The UK, like the rest of Europe, has an ageing population. Eleven million people, or 19% of the UK population is 65+ as of 2022. Many of these older adults are struggling with quality of life issues – related to health, social isolation, housing conditions, among other problems. That population will grow to 13 million or one in five within 10 years. Their individual needs, particularly health needs and dependency on social services will grow as these individuals reach their later years (see **Figure 1** and **Table 1**):

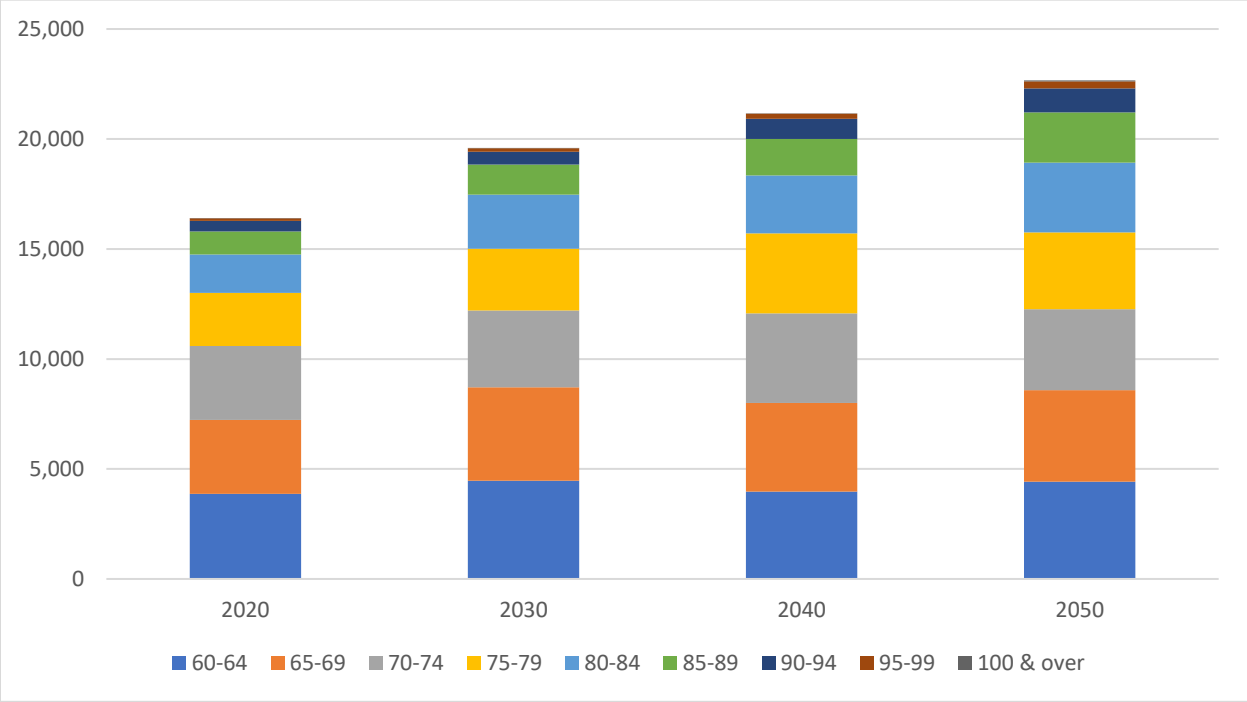

Figure 1: Resident population projection of people in the United Kingdom (UK) for 2020 to 2050, by age group (in 1,000s) SOURCE: Office for National Statistics

	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95-99	100+
2020	3,862	3,363	3,369	2,412	1,738	1,058	469	128	15
2030	4,464	4,249	3,485	2,815	2,457	1,363	594	155	19
2040	3,975	4,031	4,072	3,627	2,633	1,669	910	228	27
2050	4,418	4,165	3,673	3,501	3,170	2,281	1,088	318	50

Table 1 Detailed projections

The global population is ageing. According to the World Health Organization, today most people can expect to live into their sixties and beyond. "Every country in the world is experiencing growth in both the size and the proportion of older persons in the population. By 2030, 1 in 6 people in the world will be aged 60 years or over. At this time the share of the population aged 60 years and over will increase from 1 billion in 2020 to 1.4 billion. By 2050,

the world's population of people aged 60 years and older will double (2.1 billion). The number of persons aged 80 years or older will triple between 2020 and 2050 to reach 426 million."

