

Aging in Place and Telehealth Use Cases from the Cable Operator Perspective

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What is the problem?



The COVID-19 pandemic has required people to discover new ways to do things from home over a home network. One area where this has become obvious is wellness. Cable operators are well-positioned to provide these services. They can extend their traditional offerings of bandwidth and television service to include aging in place (AIP), telehealth, How can operators offer such services with their existing infrastructure and what do they need to build?

Key Takeaways



These use cases provide insight into how common cable operator infrastructures might be leveraged to provide a common home wellness care service that is flexible enough to support a range of use cases from assistive services to the management of complex hospital-at-home healthcare services. Cable operators can leverage their existing competencies in providing network services, installation, managing monthly subscriptions, monitoring systems, analyzing data, and providing customer service to make a legitimate case for operating home wellness services.

Key words: Telecom for Wellness, Aging in Place, Telehealth, Hospital At Home, Independent Living



Introduction

The COVID-19 pandemic has required people to discover new ways to do things from home over a home network. One area where this has become obvious is wellness. While many healthcare providers have scrambled to provide remote visits, this only solved part of the problem. What people need is a support infrastructure at home that gives wellness providers the information they need as well as the ability to provide remote assistance. This requires a secure and reliable home network with connected devices to do the observing and controlling. Additionally, connected services beyond the home are needed to log measurements, connect families and wellness providers, and provide notification of significant events.

Cable operators are well-positioned to provide these services. They can extend their traditional offerings of bandwidth and television service to include aging in place (AIP), telehealth, in-home care, and safer alternatives to surgery. This can unleash many inter-industry, revenue-generating opportunities in healthcare by linking healthcare devices, families, and wellness providers into a coordinated health community. In-home care solutions over 10G, highly available access networks can both improve the wellness experience and provide new cable operator revenue streams while fully satisfying stringent HIPAA data security and privacy requirements. The operators already have the core technology and the consumer relationships to naturally provide this type of solution.

This paper will explore use cases in this space and point out the key areas where cable operators can provide a collaborative in-home wellness solution, introducing several use cases that SCTE standards working groups are considering from the aging in place [11] and Telehealth spaces in the wellness industry, and considers use cases common to both areas such as connectivity and analytics infrastructure, as well as use cases specific to AIP and telehealth.

The Opportunity

US Healthcare costs are increasing at 5.4% year over year and are estimated to reach \$5.5 trillion by 2026 [1]. The US healthcare industry is huge, and policymakers have been concerned about its growth relative to total GDP. The criticism is sometimes characterized by the idea that the US healthcare system is a sick-care system and that boundaries must be broadened to effect positive change in national healthcare. Wellness and social determinants of health are important items for discussion within the healthcare industry. This represents an interesting opportunity for cable operators with a strong residential franchise presence.

The healthcare industry has been modernizing its infrastructure intending to control costs and improve the quality of care. Telehealth is one such mechanism that has been gaining adoption. Telehealth played a critical role in virtualizing care during the COVID pandemic. Telehealth has been growing at a yearly rate of ~15% with 2020 seeing a 175x increase in Telehealth adoption mainly due to COVID-19 [2]. This telehealth infusion is driven by the increased patient and provider adoption, better reimbursements, and relaxed regulations. Although adoption may slow during COVID case decreases, Telehealth benefits are recognized and are here to stay. Telehealth is not just video communications, but it also touches on different technological solutions that cable operators have mastered and been deploying. Healthcare has lagged most industries regarding the virtualization of services. Consider how the retail, finance, and entertainment industries have been transformed by digital technology over the last decade. The potential disruption to healthcare is inevitable. The cable industry not only brings technology and service management but also leadership in building standards-based platforms that can deliver critical cost reductions required to assist the healthcare industry.

