STL PARTNERS

Executive Briefing

5G'S HEALTHCARE IMPACT: 1 BILLION PATIENTS WITH IMPROVED ACCESS IN 2030

This report explores the impact of 5G on the healthcare industry. It illustrates the benefits and example use cases, as well as quantifying the potential efficiency gains, that 5G will enable.

Darius Singh, Consultant | Darius.singh@stlpartners.com | October 2019

Preface

This document has been authored by STL Partners, an independent consulting and research firm. It is based on extensive research into the impact of 5G on industries, including interviews with healthcare enterprises and telco executives within health, as well as a survey of 109 healthcare professionals (e.g. doctors, nurses, government workers, paramedics) across both developed and developing markets. The research programme has kindly been supported by Huawei.

This report should be read by those within healthcare organisations who are responsible for the transformation and digitisation of the industry/their organisations. The content is also relevant to both healthcare application developers/enterprises and telecoms operators with a desire or strategy to explore the healthcare market.

Mentions of companies in this document are intended as illustrations of market evolution and are not intended as endorsements or product/service recommendations.

If you find this report of interest and would like to discuss any aspects of the content further, please contact any of the following:

STL Partners:

- Darius Singh: Consultant and Lead Author, darius.singh@stlpartners.com

- Chris Barraclough: Partner, chris.barraclough@stlpartners.com

Key contributors:

- Ian Mash: Director - CTO Carrier Business Group, ian.mash@huawei.com

- Mark Easton: Principal Consultant - CTO Carrier Business Group, mark.easton@huawei.com

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STL Partners is continuously working to understand how 5G can benefit other industries and develop strategies for telecoms operators and other industries to accelerate the delivery of benefits. Should you like to learn more about this research and future projects or find out how we can help operators and the healthcare industry to work more effectively together and take advantage of 5G please contact us.
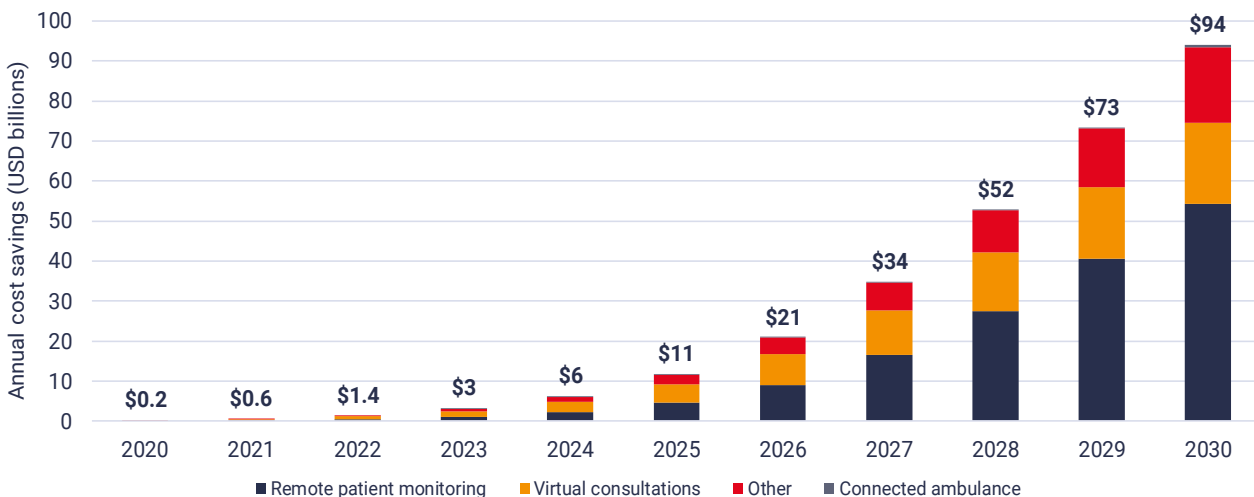

Other reports in this 5G series include:

- $1.4Tn Of Benefits In 2030: 5G's Impact On Industry Verticals

- Curtailing Carbon Emissions: Can 5G Help?

- 5G's Impact On Manufacturing: $740bn Of Benefits In 2030

- 5G Regulation: Ensuring Successful Industrial Transformation

Executive summary

5G could bring global savings of c. $90 billion to the healthcare industry in 2030

The global increase in the cost of providing healthcare to an ageing and growing population is not sustainable – the healthcare industry therefore needs a solution to help drive efficiencies in the healthcare system, while also increasing patient access to better healthcare.

Based on research involving hundreds of executives from the healthcare and telecoms sectors, STL Partners forecasts that at an aggregated global level, 5G could bring **cost savings of approximately $94 billion USD** to the healthcare industry in 2030.[1] We believe 5G versus other communications technologies (due to the unique capabilities mentioned below and detailed in a previous instalment of this report series)[2] will enable a suite of use cases to be **adopted at scale**, through a perceived increase in **reliability of service** in the field and not just in a lab environment. It will therefore bring real value to the industry, which we have quantified in this report.

Source: STL Partners analysis

However, in healthcare, **it's not all about the money**. Although we have forecast these significant annual cost savings, the real value comes from **reallocating this resource** to treating more patients and **increasing the reach and access of healthcare expertise** to more remote and less developed corners of the globe. **This will lead to almost a billion extra patients treated globally each year by 2030.**

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[1] The assumptions and analysis to generate this forecast were informed by interviews with healthcare and telecoms industry representatives and a survey of over 100 healthcare providers worldwide.
[2] See $1.4Tn Of Benefits In 2030: 5G's Impact On Industry Verticals.

This is driven by the adoption of new or enhanced use cases that help to bring **better coordination** across the healthcare ecosystem. 5G and the use cases we have described in this report will support the healthcare industry in making better use of their limited resources (both financially and in terms of available skills/infrastructure) and help get the necessary expertise, assets, and information to the right place in the right time[3].

However, there are clear challenges to widespread 5G roll-out, which will prevent benefits being realised at scale

Although there are clear advantages to the implementation and adoption of 5G, there are still technological barriers that may prevent healthcare providers from leveraging 5G's capabilities and realising the benefits laid out above:

- **Hindered roll-out:** operators are struggling to fund the investment required for 5G. This leads to slower and staggered deployments of the technology. For example, enhanced mobile broadband, massive M2M-type communications, and ultra-reliable low-latency communications (all of which are 5G-enabled technologies) are being rolled-out at different times. We have accounted for this in our quantification of 5G's impact by delaying the adoption of use cases which rely on these types of communications. If 5G roll-out is slower than we have assumed, the benefits we have forecast for the healthcare industry will be realised later.

- **Coverage:** telecoms operators will initially target major cities for 5G so that they can maximise population coverage. There is also current scepticism around 5G's indoor coverage capabilities. Much of the benefit from healthcare use cases relies upon ubiquitous coverage, reaching those in more remote areas and also patients within their own homes. This has been reflected in our quantification of 5G's impact: we have only accounted for the benefit of 5G when coverage is assumed to be >30% in that country.

