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Future Care Capital

Report

Care Tech Landscape Review

Learning Disability

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Newmarket Strategy

About FCC

Future Care Capital is a charity which undertakes research to advance ideas that will help shape future health and social care policy and deliver better outcomes for individuals living in the UK. Beginning life as the National Nursery Examination Board in 1945, the charity has evolved throughout its 70-year history and we continue to have Her Majesty the Queen as our Royal Patron.

Newmarket Strategy is a specialist UK consultancy dedicated to improving access to healthcare innovation. Launched in March 2021 following the merger of three existing companies, the founders of Newmarket Strategy – Berkeley Greenwood, Ed Jones and James O'Shaughnessy – apply deep regulatory, policy and market entry expertise to supporting healthcare, life sciences and health tech companies drive uptake of their innovative products and services.

About the Authors

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The start-ups, technologies and products described in this report are to inform the audience. Future Care Capital and Newmarket strategy are independent, neutral organisations that do not endorse any company or solution.

The Authors would also like to thank Professor Jane Seale, Edel Harris OBE, Tracey Richards, Claudia Forsyth, Romney Gwynn, and Stephen Chia for their work on this review.

Contents

Forewords

Although the digital technology market is growing rapidly across health and social care, it is nascent in the learning disability space. This report, the Learning Disability Care Tech Review, explores those start-ups deploying technological solutions in England and the benefits they bring to users, carers, and health and social care, particularly post-COVID.

The benefit of both specialist and everyday mainstream digital technologies in the learning disability context is clear. Digital solutions could provide alternative pathways to access health and social care services; encourage pathway redesign and support a move towards a smarter, more person-centred health and care system. Perhaps most importantly, for users, technology has the potential to promote agency and independence, and lead to more connected and enriched lives.

The review identified that there are major opportunities to improve health and social care provision for adults with learning disabilities in England through the use of technology. There are comparatively few technologies that are specifically for adults with learning disability, and there is a bias for technology development in paediatric and educational settings. There is a risk that the learning disability community may be left behind.

It is crucial to give those with learning disabilities a voice to support the development of technologies that better respond to system and user needs. Meaningful engagement and co-design are possible with appropriate support. Community and collaboration will be crucial. As is discussed in the review, multi-stakeholder approaches to technology development have already been proven to be successful. There is also scope for the new Centre for Assistive and Accessible Technology announced in the National Disability Strategy to act as a broker to facilitate relationships between innovators, carers and individuals with learning disabilities.

However, having the right technology is only one piece of the puzzle – individuals must also be able to afford it and have the appropriate support to use it. Here, there is no simple solution and whole system change will be required to ensure that individuals with learning disabilities can use the technology they want, for any purpose they want, and to be supported to do so.

Professor Jane Seale
Professor in Education at the Open University

The past 18 months of living through a pandemic have been difficult for all of us. In particular, they have shone a spotlight on the inequalities already faced by people with a learning disability. They faced a double disadvantage. Trapped at home often without social care support, many were cut off from the routines and activities that normally give shape to their lives. At the same time, many lacked access to the technology that would allow them to carry out online shopping or talk to friends.

Technology has a vital role to play in supporting people with learning disabilities, and this report highlights both the many ways in which it is already helping (for example, through speech-to-text converters and memory aides), and the gaps that need to be addressed.

One issue is that technology designed to support older people is sometimes poorly adapted for use with young people who have learning disabilities. These are people with very different needs. In the case of older people, technology aims to help them maintain their skills and prevent decline, whereas for people with learning disabilities, technology can prove liberating, enabling them to improve their skills and gain more independence.

It's too often the case that technology is designed for users rather than with users. Young people who require adult social care are often very tech-savvy and will shy away from technology that resembles something their grandparents are using. Tech for young people needs to be engaging and fun, even if the outcome is the same. Similarly, there is a risk when making products that are accessible or easy to read of going too far and making them babyish and condescending. Co-production with users – asking them what they want – is crucial to getting it right.

We also face the problem that technology to assist people who have a learning disability is often very expensive, sometimes unnecessarily so. We need to find ways of bringing down the cost to ensure technological solutions are more affordable.

It is true that ordinary, everyday technologies can be transformative without extra adaptation, such as Alexa, the Amazon Echo voice assistant. We would like to see a technology assessment become an integral part of an initial care assessment: what are the person's needs? How might technology empower them to look after themselves? Currently, technology as an aide to living a fulfilled life is often an afterthought, but it shouldn't be. Sometimes a good piece of assistive technology can provide greater independence, removing the need for the overnight support of a carer, for example. Being trusted to be safe on your own can be a massive confidence boost, when it is safe to do so.

We hope that this report encourages companies to seize the commercial opportunities and create technology for people with learning disabilities that is engaging, accessible and transformative. At Mencap, we want the UK to be the best place in the world for people with a learning disability to live happy and healthy lives. We believe that the right technology has a major role to play in making that aspiration a reality.

Edel Harris OBE
Chief Executive Officer, Mencap

Key Findings

This review is the third instalment in a series exploring the advanced digital technologies being developed for, and deployed to, the adult social care sector in England. We have previously explored home care technology and mental health care technology. The present research provides an overview of learning disability technology solutions and maps the technology companies providing solutions for people with learning disabilities. Through this review, we highlight where there are gaps in technology provisions and consult with experts in the learning disability technology domain to better understand how a larger number of appropriate solutions could be provided to the sector.

The research identified 19 companies developing digital technology solutions for the learning disability market. The key findings below demonstrate the size of the market, locations of companies developing solutions and quantifies the available information about investment in solutions.

Technologies

Our research identified a small group of start-ups developing learning disability care technology. Figure 1. shows the distribution of company headquarters across England and the function of technology in development. Of the developers we discovered, the main technologies being developed were: Apps (14), Platforms (6) and IoT (Internet of Things) technologies (5). While only 19 companies were found, a number had both Apps and Platforms, or IoT products in combination. It is interesting to note that of the 11 companies which only deploy products to learning disability (rather than multiple care settings) and 5 described user feedback as part of their development process. Donut charts below demonstrate the breakdown of three main technology types being developed and the size bracket of each:

