written evidence: Our review indicated that the 45-55 cohort are increasingly online and investing in smart phones/ tablets. Their expectations related to technologies and housing will be very different from older cohorts. We also know that there will be increasing numbers living alone in later life, with increasingly numbers of childless people, which has implications for informal caring networks.
What are the biggest barriers preventing commissioners, providers and others from moving towards true digital transformation?
Written evidence: Differences in digital infrastructure regionally present a significant barrier and source of inequality- we have reviewed the variations in access to the infrastructure required to support digital technologies, such as Internet of Things devices but also digital technology-enabled care devices and services, which are increasingly being used to support older adults and people with care needs. Digital devices will be increasingly important as the analogue to digital switchover takes place across the UK by 2025 (some areas have already switched over). Our review highlighted particular areas of the UK which are facing challenges related to ageing populations and solo living later in life, plus poor digital infrastructure. We have also written a paper and policy brief exploring the potential and challenges related to the use of digital and mainstream technologies in adult social care, including the need to update technology-enabled care safety standards and the ethics, privacy and data security measures that ensure digital products and services safeguard the interests of users. We have also conducted stakeholder consultations which indicated: 1. Technology enabled care marketplace is fragmented & confusing for local authorities, homecare providers & users to navigate. 2. Commissioning cycles & arrangements described as 'slow' & inflexible 3. Large numbers of start-ups (e.g. digital homecare planning) – concerns about longevity & support 4. People who use services, care workers and commissioners have preconceived ideas about the role of technology in care that are hard to change. At the same

time, robust evidence of positive outcomes needed to change attitudes & justify funding technology is lacking.

5. Lots of pilots to try & fill the evidence gap but create issues of sustainability & scalability.

6. Digital switchover- 'waiting game' for guidance/ funding from government or new technologies.

Good Practice

Please provide best examples of innovation and true integration of digitally enabled technology in housing and care settings, in the UK or internationally
Written evidence: Please see below case study of Liverpool City Council.

Case Study: Liverpool City Council

Introduction

This report presents an overview of recent strategies, services and projects developed by Liverpool City Council (LCC) and its partners involving use of technology in adult social care (ASC). It forms part of a wider study on the potential of technology to contribute to sustainability in the UK's social care systems, and is part of a programme of research, *Sustainable Care: connecting people and systems,* being undertaken in 2017-21 with funding from the UK Economic and Social Research Council awarded to the University of Sheffield.

The main focus of the report is on ASC strategies and commissioning and the council's digital strategy. Documents reviewed included:

- Joint Strategic Needs Assessment (JSNA)
- Finance & Resources Budget Book 2019/20
- Liverpool City Region Digital Infrastructure Updates
- Skills for Growth Action Plan for Health & Care
- Inclusive Growth Plan
- Strategies for health and housing
- Local system review report
- Market position statement
- Relevant news articles and project reports.

The report begins with a brief summary of the relevant local context, including demand for social care and the council's funding position. The four main sections of the report then follow. These discuss how LCC has been developing, experimenting with and using technology in ASC, focusing on: (i) digital technologies to deliver, or facilitate the delivery of, social care (including telecare, telehealth and telemedicine but also mainstream technologies); (ii) data and information management; (iii) developing the council's ICT infrastructure.

Local Context

Demography and health

In 2017, in Liverpool there were 96,384 people aged over 60, a rise of 10% since 2001. In the same period, the population aged over 85 rose by 26% (LCC, 2019a). Life expectancy at birth is below average for England (in 2016-2017, 76.1 years for men and 80.2 years for women, compared with 79.5 and 83.1 respectively in England, ONS, 2018) and has plateaued in recent years.

Liverpool has the fourth lowest level of health-related quality of life of all areas in England, and of the eight English 'core cities'[1] – Birmingham, Bristol, Leeds, Liverpool, Newcastle, Nottingham, Manchester and Sheffield – it has the lowest (LCC, 2019a). Among older people, falls are the largest cause of admission to A&E at 2,200 annually (2017/18) which is the second highest level in the country. Over 500 of these people suffered resultant hip fractures (also

[1] The eight cities established this group in 1995 and during the passage of the Localism Act 2011, the 'Core Cities amendment' was passed to allow for bespoke decentralisation to its members.

significantly above the national average) and two-thirds did not return to their former level of independence (LCC, 2019a).

Financial context

Since 2010, the council has experienced severe budget cuts, and finance it can raise through local assets or resources is constrained as the city is the 4th most deprived[2] of England's 326 district or unitary authorities, and therefore *'the potential amount per head that can be raised from the social care precept in Liverpool is relatively low'* (Cromarty et al., 2017:1).