  Furthermore, through our conversations with telco executives and key industry stakeholders, there is the belief that at maturity, 5G's indoor coverage and fixed wireless access will provide a better, more reliable, and less patchy service than Wi-Fi. There is also the sense that cheaper costs per bit with 5G will allow faster roll-out to more rural areas. This is especially true in less developed markets where cheaper roll-out of 5G networks compared to LTE will allow network coverage to extend to previously unreached locations.

- **Standards are still being set:** although targets have been defined, the telecommunications standards body 3GPP is still in the process of defining the standards for the next release of 5G. This may hinger roll-out as well as lead to unnecessary stipulations, which are not relevant to the healthcare industry or associated use cases, being placed on the telco.

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[3] See more on our research into the Coordination Age

These issues arise because 5G is still nascent. As 5G matures, these questions will begin to be resolved and the new and improved use cases we detail in this report will emerge. The rate of 5G maturity will therefore dictate the timeframe in which the benefits we have quantified from these use cases will be derived.

5G will enable new and improved use cases, allowing the potential benefits to be realised

The healthcare industry remains one of the least digitised industries worldwide, with many hospitals and practices globally still running paper-based operations. The sector has been slow to adopt technology due to a lack of IT budget and expertise, variations in technical maturity across localities, and stringent regulations around reliability and security (especially when it comes to patient data).

5G has generated a buzz due to the promise of helping solve some of the issues above and enabling new and improved use cases which will unlock benefits for the industry. This is both due to the capabilities of the technology itself (detailed below) as well as its ability to catalyse a chain reaction of digital transformation. Those within the healthcare industry feel that 5G, and the hype around it, will help drive general innovation, adoption and implementation of new technologies and solutions.

5G's unique capabilities

5G is distinct from previous generations of the mobile network - it is not simply faster than 4G. It has been designed to meet the needs of different use cases. The main improvements to the network are in three areas:
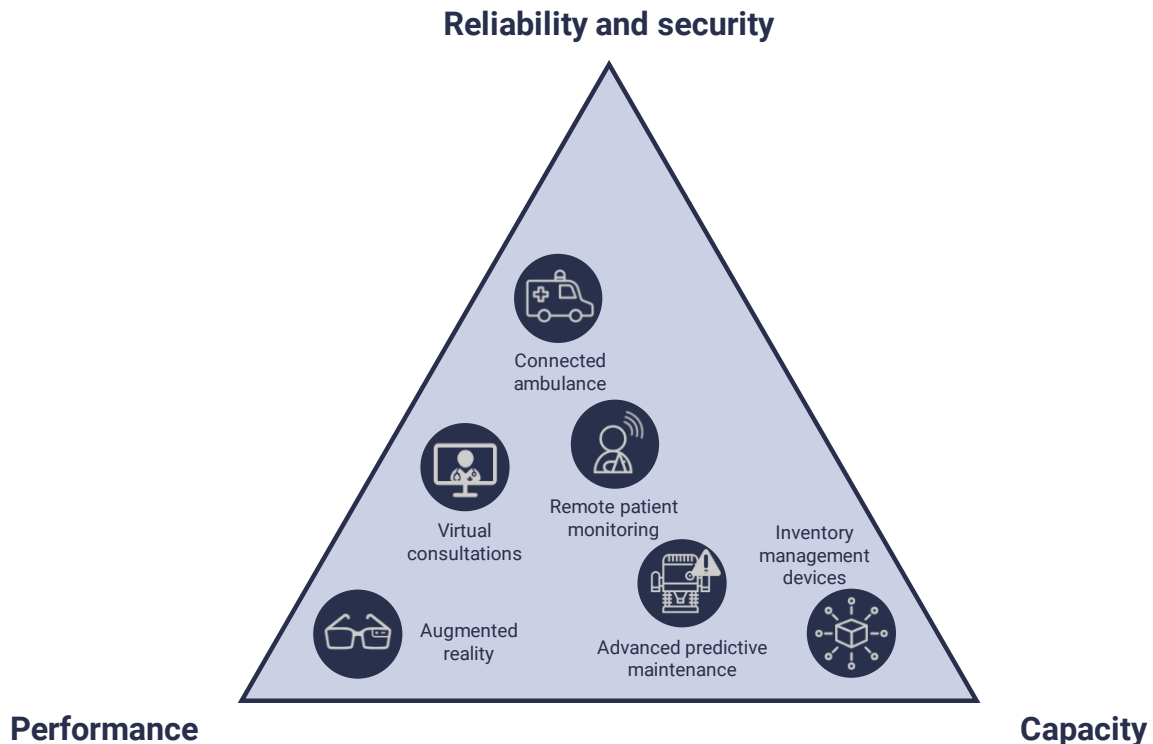
- **Reliability and security:** 5G promises ultra-reliable and secure connectivity, with some suggesting that 5G will bring 99.999% network reliability[4]. This is through new capabilities like network slicing technology, encryption of data in motion, and reliable handover between radio/network nodes. Additionally, 5G's move towards virtualised and software defined infrastructure means network faults and downtime can be significantly reduced. This is a key advantage of 5G over other connectivity solutions (e.g. 4G, Wi-Fi, Bluetooth).

- **Performance:** 5G (as the 3GPP release 16 standards dictate) will bring significant improvements in network performance. This includes reductions in **latency** of 90% compared with 4G/LTE[5]. It also includes huge increases in **bandwidth** - data can travel at 100Mb/s on average (compared to 10Mb/s on 4G/LTE) and reach up to 20Gb/s at peak rates (where 4G/LTE is capped at 1Gb/s).

- **Capacity:** the number of connected devices globally is expected to explode, with many forecasts estimating connected device numbers to be around 29 billion by 2022[6]. Current connectivity solutions such as Bluetooth, Zigbee, LPWAN and NB-IoT are not expected to be able to handle this increase in device density – particularly as use cases begin to rely on not one or two

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[4] Source from STL interview programme – Director, North American converged network operator
[5] 5G round trip latency under 10 milliseconds compared to under 100 milliseconds for 4G/LTE; airlink latency under 1 millisecond compared to 10 milliseconds for 4G/LTE (Source – Nokia 5G lecture)
[6] Ericsson Mobility report: Cisco VNI

elements being monitored, but hundreds of different factors. 5G promises capacity of up to 1 million connected devices per km^2 (compared to only 100 thousand on 4G/LTE).

Reliability and security

Connected ambulance

Remote patient monitoring

Virtual consultations

Inventory management devices

Augmented reality

Advanced predictive maintenance

Performance

Capacity

Source: STL Partners

The reliability and security gains are essential for maintaining patient data privacy and continuity of service for mission critical applications; the increases in performance allow new applications to be delivered; the greater network capacity brings scale and coverage. Though the healthcare industry may not have the same level of dependency on 5G's individual capabilities as other industries (e.g. media/entertainment where low-latency gaming applications dicate sub 10ms latency), together, these capabilities will significantly **improve the end user experience** of new applications. Patients will get a more seamless experience free, for example, from lag and jitter. This will be vital in driving adoption of technology driven use cases in the healthcare industry.