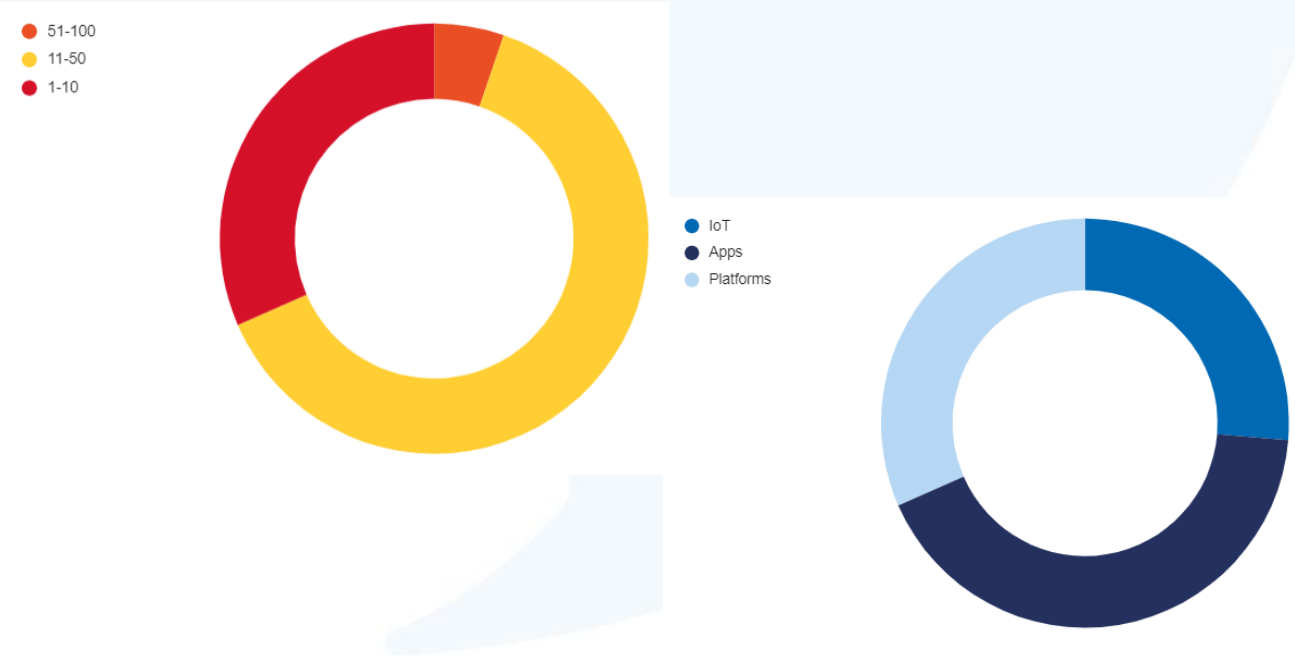


Chart 1. Breakdown of company size and technology deployed

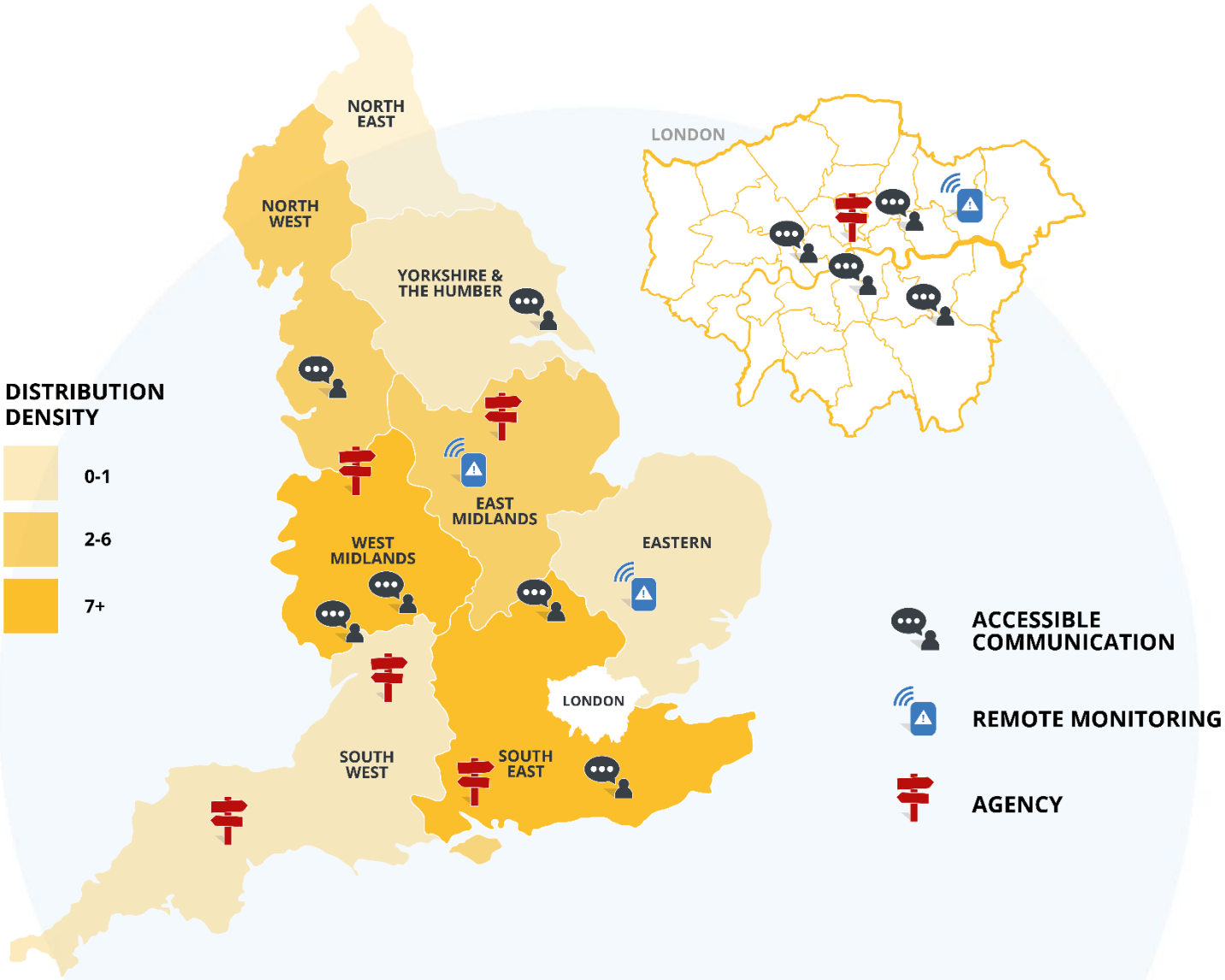


Figure 1. Where are the solution developers based?
Density and distribution of technology developers in England providing solutions to enable accessible communication, remote monitoring, and providing individuals with personal agency and autonomy for decision making.

Investment

The investment received by these companies is comparable to similar companies in other sectors or sector niches. For example, companies developing mental healthcare technology solutions according to this review's criteria: £3.7m. For Home care technology companies in the first review we conducted, the average investment was £800k.

The COVID-19 pandemic has dominated the health and care narrative since March 2020. It is abundantly clear that not all groups have experienced the pandemic in the same way. As more evidence has emerged, the statistics have painted a grim picture of the impact of COVID-19 on the learning disability community, where people with a learning disability are five times more likely to be admitted to hospital, and eight times more likely to die from COVID-19 than the national average[1].