Social isolation is a growing problem and opportunity for pet ownership and technology. In the UK, 36% of women and 25% of men aged 65+ live alone. For these individuals, the risk of becoming socially isolated is great –1.4 million people in the UK are often lonely. Sixty-two percent of UK households have at least one pet, most likely a dog. However, in one survey, 70% of responders aged 65+ said that owning cats made them feel less lonely. Two million aged 75+ in the UK were still not connected to the Internet as of 2021. However, since the Covid-19 pandemic, efforts have been underway to boost adoption.

Along with ageing – there is a correlation between becoming older and poor health. Although people are living longer and can enjoy activities and engagement with others in their later years, that ability is constrained by poor health. Consider the 10-year change in 'Years of Lives Lost' (YLL) attributable to health causes (**see Figure 2**). The global prevalence of cardiovascular disease is particularly worrisome – potentially related to increases in sedentary lifestyles, prevalence of obesity and diabetes.

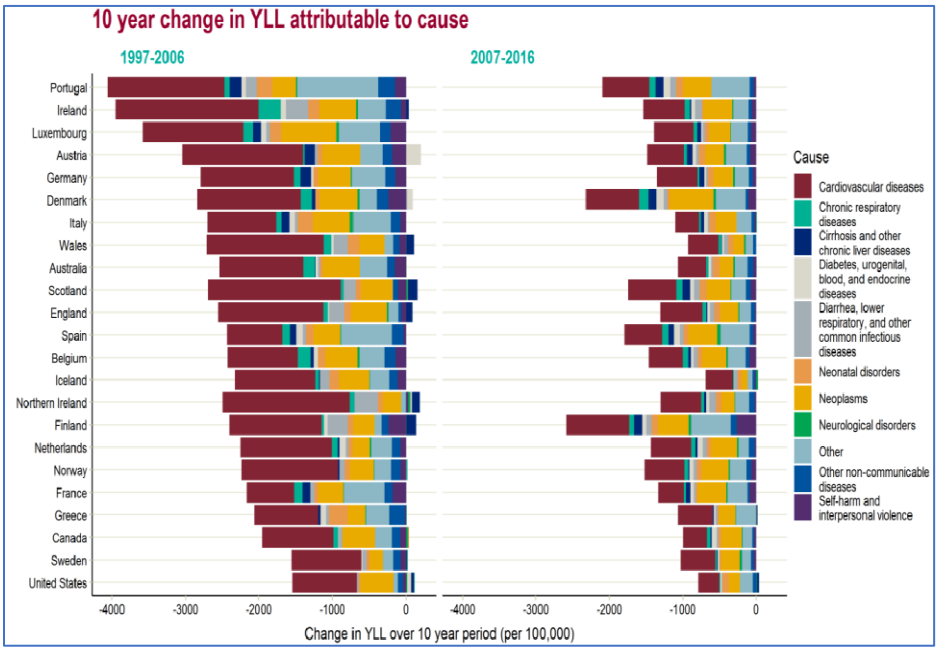

Figure 2 Years of lives lost over a 10-year span, by disease 2020 Burden of Disease

Tracking UK VC investments and age-related innovations. Investment in the health sector is a government and private sector priority, and health is now number two among tech sectors attracting venture capital investment in the UK. However, the care home financial structure in the UK has been increasingly dominated by private equity – not necessarily in the service of older adults. However, Age Tech startups in the UK are increasingly a pillar of innovation, according to Keren Etkin, who tracks startups in The Gerontechnologist, And Aging 2.0 out of London and the Healthy Ageing Challenge Report from UKRI also track (see **Figure 3)**:

Figure 3 Age Tech Market Map

The Internet of Caring Things – February 2023

Why does an Internet of Caring Things matter?

Looking through the various Age Tech startups in the graphic (many are US firms), one can see that more work is needed. So much of the technology world produces new offerings in a vacuum of understanding about older adults – and particularly understanding about those in the UK. This is demonstrated best with the laundry list of almost random technologies emerging from CES 2023, even under the category of so-called official category of Age Tech. Each individual startup and innovator may offer a value proposition for older adults, such as providing support for care, dealing with limitations, or serving those who care for them. But collectively, they produce a cacophony of press releases and announcements. However, older adults will gain greatest benefit from an integrated solution that serves them well over time, not a point product here or there.

The Internet of Caring Things -- new business opportunities, products, services

What is The Internet of Caring Things? The original 2016 definition from Susann Keohane and Nicola Palmarini at IBM stated: "A network of connected objects (devices, sensors) and cognitive systems with a clear mission: to actively care for people – their physical and mental well-being, homes, loved ones…and….when applied to the aging population, to allow family members, doctors, and caregivers to proactively monitor the health and well-being of the world's aging population."