Despite a 58% fall (a real terms cut of £368m) in the funds it received between 2010/11 and 2016/17, the council managed to protect the funding it allocated to Adult Social Care (ASC), increasing from 26% of its total budget to 30% (LCC, 2016a). Most of the ASC budget was used to commission services from the third and independent sectors (in 2015/16, an estimated 70%). LCC's allocation of Better Care Fund resources provided a boost for ASC between 2015/16 (when the approved ASC pooled budget was £55.7m). At that time, the city's Market Position Statement noted that ASC had delivered gross savings of £76m over the previous six years:

> *'against a backdrop of significant additional budget pressures due to demographic, demand, and inflationary increases, and with the additional new burdens transferred to Adult Social Care services from central Government … We have also had to make provision to meet … additional requirements in the Care Act 2014, (including) … new provisions for carers"* (LCC 2016:9).

In 2019, the Mayor noted that, "*as we enter the 10th year of austerity, we have had to find another £21.1m of cuts. Government has now cut 63% of our funding, equal to £436m"* (LCC, 2019b: 5).

Adult Social Care Spending and Strategy

Amid these cuts, Liverpool City Council's Adult Social Care spending has been cut by £92m since 2010, while demand has risen 15% (Liverpool 5G Testbed, 2020). Its forward budgets for Adult Services and Health (2019/20 – 2020-23) set out expenditure increases (see Table 1). In 2016, LCC reported that it had commissioned seven home care providers to provide 30,000 hours of home care per week to 2,600 people. It purchased two main types of home care: 'standard' home care - means-tested, but without additional charge for 'double-hander' visits or visits for medication prompts or commode cleaning; and REACT, a non-chargeable re-ablement service for people discharged from hospital (LCC, 2016). In September 2014, the weekly cost of its home care services was £300,000 and the average number of hours received per person supported was 13. Liverpool operated a system of 'tier 1' and 'tier 2' providers, the former having 'first refusal' of care packages (which were offered to tier 2 providers if they failed to respond quickly enough). Home care was commissioned in 30 minute slots (no 15 minute visits) and in February 2015, all providers were paid £11.88 per hour (LCC, 2016).

[2] Using the Index of Multiple Deprivation 2015.

Table 1: Liverpool City Council Budget and Forecast for Adult Services and Health Expenditure, Objective Analysis

£000s

	2018/19 Budget £000s	2019/20 budget £000s	2020/21 forecast £000s	2021/22 forecast £000s	2022/23 forecast £000s
Adult Services and Health Total	**171,121**	**180,753**	**183,724**	**184,583**	**185,499**
Homeless service	8.221	7,624	9,434	9,754	10,081
Care delivery	6,826	7,624	9,434	9,754	10,081
Integrated Commissioning & Health	134,792	141,511	142,515	142,588	142,703
Assessment & Care Management	22,282	23,257	23,488	23,932	24,385

Source: Liverpool City Council, 2019b: 19.

Technology Policy and Strategy

1) Digital technologies to deliver, or facilitate the delivery of, social care

Back in 2004-06, LCC (with British Telecom [BT] and Liverpool Direct) had piloted a new approach to telecare that aimed to shift focus from a purely emergency response system to one that could collect and use data to produce information profiles of service users to assist care professionals and informal carers. The approach used different types of sensors communicating via broadband: passive infrared (PIR) motion detectors; 'state change sensors', such as those for bed occupancy; fridge/freezer usage detectors; doors or windows opening/closing; and temperature sensors (Buckland et al., 2006). The results of a pilot (with 21 users) indicated that when deployed in this way, telecare could be more 'proactive'. The response centre could contact clients when a deviation from their normal patterns of behaviour was detected, and they did not need to wear a pendant alarm at all times to be able to summon help. There were, however, some problems with the sensitivity of the devices used and the resultant false positives they produced (Barnes et al., 2006).

Shortly after, in common with other metropolitan cities, LCC received funds (£339,397 in 2006/7; £557,119 in 2007/8) as part of a 'ring-fenced' central government Preventative Technology Grant, designed to stimulate English local authorities' use of telecare (Table 2).

Table 2: Preventative Technology Grant received by Principal Metropolitan Cities (£s)

Principal Metropolitan Cities	**2006/7**	**2007/8**	**Total**
Newcastle upon Tyne	194,562	320,105	514,667
Manchester	301,640	493,914	795,554
Liverpool	339,397	557,119	896,516
Sheffield	370,689	613,021	983,710
Leeds	430,066	710,355	1,140,421
Birmingham	701,422	1,153,746	1,855,168

Source: Office of the Deputy Prime Minister and Department of Health, 2006.

By 2019, the telecare service in Liverpool was being offered free to users. Packages included pendant alarms (including SIM-enabled models) and sensors (door/bed exit and smoke, flood and carbon monoxide sensors provided by Riverside), using family or friends as first responders, with a council-commissioned response service (Local Solutions) as an alternative.