While the pandemic provides an immediate context for the care sector, the Health and Care Bill is defining plans for the integration of health and care services through integrated care systems (ICSs) [2]. A long-awaited plan for social care reform appears to have been replaced by a 1.25% national insurance levy[3] to address elective procedure backlogs and help with a limited number of concerns for care provision. These plans have received criticisms for only addressing a small portion of the problems facing the sector and not taking a more comprehensive structural approach[4]. More recently however, the Government have announced plans for a comprehensive review of health and social care leadership[5]. The National Disability Strategy was published in July 2021 and highlighted a key role for technology in learning disability. The strategy included the announcement of a new Centre for Assistive and Accessible Technology, with £1 million allocated for development, with plans set to be announced in summer 2022[6].

Research, development, and innovation are key to government plans to stimulate the economy and enable the recovery from the pandemic, as well as being a part of the policy and regulatory changes needed as a result of Brexit. The aspiration to increase research and development (R&D) spend in the UK to 2.4% of GDP, alongside the introduction of the Advanced Research and Innovation Agency (ARIA) through the ARIA Bill demonstrate a will to invest and innovate for the future, with healthcare being a focus area[7]. There is however limited consideration of how care factors into R&D plans and there is a risk of healthcare continuing to dominate the funding landscape. Where there is an aging population in the UK with care costs and needs growing concurrently, investment in new approaches is certainly essential. The visibility of learning disability in such plans needs improving and consideration of both social and clinical need are required.

Learning Disability Care

The distinction between disability and learning disability is worth considering for this piece of research. Disability more broadly could include physical disability as well as learning disabilities. However, a learning disability is defined by a person's capacity to learn and is distinct from a learning difficulty, which does not affect IQ, and can be overcome with appropriate strategies. There are a range of subtle distinctions, both clinical and social, which are important when considering this sector of care. Traumatic brain injury can result in a reduction in capacity to learn. Similarly, there is cognitive decline in different forms of dementia, as well as a certain amount in healthy aging. These however are acquired forms of learning disability and in this research, we focus on life-long learning disability. We describe the full criteria for selection in the methods section and Appendix 1.

In the England, there are 731,000 working age adults (18-64) living with a learning disability[8] who are supported by 665,000 carers in the learning disabilities and/or autism workforce[9]. The landscape of learning disability care provision is, at times, skewed towards early years, childhood care and education. This is a noteworthy bias, as learning disability often requires life-long support. Digital technology is increasingly being used across adult social care. We have seen in previous instalments of the Care Technology Landscape Review series how people engaging with care services and practitioners alike are being supplied with new forms of technology. Many technologies discussed in this research do not solely focus on care provision and are developed to enable a better quality of life and improved outcomes.

Funding for Learning Disability Technology

The funding landscape for learning disability technology is difficult to assess. Where market research and industry reports have demonstrated the size of market and value of investment in previous instalments of this series, similar intelligence appears to be lacking in this instance. However, innovation funding for R&D related to assistive technology from UK Research and Innovation (UKRI) between 2019 and 2020 was £58.4 million and the Industrial Strategy Challenge Fund has invested £1.4 million to date[6]. For disability technology overall, it is slightly easier to understand the amount of investment going into early-stage start-ups to provide context for this research. There have been several pilots and single cohort programmes to support technology development for disabilities[10][11]. These largely seem to be funded through corporate social responsibility funds and do not appear to have been run as multi-year national development programmes. There have been recent signs of early activity in this area, with the launch of a Tech London Advocates group for disability tech start-ups[12].

Development and design of technology for care settings is difficult to get right, and accessibility is key for a user friendly and safe provision of care services. We saw examples of technology being designed with user focus groups as a part of the *Home Care Tech Landscape Review*[13] and an equally considered approach is just as vital for learning disability technology[14]. The use of self-advocacy in learning disability policy discussions and operation of care provision can provide a voice for people who are often overlooked[15], similar approaches can be used when designing and developing, or adapting, technology.

Inclusion/Exclusion criteria

To develop the following criteria, we considered solutions from the perspectives of learning disability specificity, clinical or care function, clinical input, and technical features. To reduce sample bias, the search terms and learning disability definitions used were validated by two separate experts in the field.

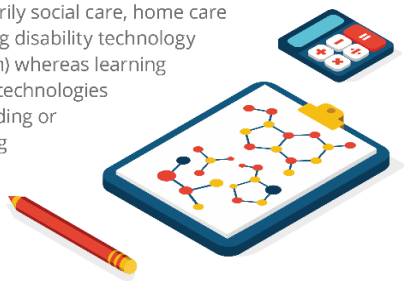
Specificity

We found a small pool of technologies that could be useful to individuals with a learning disability but that were not specifically tailored to them – this was primarily seen in elderly care focused technology. To allow us to best interpret the start-up sector for learning disabilities, these technologies were excluded as not being specifically developed for our research demographic. As defined earlier, cognitive decline is not considered to be a learning disability in this review. Therefore, to be included, companies were required to market their products for individuals with learning disabilities, or at least, suggest that they could be used by a wider pool than the elderly. This may be done by marketing technology for the 'vulnerable' or those in social care settings.

The research found some overlap between learning and physical disabilities, perhaps reflecting that such a distinct categorisation is not prevalent in the real world; some individuals, such as those with profound and multiple learning disability (PMLD), have both learning and physical disabilities[16]. Similarly, there are also companies developing technologies for individuals with both physical and learning disabilities independent of PMLD. In this review, only technology that has specific applications to those with learning disabilities were included. Of the tech reviewed that did cater to physical disabilities, it mostly focused on mobility and physical rehabilitation and was largely excluded.

Educational

This review chose to focus on technology used outside of educational settings (i.e., primarily social care, home care or clinical settings). The main differentiation between educational technology and learning disability technology being that educational technology is delivered in a controlled environment (the classroom) whereas learning disability technology largely needs to be useful in many different scenarios. Importantly, technologies that could be used inside and outside of the classroom, such as accessibility tools for reading or using the internet, were included in this review. Despite the coronavirus pandemic leading to a rise in home-schooling, distinguishing education technology by the environment in which it is applied was a clear-cut approach.



Paediatric

As with the previous instalments of the Care Technology Review series, this landscape review focused on adult care technology, and excluded technology designed solely for paediatric populations. It is worth noting that in the early stages of research, a considerable amount of the technology discovered was focused on helping the development of children with learning disabilities, as childhood is a key cognitive development stage.

Importantly, the lines between adult and child are blurred from a legal and safeguarding perspective for those with learning disabilities. Most learning disabilities develop in childhood, and in some settings, people with learning disabilities are not legally considered adults until 2417. Here, we relied on the online content produced by companies to determine whether a product was developed for paediatric or adult use. In an effort to maximise the pool of technologies available, where the product could be used by both age brackets, solutions were included.