This is because, through the maturation of the information age, patients have greater knowledge of their own diseases and treatment options. They therefore become a more demanding consumer – they can be selective about their treatment processes and the solutions which they choose to adopt and use. This is where 5G will have a significant impact compared to LTE and other communications technologies, in driving adoption of use cases at scale.

In this report, we have detailed and quantified the benefit for three key industry use cases which are enabled and enhanced by 5G's capabilities:

1. **Remote patient monitoring:** real-time streaming, analysis, and monitoring of patient data from e-health devices and patient wearables. An example of this is Diabetacare[7] – a solution which provides 24/7 monitoring and support for those suffering from diabetes.

2. **Virtual consultations via high-definition (HD) video:** HD, two-way video streaming between doctor and patient (e.g. for routine appointment) or primary care and specialist doctor (e.g. for a referral appointment). One enterprise which is helping to deliver a similar solution is Babylon Health.

3. **Connected ambulances:** real-time streaming of patient data and information from sensors and high-definition cameras between ambulance crews and in-hospital emergency departments. BT in the UK is running 5G tests for connected ambulances in Birmingham – currently the connected ambulance connects paramedics to doctors in the hospital and allows the doctor to seamlessly guide the on-site paramedic through a remote ultrasound diagnosis.

The benefits derived from each use case, as well as their dependency on 5G, are detailed further in this report.

The healthcare industry must collaborate with the telecommunciations industry to derive value from 5G

In order to take full advantage of 5G and the benefits it could bring, healthcare providers as well as application developers must take an active role in the acceleration of 5G roll-out and use case adoption. To do this, they must successfully collaborate with the telecommunications industry and key players within the ecosystem.

Key recommendations for the healthcare industry:

1. **Building key criteria and requirements for 5G spectrum "beauty contests":** traditionally, selling of spectrum has occurred through a bidding process, with the telco who offers the greatest sum of money receiving the spectrum license. Although large spectrum licensing fees are attractive in the short-term, they potentially inhibit service innovation and network roll-out. There is a role for healthcare developers and providers to input into 5G spectrum beauty contests, helping to define the criteria and requirements for network deployment. They should clearly articulate their needs and so encourage regulators to move away from simple auctions and instead focus on contests that specify how operators should deploy 5G to meet healthcare (and other industry) needs. This will help ensure requirements aren't "over spec'd" and help to accelerate roll-out.

2. **Inputting into the development of 5G standards and regulation:** to help accelerate the process and overcome the barriers mentioned above, industry players should seek to influence and input into the standards for 5G. By informing the 3GPP standards forum of the real requirements to deliver use cases, healthcare bodies can help to speed up the process of defining the standards,

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[7] Diabetacare

as well as remove unnecessary technological stipulations on the telco and emphasise the important needs of the healthcare bodies.

3. **Collaborating with the telecoms industry to co-deliver solutions and drive adoption:** telcos may have a significant role to play in healthcare beyond connectivity. As a local, trusted and heavily regulated brand, telcos have a right to play in delivering end-to-end solutions to healthcare customers – a service which, given its lack of IT expertise, the healthcare industry desperately needs.

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Technologies' role in the healthcare industry

The challenges facing the healthcare industry

The landscape of the healthcare industry is changing on a global scale. Populations, including in developing markets, are growing, ageing, and increasing in wealth. This brings new challenges to healthcare providers. It brings a shift towards the management of non-communicable and chronic diseases (NCDs) such as diabetes, chronic obstructive pulmonary disease, and cancer, and moves away from the treatment of infectious and acute diseases. This holds true even in many emerging markets where the treatment and prevention of, for example, malaria, dysentery, and yellow/dengue fever has advanced significantly over the past decade.

Why does this trend towards the management of NCDs and a growing population create difficulties for healthcare providers? It comes down to a **lack of resource** in the industry:
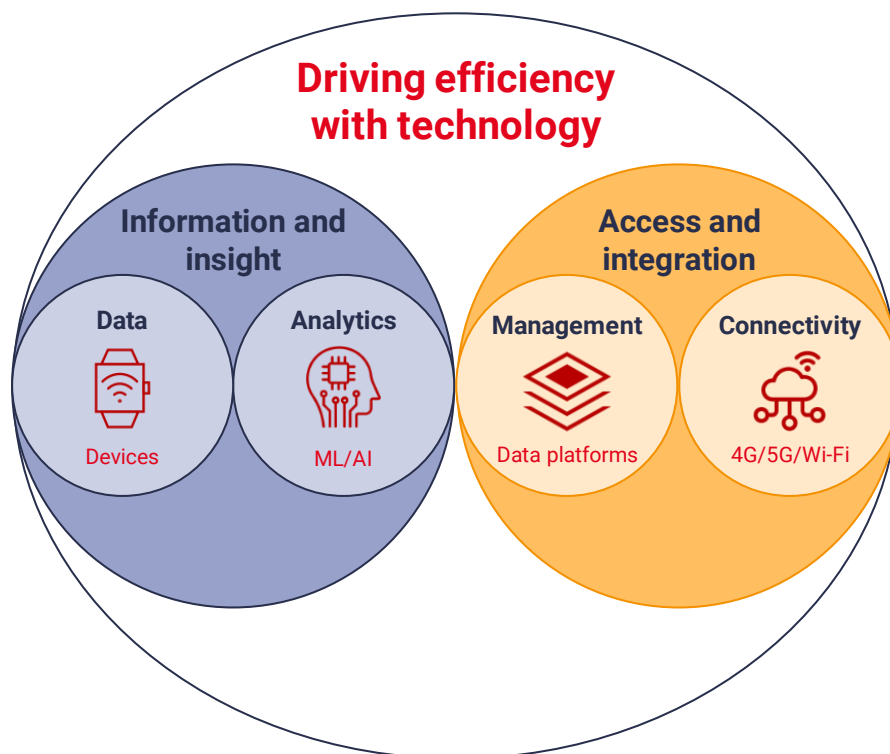
- **A lack of medical professionals, including both general and specialist practitioners:** as populations continue to grow and age, the ratio of patients to doctors becomes increasingly strained. The shift towards NCDs also begins to blur the lines between healthcare and wellness. Primary care practitioners, therefore, have more demands on their time as patient wellbeing becomes a bigger part of their role. Furthermore, this decrease in specialist availability and shortage of skills leads to longer wait times for treatment.