Publicly-available data on technology-enabled care delivery in Liverpool reveal a mixed picture:

- In 2017, ASC services provided over 1,700 people with telecare devices and services; 2,600 people with telehealth devices and services; and home adaptations for over 3,800 people. The city had 'the largest take-up of telecare and telehealth in the country', with over 5,000 users (Mayor of Liverpool, 2018).
- By 2018, there were 4,006 telecare package users; of these, 2,233 were funded by LCC, and 1,773 by the local CCG (Williams & Kay, 2018).
- Also in 2018, approximately 5,600 people in Liverpool were using telehealth devices[3]. At the time, LCC believed this to be the largest deployment of telehealth equipment in Europe (response to CQC System Overview Information Request [SOIR], CQC 2018). Forward plans reported to the CQC during a local system review included expanding telehealth to 10,000 people, with the aim of supporting early hospital discharge.

The in their response to the CQC's 2018 SOIR, LCC appeared confident that the telehealth scheme is producing positive results, reporting that telehealth contributed to a 22-32% reduction in emergency admissions for device users when compared to a control group. A CCG trial (using patient-outcome measures) relating to the telehealth service available in Liverpool found that 55% of patients reported decreased health care utilisation, 90% had 'more control, confidence or ability to cope', 64% were 'sharing self-care results with others' and 79% felt they had improved health or better health management (Williams & Kay, 2018).

The strategic link between housing and technology-enabled care is emphasised in a 2017 report for LCC. This observed that the Council and CCG's principles for older people's housing included *"Improving the use of technology, particularly use of digital technology to replace, for example, analogue telecare systems"* (IB&A, 2017a: 18). The reference to technology as a key element in support for older adults England's 2014 Care Act is also mentioned. The report nevertheless found '*limited development in the past 30 years'* of existing telecare services in England, with continued reliance on unsustainable analogue systems unable to benefit from developments in internet-connected devices, despite evidence that the internet can help people connect with others and reduce social isolation. The report also refers to the commissioning priorities of the Liverpool Health & Wellbeing Board, which included '*Promote the use of care enabled technology*', and the Board's intention, as *'part of the roll out of care enabled technology by the Council to support domiciliary care service users,* commencing September 2017, to *'work with older people's housing and support providers to maximize the range and use of assistive and care enabled technology to support older people to maintain their independence in supported and mainstream housing'* (p. 27). In a companion report on housing and support for adults with care needs, the same authors also note that 'extending the use of care enabled technology' is a priority, with the commissioning approach described as piloting

[3] It is not entirely clear from the CQC report how telecare and telehealth were defined or delineated. For example, one reference to telecare seems to refer to a telehealth device: "Many people were receiving telehealth to support them to remain in their usual place of residence and telecare had been rolled out to care homes for remote consultations" (p. 9).

technologies in supported housing schemes for people with learning disabilities before these are rolled in all support packages in supported housing (IB&A, 2017b).

In 2019, forward planning of telecare in Liverpool identified that, of the city's 4-5,000 users of telecare devices, most were older adults (400 devices had been installed for survivors of domestic violence). Current devices relied on analogue networks, so alternatives were needed ahead of the full digital switchover (by 2025, and in some areas this has already begun); LCC '*needs to find affordable and future-fit technologies to replace current telehealth services'* (techUK & L5GT, 2019: 4). To 'stand still' and transfer analogue devices to alternative, SIM-enabled telecare devices, the estimated cost, exclusive of new service users, was £234,000 (Williams & Kay, 2018). At that time the service had 1,000 SIM telecare units in use, but these has not provided a sufficiently reliable service. The council's telecare supplier contract was up for procurement in 2020, and LCC was exploring alternatives. Problems included that SIM-enabled 'button and box' telecare is not compliant with Technology Enabled Care Services Association (TSA), BSI or European standards for alarm services if the backup battery life is less than 24 hours; and Internet of Things (IoT) options could not provide the same type of emergency response service as traditional telecare (personal communication, 2019). Existing analogue telecare devices cost £1.49 per item per week to monitor, but shifting to IoT-based systems could result in altered ongoing costs (Williams & Kay, 2018).

By 2019-20 LCC was exploring the use of mainstream devices, such as the Amazon's Alexa, in its 5G testbed to fill a gap (absence of voice activation and control devices) in Safe House technology (see section ii. Liverpool 5G Testbed). The council had been working with Amazon to provide information on council services via Alexa devices, including bin collections and library and Lifestyle centre opening times. The service reduces demand on council helplines and provides an alternative when these lines are closed; on Christmas Day 2019, for example, Alexa answered 1,500 enquiries about bin collections (personal communication, 2019).