Employment

It was considered that employability technology is a distinct market that falls outside of the remit of this review, which is focused on a narrower sector in health and social care settings.

For context, the PRISMA diagram (figure 4 in the methodology appendix) shows how many companies were included at different phases of review. Of the relevant companies examined (102), the vast majority (83) were excluded for not matching the criteria above, particularly the specificity and paediatric criteria. In comparison to the previous two reviews, far fewer technologies were identified in the initial CrunchBase and additional searches. It is interesting to consider why this may be the case, which will be explored further in the discussion.

Table 1. Inclusion and exclusion criteria[1617]

Figure 2. Technology segmentation

Importantly, accessible communication, remote monitoring and agency were the only three types of technology found under the umbrella of assistive technology. The central pillar in the graphic above demonstrates the types of technologies identified in the home care and mental health instalments of this series, which are largely absent in the learning disability sector. This is explored further in the discussion.

The development of this segmentation by function was a fairly intuitive process based on the types of technologies found. It is worth noting that, in contrast to the mental healthcare review, there was no perceived overlap between the three segments, with each set of technologies focusing on addressing separate problems: issues communicating or accessing information; the need for 24/7 care; and the difficulties in carrying out daily tasks and making decisions independently.

Case Studies

Group 1 - Accessible communication: This was the largest technology group, suggesting these are some of the most common technologies currently being developed for learning disability. Communication and access to information is key for the relational aspects of care and everyday life. It is therefore unsurprising that communication technologies were the most common solutions. Accessible communication includes technology designed to help non-verbal individuals communicate via eyesight tracking or through image association, known as Augmentative and Alternative Communication (AAC). Alternative approaches make information more accessible via reading aides or speech to text converters. These solutions rely heavily on platforms and often come in the format of an app. However, companies explored in this review would often provide their technology in several different formats, such as an app or software to go with an IoT based device. Solutions facilitating communication, such as those making websites more accessible, can often be used on a number of platforms and are often downloaded directly onto existing devices (computers, phones, tablets). These rely on existing infrastructure and connectivity. Most of these technologies require a period of training or guided use, with the expectation of independent use by individuals with learning disabilities in the long term.

Group 2 - Remote monitoring: This category includes technology helping to monitor individuals with learning disabilities. These technologies are IoT based and often include a combination of cameras, wearable sensors and fall alarms. It also includes technologies enabling social connection, such as facetiming. This group of technologies often appears to initially be designed for the elderly, and subsequently adapted to the needs of individuals with learning disabilities. The main beneficiaries of assistive technology are the elderly and the disabled[18]. The passive data collection from these applications, could be useful to individual users, carers and their family members. This was particularly true during the coronavirus pandemic, in which a considerable number of individuals with learning disabilities were classed as vulnerable and needed to shield[19]. These technologies are mostly used by carers or family members.

Group 3 - Agency: This group of technologies is slightly more of an assortment, although all ultimately support those with learning disabilities to exercise their agency. Technologies in this category include memory aides, step-by-step walkthroughs, digital health records, an app that helps carers uphold the human rights of the individual, and another app displaying refuge spaces where people can go when overwhelmed in public. Most of these technologies are for individual or independent use, with some being used by carers as well. Here, convenience and accessibility are key. The ability to easily access and interpret information or support at any given time, without needing to rely on carers or family members, is an attractive feature of technology for individuals with learning disabilities.

Group 4 – Omissions: Assistive technology is an umbrella term for technology that aims to improve or maintain individual's functioning and independence. It reduces the need for formal health and social care services. This enables people to live more healthy, productive, independent, and dignified lives[19]. Despite encompassing such a broad range of uses, the technologies seen in this review are comparatively limited. In particular, technologies using 5G, AI, VR and other cutting-edge innovations were lacking. There was little evidence of analytics and insights platforms, which can empower individuals to manage and understand their own care. Similarly, there were also few technologies for use by carers or medical practitioners, such as administrative tools, caseload management apps, secure communication platforms, or encrypted recording of sensitive medical or social care data specific to learning disability.

Understanding the landscape

This review is the third instalment of a four-part series examining the state of play for digital products and services across different branches of adult social care in England. The quality and breadth of information about technology in learning disability is variable. Further work is needed to understand the prevalence of technology use amongst the learning disability population, the types of technology already adopted, and where the UK stands in relation to other countries. Learning disability is a complex and nuanced field of care delivery. Therefore, this review was guided by the available data and conversations with experts in the field. We are thankful to Tracey Richards, Assistive Technology Lead at Mencap and Professor Jane Seale, Professor in Education at the Open University for their contributions.

To contextualise the review's findings in learning disability, it is useful to draw comparisons between the two previous reviews in the series, focused on home care and mental health care. The number, types and geographical spread of technologies varies considerably.

This review identified 19 relevant technologies, less than half of the number discovered in home care (49) or mental health (56). Throughout the discussion we will consider why this may be the case. Due to the smaller sample of companies identified, there may be a greater relative amount of bias in the data. Importantly, technologies that are marketed for children with learning disabilities, but also regularly used by adults (without being marketed to them) may have been omitted from the research. Equally, innovative and interesting technologies that were exclusive to children, which could inspire new approaches for adult care, may have been omitted from this review. Opportunities for future research may include consideration of the breadth, types and impact of paediatric learning disability technologies.

As with the mental health care sector, we see many app-based solutions in learning disability, suggesting that we are looking at an early stage, underdeveloped technology market. Apps are an affordable, accessible and popular technology which provide an easy avenue to consumers and developers. It is easy to develop a rudimentary app and then build something more sophisticated down the line. The prevalence of apps compared to other technology platforms may also reflect the financial situation of users. The market's user base are often individuals with high medical and social care costs, compounded with lower rates of employment and a reliance on financial support from a range of sources[20]. This could mean that more expensive devices such as laptops or tablets may not be as easily accessible as a smartphone.

The learning disability technology market is at an early stage, and it is expected that the types of technologies available will diversify as the market matures. According to the "*Maturity model for start-up ecosystems*" published in the Journal of Innovation and Entrepreneurship, the learning disability care market described in this review would be classified as a nascent sector – there are some existing start-ups and government initiatives to accelerate ecosystem development already in place, but wider impacts in terms of job generation or global scaling are yet to be realised[21]. An evolving or mature ecosystem requires a considerable amount of investment deals, as well as a first generation of successful entrepreneurs and start-ups with worldwide penetration. For the market to reach its full maturity and become self-sustainable, entrepreneur

mentors, especially angel investors, and high-quality technical talent is needed. Therefore, for the learning disability care technology market to mature into a sustainable ecosystem is a complex and interdependent process relying on a number of factors. Incentivising this development is multi-factorial, and may involve funding, workforce development, mentorship networks and fiscal incentives, to name a few.