Today's definition expands the role of IoCT and Healthy Aging. Carry the original forward to today's National Innovation Centre for Ageing: **"**IoCT devices can enable healthy aging by utilising connected devices, making social connections, providing mental stimulation, increasing safety, encouraging exercise, helping with health care, and importantly delivering fun. Innovations linked to IoCT and Healthy Ageing such as sensors to detect falls and wearable devices to monitor health, are the more obvious connected solutions and should be celebrated." IoCT expands on the idea of how caring – for example, for our pets or gardens or the Planet itself - can also give us or our loved ones an indication of our health and well-being."

Why does this matter? The Internet of Caring Things expands the narrow definition the so-called Internet of Things (IoT) beyond the land of sensors and gadgets to the way technologies are enablers for increasing the level of care and caring – both for ourselves, families, our gardens and pets.

CES 2023 – Fitting the Profile Internet of Caring Things

CES 2023 offering	What it does	Website
PetNow	AI-driven Pet ID for dogs and cats	PetNow
Jabra Enhance Plus OTC Hearing aid	Miniaturized 3-in-1 earbuds for hearing enhancement, music and calls	Jabra Enhance Plus OTC
Xander Glasses (real-time captioning)	Displays real-time captions of what other people are saying	Xander.tech
Healables (smart textiles)	Wearable to reduce inflammation	Healables.com
Rise Garden smart watering system for indoor gardens	Hydroponic plants	Risegardens.com
Whissp	AI-powered speech tech for impaired speech patterns	Whisp.com
Foldable fitness equipment	Folding treadmill and water rower	King Smith Fitness

Figure 4 From CES 2023

NICA-recommended Caring Things

The offering	What it does	Website
Sony Playstation controller for gamers with disabilities	First Accessible game controller	Press release
Smartheal sensor – award winning innovation from Poland	Measures pH balance wound to note possible infection without dressing change	Press release
Whoop band – to monitor health and fitness	Offers real-time feedback on what to do next	Whoop.com
Bbalance mat	Monitor weight, body composition, balance, posture	Bbalance.io (pre-order)
Withings scale, health tech	Smart scale, weight, body composition	Withings.com
Luno	Smart sleep apnea assistant	Anna Gębala Products
Canairi	Fresh air monitoring	Canairi.io
DopPlot	Breast self-exam tool	DopPlot
FormsSwim	Swim coach built into goggles	FormsSwim.com

Figure 5 NICA-recommended Caring Things

Why do IoT products fail – and what can be done? The original prediction a decade ago about 50 billion devices, all connected to the Internet (i.e. the Internet of Things) was based on a false assumption about the availability of connectivity – both for these devices and the Internet, or these devices and each other. Instead, patchy connectivity that varies across locations, never mind countries, was one major barrier. And the second was that these devices (such as sensors) did not connect effectively with each other or to solutions that could make use of the data. That is beginning to change today with the introduction of the smart home Matter standard of device interoperability through a single hub, versus multiple hubs. And the second major change is that data from sensing devices can now be sent to a central hub, combined with other data, to deliver information about health and wellbeing.

In addition, according to consultant Nick Earle: "Currently, it's estimated that around 30% of the world's food is wasted. Imagine if the location, age and temperature of every box of produce was constantly being monitored, from farm to store. How big an impact would that have? Today, eWaterPAY is helping to solve the challenge of providing continuous clean water resources to rural communities in Tanzania, Ghana and the Gambia. IoT connected pumps can collect micropayments via mobile phones to help pay for their maintenance and upkeep, and alert engineers if they fail." – Nick Earle, CEO Eseye

Advice to Vendors From 2023 Market Overview Technology for Aging:

As people age into the market for and around the Internet of Caring Things, multiple changes must take place in how companies must go to market with their offerings to succeed. Over the next five years, those that do well will understand that:

One go-to-market channel is not enough. Depending on the product or service, it may need a mix of resellers/distributors, face-to-face, and online sales. The 2021 UK Internet usage revealed the geographic areas of the UK that lack high speed Internet access, and even if it were available, many people do not go online, whether due to perceived lack of benefit, cost, or lack of awareness. If that population needs a technology or service, such as access to benefits, their caregivers must search online on their behalf. If looking for assistive tech for older adults, today there are multiple options, including Amazon or GP Supplies. But new entrants should find local partners to test product effectiveness before going national or global.