- **A lack of infrastructure:** as well as the number of available medical professionals, the accessibility and scale of infrastructure is a key issue facing the healthcare industry. Patients, especially in rural areas or developing markets, may not be able to travel the distance to their nearest healthcare premises. As well as the patient, it can be difficult to transport medication and equipment to these locations, leading to limited availability of and access to often life-saving treatments. This can also increase waiting times for patients, as more individuals are constrained to using the same infrastructure.

- **A lack of budget:** In most markets the healthcare industry is facing funding constraints. While budgets globally are increasing, they are often not increasing proportionally to the growing expense of treating an ageing and growing population. This is not a sustainable model as budgets cannot increase in perpetuity. On top of this, government bodies and regulators are implementing more stringent targets and codes of conduct on healthcare professionals with at least some budget contingent upon hitting targets.

The role of technology in driving efficiency

Improved healthcare efficiency is required to address the challenges above and the **digital transformation** of healthcare, through better and more proactive patient management, is a way to achieve this.

The key to unlocking efficiencies is the generation of richer information and insight, and the ability of users to have simple and real-time access to that information so that better decisions can be made faster. Four key technological pillars underpin these two change drivers (see Figure 1).

Figure 1: The four pillars of technology that will help in driving efficiency

Source: STL Partners

Information and insight

- **Data:** Big Data and its potential value in bringing new insights to organisations has been hyped in recent years across many industries. In healthcare, the hope is that as technological advances allow richer, more granular, and higher quality data to be collected on patients (e.g. blood glucose levels, blood cell/haemoglobin counts, HD video), treatment processes will become more effective. This includes a **shift to preventative care** rather than expensive treatments that seek to cure or care for patients with chronic conditions.

  This has already been seen at scale in wellbeing and consumer wearables (e.g. Fitbit). By collecting data on themselves (e.g. heart rate, calories burnt, steps taken etc.) through e-health devices, end users have better insight into and management of their own wellness – leading to a healthier population with less strain on the healthcare system.

- **Analytics:** better collection, management, and analysis of patient data will lead to significant improvements in treatment processes. The insights gathered from the data will allow patients to have a bigger role in their own care, some level of personalised/tailored care, and give epidemiologists a better understanding of health trends to make more informed and proactive decisions.

Examples of analytics and AI being used in healthcare include the analysis of images (e.g. MRI scans) to diagnose patients with a high degree of certainty, or Google DeepMind's application for the early identification of acute kidney injury (AKI)[8]. Both these use cases significantly speed up time to diagnosis, limit the constraint on specialist time, and increase patients' chances of survival.

Looking further into the future, information and insight may not be constrained to just patient data. Healthcare enterprises will begin to use, for example, environmental data and socio-economic data in conjunction with medical/patient data to create richer pictures of population health. This will enable healthcare providers to make better, more proactive and more bespoke decisions, in real-time.

Access and integration

As useful as having more information is, if those who need it cannot access the information at the right time, its value cannot be derived. The industry will therefore need:

- **Management:** to be valuable, information sources on patients need to be integrated into existing systems (to make access and user experience as simple as possible) and accessible to only the right people at the right time. Furthermore, data will often be collected by different end devices produced by different 3rd party manufacturers – these data sources will need to be "translated" and converted to the same format to allow analysis across the entirety of the patient's electronic medical record (EMR). This would ideally be through a unified platform/portal to avoid data siloes with partial views.

- **Connectivity:** underpinning the digital transformation of the healthcare industry is connectivity – allowing information to be transferred safely, securely, and at the right time, between geographically distant locations to those who need to access it. Connectivity solutions such as 4G, Wi-Fi, and eventually 5G, help bridge the distance between healthcare providers and patients.

By addressing these key pillars, the healthcare industry can transform its current processes and drive efficiencies. It can become more proactive in managing and triaging patients, limiting the number of individuals who require acute, more expensive treatment options. In turn, this will provide better access to healthcare expertise for those who need it and more effective use of healthcare resources.

The role of 5th generation (5G) networks in digital transformation

The healthcare industry remains one of the least digitised sectors worldwide, with many hospitals and practices globally still running paper-based operations. There are three reasons for this:

1. **Lack of IT budget and knowledge:** healthcare providers have limited resource and expertise to explore, develop, implement, and manage new digital solutions.

2. **Variation in systems and technological maturity:** as mentioned above, there are hospitals even in developed markets which are still using paper-based systems to conduct their operations.

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[8] Google DeepMind's AKI use case

However, others are using electronic medical records (EMR), online scheduling systems, and diagnostic applications to augment their daily activity. This disparity between systems makes developing, implementing, and integrating new technology at scale difficult.

3. **Reliability and security:** as Figure 1 highlights, making better use of data is key to improving the healthcare industry. However, this brings its own series of challenges, including maintaining the highest level of confidentiality and data privacy. Additionally, to reap the benefits of digital transformation, healthcare professionals will have to rely on technology for many mission critical processes. Therefore, if the technology fails, patient lives could be at risk. Healthcare providers will need the highest level of reliability of service which, to date, has been lacking for many digital use cases.

5G has generated a buzz due to the promise of helping solve some of the issues above and enabling new and improved use cases which will drive the benefits realised by the industry. This is both due to the capabilities of the technology itself[9] as well as its ability to catalyse a chain reaction of digital transformation. Those within the healthcare industry feel that 5G, and the hype around it, will help drive the innovation, adoption and implementation of new technologies and solutions. This report will look to explore and quantify the benefit of 5G on the healthcare industry, as well as highlight the practical next steps towards implementation.

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[9] See "What is 5G?"

The impact of 5G on the healthcare industry

What is 5G?

5G is the latest generation of mobile technology, distinct from previous generations because it is not simply a step up from 4G in terms of speeds; 5G has been designed to consolidate requirements from multiple different use cases and drivers:

- **Reliability and security:** 5G promises ultra-reliable and secure connectivity, with some suggesting that 5G will bring 99.999% network reliability[10]. This is through new capabilities like network slicing technology, encryption of data in motion, and reliable handover between radio/network nodes. Additionally, 5G's move towards virtualised and software defined infrastructure means network faults and downtime can be significantly reduced. This is a key advantage of 5G over other connectivity solutions (e.g. 4G, Wi-Fi, Bluetooth).

- **Performance:** 5G (as the 3GPP release 16 standards dictate) will bring significant improvements in network performance. This includes reductions in **latency** of 90% compared with 4G/LTE[11]. It also includes huge increases in **bandwidth** - data can travel at 100Mb/s on average (compared to 10Mb/s on 4G/LTE) and reach up to 20Gb/s at peak rates (where 4G/LTE is capped at 1Gb/s).

- **Capacity:** The number of connected devices globally is expected to explode, with many forecasts estimating connected device numbers to be around 29 billion by 2022[12]. Current connectivity solutions such as Bluetooth, Zigbee, LPWAN and NB-IoT are not expected to be able to handle this increase in device density – particularly as use cases begin to rely on not one or two elements being monitored, but hundreds of different factors. 5G promises capacity of up to 1 million connected devices per km^2 (compared to only 100 thousand on 4G/LTE).