The location of technology development is revealing too. Mental health care technologies were developed around clear innovation hubs and were broadly aligned to areas with the longest waiting lists for mental health services. Instead, both the learning disability and home care reviews saw technologies evenly spread out across England. This may be a consequence of the absence of traditional funding mechanisms, meaning that technologies are not concentrated around usual innovation hubs, such as Cambridge, London and Oxford – the Golden Triangle within the greater South East of England[22]. Indeed, for this review, almost 75% of technologies were based outside of London. For those that were based in the capital, companies were clustered in central London.

Potentially related to this, the average funding for learning disability technology was found to be £400k. That is half of the average investment in the home care review (£800 k), and far lower than that of mental healthcare (£3.7m). The sample size of companies examined was incredibly small for learning disability, with only 5/19 companies having funding information available. Yet, this appears to be broadly in line with the portrayal of the sector in the literature.[2324] From both a marketing and investment perspective, the learning disability technology niche appears to relate better to social care than health. This may in part be why the technology attracts lower than average investment in health or mental health sectors. Perception plays an important role here, and lower funding levels may also be partially attributable to a perceived low profitability of the sector. Despite there being a significant volume of potential consumers (there are an estimated 731,00 working age adults with learning disabilities in England[8]), it is a heterogenous group. There are a variety of lived experiences and needs within the sector, meaning that a degree of specialty is needed; a generic, one-size-fits all approach is not appropriate or useful. Indeed, assistive technology is sometimes known as personalised technology[25]. Where user populations are limited in size and the technology is more bespoke, it is difficult to reduce the cost to consumers[26]- this can also increase costs for consumers.

Another reason for the low levels of investment in learning disability technology may be due to the sub-optimal understanding of the learning disability community[27]. Conversations with experts have revealed that people with learning disabilities are not often perceived as being decision-makers for purchasing technology; instead, they are thought of either as having few financial resources, or lacking control over the resources they do have. In comparison, mental healthcare technologies have a broader consumer base, and there is a growing shift towards the private pay market. It was surprising, therefore, that of the 18 technologies that had pricing information available, 15 were paid-for by users, with some technologies costing upwards of £2000. Further research is needed to better understand the drivers for technological innovation in the learning disability sector.

It is also interesting to consider who the innovators are in this market. Out of the 19 companies examined, 17 were for-profit companies and 2 were not-for-profit companies. We had expected to see more not-for-profit, self-advocacy groups or charities developing technology in this area. In the mental health technology review, there were several charities developing simple, targeted apps for users, some of which were not discussed in the review for being technically unsophisticated. The fact that this was not found in learning disability suggests that the locus of innovation resides in private industry. A different interpretation of the data could be that there is no real locus of innovation, or a consolidated market in learning disability care technology, only a number of individuals acting largely through personal experience or passion for the sector. However, there is evidence of charities starting to move into this space. One such example is the partnership between Mencap and Vodafone to co-develop technology with individuals with learning disabilities. There may, therefore, be an opportunity for companies in this market, who understand the social care context and pathway for individuals with learning disability, to partner with technology companies, who have the know-how and resources to develop beneficial technology in this area.

Vodafone & Mencap Case Study: The Connected Living Solution

Vodafone and Mencap share a vision that technology "*can enable people with a learning disability to live with greater choice, dignity and independence – transforming their quality of life*"[26]. They began working together in 2017, having noticed there were no technologies in the market that address the broad needs people with a learning disability. The Connected Living project aimed to address this, by developing new technology to enable people with learning disabilities to have greater independence, choice and control in their everyday lives; and provide support workers with complementary tools to provide more personalised care[28]. Together, with the input of primary users, they co-created a solution combining Vodafone's expertise in technology and connectivity, with Mencap's knowledge of enabling people with a learning disability to lead the lives they choose. The final product, "Connected Living", features a number of functions based on IoT technology, including visual guides for everyday life, a personalised diary management tool and calling support through a digital 'panic button'. This case study further confirms that co-development is possible and useful for developing digital technologies that are needed, wanted and efficacious. It also suggests that multi-stakeholder collaborative approaches to technology development are beneficial.

Similar to other areas of care we have explored, learning disability technology appears to be developed in a relatively fragmented way, with pockets of innovation and small amounts of funding made available in a range of locations. There are some pilots and trials which appear to have been successful[29]. However, larger scale deployment and adoption needs to be better understood.

Technologies Currently Available

While the number of companies matching the criteria was considerably smaller in this review than previous reviews, some companies identified had developed multiple products, which we saw in the home care review. In this sample, the multiple products would be in the same 'segmentation', or aim to solve the same problem (such as enabling communication). This review examined the dominant technologies for each company, with the 19 solution providers developing 25 products. Of these, 14 were apps, 6 were platforms, and 5 were IoT based. In addition, 2 technologies had Artificial Intelligence (AI) capabilities, and 1 technology had gamification and Virtual Reality (VR) capabilities. Many technologies observed were consumer-based and intended for use in the home; in contrast to previous reviews, a lot of the technology is neither about providing care, nor a lifestyle technology, instead sitting somewhere in between the two.

Only 3 out of 19 technologies were targeted towards carers or medical professionals looking after people with learning disabilities, fewer than in previous reports. This was a surprising find, as there is scope and an urgent need to drive efficiency and support effective care delivery in social care and medical contexts. According to Mencap, there is a lack of education aimed at helping clinicians understand the specific needs of individuals with learning disabilities, which may be a contributing factor to the lack of digital tools being developed for clinical settings[30]. Similarly, people living with a learning disability are predisposed to a range of health conditions, including respiratory illnesses and asthma, which has been highlighted by the pandemic[24]. It is therefore surprising that this review found no digital solutions currently available or in development to improve health outcomes, particularly with the NHS looking to deliver more services in the home and remove patient flows from hospitals post-COVID.

With so few technologies targeted to carers and medical professionals, 16/19 technologies were instead targeted for use by individuals with learning disabilities. Of these, almost half (7/19) required 'guided use', that is, some degree of support or training by carers to enable the individual to use the technology. 9/19 technologies appeared to be for independent use*. Login details were used as another proxy for accessibility, with 10 technologies requiring login details to use the technologies, (2 did not and 7 had no data). This was not a consideration for other reviews and adds another layer of complexity to technology uptake in the learning disability care context. Individuals with learning disabilities are sometimes dependent on external support to access technology, meaning that well-intentioned carers and family members effectively behave as the enablers of, or obstacles to, technology. There has been a positive shift during the coronavirus pandemic, with the value of digital technologies in care provision becoming clearer, for example through telemedicine[31]. Following this, staff development, digital upskilling and formalisation of these responsibilities is paramount to build on progress to date and encourage more widespread adoption of technology.

