

Assistive Technology Proof of Concept Evaluation Report

Key Messages

The Assistive Technology (AT) Proof of Concept has successfully shown that AT is an acceptable and feasible complementary solution for creating greater efficiencies in social care in Hertfordshire, providing greater support and reassurance for families and helping improve older people's health and wellbeing.

A number of factors cemented this outcome;

- HCC developed leading-edge Analytics. The introduction of new and novel techniques to visualise complex data and gain insights quickly.
- Deployment of an appropriate quantity and diversity of sensors to match the risks identified.
- Analytics requirements were driven from HCC Social Care and Health professional engagement; allowing emerging risks and issues for the Service Users (SU) to be defined.

The potential benefits for Hertfordshire County Council of including AT within Homecare Packages include;

- AT for use as a preventative tool (keep people on small care package/pre-care).
- Redistribution of limited homecare resources; delaying the need for 24-hour care and preventing the escalation of care needs.
- Informal carer support/stress reduction/prevention of carer breakdown.
- Getting the size/length of mainstream and Specialist Care at Home (SCAH) packages of care right for each service user.

There are also potential benefits for health organisations especially where people have a health and social care joint need.

Thorough planning and scoping activities involving all stakeholders will enable phase two to effectively demonstrate impact.

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Purpose of Report

This report describes the learning from the Assistive Technology (AT) Proof of Concept (PoC) project, outlines the benefits identified by various stakeholder groups and informs the planning phase of a future pilot/incremental roll-out.

Objectives of the Proof of Concept:

- To explore service user and informal carer attitudes to and engagement with AT
- To explore professional attitudes to and engagement with AT, including perceptions of the costs, benefits, and impact on working practices
- To examine changes in management and care arrangements associated with AT interventions, including impact on caring relationships (informal and professional) and use of services and resources
- To explore targeting resources and maximising available capacity in the publicly funded care system.
- To explore whether AT can help service users to meet their individual outcomes.
- To explore whether AT can improve hospital discharge and prevent hospital readmissions.

Definitions

Telecare describes the remote, automatic and passive monitoring of changes in an individual's condition or lifestyle (including emergencies) in order to manage the risks of independent living. Examples include movement sensors, falls sensors, and bed/chair occupancy sensors; primarily 'react and respond' technologies.

Assistive Technology includes traditional Telecare plus digital participation and wellness services; brought together through use of an analytics dashboard where activity can be shown in near real time.

This project describes part of an ongoing journey of continual improvement moving from analogue telecare, to a blend of digital telecare, sensors and dashboards (Assistive Technology) with the next step being **Predictive Care Technology**. This will enable a more pro-active approach to care planning and delivery.

Situation in Hertfordshire

Hertfordshire County Council supports over 13,000 people with a range of Assistive Technology, from community alarms to more complex packages to promote personal independence and carer support linked to an emergency monitoring centre. Whilst Hertfordshire is moving towards digitally enabled infrastructure, such as digitally enabled telecare (for example pendant alarms and environmental sensors), the present offer does not include provision of individualised dashboards for use by family carers, social care and health professionals.

Much of the existing provision represents incremental improvements to long-standing technologies developed primarily to provide a reactive emergency response. The infrastructure is currently predominately analogue based, and national support for this network is being progressively wound down and ultimately 'switched off' in 2025, to be replaced with voice over IP (VoIP) technology. For AT to remain effective, a switch to VoIP will be necessary. This presents a valuable opportunity to rethink AT in Hertfordshire; including the digitalisation of the existing telecare offer and introducing targeted digitally-enabled AT as an integral part of an individual's care plan.

This PoC pilot was funded via HCC's Invest to Transform (ItT) arrangements. A further bid will be submitted to scale up AT rollout across a whole locality to further test the new arrangements at scale across a wider cohort of residents and partners. It must also be stressed that one of the key drivers for success has been the joint working across a number of disciplines including ICT, Information Governance and front-line practitioners, which will be built into the future ItT funding arrangements.

Introduction and literature review

With an ageing population, many people are living longer with multiple long-term health conditions, placing unsustainable demands on health and social care services (Suzman et al. 2015, National Audit Office, 2014). These issues are compounded by difficulties in recruiting enough care workers to meet demand (LGA, 2016). Such challenges require a complete rethink about how we provide care services, to enable an efficient, appropriate and targeted delivery. There are increased funding opportunities for digital technology solutions, on the hypothesis that AT such as sensors on doors, kettles, fridges and medicine boxes could help people remain independent for longer, delaying costly care packages or residential care.