5G's relevance in the healthcare industry

As shown in Figure 2, industry players believe these capabilities will help address some of the issues the healthcare industry is facing in adopting new technology. The reliability and security gains are essential for maintaining patient data privacy and continuity of service for mission critical applications; the increases in performance allow new applications to be delivered; the greater network capacity brings scale and coverage.

Patients have growing knowledge of, input into, and ownership of, their own care. They can therefore be selective about specific treatment processes, services, and products, becoming a more **demanding consumer** in their approach to healthcare solutions. The 5G benefits laid out in Figure 2 can therefore be consolidated into an improvement in end user (often the patient/consumer) experience, helping to
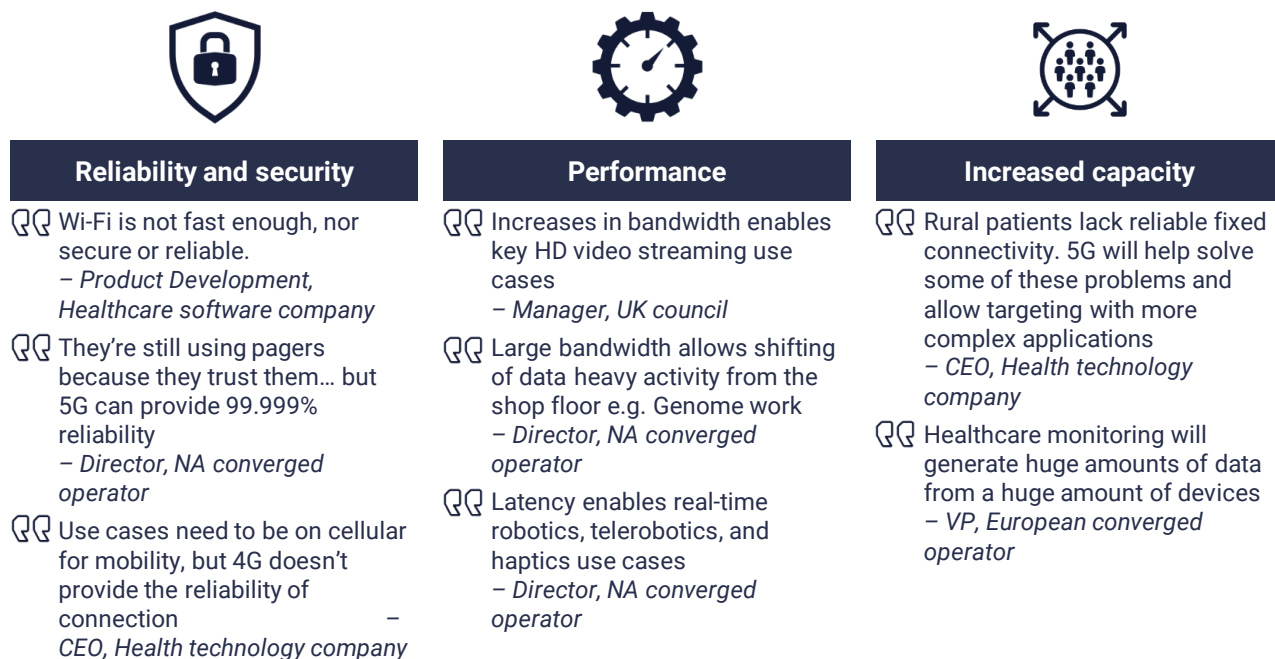
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[10] Source from STL interview programme – Director, North American converged network operator
[11] 5G round trip latency under 10 milliseconds compared to under 100 milliseconds for 4G/LTE; airlink latency under 1 millisecond compared to 10 milliseconds for 4G/LTE (Source – Nokia 5G lecture)
[12] Ericsson Mobility report: Cisco VNI

drive the adoption of use cases and achieve the scale necessary for the industry to derive value from the technology.

Figure 2: The benefits of 5G to the healthcare industry

Reliability and security	Performance	Increased capacity
Wi-Fi is not fast enough, nor secure or reliable. *– Product Development, Healthcare software company*	Increases in bandwidth enables key HD video streaming use cases *– Manager, UK council*	Rural patients lack reliable fixed connectivity. 5G will help solve some of these problems and allow targeting with more complex applications *– CEO, Health technology company*
They're still using pagers because they trust them… but 5G can provide 99.999% reliability *– Director, NA converged operator*	Large bandwidth allows shifting of data heavy activity from the shop floor e.g. Genome work *– Director, NA converged operator*	Healthcare monitoring will generate huge amounts of data from a huge amount of devices *– VP, European converged operator*
Use cases need to be on cellular for mobility, but 4G doesn't provide the reliability of connection *– CEO, Health technology company*	Latency enables real-time robotics, telerobotics, and haptics use cases *– Director, NA converged operator*	

Increasing end user experience and driving use case adoption

Source: STL Partners research programme July 2019

Driving efficiency with 5G

Through the capabilities mentioned above, 5G can impact (both directly and indirectly) three of the key technological pillars needed to drive efficiency in the healthcare industry (see Figure 3). By impacting these, right-time and preventative measures can be implemented in patient care.

On top of the direct impact to connectivity[13], providing the industry a more trusted communications solution, 5G can positively affect both the data and management pillars:

1. By increasing bandwidth and capacity, 5G enables more e-health devices (e.g. patient wearables/ machine monitoring sensors) to be deployed within the same area network.

2. In terms of management, we have previously mentioned that 5G has created a buzz due to its ability to drive general digital transformation in the industry. This includes the development of

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[13] See report section "What is 5G"

data management platforms with a more consistent interface across localities to handle the growing number of data streams and higher data volumes.

Figure 3: The role of 5G in driving efficiency

Source: STL Partners

New use cases and applications enabled by 5G

By impacting these three pillars of technology, 5G can drive implementation and adoption of new use cases for the healthcare industry (see Figure 4). These use cases all rely on key capabilities 5G – which capabilities are most important to each use case is mapped in Figure 5[14].

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[14] In practice, these use cases will rely and make use of all of the benefits and capabilities that 5G can bring. This figure shows the strength of their reliance on each capability relative to each other.