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* *Disclaimer: Making decisions of usability or accessibility, particularly as a non-disabled person, is subjective. However, the authors of the review carefully considered each of the technologies.*

One theme that came across strongly in our research is that a considerable amount of technology used for individuals with learning disabilities was originally developed for the elderly, and subsequently adapted (or at the very least, re-marketed). A positive reading of this will point to resource optimisation in the social care context; a pessimistic reading may be that learning disabilities are an afterthought in health and care. Who the technology was intended for is not a superficial consideration. Technology for the elderly appears to focus on maintaining function, whereas technology for the learning disabled focuses on gaining and establishing independence. Specificity, therefore, became a particularly important consideration when developing the review. Out of the 19 companies found, 12 developed technologies that were specific to individuals with learning disability (not for the elderly), 3 targeted their products to both (including the elderly), and 4 were vague, targeting their products to 'vulnerable groups' or those in 'social care' settings. Of the technologies marketed for use by individuals with learning disabilities, 5 discuss forms of user feedback in their product explanation, 2 allude to it, and 4 do not mention the involvement of users in any stage of their product development process. User-centric development is key to developing usable products that align with system and user needs.

It was interesting to see remote monitoring, a generic type of technology, have the lowest number of companies of the three segments (3/19). Remote monitoring is perhaps one of the simplest use cases for technology in learning disability. There is clearly a market for remote monitoring and telecare in the broader care sector too. Both before and during the COVID-19 pandemic, solution developers have worked with charity and private care homes[32]. In addition to encouraging independence, remote monitoring technologies can release system capacity and optimise carer time allocation. Such technologies are relatively straightforward to deploy. However, widespread adoption and integration into existing care pathways can take considerable time. The poor uptake of this type of technology points to the low digitisation of social care pathways.

The present research suggests that technology in the learning disability sector could be considered akin to a market failure. That is to say, there is an absence of traditional incentives for R&D, meaning that the potential market is much larger than the pool of companies currently addressing user concerns, needs or wants. In Robert Watcher's 2016 review of digital transformation of the NHS, there was a stark warning that financial returns on investment can take up to ten years to materialise[33]. In fact, a short-term increase in capacity and resources may be needed to upskill staff and pilot new forms of delivering care, with a clear expectation that some pilots will fail[34]. It is, therefore, untenable to seek the benefits of digital tools without prior investment. Learning disability technology is no different in this regard, with users, and those supporting them, requiring some degree of support to develop digital skills and use beneficial technologies. This conflict of perception will need to be reconciled in order for the digital technology opportunity to be fully realised for the sector.

Gaps in the Market

It is easy to get excited about the potential of digital technology in any area of health and care, yet conversations with experts have revealed that technology does not need to be leading edge or 'sexy' to be helpful. In fact, it may be that cutting edge innovation is not the most usable or accessible in the learning disability context. Some of the most useful technology would enable existing technology and service offerings to be more accessible to individuals with learning disabilities. The research pointed to several gaps in the market, where technology has the potential to be desirable and efficacious:

- **Leisure or gamified approaches to technology.** In discussions with sector experts, it was suggested that demand for leisure technology is high, and gamified formats would be a particularly effective way to deliver health or social care interventions. Where individuals with learning disabilities are less likely to own landline phones, computers, and smartphones than non-disabled people, they are just as likely to have a games console or a simple mobile phone in their household[35].
- **Technologies making everyday situations more accessible**. Technology or applications to help individuals stay connected to family and friends was a common theme throughout our research. Isolation and loneliness are an unmet need in this community[29]. Making social network platforms more accessible can widen opportunities for social interaction, which has a protective effect on wellbeing[3637], and help to ensure people with disabilities are not left behind when it comes to the benefits of technology.
- **Easier access to specialist support in clinical or care settings**. Such as specialist mental health advice or management for conditions that are more prevalent in the learning disability population. For example, around 40%-80% of individuals with Down's syndrome will have early onset Alzheimer's[38]. Equally, COVID-19 briefings and advice that was published online was not easily accessible to learning disabled individuals. This is problematic, particularly due to the higher rates of mortality in this population[1]. Accessing care and clinical support is increasingly digitally enabled, yet access is not universal. Once more health technologies are developed, ICSs may be best placed to drive uptake and ensure they are also embedded into social care pathways.

In a running theme through this series of reviews, there is also scope for technology to go further than current service provision and develop new, improved models of care. This is where creativity, service redesign and feedback from users will be key. Well-intentioned support workers and family members have previously driven technology development in this area. This has been helpful, but it is crucial to truly understand what is needed and beneficial from the perspective of primary users with learning disabilities themselves. This will need to be part of a wider sectoral shift, whereby individuals with learning disabilities are treated as consumers in their own right, who have agency, independence, and preferences.

Importantly, all the technology examined in this review has been focused on solving specific problems. It has mostly been reactive, rather than proactive – to alert about falls once they have happened, improve existing speech impediments and provide tools to promote independence (reducing oversight from carers).

However, there are also risks associated with technology use, and it is important for individuals with learning disabilities to understand them. There are sensitivities around managing data privacy and information governance in this space, and some individuals with learning disabilities are able to participate in these conversations if supported. Appropriate support and mitigation mechanisms need to be put in place to ensure the disabled can use digital tools safely.

Recommendations

1) In addition to scaling current uses of technology, there is an opportunity for the development of new interventions or the optimisation of care pathways for learning disability. More research is needed to understand what types of technologies would be effective, needed, wanted, and scalable across health and social care systems. Here, making use of self-advocacy groups for advice on the design of user-centric technologies and approaches to programmes is strongly recommended.

2) In order for the full range of technology uses to be explored, and for the development of robust clinical research, it would be beneficial for clinicians to have a better understanding of the unique healthcare needs of individuals with learning disability. This review recommends building on the work of Mencap's *Treat Me Well* campaign, to explore how digital tools can help to make reasonable medical adjustments, improve health outcomes, and reduce unnecessary mortality in individuals with learning disabilities[33].

3) To date, learning disability technology start-ups have been underfunded, resulting in unequal access across care and consumer tech sectors, akin to a market failure. It is imperative that appropriate incentives are developed and implemented to research, develop and scale beneficial technology. Such interventions could include:

    a) Ring fenced funding combined with a "learning disability technology" initiative, to kick start technology development in this area. We urge the Government to increase the £1 million allocation for the upcoming Centre for Assistive and Accessible Technology, which will be shared across intellectual and physical disabilities, as detailed in the 2021 National Disability Strategy[6].

    b) Collaborative partnerships between large-scale technology developers, start-ups, charities, academics, the Government and users, which should facilitate the right skill-mix to develop technologies that better address system and user needs.

    c) Social care should be afforded the same levels of flexibility and innovative deal-making as other areas of healthcare. New funding and access models to encourage technology development and equity of access could be piloted, such as the subscription-style payment model being piloted in antimicrobial resistance, where companies are paid for the perceived value of their product rather than the volume used[39]. This is only one example of how Government can incentivise R&D into areas that are not traditionally profitable.