2) Data and information

i. <u>iLINKS</u>

In 2014, the iLINKS Informatics Transformation Programme was launched at the iLINKS Innovations conference and exhibition. The programme's priorities included information governance, data sharing agreements and identifying technology requirements for information exchange, with the ultimate goal of sharing and providing data and information across health and social care practitioners in North Mersey. The iLINKS Informatics Transformation Programme aimed to:

i. Join IT systems across health and social care to share information seamlessly;
ii. Ensure all local health and social care organisations work together in relation to IT and information sharing;
iii. Exploit the benefits and investment of existing and future technologies and processes.

This programme resulted in the iLINKS Information Sharing Framework which provided safeguards and principles for information sharing and an Information Sharing Model to be used in direct care. Organisations covered by the framework included: CCGs (Liverpool, Knowsley, South Sefton, Southport and Formby), Health and Wellbeing Boards (Liverpool and Sefton),

Liverpool Clinical Laboratories, Local Authorities (Liverpool City Council and Sefton Council), Local Medical Committees (Liverpool and Sefton) and provider organisations (NHS trusts, GP practices).

The results of this programme in terms of data-sharing via technology, within ASC and between health and social care, were considered in a CQC local system review of ASC in Liverpool in 2018 (CQC, 2018a). This found '*[t]here was a clear intent from system leaders'* (p14) and '*considerable investment in the use of technology to support people as they moved through and between health and social care services and innovative use of data in predictive analysis to help inform commissioning decisions'* (p8). Examples included the single records system in primary care and plans to mirror this in secondary care. Responding to a CQC SOIR in 2018, LCC stated that the single information sharing agreement had enabled integrated care, resulting in over 100 million shared records. CQC's review nevertheless found only 'pockets' of integrated records (not system-wide integration) and noted that while partners in the system could legally access each other's records, this was not occurring in practice. In some parts of the system (citing homecare) CQC found that digitalisation of records had made sharing data more difficult. Commissioners, providers and service users could monitor the quality of service provision, but community health and social care teams lacked compatible mobile technology enabling them to add information into the same record. CQC argued that '*the lack of compatible technology between community care and domiciliary care may put people at risk of inappropriate care if key information or messages cannot easily be communicated between care partners'* (p19). Based on consultations with frontline staff, they concluded that: '*there had been some considerable efforts made to improve information sharing capabilities, but still described technology as a key barrier to providing joined-up care"* (p18). Nevertheless, in 2016 Liverpool's data sharing efforts in health and social care were recognised nationally and four (of 23) examples in the NHS England 'Global Digital Exemplar' (GDE) Programme were from Liverpool (CQC, 2018b).

Various subsequent policy documents link the sharing of data and information with improved health and social care delivery. The 'Skills for Growth Action Plan: Digital and Creative' (LCRCA, 2018b), for example, highlights the following:

- Sharing of information across health and social care services;
- Preventative use of apps to allow users to access GP and outpatient services online;
- "*public-facing digital services, which support and empower people to stay healthy and independent for longer"* (LCRCA, 2018b: 18) including online access to clinicians, personalised health information, telemedicine, remote monitoring, sensors, IoT, machine learning and AI.

The Action Plan also states that, for digital approaches to really succeed, the workforce must be 'empowered' to identify where technology may be beneficial and able to implement it.

Liverpool's 'Inclusive Growth Plan' (Mayor of Liverpool, 2018) aims to improve services through digital technology, including by sharing data to redesign services to be more responsive and able to identify people before crisis point. The Council's 'Digital First'

approach will make all suitable services accessible online. The plan also references the need for workforce training to capitalise on the benefits of digital technology. Its priorities include:

- 'Supporting people to manage their own care and live safe, healthy and independent lives': *'Increasing the use of technological solutions such as telecare and telemedicine'* and *'Increasing the staff use of data sharing and mobile technology to improve services and reduce waiting times for services and assessments'* (p43).
- 'Providing access to safe, sustainable and quality services for disabled and vulnerable residents and their carers', also includes reference to technology: *"Continuing to expand the use of innovative digital technology in care settings to improve quality. Liverpool has witnessed the biggest uptake of telehealth / telecare in the country and over 5,000 people already have technology in their home that allows them to live more independently"* (p45).

ii. eMAR (Electronic Medicines Adherence Record)

In 2017/18, in collaboration with the CCG, the council had one of 19 projects that received NHS Digital Local Investment Programme funding (overseen by the Local Government Association). The eMAR project aimed to address medication compliance and staffing issues in residential care. CQC inspections had highlighted medication management as a concern in care homes in Liverpool. The council selected 20 care homes where serious medication-related safeguarding issues had been identified. It was predicted that a digital electronic system for monitoring medication would save 180-200 hours of staff time (per care home, per year) in managing medicines administration, and reduce the resources required to store paper records. Council savings from safeguarding investigations avoided (roughly £500 per investigation) and a 20% reduction in the number of incidents needing investigation, saving £48,400, were predicted. Reducing medication waste (via automated prompts to pharmacists) would also save an estimated £117,120.