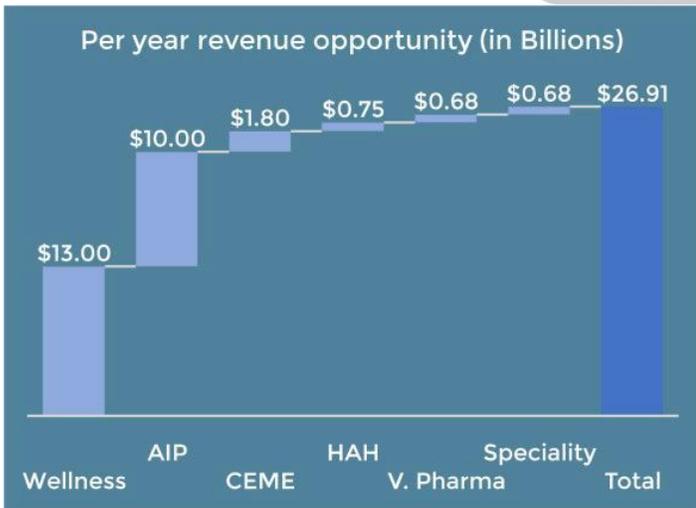
The Center for Medicare and Medicaid Services (CMS) projects up to \$5.5T in healthcare spending in 2026. Duke Tech Solutions (DTS) projects of the total spend, of \$3T can be optimally addressed by virtualizing the care models with telehealth and



better connecting the existing wellness and housing sectors to the healthcare industry [3]. \$1.3T of this total spend can be addressed and reduced by Telecom operators. In this report, we demonstrate some of the needs that Cable operators can support using their developing capabilities such as in-home technologies, IoT, broadband communication enhancements, consumer service development, platform standardization expertise, back-office capabilities, and installation and support resources.

DTS has analyzed different services which are driving healthcare costs that can be addressed by Telehealth initiatives [3]. These services include perpetual wellness, aging in place (AIP), communication-enabled medical encounters (CEME), virtual pharmacy, hospital at home (HAH), and remote specialty services. A very conservative analysis of these six segments shows in the figure below that a US telecom operator can recognize ~\$27 billion per year.

Figure 1 A Conservative Estimation of US Telecom for Wellness Opportunity from DTS [3]

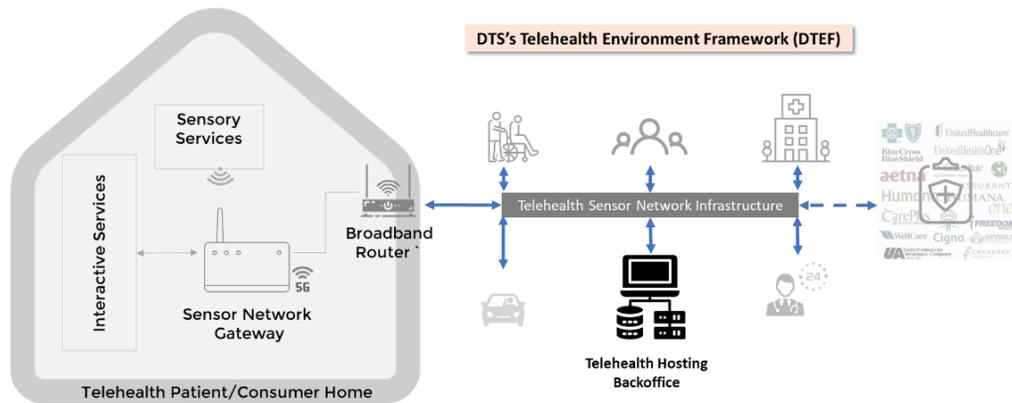


In this paper, we will concentrate on three use cases, Aging-in-Place, CEME for independent living, and Hospital-at-Home. Each of the use cases considered is analyzed from the Wellness stakeholders' point of view with a clear definition

of the problem, how stakeholders interact with each other, how and what to sell to the stakeholders, what is involved in the solutions, what are the opportunities for the stakeholders, and what are the opportunities for the Cable operators.