4) Access to a widespread digital upskilling programme for individuals with learning disability, carers and family members would be beneficial. Carers and family members can sometimes act as the enabler, or obstacle, to digital access. Hence it is particularly important to spark a cultural change whereby stakeholders focus on encouraging exploration and independent

use of technology by learning disabled users. Here, workforce development, agency and empowering choice will be key.

5) For the learning disability community to seize the digital opportunity, measures to support the uptake and appropriate usage of technologies are needed. There are specific governance and duty of care considerations for individuals with learning disabilities. Resources on information governance and data privacy, as well as adequate support, must be made available so that individuals with learning disabilities can be involved and make independent decisions regarding data sharing. Making the digital opt out reversible would be beneficial in this community.

References and Appendices

Appendix 1 - Methodology

While undertaking this Learning Disability Care Technology Landscape Review, we conducted a variety of searches, including in reviews and company databases, to ensure we captured as many types of learning disability technology and early-stage companies developing them as possible. Companies were discovered through an initial search on Crunchbase.com, a platform which provides market information on registered companies relevant to keyword searches. It hosts information on investment, size, scope, description, location, and founding members. There are >104,900 companies based in the UK across 1055 industry labels, with 47 industry groups.

Several iterative steps were taken to collect and clean the data (See Figure 4. PRISMA diagram below): 177 eligible companies were initially identified, which after manual cleaning and matching against the criteria further reduced the cohort of 15. Through additional online searches and comparisons with the literature, NHS App store, Google Play Store and App Store (Apple inc.), this was increased to 19 companies in total (4 added).

An aggregate list of companies was de-duplicated and cleaned to ensure that company information demonstrated the following:

- Developing a form of digital technology
- Registered in England
- Deploying products or services specifically designed for the learning disability care market
- An early-stage company smaller than 250 employees

Data were then quality assured through a series of comparisons with the literature, online searches, and cross referencing with a range of start-up acceleration programmes.

To ensure we identified the widest possible range of relevant companies, we constructed individual searches using the following terms: autism, autistic, learning disability, learning disabled, disability, disabled, learning difficulty, intellectual impairment, cognitive impairment, cognitive disorder, speech disorder, language impairment, multi-sensory impairment, Asperger's, Trisomy, fetal alcohol syndrome, downs syndrome, down's syndrome, williams syndrome, rett syndrome, cerebral palsy, global developmental delay, batten disease, tay sachs disease, assistive technology, and alternative and augmentative communication.

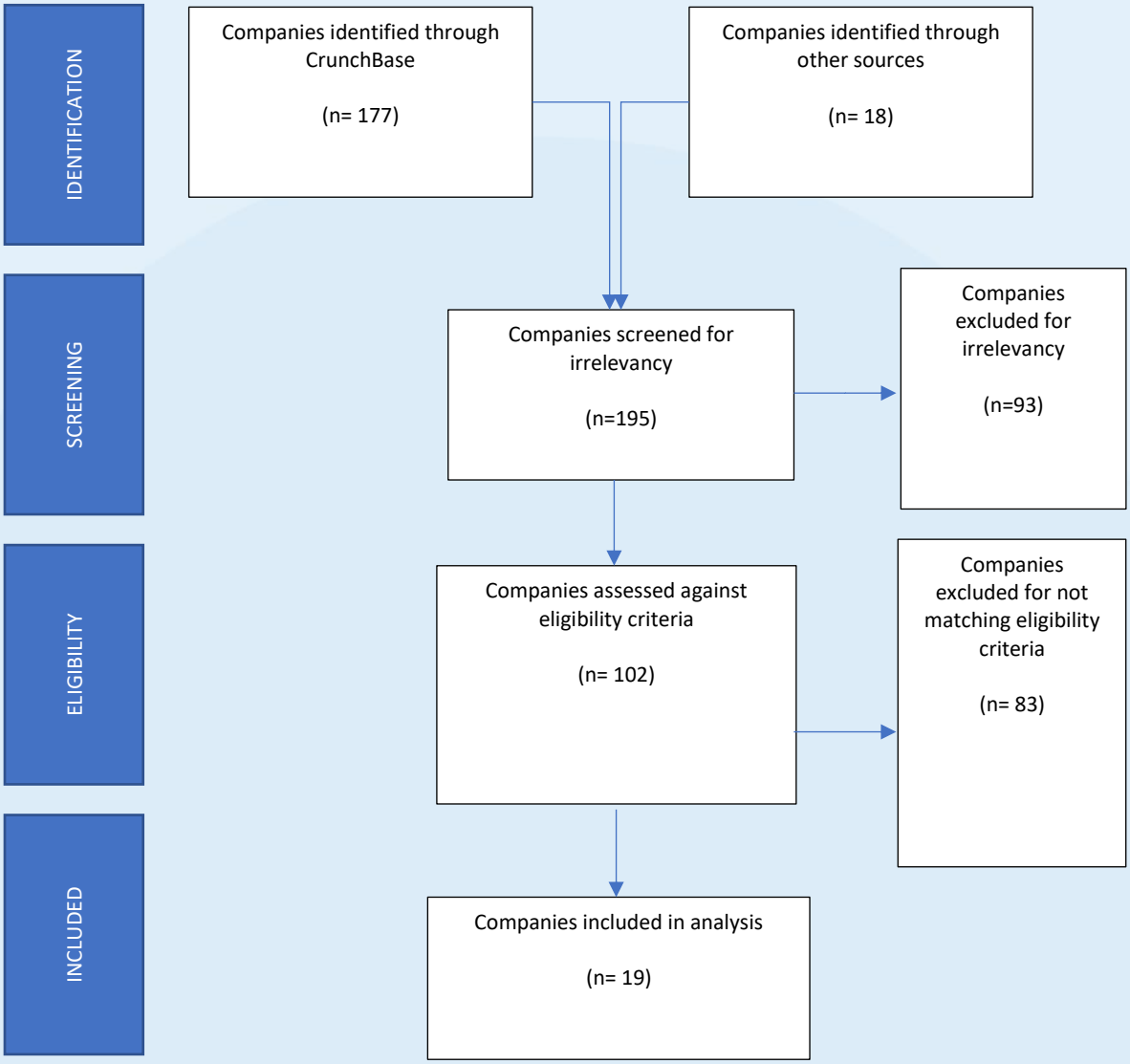

Figure 3. PRISMA Diagram

Appendix 2 - Glossary

Digital Platform

A digital platform serves to facilitate interactions between two or more distinct but interdependent sets of users. These can be either organisations or individuals who interact on the platform via the internet. Fundamentally, the platform provides a service[40], and in the realm of learning disability care technology, this can look like a website or software where clinicians can access information inputted from another user for analysis and understanding purposes.