At present, evidence supporting AT in health and social care is mixed. A 2008 Cochrane review stated that despite extensive literature on 'smart home technologies', there was insufficient evidence to verify its usefulness within health and social care (Martin et al. 2008). The review inferred that to reach potential, AT must be person-centred, flexibly adapted and proactively utilised. Following this, the world's largest randomised control trial of telecare and telehealth, running over 3.5 years, was launched in 2008, with 6,000 participants across three UK sites, at a cost of £31m. However, the 20 subsequent reports showed few conclusive results. Telehealth did not improve quality of life or psychological outcomes (Cartwright et al, 2013), did not conclusively reduce hospital costs (Steventon et al, 2013), and was not a cost-effective alternative to standard care (Newman et al, 2014, Mistry et al. 2012).

Despite inconclusive research findings, telecare – the use of passive sensors to monitor activity and send alerts based on pre-defined thresholds - has continued to grow, and now forms a key part of adult social care provision. Many adult social care departments now use it to manage funding cuts and demographic pressure (Knapp et al. 2016). It is often a 'gateway' service, and in many places has garnered considerable local investment (Woolham et al. 2018, Knapp et al. 2016). Recent evidence for its effectiveness seems more positive, perhaps due to improvements in AT capabilities. For example, early evaluations of telecare for people with dementia suggest it could prolong independence by improving risk management, and save money by delaying admission into care and preventing unnecessary hospitalisation (Knapp et al. 2016). In a 2017 national survey of local

authority telecare provision, 24% of respondents estimated that telecare saved money. However, this was often based on 'hypothecated savings' rather than firm evidence (Woolham et al 2018).

While telecare use is growing in popularity, barriers to use remain. For commissioners and senior managers, these include perceived skill deficits amongst professional staff to make assessments, the inflexibility of 'service bundles' or contracts with existing suppliers, and lack of staff skilled in telecare installation (Woolham et al. 2018). From a service-user perspective, Sanders et al (2012). found that, alongside privacy concerns and dislike of technology, barriers included the perceived requirement for technical competence, threats to identity, and fear of disruption to existing services. A further study showed lack of trustworthy communication to be a barrier, and that Telecare is often *perceived* as a last resort rather than a preventative measure (Bentley et al 2018).

One often overlooked aspect of telecare is the impact on informal carers. Family carers make an enormous contribution to health and social care. However, the risk of burn out, through isolation, psychological distress, depression and poor lifestyle behaviours, is significant (Cook et al. 2018). Burn out comes at significant cost to the system (Mortenson et al, 2013). AT devices have a well-documented positive impact on family caregivers, by offering high-quality reassurance (Cook et al 2018, Mortenson et al. 2013). Recent studies found that caregiver burden decreased significantly over time after the introduction of AT (Knapp et al 2016, Mortenson et al 2013), enabling them to provide support for longer, at a significant saving to the system.

Description of the Intervention

The PoC aimed to examine whether AT can assist SU's:

- With a falls risk
- Prone to UTIs
- At risk of dehydration
- Who may not be regularly accessing food
- Prone to sustained declined mobility
- At risk of disorientation or depression due to low light levels and not opening their curtains
- Suffering from breathing difficulties and lung issues, who don't maintain an appropriate temperature for their condition
- Who are forgetful about medication
- Placing themselves at risk by leaving front or back doors open.

All activities related to this project were undertaken with the involvement and subsequent approvals from the relevant teams, including data protection, legal, research/practice governance, and ICT security teams within HCC.

A multi-agency Steering Group was formed to create an AT Strategy for Hertfordshire's adult social care. At the heart of the strategy is Hertfordshire County Council's vision:

"To embed the vital role of technology and work with our partners to support people to live independent lives in their own homes, stay connected to their local communities and stay fit and active for longer."

In addition, Steering Group members provided advice on how to integrate services around the individual and their needs, and ensure services are ethically based, outcomes focused and future proofed.

An additional, a more strategic group (the AT Programme Board) was created to:

- ensure all the work strands are moving in the right direction
- ensure emerging issues and risks are mitigated against
- ensure dependencies with other parts of HCC are considered
- ensure headline concerns can be discussed and resolved more efficiently
- identify corporate lessons for future improvement
- ensure effective engagement at strategic level with Care Providers.