All these opportunities are analyzed against the framework provided by DTEF (A DTS Telehealth Environment Framework) [3], [4], as shown in Figure 2. The cable operator can use this framework to realize their telecom for healthcare (T4H) solutions. The DTEF framework includes telehealth patient/consumer home components, the telehealth sensor network infrastructure, and the telehealth hosting back-office infrastructure.

Figure 2 Duke Tech Solutions Telehealth Environment Framework (DTEF)



COVID-19 has accelerated the rollout of telehealth from an experimental new service to a necessity. It has uncovered a powerful new wellness delivery model that could fundamentally change the cost structure of the entire wellness industry. Because of this, the transition to a virtualized Wellness service model is at the top of the Wellness strategy stack. We believe the wellness industry transformation goals can be addressed by the cable operators, making this inter-industry collaboration a success. As mentioned previously, it has the potential to mold into a \$1.3 trillion opportunity for US telecom operators by 2026 [3].



Telehealth Concepts

There is too much confusion on the Tele-X terminology [5]. The US Department of Health and Human Services (HHS) [6] defines telehealth as “the use of electronic information and Telecommunications technology to support and promote long-distance clinical health care, patient and professional health-related education, and public health and health administration”.

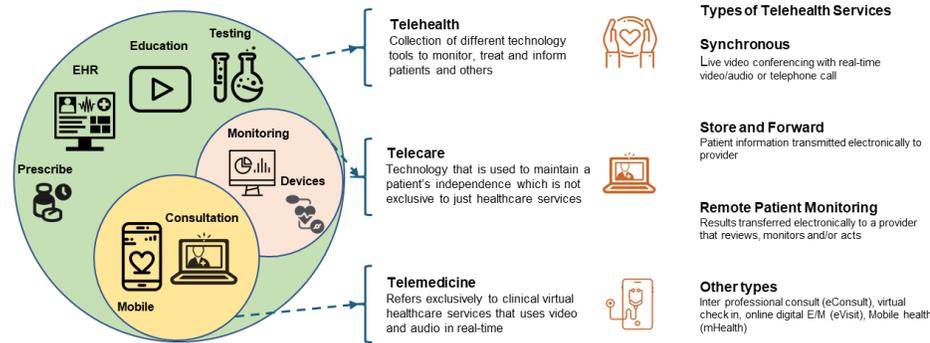


Figure 3 Untangling the Tele-X Terminology [5]

Because universal definitions for virtual care have yet to be established, the Federal Communications Commission (FCC) uses different terms and definitions for the Tele-X space than HHS [7]. Thus, it is imperative to acknowledge that the industry has yet to land on universal definitions around virtual care. In this report, we use the definitions presented in the above figure (per DTS blog at [5]) to discuss opportunities for Telecoms across various Telehealth services.

The Stakeholders

Every patient ages uniquely and has unique needs. The solution for effectively addressing the needs of patients will need to be tailored to those needs. However, there is a sort of continuum of aging that is common. A patient moves from a position of relative independence toward more dependence on a team of supporting stakeholders.

The patient is the focus of this support. Stakeholders in the process of caring for the patient include a community of family and friends such as the patient advocate/power of attorney (POA) and neighbors, and a collection of

caregivers including primary care doctors, medical specialists, nurses, therapists, personal care assistants, housekeepers, meal providers, etc. There are also insurance companies, Medicare, and other payors. Many patients want to remain in their own homes with relative autonomy for as long as possible. Covid has pushed the limits of some of these ideas. Technology has demonstrated that telecommunications, networking, and automation can fill in gaps that

previously required manual or higher-level assistance. Technology solutions can be more convenient, more effective, and less expensive. This is an opportunity for cable operators. Refer to the detailed business cases conducted by our team for additional details [8], [9].

Patient or User: The primary stakeholder is the patient. Proper care of the patient is the primary goal. Proper care includes providing that care in compliance with the patient's preferences as far as possible. The stakeholders must have a common plan of care. They must be able to communicate that plan and execute it effectively. Clear means of measuring the effectiveness of the care and communicating that information with all the stakeholders is key.