Figure 4: 5G use cases for the healthcare industry

	Use case		Benefits	Why 5G?
	Advanced predictive maintenance	Using dozens of sensors to give an accurate, real-time representation of the status of a machine to perform predictive and preventative maintenance	Reduce downtime Reduce spend on maintenance Reduce machine replacement rate	Capacity Reliability Device costs
	Remote patient monitoring	Real-time streaming, monitoring and analysis of patient data from e-health devices and wearables	Reduce transfer delays Increase hospital throughput Increase emergency turnover	Device density Bandwidth MMTC
	Augmented reality	Using augmented reality headsets to train/guide medical professionals, or create an immersive/ purposefully distracting experience for patients	Reduce maintenance resources Reduce spend on training Improve patient experience	Bandwidth Ultra-low latency
	HD virtual consultations	HD video streaming between doctor and patient (e.g. for a routine appointment) or primary care and specialist doctor (e.g. for a referral appointment)	Increase patient throughput Reduce cost of appointments Cut "Did not attend" rates	Low-latency Bandwidth Reliability
	Connected ambulance	Real-time streaming of patient data/information (sensors + HD video) between ambulances and the hospital	Reduce ambulance handover times Increase emergency department turnover	Ultra-low latency Bandwidth Reliability
	Inventory management devices	Using light 5G sim devices (e.g. smart phone) to scan, track and manage inventory stores in hospitals or pharmacies	Reduce inventory costs Increase human productivity	Device costs Capacity

Source: STL Partners

Figure 5: Mapping healthcare use cases to 5G's capabilities

Source: STL Partners

The following sections will explore three of these 5G-enabled use cases (remote patient monitoring, virtual consultations, and connected ambulances) in detail, including a quantification of their impact on the healthcare industry.

1. Remote patient monitoring

Many of the issues in treating chronic patients could be reduced or resolved through more efficient patient care. Patient mismanagement leads to the need for otherwise preventable appointments. This in turn leads to greater strain on healthcare professionals' time, increased healthcare spending and longer waiting times for patients who require treatment.

Remote patient monitoring is seen as a solution to this problem, with 52% of survey respondents from developed markets expecting to implement remote patient monitoring widely within 1-5 years[15]. By using sensors, wearables and e-health devices, patient attributes can be collected and analysed without the need for patients to travel to primary care facilities and have a face to face appointment with a medical professional.

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[15] Data taken from results of STL Partners survey with healthcare professionals, August 2019

There are remote patient monitoring services that exist today without 5G. One example is Diabetacare – a solution which provides 24/7 monitoring and support for those suffering from diabetes[16]. The solution currently functions successfully in Bangalore using Vodafone's Managed IoT Connectivity Platform. So, if healthcare enterprises and providers can deliver remote patient monitoring solutions today on existing technologies, why is there a buzz around this as a 5G use case?

Why 5G?

Taking this specific implementation of remote patient monitoring, Vodafone's Managed IoT Connectivity Platform provided Diabetacare with the necessary performance, reliability and security, and capacity to deliver the solution to c. 100,000 patients. However, in the circumstance where this solution is rolled out to the 100 million diabetics in India[17], and healthcare providers are also monitoring a variety of other chronic diseases, Vodafone's current solution may not provide the necessary scale or usability for medical professionals. This boils down to two reasons:

1. **Reliability and quality of the service:** through reliability, performance and capacity increases against other connectivity solutions (e.g. LTE), 5G can promise patients and providers a consistent quality of service – this is essential for mission critical applications revolving around patient care. Furthermore, 5G offers a secure WAN solution compared to traditional in-home Wi-Fi, meaning patients can be monitored on the move, and do not have to be in a fixed locations.
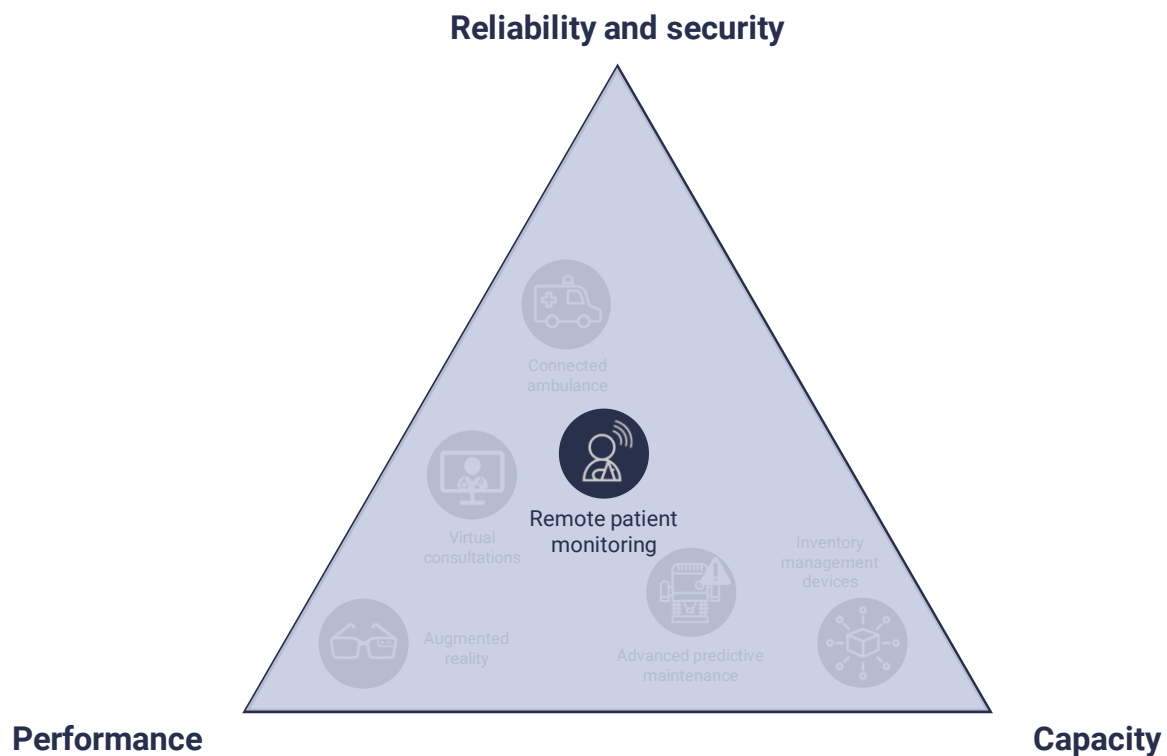
   The benefits of 5G become more pronounced as use case adoption increases. By significantly increasing the number of connected devices per square kilometre, a greater strain is put on the network's capacity. On top of this, as the use of HD video in patient monitoring becomes more widely implemented there is a greater need for better network performance

2. **A ubiquitous platform:** each solution for each disease (which would likely be provided by different healthcare application developers and enterprises) may require a different connectivity solution, each with its own managed service, specific performance configuration, security protocols, billing systems, device management etc. This may be prohibitively difficult for healthcare providers, where there is limited resource and expertise dedicated to IT, to integrate and manage.

   5G offers a ubiquitous solution which would remove the need for individual managed networks and multiple connectivity solutions per disease – each solution/device could connect via a 5G SIM.