Privacy and security features will be built into design of software and websites. It hasn't happened yet. But scams targeting the elderly have ballooned to one scam every 40 seconds – and that includes only those that are self-reported. For safety-oriented apps and sites that include the role of the senior, it's critical to verify identity among provider and user roles. Two-factor authentication will likely be required as part of all online apps, including financial and health-related services. However, that process can be stressful for the user and may result in a less-determined individual giving up.

Technologies must be well-supported and intuitive. Most people have a lengthy list of frustrations with technology, regardless of age. The failure of previous direct-to-consumer approaches underscored the fallacy of inventor-centric thinking that 'if we create it, they will buy it from us' or at least find it on Amazon. However, 76% of responders aged 70+ in the most recent US AARP survey do not think technology was designed with them in mind. This complaint persists despite growth in adoption among that age group. So remote configuration and support partners must be a major part of the offering – or doom the user and family to frustration and tech abandonment.

Device and app vendors must be capable of integration and extension. Despite standards initiatives like Matter in 2022, or ONC Interoperability US efforts, many of today's gadgets still don't communicate – especially with each other's proprietary systems or data sets (like hospital Electronic Health Records). So mobile health devices, apps or medication reminders may be useful, but touch a tiny aspect of the whole person's life or health. Patients struggle to get their own records in a transferrable form upon discharge.

Upgrades must be invisible or painless. Consumers already gravitate towards cloud software applications that work with ones they already use, including Gmail, Facebook, FaceTime, Teams, Zoom, Siri, and Google Assistant – most working across multiple devices. However, people can be worn down by the constant requirement to take extra steps for an upgrade. So personalized interfaces (like Amazon and Netflix) that are updated in the cloud are increasingly

expected. Continuous phone and watch patches should not be expected and indicate inadequate testing.

Standards enable users and integrators to cross tech boundaries. Times are changing – as in this smart home interoperability initiative – a recognition that, despite intense competition, consumers likely own a variety of devices and software that should be able to work better together. Amazon launched a similar initiative for voice offerings like smart speakers and voice assistants. Ensure that the new offering works across multiple platforms and comes in multiple form factors – voice, smartphone, web, for example.

Access to ongoing training and refreshers – much work needed. To be sure, despite growth in adoption, the oldest are likely to approach smartphones as just like a flip phone – until they learn of their utility in a store, online, from family, or in community training centers. But automatic updates and software changes force users back for refreshers to avoid considerable frustration. AARP/OATS 2021 partnership was developed to help seniors with technology. GetSetUp offers training about technology. Senior centers and other social services organizations may help seniors keep up with tech change. But the rapid growth of threats, including hackers' ability to pinpoint location and steal personal data, remains a challenge.

The real user need – a service problem solved. Seniors and their adult children may not imagine on their own what to do with tiny sensor networks, voice assistants, or smart speakers. A home security company could help explain the benefits, for example, of care coordination, when selling tech to a home health agency. Vendors should fit solution descriptions, service provider stories, and senior support processes along the continuum of needed care and socialization. This necessitates a grasp of the decision points that spike need and interest, using these as part of websites and marketing.

How individual aspects of the Market of Caring Things will change in coming years? Changes over the next few years will be driven by the availability of new technologies and services that can deliver them. They will span multiple types of offerings, from how people access information that they and their caregivers will need, to the technologies that will enable them to stay safe, fit and healthy, to the methods for obtaining those technologies, including pricing and training. The chart below is intended to communicate the contrast between the current technology environment and the environment available in the future (see **Figure 6):**

Changes 2023, beyond	FROM	TO
Access to information	Driven by search vendors	Enabled by AI chatbots
Product pricing	Individually, plus upgrades	Solution subscription
Voice First technology	Smart speakers, Voice assistants	Part of multi-modal interactions
Hearing technology	High price hearing aids, sold through audiologists	Hearables, low-cost hearing aids, self-serv
Caregiver technology	Assisting care workers	In care, supplements in-home monitoring
Fall detection	On body pendant, private pay	Wrist, in-room and Wi-Fi-enabled, reimbur
Senior In-home fitness	New post-Covid category	Tele-fitness
Blood pressure tracking	Cuff-based	Multi-format, add wrist
Location technology	GPS device, phone locator	Smart location sensors
Tech training for seniors	Fragmented	Nationwide availability
Ease of upgrades	Device-specific	Automatic or cloud-based

Figure 6 Older Adults need changes in the technology marketplace