Community: Perhaps the most important group of stakeholders in the patient's circle are their friends and family. These are the people with the most direct and personal relationships with the patient. In many cases, they are responsible for making decisions about the patient's care. They should be notified of significant events and be in regular communication with the patient and other caregivers.

Caregiver: Caregivers include those responsible for providing patient care. Caregivers include physicians, nurses, therapists, specialists, and other healthcare providers, but also include cleaning services, personal hygiene providers, and meal providers. They will interact with the patient on a scheduled or routine basis but may also be required to respond to emergency needs. Also, it



is important to note that the location of the service could be at home, an independent living facility, or an assisted living facility. Providing the continuum of care for a given user throughout their transitions is very rewarding and increases the stickiness of the user.

Payor or Insurance: Except for the patient's community of family and friends, most stakeholders will need to be paid. Depending on the circumstances, this can include personal funds, insurance coverage, and government resources. This stakeholder service can be highly automated to simplify interactions and ensure that caregivers and service providers are promptly compensated while the patient and their designated care advocate(s) clearly understand the process, costs, and expected benefits.

Infrastructure

Infrastructure is the most important aspect of a remotely-delivered integrated wellness care system. This is what ties all the component pieces together. At the most basic level, this includes installing sensors, actuators, and monitoring equipment. At the higher levels, it involves keeping track of all the stakeholders, providing them with the information they need, and providing the tools so they can act on that information.

Wellness-related infrastructure: Wellness infrastructure is the glue that alerts families and caregivers when the patient needs attention. It communicates when care is rendered so the insurance company can pay for the service. It reminds the patient to take medications and schedules visits. This would be a new area for Cable operators, so it may make sense to partner with or acquire a company that has expertise in this area already.

Technical: Technical infrastructure is where the cable operators have an incumbent advantage. Providing networking to the home is a core competency. Connecting in-home devices (such as WiFi infrastructure, sensor devices, television, and other

equipment) inside the home is also routine for cable operators. Extending the connectivity to networked health and monitoring devices is certainly within current skill sets. Setting these monitoring systems up may require wellness care partnerships or additional training. There will be additional security regulatory requirements for the type of traffic transported. There may be an opportunity to provide monitoring, data collection, and data analytics services on behalf of the wellness care stakeholders.

Use Cases

Use cases in wellness care are as unique as the patients themselves, so flexibility is very important. However, there are some key categories of service that are common across most use cases. This paper examines three use cases that cover the spectrum from simple assistance for daily living to acute hospital care from home.

Aging in Place

Aging in place involves passive monitoring with selective assistance for daily tasks. The best Aging in Place technologies does little or nothing to disrupt a patient's normal activities. For example, a connected pillbox can report which medications a patient takes and when. Falls can be detected by a watch or other item that is worn or detected passively by a floor-mounted impact sensor. The point is to provide technical tools and assistance to help the patient do simply what might otherwise be difficult.

The table below maps several services that might be required for a patient aging-in-place mapped against the various stakeholders who might be involved in delivering that service.

Table 1 Aging-in-Place Services

Service	Community	Caregiver	Payor	Infrastructure
Connectivity	H	L	L	M
Installation	M	L	N/A	M
Communication	M	M	L	M
Monitoring	M	L	N/A	M
Analytics	L	L	L	L
Cable operator opportunity: (L)ow, (M)edium, (H)igh, (N/A) not applicable				



The in-home architecture illustrated in Figure 2 outlines an infrastructure that can provide these services. The data network in the home connects all the relevant devices. It also allows for remote communication with the patient's community and healthcare providers. Information from the sensors can be logged and analyzed and can be shared during remote visits. All this information travels over the network protected by the highest reasonable levels of data and transport security. The status of each connected device can be monitored with deviations from expected norms reported. Defective equipment can be not only detected but proactively determined for immediate service or replacement.