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[16] Diabetacare
[17] Diabetacare – Vodafone case study

Figure 6: Mapping remote patient monitoring to 5G's capabilities
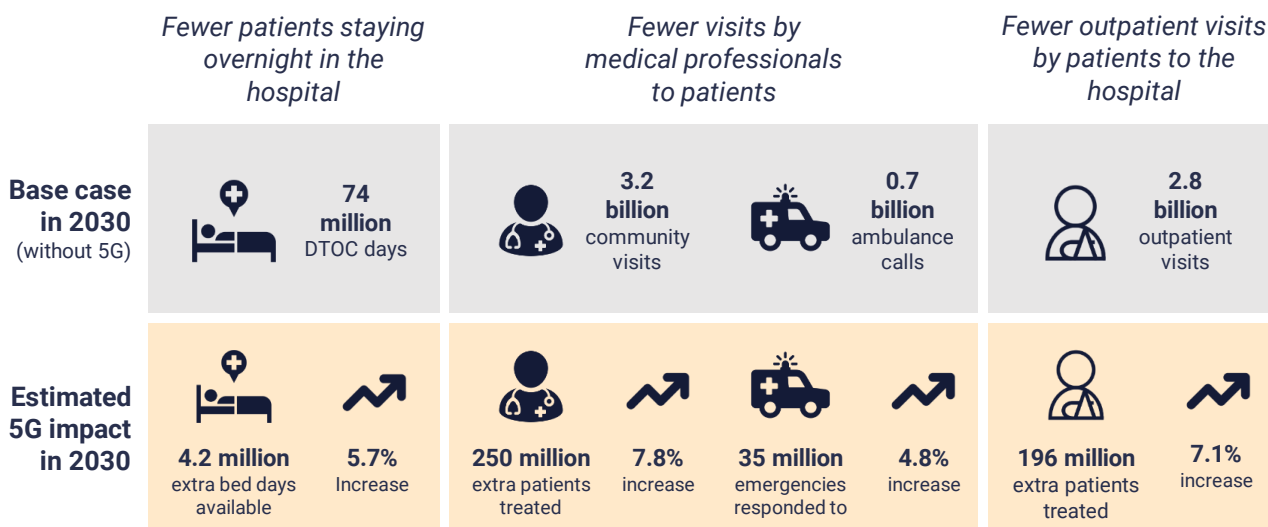

Source: STL Partners

The impact of 5G-enabled remote patient monitoring

Through our conversations with players in the healthcare space and our survey of 109 healthcare professionals, we concluded that 5G-enabled remote patient monitoring will impact three key measures for healthcare providers (see Figure 7).

1. **Fewer patients staying overnight in the hospital.** Remote patient monitoring helps to free up bed space in hospitals by reducing the number of in-patients who require overnight care and monitoring. The main way it impacts this metric is by reducing delays in transfers of care (i.e. delays in patient discharge or transfer to another ward) which take up bed days that could otherwise be used for patients who require more immediate treatment. These will be referred to as *delayed transfer of care* (DTOC) days.

2. **Fewer visits by medical professionals to patients in the community.** Throughout the year healthcare professionals will make visits to patients in the community. Examples include a specialist physician visiting an elderly patient, a midwife visiting a new mother, and a paramedic arriving on scene in an emergency. Remote patient monitoring will reduce the need for some of these visits.

3. **Fewer outpatient visits by patients to the hospital.** Real-time information that healthcare professionals have on patients via remote monitoring, coupled with better insights that patients

themselves have into their own illnesses, will reduce the need for some visits by out-patients to the hospital.

Figure 7: Estimated global impact of remote patient monitoring (2030)

	Fewer patients staying overnight in the hospital	Fewer visits by medical professionals to patients		Fewer outpatient visits by patients to the hospital
Base case in 2030 (without 5G)	74 million DTOC days	3.2 billion community visits	0.7 billion ambulance calls	2.8 billion outpatient visits
Estimated 5G impact in 2030	4.2 million extra bed days available — 5.7% Increase	250 million extra patients treated — 7.8% increase	35 million emergencies responded to — 4.8% increase	196 million extra patients treated — 7.1% increase

Source: STL Partners analysis, NHS data, NHS England data, STL Partners survey August 2019, World Bank Data

This use case means that healthcare professionals can spend the majority of their face time with those who require more direct attention. They can do this while still providing care to the patients being remotely monitored by, based off the analytical insights, triggering any necessary responses to changes in patient states. Furthermore, they can do this without significantly increasing healthcare spend by reallocating the resource saved from previously unnecessary appointments. In other words, remote patient monitoring will enable limited resources to be used more effectively, resulting in better patient outcomes.

The analysis of patient data in this way will allow healthcare providers to take preventative and proactive measures in patient management. This will reduce the number of, and therefore cost associated with, emergency or acute treatments that arise from complications/ mismanagement of diseases.

2. Virtual consultations via high definition (HD) video

Another key issue facing the healthcare industry is infrastructure access. Many patients who require treatment live too far from the necessary facilities, often making travel to these places prohibitively difficult, time consuming, and costly for the individual. These patients therefore go without the care they need, leading to increased emergency treatments and higher mortality rates. This is especially true in heavily rural markets, such as Australia or Canada, where much of the population live in remote areas, or developing markets, such as those within Sub-Saharan Africa where healthcare and transport infrastructure is limited.

Virtual consultations via HD video is already being widely considered by many professionals in the healthcare industry as a potential solution to this issue - 75% of survey respondents are already exploring the use case in some capacity.
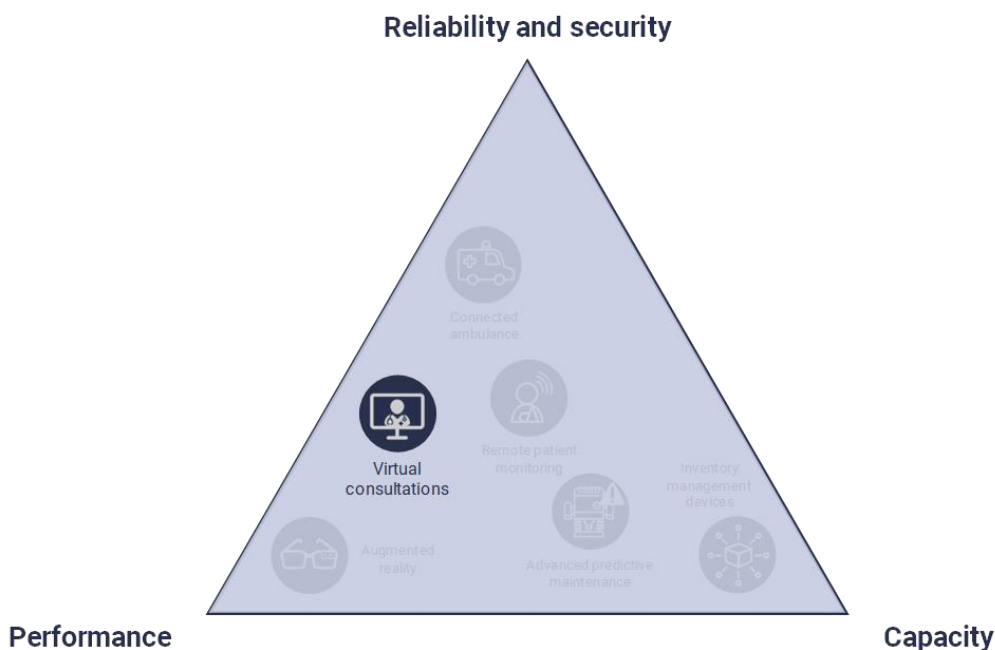
Two-way HD video is used between the patient and a primary/secondary care professional to conduct, initial screening assessments, routine check-ups (which do not require physical procedures), therapy/rehabilitation sessions, and increasingly visual diagnoses (e.g. identifying dermatological conditions and symptoms). By conducting these appointments over the air, patients do not need to travel to see healthcare professionals and vice versa, reducing the burden on the patient and decreasing the cost of each appointment.