Internet of Things (IoT)

The IoT is a concept which underpins a "smart" and connected environment. This can be in the home, or part of a range of different public and private spaces. This category of technology relies heavily on connectivity and storage described below and is typically embedded in the infrastructure of a given setting, be that walls, furniture, or street level architecture. IoT is made up of networked objects and devices which can provide information from a location in the form of a live data stream, these devices are IoT sensors. IoT objects, known as actuators, in an environment can also be used to make changes to an environment, for example if a temperature sensor detects a drop in temperature, the actuator would increase the temperature. Depending on the connectivity available IoT cameras, speakers and interactive devices or assistants can be deployed. The richer the data, the better connectivity will be needed. For example, a string of numbers is easy to manage, whereas high resolution video would need a considerable amount of infrastructure. IoT technologies do not typically have computational power built into the device or object, so the analysis of data would generally occur on a separate computing device or remotely in the cloud, we discuss this more in the analysis and informed decision-making section.

Personal devices

Alongside the devices and objects making up IoT technology, there are numerous apps and platforms being developed to run on personal computers, tablets, and mobile phones. The more analytical forms will be discussed later from the perspective of care provision and coordination, however here we will focus on more personal, care recipient focused deployments. These devices can be used to interact with care providers, or family members as well as managing home delivery services, entertainment, lifestyle products and enabling different ways for people to work remotely. Several start-ups are also developing personal dashboards which allow users to monitor their environment, in conjunction with IoT objects.

Virtual Reality

Virtual Reality (VR) are in their early stages and, to date, are being used overwhelmingly for gaming or entertainment purposes. VR makes use of headsets to provide an immersive, fully virtual environment. VR can be combined with multisensory stimulation or haptic feedback. In this research found start-ups developing different technical realities for learning disability healthcare apps. The products focus on transporting the user to stress free environments, or using the VR headset to allow the user to express their emotions in a visual way.

Analysis and informed decision to making

The objects, devices, interfaces and forms of connectivity described above have the capacity to produce and store large quantities of data which can be analysed and used to better inform care and improve care quality. This data can be used in a variety of ways, from relatively simple statistical analysis, to much more advanced modelling techniques providing predictive insights. The outputs of this analysis can be used very effectively to detect anomalies, suggest better care options and pathways, and help with lifestyle to based scheduling, monitoring and choices.

Artificial intelligence, machine learning and data analytics

Data centric technology is advancing at a rapid pace and the emergence of machine learning (ML), artificial intelligence (AI) and analysis of vast quantities of data have provided new possibilities for machines to augment human practice. Current "AI" techniques can provide accurate predictions and analyse or categorise huge quantities of data which at times would be beyond the abilities of a human. They are good at "narrow" apps, where they are designed and implemented for a very specific task, often requiring large amounts of computational power to process data. For example, by monitoring the heart rate of an individual with learning disabilities, an AI algorithm can collect the data overtime, create a personal profile of the individual, and predict distress and anxiety. This information can be relayed to either family or carers, who can step in pre-emptively, whilst the distress is rising, to calm the individual down and prevent potentially harmful outbursts.

Connectivity and Storage

Fundamental to the deployment of the technologies described here is the underlying infrastructure which enables connectivity, communication, and storage. This is crucial for device operation and interactions between recipients of care and care providers, but also is of great importance for the collection, storage and processing of data, which we will explore in a later section. In the home, Wi to Fi and mobile connectivity are some of the most familiar forms of connectivity. Through this connectivity recipients of care can interact with loved ones, healthcare professionals, as well as manage deliveries and a range of services.

Appendix 3 – Solution Provider List

Company	Short Tech Focus	Employees	Headquarters Location
Abilia	IoT	51 - 100	Cambridgeshire
Alcove	IoT / App	11 - 50	London
Alcuris and Memo	IoT	11 - 50	Loughborough
Autonome	App	11 - 50	Bristol
Brain in Hand	Platform / App	11 - 50	Exeter
BW Story App	App	11 - 50	London
CityMaaS	App	1 - 10	London
Claro Software	Platform / App,	11 - 50	Preston
Crick Software Ltd	Platform (software)	11 - 50	Northampton
Dolphin Computer Access	Platform / app	1 - 10	Worcestershire
Hear me now	App	1 - 10	London
MyLiferaft	App	1 - 10	Southampton
Recite Me	App	11 - 50	Tyne and Wear
Safe Places	App	1 - 10	Nottingham
Sensory Guru	IoT	11 - 50	Hartfield
Smartbox	Platform / App	11 - 50	Worcestershire
Support Right	App	11 - 50	Liverpool
Tendertec	IoT	1 - 10	Cardiff
Therapy to Box	Platform / App	11 - 50	London

Appendix 4 – Spotlight Technologies

These 'spotlight technologies' have been included to showcase innovative technologies in the space of learning disabilities health and care. These technologies did not match the inclusion criteria for a variety of reasons but were chosen as they highlight how the learning disabilities care market could develop in the future. These case studies are an important reminder that innovation is taking place in the learning disabilities sector, even if it is not directly in health and social care settings.

Ina Ciel Digital: This start-up focuses on developing technologies with and for individuals with learning disabilities. It has yet to develop a product, hence its exclusion from the review, but is innovative in this space due to its emphasis on inclusivity and user-centric design. This company was deemed to be innovative as many of the technologies surveyed during this landscape review did not incorporate any type of consumer engagement.

Movia Robotics: Movia Robotics was excluded due to the company being located in America and the technology focuses on children. However, the start-up's product, Home Pal, utilises a small moveable robot that helps children with learning disabilities develop their social skills, build relationships with their families, peers, and teachers, in a novel, fun, and accessible manner. As far as we are aware, this is the only technology reviewed that used robotics to engage with people with learning disabilities.

Human Rights Town: Commissioned by the Scottish Commission for People with Learning Disabilities, this app allows those with the conditions to learn about their rights in a gamified app. The development of the app was led by a group of people with learning disabilities and has the potential to be an effective tool for self-empowerment. It was excluded for being based in Scotland, as this series of reviews has focused on England. This is an exciting and innovative technology that focuses on a niche, but important, aspect of independence, and incorporates gamification technology to drive user engagement.

Awake Labs: The Reveal watch from Awake Labs, based in Toronto, measures the heart rate of the wearer, detecting anomalies and transferring data to an app that predicts emotional episodes and stress. This data analysis allows for the pre-emptive notification of distress within people with learning disabilities, and can alert their family and carers before a 'melt-down' has occurred. In comparison to the majority of the other 'reactive' IoT technologies included in this review, this technology aimed to pre-empt issues, reducing harm in the long term.

Disclaimer - *The start-ups, technologies and products described in this review are to inform our audience, Future Care Capital does not endorse any company or solution and is an independent and neutral organisation.*

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