To be sure, the data collected has HIPAA security and privacy implications for it to be carefully secured and managed throughout its lifetime. It is expected that the health infrastructure provider will manage this, and the physical security of the network will be the responsibility of the technical service provider. The ultimate success of the system will be indicated by positive health outcomes at a lower total capital and operational cost than current alternatives. With lower costs and improved patient outcomes, this system can be attractive to all stakeholders.

Independent Living

The next level of use case is independent living [10]. In this circumstance, patients are not able to do some daily living activities without assistance. Patients may have mobility issues around the home, or they may have cognitive impairments that require personal assistance. It may be important to have professional home visits scheduled and audio or other reminders provided. Physical access to the home may need to be controlled through a video camera interface and verified credentials. Automated locks can secure the home but allow access for verified visitors. The table below illustrates some of the differences between aging-in-place and independent living patients.

Table 2 Independent Living Services

Service	Community	Caregiver	Payor	Infrastructure
Connectivity	H	L	L	M
Installation	H	M	N/A	H
Communication	H	M	L	H
Monitoring	M	M	N/A	M
Analytics	M	L	L	M
Cable operator opportunity: (L)ow, (M)edium, (H)igh, (N/A) not applicable				

Some of the stakeholder roles may be different, but they fall into the same general categories. Independent living still requires connectivity, infrastructure, and security. While aging-in-place can get away with mostly passive monitoring, assisted living use cases may require more direct monitoring. This might include blood, urine, and other samples that may need to be performed by a professional with data collection, storage, and analysis capabilities by the envisioned system.

Hospital at Home

At the end of the spectrum is the hospital-at-home use case. In this instance, acute care is needed. The patient may be bedridden or otherwise be mobility limited. Maybe complicated procedures need to be regularly performed. If constant in-person professional monitoring is not required, though, the patient will often prefer in-home care where they can be in familiar surroundings and with family more frequently. This alternative when possible also drastically reduces the provider costs. Assistance with meal preparation and personal hygiene may be required. The table below shows how hospital-at-home services differ from aging-in-place or independent living use cases.

Table 3 Hospital-at-Home Services

Service	Community	Caregiver	Payor	Infrastructure
Connectivity	H	L	L	H
Installation	H	H	N/A	H
Communication	H	H	M	H
Monitoring	H	H	N/A	H
Analytics	H	H	M	H
Cable operator opportunity: (L)ow, (M)edium, (H)igh, (N/A) not applicable				

Again, the technical infrastructure is the same. Just the level of service is increased.



Services

Now let's look in a little more detail at the technical service categories required by patients in these various use cases.

Secure Connectivity: At the most basic level, any sort of in-home care requires a secure, reliable network. This is already the core service that cable operators provide to homes. What is new is the extension of networking to devices within the home. In general, this has been the responsibility of the homeowner. Any device being managed within the home will have to be verified to work on the network and the security of the data traveling or at rest while under the control of the operator will need to be guaranteed. A service level agreement (SLA) for network availability and quality as well as a detailed HIPAA conformance test will likely be required. Secure connectivity is also required by the other stakeholders on the business side. Depending on the markets addressed by the cable operators, there may be connectivity opportunities here as well.

Accessible Communications: Beyond the basic network, applications will be required for communication. This will include video conferencing to communicate with the community and with caregivers. During Covid, many people became quite familiar with this technology, but older patients will likely need drop/moisture-proof and cleanable equipment design, simpler user interfaces, and pre-populated call lists. Patients may find it easier and more convenient to do video conferencing on the television from their couch.

Communications will also need to extend beyond video conferencing. During medical visits, it may be important to share output from devices like networked blood pressure cuffs or pulse oximeters. This information becomes even more useful if it has been logged over time with significant readings/events highlighted and commented on. A video conference may be initiated by sensors noting events that need to be evaluated by medical professionals.