The project had some difficulty in introducing the eMar system in care homes (mainly due to inadequate Wifi networks) and only 13 (of 20 planned) were using an eMar system when the project ended; homes could choose from several systems; nine selected the Cura medication module and four Everylife Solutions' PASS system (CHIP, 2018; LGA, 2019).

iii. Stop and Go (Sustainable Technology for Older People – Get Organised)

LCC also used the PASS system in a separate project in 2017 focused on domiciliary care services. The Council was keen for the care services it commissioned to include technology solutions in their offers, but found providers resistant to change, citing low profit margins and high initial costs of integrating ICT. 'Stop and Go' was an EU-funded PPI project with KTN which covered 20% of the cost of any service included in the project, and focused on removing barriers in domiciliary care companies to technology adoption. The evaluation report found its 'co-design' approach and initial speed-networking event in 2016 for technology manufacturers / providers and care companies was valuable: '*It's not about the technology – it's about the service. The human element of the implementation is far more complex than the technology. The technology can enable the service development but cannot be pushed / forced onto services'* (LCC and e-Health Cluster, 2018: 1). Preferred care service providers then created a 'wish list' for technology that could be commissioned (at no cost to their company), resulting

in commissioning of the 'EveryLife Technologies' PASS system. This digitises care records, which can be accessed in real time on an app-based system by homecare workers and a care recipient's unpaid carers. Homecare workers can also use a QR code on entering a client's home to view information about them (food preferences, if they have taken medication, need shopping, etc.). The system could be managed centrally (to ensure coverage if a worker was delayed or unable to attend) and used 'red flag' alerts if discrepancies in care plans were detected. Family members could access information on care visits in 'real time'.

The project also used the 'Caring Cloud', which used monitoring devices (Safehouse IoT sensors) in housing via LoRaWAN (Low Power, Wide Area Network) technology. Data from these could be accessed by homecare teams and unpaid carers. LCC installed LoRaWAN technology in 2017 to provide city-wide coverage, enabling care providers and families to take advantage of the latest IoT devices to enhance care services (e-Health Cluster, undated). Care supervisors and assessors installed Safehouse devices and conducted the evaluation with care users. The Safehouse base unit monitors power failure, temperature and humidity and can detect fire and carbon dioxide alarms and smoke and heat detectors (including if a smoke alarm battery is low). An additional eight sensors can be connected to the base unit and monitored via an app (for unpaid carers). Alerts can be programmed to go to up to six people (the final call always goes to the LCC telecare response service operated by Riverside). Care providers were involved in a co-design process for the dashboard. The device has no voice function, however; LCC is aware this can create anxiety as the person cannot ask for a specific responder.

3) ICT infrastructure

i. LCR Digital Strategy and Action Plan

In 2018, LCC began developing a Digital Infrastructure Action Plan (DIAP) for the City Region (LCR), with the aim of including a '*full fibre network 'superspine' to facilitate the deployment of further full fibre connectivity throughout the City Region to unlock economic growth'* (LCRCA, 2018a:1) resourced from the Combined Authority's Strategic Investment Fund.[4] At this stage, the goal was that a 284km 'superspine' would deliver ultra-fast broadband for all six constituent districts, at an estimated cost of £23m (LCRCA, 2018a). In December 2020, LCR published its draft LCR Digital Strategy and Action Plan, inviting responses by January 2021 with a view to presenting it to the LCR Combined Authority on 26 February for approval. The draft Strategy (2020a) and Action Plan (LCRCA, 2020b) set out six key areas:

1. Digital Infrastructure & Connectivity
2. Tech for Good & a Smart City Region
3. Digital & CreaTech Sector Development
4. Cross-Sector Digitalisation & Artificial Intelligence (AI)
5. Digital Skills for Recovery & Growth
6. Digital Inclusion

[4] The Strategic Investment Fund of £500 million is available to large and small firms, as well as to councils and public bodies in the Liverpool city region.