Recruitment

The inclusion criteria for referral into the PoC pilot were as follows:

- Capacity to consent (assessed by care manager)
- Presence of an engaged informal carer
- Over 60 years old
- Careline pendant already installed
- Active care manager who completed a referral form
- Recent care assessment
- Identification of risks for which AT could assist (*NB. List evolved throughout the duration of the PoC*)

Recruitment occurred between December 2018 and September 2019, during which 115 referrals were received. A total of 53 service users were accepted onto the PoC (46%). The average SU age was 84 (range 60 to 96 years), and 68% were female. Geographically, the largest number of successful referrals came from East Hertfordshire and North Hertfordshire (34% and 24% respectively). In terms of source, the largest number of successful referrals came from Post Hospital Discharge Teams (32%) and Post Hospital Review Teams (24%). Eight SUs had sensors removed during the PoC due to a move to residential care or death. These sensors were subsequently redeployed.

Consent

Full and informed consent was sought from SU and family responders for enrolment onto the pilot (see Appendix 3 for information sheet and consent forms). Informed consent to take part in evaluation activities was also obtained during the initial consent visit (see Appendix 4). Participants were given a privacy notice on how their data would be used and were able to withdraw from the pilot at any point, without giving a reason, if they so wished; however, none did.

Description of the Assistive Technology

Following a suitability assessment, a range of digital sensors, including motion sensors, smart plugs, and door sensors (also used on medication boxes), were installed alongside current Careline telecare equipment in SU's homes. The pilot equipment was installed alongside the existing prescribed equipment to ensure the continued safety of the service user whilst the robustness of the new technology was tested and families were not asked for any additional financial contribution for the new equipment or digital connectivity. These sensors were linked to a dashboard (accessed by a family carer) and alerts were set up according to individually identified risks and pre-defined parameters (see Appendix 1 for further details and examples of the dashboard and message alerts). Initially, the supplier provided software did not provide a meaningful summary of data obtained for use by HCC frontline staff. Instead, this capability was designed and developed by the AT analytics team (in conjunction with frontline staff). Using this data, the analytics team could provide a wide range of information (e.g. trend analysis, daily routine summaries and outliers) to care managers, which could then inform care planning where applicable. A key risk is declaring victory too soon as it is estimated that we have met only 30% of our HCC frontline staff requirements for suitable analytics/machine learning, and there is keen interest in providing a self-service dashboard, rather than requesting analytic outputs ad hoc.

The PoC ran for 9 months from the first install on 20th Feb 2019 to the final evaluation activity on 29th November 2019. As the pilot progressed, additional sensors were deployed to seven 'deep dive' SUs, to ensure that the PoC was correctly measuring and interpreting the data received (improved validity). This had a profound impact on the quality of the data and the insights that could be gleaned. The deep dive SUs had an average of 12 sensors, and the rest of the cohort had an average of 8 sensors. In order to provide continuity of service for SUs on the PoC, sensor kits were left in place following the PoC, to be regularly reviewed.

Evaluation method

Due to the complexity of the AT intervention, a realist evaluation approach was used (Berge M. 2017). Typical outcome evaluations assume homogeneity across participants, and controllability or irrelevance of context (linear thinking). A realist evaluation approach makes no such assumptions, instead allowing us to deconstruct conditions underlying an intervention, to understand why complex interventions work (or not) in given settings or contexts. Theories are tested via evidence from interviews, focus groups and questionnaires. Data gathering continues until saturation – when no new things are heard.

Summary of Evaluation Activities

The evaluation included a range of quantitative and qualitative methods, as follows:

	Quantitative measures	Qualitative measures
Service users:	Pre/post Short Warwick-Edinburgh mental wellbeing scale (Tennant et al. 2007)	5 face-to-face interviews

	<p>Campaign to End Loneliness Measurement Scale (https://www.campaigntoendloneliness.org/wp-content/uploads/Loneliness-Measurement-Guidance1.pdf)</p> <p>A scale developed to define individual outcomes (relating to AT) and understand how close the individual SU feels they are to achieving these.</p>	
Family carers	<p>Pre/post Short Warwick-Edinburgh mental wellbeing scale (Tennant et al. 2007)</p> <p>Campaign to End Loneliness Measurement Scale</p> <p>Carer Strain Index (Thornton and Travis 2011)</p>	19 semi-structured telephone interviews
Staff		<p>10 purposely sampled semi-structured interviews (telephone and face-to-face), including two Community Care Officers, four Social Workers, four Team Managers, one Independent Living Services Manager.</p> <p>5 focus groups with frontline staff and managers (total 25 participants)</p> <p>2 workshops with care agencies</p> <p>Mapping theory of change and outcome benefits exercise</p>

Qualitative Data: Semi-structured interviews were conducted by Nichola Lee, Public Health Evaluation Officer (see appendix 5 for interview questions). Interview/workshop transcripts were analysed using an inductive thematic approach. Analysis was carried out by Nichola Lee and Khadija Mohamud (Public Health Evaluation Officers) using NVIVO 12 software.