An important part of this communication network is the notification infrastructure. In certain cases, a caregiver, doctor, or nurse may need to be notified that conditions have exceeded a certain threshold. Other less critical circumstances (like a change of routine or elapsed time since the bathroom was used or the refrigerator door opened) might trigger an alert to a family member who may discuss the change with the patient. A complex set of rules for guiding who gets notified and when information is collected becomes a feature that sets home care apart from more traditional medicine. Monitoring, informing and control happen automatically and immediately so nobody needs to remember anything, and events are logged for analysis. This information collection is generally inexpensive or even free, decreasing the cost for everyone while improving the level of patient care.

Monitoring: Connecting equipment to a secure network enables remote monitoring. On a basic level, this can be door and motion sensors that record when the patient uses the bathroom. Other instruments may monitor sleep conditions or measure parameters from more involved medical instruments. Authorized caregivers or family might be alerted to a fall or failure to take medications. Equipment can notify technicians if it fails calibration or needs service. Alerts can be generated if the equipment becomes disconnected and fails to call in on a specified schedule. Data can be securely logged so the circumstances of any event can be placed in context even after it occurs.

Analytics: Collecting accurate time-stamped data is critically important, but often isolated data yields little insight. Predictive and proactive analytics must take information from all sources, look at it in context and extract the important information. Big data analytics techniques can evaluate massive amounts of unstructured data and determine correlations that might be impossible for humans to discover. More information with better insights obtained more immediately at a lower cost means more efficient healthcare and better care for the patient.



Cable Operator Solutions

This section examines how this business might make sense for cable operators. Covid forced many people to utilize remote healthcare much sooner than they might have done otherwise. While remote doctor appointments are just one feature of home health care, they introduced people to the concept.

Integration: From the start of the cable industry, cable providers have been involved in integrating and packaging services for simpler consumer consumption. Cable providers collect content from several services and sell it as a single service to consumers. The idea of aggregating wellness services from several stakeholders into a single home service is a natural evolution. The networks that connect stakeholders are provided by cable operators with billing, operations, installation, management, customer service, and other cable skills critical for a successful home wellness care service.

Connectivity Provider: Connectivity is a primary cable product. Cable operators are premium providers of networking services for consumers and businesses. A secure network is a basic infrastructure required for any home wellness care service. Customers already trust this service and are comfortable paying for it every month. Regardless of who provides home healthcare, there is a good chance based on home service penetrations that cable networks are under that service. It is not much of a stretch to think that cable operators can create a viable and secure home healthcare service.

Installation Services: Cable operators have fleets of service vehicles and trained installers who regularly install equipment in customer homes. There are few industries more capable of installing networked residential devices. Given the HIPAA requirements, additional training and certification will be required for technicians with this responsibility, but several business models could be used to manage qualified technicians.

Monitoring Services: Monitoring equipment is necessary to keep the network running optimally.

Remote monitoring is required to do this at scale. For cable operators, this is business as usual. Extending this service to wellness equipment in the home will require expansion, but it is expanding an existing service rather than introducing a new one. Data collected from equipment can be used to diagnose both individual hardware devices and the network in general. A wellness portfolio would require many more data models, increased storage capacity, and an improved analytics capability.

Analytics: Analytics involves making sense of data. The cable industry has tremendous storage and computational resources capable of performing these complex analytics. Where cable companies don't own the technical and human resources outright, they can get these services through many cloud service providers.

Conclusions

These use cases provide some insight into how common cable operator infrastructures might be leveraged to provide a common home wellness care service that is flexible enough to support a range of use cases from assistive services to the management of complex hospital-at-home healthcare services. Cable operators can leverage their existing competencies in providing network services, installation, managing monthly subscriptions, monitoring systems, analyzing data, and providing customer service to make a legitimate case for operating home healthcare services like aging-in-place, independent living, and hospital-at-home. Business conditions, and especially the presence of standards to drive the industry to common and cost-effective solutions, will determine whether Cable operators could more successfully offer these services by building their services, partnering with companies in this space, or acquisitions. As pricing pressures move basic networking services towards commoditization, Cable operators need to evaluate new business opportunities that maintain and increase profit margins. Home healthcare services offer a promising opportunity.



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