Projects, including the Liverpool 5G Testbed described below, undertaken within Liverpool's health and social care services were highlighted to be particularly relevant to the Digital 1) Infrastructure & Connectivity, 2) Tech for Good & a Smart City Region and 6) Digital Inclusion areas. The Action Plan included specific reference to "Maximise 5G connectivity (building on the Liverpool 5G mesh network) & 5G-fibre backhaul integration" (p. 2).

ii. Liverpool 5G Testbed

Part of the Action Plan also includes the expansion of the 5G mesh network, created as part of the Liverpool 5G Testbed. With the 5G testbed, LCC aimed to take forward the use of digital technologies in social care by progressing the learning and use the monitoring sensors from the Stop and Go project. The Liverpool 5G Consortium[5] received £3.5m from the Department for Digital, Culture, Media and Sports (DCMS) for the 5G Testbeds and Trials programme to deliver the Liverpool 5G Health and Social Care project. (This was one of six testbeds funded in 2018 as part of over £1bn of funding announced to boost the UK's digital infrastructure.) The Liverpool 5G testbed comprises 11 testbeds and trials in areas of Liverpool where reliable access to broadband is limited (LCRCA, 2018b). Despite aspiring to improve health and social care services through the use of technology in Liverpool, it was recognised that, without Wi-Fi infrastructure, ability to capitalise on technology would be limited/uneven:

> *"Technology is the catalyst in the rebalancing of investment from cure to prevention; from health to social care; and from professional locations to wherever is convenient for the public. The healthcare technology revolution comprises both medical grade devices, supplied to the public by medical professionals, and consumer products. The former is tested and approved by regulators, but the latter is usually not. In this revolution, data will be key: getting a consistent series of trustworthy data from patient to professional. Connectivity will be crucial, where 5G will be the latest tool in the box alongside Wi-Fi and previous generations of mobile technology."* (techUK and the Liverpool 5G Testbed, 2019: 5).

The Liverpool testbed was to be a *"blend of advanced low cost 5G technology and modern applications designed to revolutionise the future delivery of health and social care"* and a *"demonstration of how health and social care applications are enhanced and integrated through the utilisation of the high bandwidth and low latency of 5G"* (Liverpool 5G Testbed, 2018), with the broader aspiration of reducing the digital divide in the city (DCMS, 2018).

The testbed involves creating a 'mesh' 5G network using nodes on lamp-posts in the Kensington and Fairfield wards and local healthcare buildings. This Wi-Fi network is available free to users (the council owns the infrastructure) and can be used with any Wi-Fi enabled device. At the outset, an aim of the 5G mesh network was to use applications to support health and social care (e.g. *"High resolution video and distributed AI for patient event and movement monitoring; Teleconferencing, AR, VR , etc. to manage loneliness in older adults; High*

[5] Led by Sensor City with Blu Wireless Technology, AIMES, DefProc, CGA Simulation, Liverpool City Council, Royal Liverpool and Broadgreen University Hospitals NHS Trust (RLBUHT), University of Liverpool and Liverpool John Moores University and the eHealth Cluster.

resolution video and remote diagnostics for 'telehealth in a box', facilitating communication between hospitals and the community; Intelligent IoT sensors to aid independent living in the home" (Liverpool 5G Testbed, 2018).

The initial 11 testbeds and trials in Liverpool included:

1. *Telehealth in a Box* – improving communication between hospitals and the community.
2. *Cloud Based Clinical Mobility* – using 5G to accelerate mobile solutions.
3. *Enabling the new and innovative hospital (Royal Liverpool and Broadgreen University Hospitals NHS Trust) to become a test bed for SMEs.*
4. *Pharmacy in the Home – on-call access to a pharmacy assistant for vulnerable people in their own home.* Key drivers for this trial were a desire to reduce the amount of 'medication reminder' domiciliary care visits funded by LCC (over 1000 pw) and to reduce medication wastage (estimated cost £2.5m pa due to over-ordering and stockpiling, plus £500m pa due to people not taking medication correctly) (Williams & Kay, 2018). The system uses a 4K video device (Paman) co-designed with pharmacists as a medication prompt linked to pharmacists to watch the service user take their medications. Unpaid carers can also use the system to ask for advice. LCC commissioned local pharmacies to provide this service, including installation of devices, to reduce the cost of domiciliary care medication calls when alternative telecare solutions were not practical.[6] Pharmacists also complete the Medication Administration Record (MAR) chart. A future aspiration is to introduce two-way cameras so users can also see the pharmacist. User concerns about privacy were mediated by Velcro strips to cover the camera when not in use.
5. *Use of ambient IoT sensors in home care services – keeping people living independently at home for longer.* This builds on the Stop and Go programme and uses the PASS system. The 5G network absorbs some of the costs that would otherwise be borne by care providers.
6. *Push To Talk – a device to reduce social isolation.* This service was co-designed with service users to produce a 'button' device that users can push to receive a phone call, with peer support. Connectivity for 'Push-to-Talk' is 5G-enabled which gives 'always on' coverage using a Long-Range Wide Area Network (LoRaWAN): *"The bandwidth, low latency and steady signal provided by 5G ensures that the system is always on and readily available, even where the participant does not already have fixed broadband"* (techUK and the Liverpool 5G Testbed, 2019: 13). There were 35 users (70 is optimum) in 2019, but an initial evaluation found peer support was valued. There are two target groups: unpaid carers and older people at risk of isolation. For the latter, Carers Development Workers recruit carers who take the technology out to people, with a technology worker from the carers' centre following up.
7. *Reducing Loneliness in Older People – using emerging technologies and apps to bridge physical distance, using 5G.*

[6] Medication dispensers linked to a monitoring centre were viewed to have two drawbacks: they can be cancelled by being tipped up and therefore there is no certainty that the person has then taken the medication, and not all pharmacists will fill them.