Quantitative data: A battery of quantitative tools were administered. However, as the PoC progressed, it transpired that the scales used were not validated for people experiencing early stage dementia; a population from which most of the sample had been selected. In terms of additional questionnaires, poor response rate, and insufficient, poor quality data made the responses unsuitable for analysis. Instead, completed quantitative scales were used to inform qualitative interviews.

The design of the PoC has meant hospital re/admission data is not reliable or valid for use in this evaluation. Individual case studies, qualitative data and professional judgement were used to infer where the benefits might lie and impacts of the technology to date

Results

AT output statistics

- Average number of alerts generated per SU per day: 1.52
- Average number of times dashboard accessed by family carer per month: 32 (range zero to 276) *NB. Carer can use alerts only or dashboard only according to personal preference.*

Headline statistics (drawn from qualitative data):

- **100%** of **staff** articulated **benefits** for **four groups** (HCC staff, SU, Informal carers, Care Agencies) in **four categories** (see below). All of these benefits culminate in increased independence for SU's.
- On average, **staff** felt that AT would be relevant for **42%** of their current **caseloads**, range 20-75% (potential positive correlation between their perception of relevancy and their understanding of AT)
- **90%** of informal **carers** would **recommend AT to a friend**
- **84%** of informal **carers** said AT **reduced their worry/stress** levels (attributable to caring)
- **21%** of informal **carers** used the **temperature sensors** to help SU's effectively control the temperature of their houses.
- **16%** of informal **carers** could keep track of **formal care visits**, which helped them to address payment disputes.
- **48%** of informal **carers** were kept informed of the **nutritional status** of the SU through kettle, fridge and motion sensors.
- **42%** of informal **carers** helped improve **SU medication adherence** through use of the medication box sensor.

A summary of the **case study results** for three of the deep dive SU's can be found in Appendix 6.

Key themes drawn from qualitative analysis of the four stakeholder groups

Service Users (see appendix 7 for full details)

Where they were able, service users described how AT helped them to feel more confident that they would receive help quicker should anything happen to them. In some cases, SUs felt that AT was less intrusive than a traditional care package. SUs also reported feeling pleased that the AT provided reassurance to their family carers. Several positive experiences for the SU were also reported by the family carers, including increased independence; increased confidence; comfort in their home; and privacy. HCC staff felt that AT gave the potential for SUs to stay living independently at home for longer, which again increased SU independence.

Family Carers (see appendix 8 for full details)

Despite only having a small sensor package in most cases, 84% of informal carers said AT reduced their worry/stress levels (attributable to caring) and 90% of informal carers would recommend AT to a friend. While family carers maintained their planned visits, they did not need to undertake as

many unplanned visits, as the dashboard provided reassurance that all was well. Several positive impacts were reported by the family carers as a result of the assistive technology installation. These entailed: improved medication adherence; nutritional update; update with professional care visits; and better heating regulation. In addition, family carers felt that the AT allowed them to take a break from the responsibility of caring, as multiple family members could access the dashboard.

Several technical issues were raised, which included: unresponsive sensors; inaccurate sensors; dashboard crashing; and unresponsive dashboard. Two carers reported not being able to understand the dashboard interface. This feedback enabled continual improvement of the AT offer as the PoC progressed. Additional sensors to improve the ability to meet SU outcomes were suggested, including a falls sensor and bed occupancy sensor. These are currently under development within the AT team (to be included in phase two).

HCC Staff (see appendix 9 for full details)

HCC staff highlighted several potential benefits of AT, including speedier hospital discharge, and improved evidence-based care packages. They felt that AT would provide an evidence-base for planning beyond relying on feedback from families, SU and care agencies. This in turn would stop the disabling effect of large care packages often championed by family members and risk-averse discharge planners. Evidence-based conversations could also enable alternative offers to SUs who don't want a (traditional) package of care. Staff also felt that AT would be a valuable prevention tool; helping to reduce the escalation of care needs through the management of and response to alerts. Staff also felt that AT could increase multi-agency working (e.g. with health), as data could be shared with district nurses and GP's as well as hospital care and discharge teams (especially if a SU had AT in place prior to an admission).

Despite the resounding accolades promoting AT as a complementary solution, a significant gap remained; the ability for HCC staff to obtain a snapshot view across multiple Service Users and many care providers in an instant. This would be necessary to target intervention quickly and thereby reduce the likelihood of needs escalation. A capability is required, and one that we have not yet seen following many discussions with Suppliers or other County Councils. The AT Analytics team has laid foundations to fill this gap.

Alongside care planning, staff felt AT provided a clear benefit to family carers, which again would be a cost saving for HCC. However, some were concerned about certain family carers becoming too intrusive. It was suggested that this could be monitored with HCC being alerted when the number of times each dashboard is accessed goes above a certain threshold. One staff member also highlighted the possibility of AT increasing stress for family carers if they felt they couldn't switch off from receiving alerts e.g. when on holiday. Discussions around this point have led to the responder service (for those SU's without family carers) to be piloted as a 'respite service/carer break' for family carers wishing to hand over responsibility of responding to alerts for short periods.

Staff felt that AT had the potential to achieve cost savings in both mainstream and SCAH packages of care. However, some raised concerns about the funding model to be used for AT going forward, and whether the cost would be passed onto the SU, which would risk putting some families off. The

need for a robust change management plan (introducing new ways of working) was articulated, as well as continuing to demonstrate the impact of the AT as part of an ongoing study.

On average, staff felt that AT would be relevant for 42% of their current caseloads (range 20-75%); highlighting the potential for changing the way care is delivered in Hertfordshire. There is however, a potential positive correlation between their perception of relevancy and their understanding of AT. As no formal training was given, (and presentations to various teams were carried out by various team members; each with a different focus) the level of understanding/perception of relevancy was hard to gauge in the PoC.

Care Agencies (see appendix 10 for full details)

Care agencies could articulate clear benefits for SU and family carers including; improved reassurance, prevention of unplanned visits, ability to keep SU's in their own homes for longer, monitoring of environmental temperature and nutrition. Care agencies felt that there is benefit to be realised pre-care package, as well as getting people onto the right pathways using AT data.

Discussions were held around the pros and cons of the AT service and analytics being provided by HCC, rather than as a tool embedded into everyday practice by each care agency. There was a difference of views on how care providers would be able to utilise this data between spot and Lead Providers. Spot providers expressed concerns about how they would find the capacity to proactively respond to alerts and what would be expected of them in terms of response times.

Potential benefits for care agencies (of the care agency having access to HCC provided AT data/dashboard) included;

- Support with call monitoring (see how long carers are in a property)
- Support with rostering (to free up capacity within the system; dynamic scheduling of homecare)
- Tailoring care packages to individual routines and need (to free up capacity within the system)
- Providing evidence of how SU's cope with personal care (e.g. showering – humidity sensor) when they are alone to inform care planning
- A reduction in the need for funded carer breaks if family carers could be supported to target their care visits (based on AT data) and share the burden with other family members living further away
- Enable more informed conversations with family carers and social work teams if anyone raises concerns (support a care agency's request to review a care package)
- Provide evidence for welfare checks
- HCC would have the potential to contrast and compare the outcomes for Service Users based upon the level of care provided by care agencies.

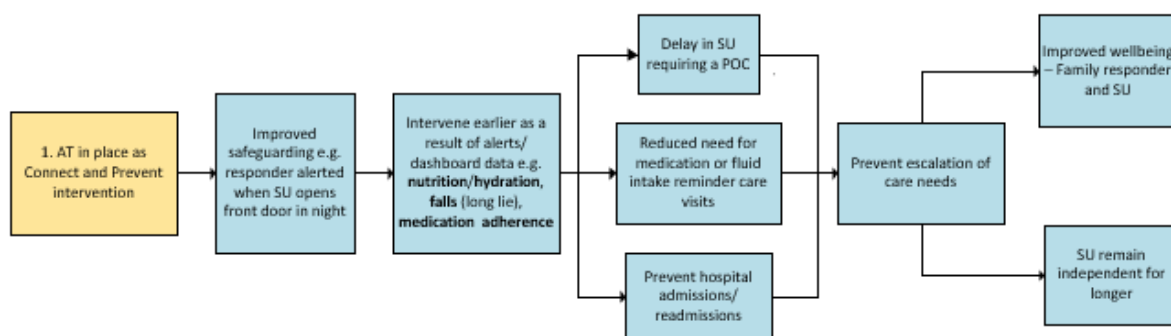
Care agencies felt there would be a number of barriers to implementation of an AT countywide including; connectivity; cost to SU's; SU resistance to monitoring; decisions around monitoring who is responding to the alerts generated (once you know something, you have a duty to act upon it);

ensuring complete sensor coverage in larger properties (family carer to become anxious if SU 'disappears').