8. *Remote Hydration Monitoring for vulnerable people.* The Warn Hydrate has been removed from the project as LCC felt the device was in R&D stage. For the 2019 project phase, a new wearable will be added to the testbed.
9. *Consent-based trusted analytics/research (TAE/TRE) environment, with access for researchers/analysts across the UK.*
10. *Chromatic Cameras in Home Care Settings – comparing patterns of behaviour at home.*
11. *Optimising access to and use of 5G networks for multiple IoT devices.*

In March 2019, the testbed was extended for 12 months with an extra £1.48m (DCMS contributed £0.94M and Testbed Consortium partners provided £0.54m). By the evaluation in 2019, these trials were grouped into 4 main outcomes-focused areas:

1. *Medication management*
    a. Paman system to promote and monitor medication compliance.
2. *Living Independently at Home*
    a. 'Safehouse' 'Internet of Things' sensors to monitor home environment and provide information to care providers via a dashboard and an App for family members.
    b. 'Chromatic Sensors' to detect changes to patterns of behaviour that could indicate age or health related problems.
    c. 'Dehydration Monitoring' to detect early signs of dehydration and alert carers
3. *Addressing Loneliness*
    a. 'Push to Talk' which links older people within peer groups for a chat and companionship.
    b. 'The Loneliness Quiz and Bingo App' to facilitate social connections for people with a learning disability or in care settings.
4. *Improving patient experience*
    a. 'Docobo Telehealth' to monitor vital signs from home as determined by clinician with the aim to support early discharge from hospital and reduce outpatients visits.
    b. Virtual Reality in the palliative care settings to assist with pain management.

These four areas and the associated six 'use cases' were then evaluated at the end of 2019 (Liverpool 5G Health and Social Care Testbed, 2019). The sample sizes are listed in the table below, with the associated reported findings. The consortium worked with DCMS to establish benefit metrics for each use case. The majority of the evaluations used surveys at baseline and at the end of the intervention period as a methodology, supplemented by some qualitative interviews. Surveys used questions from established and validated surveys including the DCMS Community Life Survey 2017-18 on quality of life and loneliness and UCLA Three-Item Loneliness Scale. The evaluation report acknowledges some of the use cases featured small sample sizes, in part due to the deliberate roll-out to modest numbers of users and in turn not all users were able to complete surveys. There were also no control groups for comparison, making causal inferences problematic and as the report notes, *"Extrapolation of the data to cover 100 users for one year gives a comparison between use cases, but should be viewed with caution - it is a potential, possible effect of these use cases, an illustration of potential impact*"

(Liverpool 5G Health and Social Care Testbed, 2019: 11). However, the overarching findings indicated potential cost savings to the health and social care services of an estimated £247,688 per hundred users per year, after use case service costs (not including network costs, and assuming service users have multiple devices).

Table 3: Liverpool 5G Test Base Use Case Evaluation Findings

Use case and number of participants	Reported outcomes
1. Medication management	

Paman
Participants: 35
	• Potential cost savings to Health and Social Care Services of £208,800 per 100 users per year.
	• Improved medication adherence levels: 40% higher than national average of 55%, at 95%.
	• Decrease in medication errors: 51% drop in the number of service users who had a medication error.
	• Medication costs reduced by over 50%, and medication wastage reduced.
	• Reduction in carer hours needed to provide medication administration support. Potential saving per 100 users per year: 30600 hours (£464,500).
	• Improved quality of life for service users.
	  • 73% increase in those confident and happy to take medication.
	  • 53% increase in those who felt safe.
	  • 40% increase in service users who felt more independent.
	• Improved safety in the home, with medicines securely stored.

2. Living Independently at Home	

Safe House
Participants: 81
	• Potential cost savings to Health and Social Care Services of £38,020 per 100 users per year.
	  • Reduced costs of telecare: Potential reduction of £14,280.00 per 100 users per year.
	  ▪ Overall reduction in telecare costs for 81 users per year: £11,566.80[7].
	  • Average hospital admissions reduced by 50%: Potential cost saving of £22,536 per 100 users per year.
	  • Reduction in average GP visits by 13%: Potential cost saving of £592 per 100 users per year.
	• Improved quality of life for service users: Average increase of 0.7 points on the life satisfaction scale.