Potential benefits in Hertfordshire

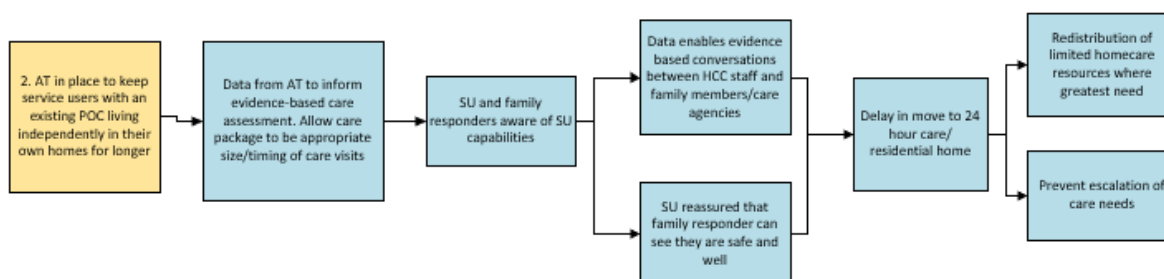
For each benefit (defined through qualitative data analysis), a summary of the mechanisms and contexts (how AT will work and in what circumstances) from the four stakeholder perspectives below. These are predicated on our ability to gather robust insights from our data.

Benefit category 1: AT for use as a preventative tool (keep people on small care package/pre-care).



AT could delay or prevent people from requiring homecare, by providing early intervention via dashboard data/alerts. In this PoC, a decline in nutritional and hydration status was prevented through the carer being able to monitor fridge and kettle usage and prompt/intervene where necessary. Medication adherence also improved due to carers monitoring the med box sensor. Such interventions helped SUs maintain good physical health, potentially reducing the need for GP appointments, hospital admissions, or additional care packages. While AT cannot prevent falls, early detection without the need for an SU-triggered alert could prevent the negative consequences of a long lie. Similarly, the door alert could improve SU safeguarding, again reducing the need for a larger care package. AT as a preventative tool could be considered when potential SUs present at the ACS 'front door' with low levels of need.

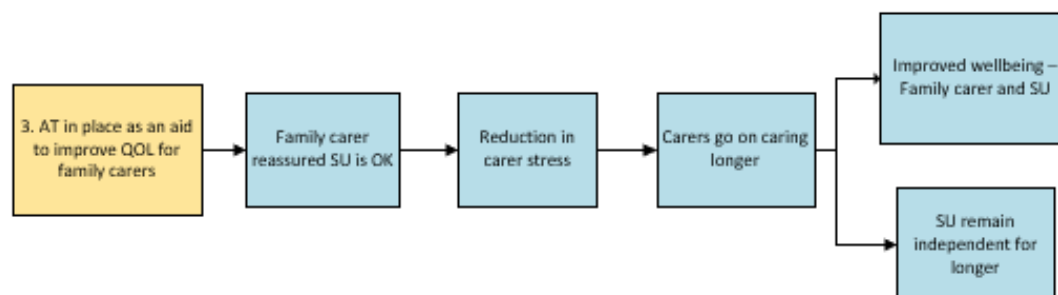
Benefit Category 2: Redistribution of limited homecare resources. To include; delaying the need for 24-hour care and preventing the escalation of care needs.



AT could reduce the cost of expensive care packages and the need for a move to residential care for those with greater needs. The mechanism for this lies in the utilisation of AT data for evidence-based care planning. Care managers and care agencies are better informed of how someone is

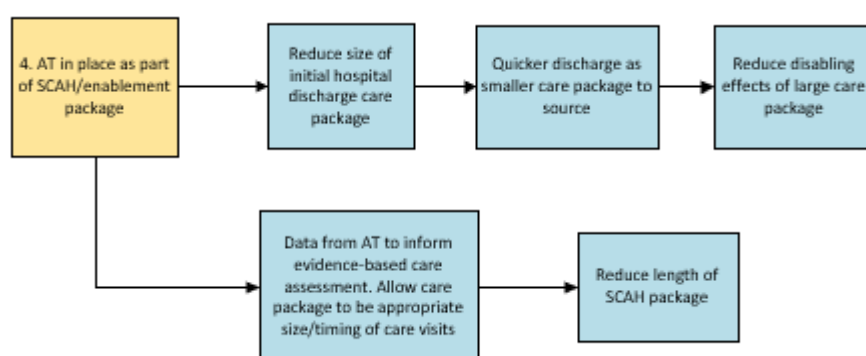
coping in their home; the real needs and abilities of the SU can be identified. Since family carers are often the driving force behind a large care package, having the data available from AT would make it easier to achieve a care package of an appropriate size. Proportional care packages and timings of visits targeted according to the SU's actual daily routine would then free up capacity within care agencies, aiding the future sustainability of care provision across Hertfordshire.