[7] Based on current cost of telecare network and support at £3.48 per user per week per person (data provided by Liverpool City Council) and cost of monitoring equipment and maintenance at £113.36 per user per year (data provided by Liverpool City Council) versus Safehouse cost of telecare network and support at £0.58 per user per week per person (costs data provided by Safehouse) and cost of Safehouse monitoring equipment and maintenance of £121.36 per user per year (cost data provided by Safehouse).

Chromatic sensors Participants: 1	• Improved notification on incident to carer. • Estimated reduction in carer time dealing with incident.
WarnHydrate Participants: 5 (2018-19)	• *"the trial proved that the technology worked, the interface with the care organization would need to be developed further for the care providers to make effective use of the readings"* (p. 52).
3. Addressing Loneliness	

Push to Talk
Participants: 41
	• Reduction in loneliness in users:
	  • 25% increase in those who said that they hardly ever felt that they lack companionship.
	  • 75% increase in those that said they hardly ever felt left out
	  • 50% increase in those who said they hardly ever felt isolated from others.
	• Reduction of over 30% in the number of people who visited their GP and 16% drop in average number of visits per user. Potential cost saving per 100 users per year: £868.

Loneliness Quiz and Bingo App
Participants: 49
	• Reduction in loneliness in users:
	  • 28% decrease in those who said that they often felt that they lack companionship.
	  • 20% decrease in those who said that they often felt left out
	  • 13% increase in those who said that they hardly ever felt isolated from others.
	  • 26% decrease in those who said that they often or sometimes felt lonely.
	• Improved quality of life in service users, with an increase of an average of 1.4 points on the life satisfaction scale.
	• Reduced digital exclusion, with users more confident to use technology.

4. Improving patient experience	
Telehealth in a Box Participants: Telehealth: 4	• Decreased use of primary health services and hospital services. • Improved health for service users and increased ability to manage their own health.
VR in palliative care: 22	• Improved quality of life and wellbeing for patients. • Some reduction in pain medication for patients.

Source: Liverpool 5G Health and Social Care Testbed, 2019.

Challenges the 5G testbed has experienced included fears about the safety of 5G related to social media campaigns about radiation; incidents of graffiti and vandalism in which three nodes were damaged (personal communication, 2019). In June 2020 an additional £4.3m was secured as part of '5G Create' DCMS funding competition. The plan from this point was to scale out the network in order to reduce digital poverty and exclusion and create a new transferable commercial model as LCC acknowledges the service ultimately needs to be self-sustaining. 5G Create is referenced in the LCR Digital Strategy Action Plan (LCRCA, 2020b), which suggests it will be taken forward to *"will develop an independent 5G network for health and social care services in selected areas of Liverpool, scaling out the initial testbed. The*

network will reduce digital poverty for vulnerable people in need, providing safe, free and accessible connectivity to public services including health, social care and education, and establish a new transferable sustainable model" (p. 2), with the 5G network scaled out to include all of Liverpool and the Liverpool City Region.

Summary

LCC is an example of a local authority that has made progress in applying technology in social care settings. Technologies to deliver care, such as telecare, were adopted in a comparatively early pilot exploring the potential for using broadband-enabled devices in a proactive (rather than reactive way), moving beyond the traditional 'first generation' telecare (Doughty et al., 1996). The iLINKS programme led to some advances in data sharing within and between health and social care, but (as the CQC noted) this was concentrated in particular areas, with home care being one where, though frameworks are in place, in practice sharing data and information was still challenging. The Stop and Go project sought to create change in home care provision, but LCC's strength has been in investing in the ICT infrastructures to enable use of digital devices in care through a 5G mesh network and planned broadband 'superspine'. The council has recognised the importance of ensuring an infrastructure is in place for fast, reliable and free broadband to facilitate the switchover from analogue to digital technology enabled care services. LCC has therefore been innovative in its approach to technology and care since the 2000s, but there has been a focus on pilots and testbeds – often resourced through applications to EU or national funding bodies – raising the question of sustainability, which the plan to explore the potential of commercialisation may address.

About the Research

The Sustainable Care: connecting people and systems programme explores how care arrangements can be made sustainable with wellbeing outcomes. It studies the systems, work and relationships of care in the context of changes in technology and mobility and aims to support policymakers, the care sector and academics to conceptualise sustainable care as about ethics, justice and the distribution of resources. The programme focuses on adults living at home with chronic health problems or disabilities and their families, carers and paid workers. Funded by the ESRC, it is delivered by eight universities and Carers UK, led at the University of Sheffield by Professor Sue Yeandle. This case study was authored by Dr. Kate Hamblin as part of the *Achieving Sustainability in Care Systems: The potential of technology* project.

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