Benefit Category 3: Informal carer support/stress reduction/prevention of carer breakdown.



AT has been shown to reduce carer stress in Hertfordshire. This is because carers can monitor sensors, receive alerts (when pre-defined parameters are breached) and feel reassured. Rather than conducting unplanned visits when a SU doesn't answer their phone, carers can check for recent activity in the property, thus causing less disruption to their own lives. AT can also reassure carers that the SU is mobilising, eating, drinking and taking medication on time. By reducing stress, AT potentially enables carers to continue caring for longer, reducing the need for more expensive care packages and funded carer breaks.

Benefit Category 4: Getting the size and length of mainstream care and Specialist Care at Home (SCAH) packages right for each SU.



Many SUs are discharged with a SCAH package as a 'just in case' measure, to check the capabilities of a SU in their home environment (including medication adherence). These packages are often unwanted by the SU and can have a disabling effect. Offering AT at the point of discharge allows needs assessment in a non-intrusive way (including night-time activity), and provides reassurance for family carers, who often push for a larger package of care. HCC staff can use AT generated data to adjust care packages according to the SU's home routine and current capabilities. Sourcing smaller SCAH packages would allow speedier discharge; providing AT could be deployed in a 'rapid

response' manner. This would enable care agencies to better distribute limited resources, reducing homecare waiting lists and accelerating hospital discharge.

Other potential outcomes defined but not explored in the PoC:

- Reduction in social isolation (e.g. with the use of Alexa)
- Improvement in doorstep safety (e.g. with the use of camera-doorbells)

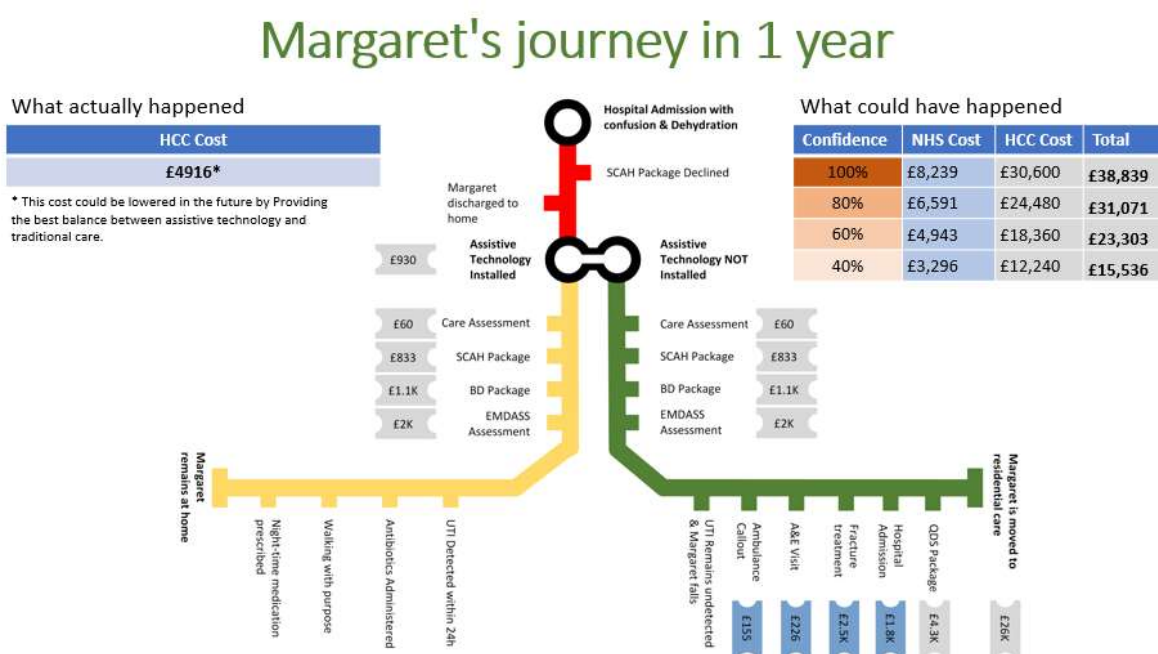
Margaret's journey - Case Study

Margaret's journey demonstrates the significant impact of AT (see Appendix 6 for details) through the early detection of a urinary tract infection and walking with purpose (which correlated with panic attacks).

Figure 1 highlights a 'what could have happened' scenario. Based on professional judgement from front line staff, a prediction around what would likely have happened to Margaret without the use of AT was made; an all-too-familiar picture of increasing dependency upon public services as health declines. A major factor in achieving a positive outcome was HCC's use of predictive algorithms.

It's not possible to know how her journey could have panned out, but with only 40% of this being true, AT has saved £10,000 and enabled Margaret to stay at home where she wishes to be.

Figure 1: Margaret's journey over one year; based on professional judgement.



Unintended consequences

SUs on the PoC inevitably had additional contact with professionals, due to the need for installation and maintenance of equipment. It is possible that any reported reductions in social isolation might

have occurred due to this additional contact, rather than due to the AT itself. Another hypothesis was that family carers would reduce the number of **planned** visits, due to the reassurances provided by the AT. However, data showed this not to be the case but there was anecdotal evidence that **unplanned** visits (such as when the family could not contact the service user and were therefore concerned over safety issues) were reduced.

Limitations

As a PoC, this study was short in duration with a small number of participants and no control group. Therefore, any changes noted in SU's/carers/staff could not be attributed to the intervention alone. The potential mechanisms for change outlined in the PoC are theoretical, based on qualitative data.

Learning from the PoC.

The AT PoC successfully defined the target audience(s) and potential benefits of AT in Hertfordshire. Several points of learning from the PoC will benefit a future pilot/phased rollout. For example, a larger sample size, inclusion of a control group and longer intervention period will all aid the ability to draw robust conclusions regarding the quantity of money HCC can reinvest alongside impacts on quality of life and the level of care provided.

A recruitment strategy targeting specific location/s would enable better uptake and targeting of evaluation activities and engagement of care agencies.

It has been highlighted by staff and care agencies that the AT offer could benefit SUs without capacity, alongside their carers.

A well-designed training programme for staff would ensure they have a good understanding of AT.

The PoC highlighted that SU's and carers weren't forthcoming in reporting technical issues to either the provider or project team. Therefore, regular contact with SUs and carers is needed to ensure any technical issues are promptly resolved.

The PoC highlighted the need to deploy many more devices in SU homes. Data from additional sensors led to earlier intervention from both NHS and Social Services. The phase two objectives should increasingly stretch as the technology and our understanding improves/progresses (see Appendix 11 for further details on the proposed study design and evaluation plan).

Contexts to be further explored in phase 2 (compare outcomes for each group):

- Living with dementia/no dementia diagnosis
- SU with capacity/SU without capacity
- Informal carer lives close by/far away
- Presence of an informal carer/use of commissioned responder service
- SU lives as part of a couple/on their own
- SU has a pet(s) free roaming in the house (effect on motion sensors)

Recommendations: Targets for incremental roll-out with study

Have a clear and defensible representation of the value (efficiency savings) as a result of selecting the right blend of rigor, discipline & scientific acumen. An options paper was presented to ACS Management board members in December 2019 (see appendix 12). All options are to be supported by:

1. Qualified and competent social workers who know how to deploy AT and have gained confidence that known risks can be mitigated by use of technology.
2. A rich analytics environment for future Assistive technology efforts, whether procured or developed organically. The analytics environment to be fit for purpose whether used by informal carers, Care Managers or Care agencies.
3. Underpinned by Change management; values & behaviours exhibited by care managers reflect the need to review data and act accordingly. Care managers have embedded use of AT in their ways of working. Care packages have been sized to enable sufficient quality of life in a cost-effective manner. The Council supports these new ways of working and demonstrates support for behaviours.
4. Established line of sight between Service Users risks and technology/analytics required.
5. A dedicated Assistive Technology function that focusses on continual improvement and implements increasingly stretched measures on the organisation. Effort is invested in investigating technology and analytics to mature and enable us to meet those targets.
6. Coordinated, appropriate and economic response to data we are receiving across multiple parties; Emergency Services, Responder Service, Formal Carers & Informal Carers. Technologies and workflows trigger appropriate responses for each.

The decision was made to provide board with a detailed proposal for option 1 in January 2020, thus allowing the true value of the assistive technology to be measured appropriately and with suitable rigor in phase two.

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