One enterprise which is helping to deliver such a solution is Babylon Health. A key element of Babylon's service, which healthcare providers/insurers pay a monthly subscription for, is 24/7 access to a doctor through virtual consultations. This provides right time access to healthcare to many who need it – including in Rwanda (though not yet via video) with plans to expand to China, North America, and the Middle East[18].

Why 5G?

Babylon Health provides a clear example that virtual consultations already exist, so why is there so much hype around 5G? While our survey showed that 75% of respondents were **exploring** the use of virtual consultations within their practices, only 9% of those within developed markets were **implementing** widely across their practices. The reason for this stark discrepancy comes down to performance and subsequently user experience (see Figure 8).

Figure 8: Mapping virtual consultations to 5G's capabilities

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[18] Read our recent summary of the TELUS health summit and Babylon's roadmap to success

To be successful, virtual consultations need to be able to happen from anywhere where the patient or physician is located through a device which they would readily carry. If patients or healthcare professionals must travel to, or remain in, specific locations, or carry round a specialised device to make use of the service, much of the benefit is diminished.
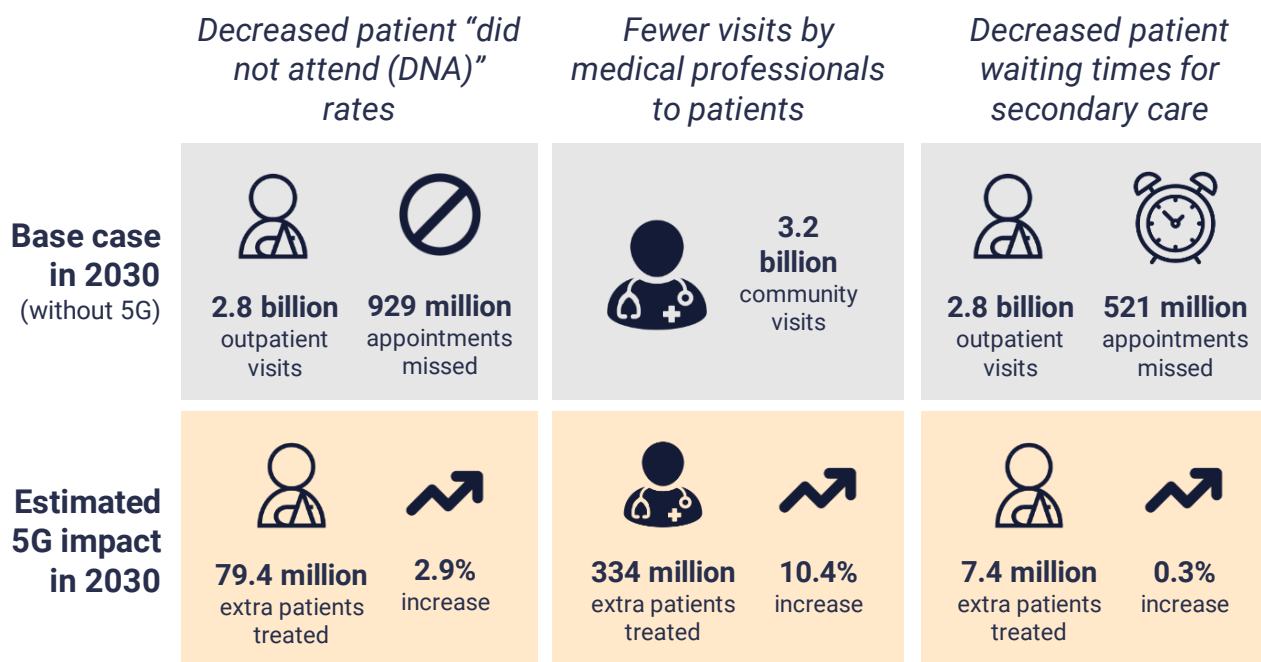
For this to happen, parties must be able to use their mobile smartphone and therefore will rely on cellular connectivity. There is the argument that Wi-Fi would meet the necessary performance requirements (in terms of latency and bandwidth), however, public Wi-Fi as it stands today would not meet the necessary reliability and security needs and using home Wi-Fi/fixed connection would remove the mobility aspect.

While 4G in a lab environment may meet the necessary performance capabilities for the use case, it does not have the sufficient consistency of performance in the real world to stream and send HD video without lag, jitter, or degradation of video quality, meaning the service would not be good enough to implement this use case successfully. This is an increasingly important factor as diagnoses through virtual consultations become more prevalent – primary and secondary care practitioners will need reliable, high-quality video to examine physical conditions and make meaningful recommendations.

The impact of 5G-enabled virtual consultations

From our interview programme and survey to healthcare professionals, virtual consultations via HD video will impact three key measures for healthcare providers (see Figure 9):

Figure 9: Estimated global impact of virtual consultations via HD video (2030)

	Decreased patient "did not attend (DNA)" rates		Fewer visits by medical professionals to patients		Decreased patient waiting times for secondary care	
Base case in 2030 (without 5G)	**2.8 billion** outpatient visits	**929 million** appointments missed	**3.2 billion** community visits		**2.8 billion** outpatient visits	**521 million** appointments missed
Estimated 5G impact in 2030	**79.4 million** extra patients treated	**2.9%** increase	**334 million** extra patients treated	**10.4%** increase	**7.4 million** extra patients treated	**0.3%** increase

Source: STL Partners analysis and survey (August 2019), NHS quarterly statistics, NHS reference costs, NHS GP data, NHS waiting times, World Bank

1. **Decreased "did not attend" rates.** Currently, in the UK, around 5% of all healthcare appointments are missed – many without enough of a notice period for appointments to be reallocated[19]. These appointments can often be missed, for example, due to inability or lack of desire to travel. Virtual consultations could help reduce the proportion of missed appointments by making attendance easier for the patient.

2. **Fewer visits by medical professionals to patients.** As with remote patient monitoring, virtual consultations help reduce the frequency of healthcare professionals travelling to patients in the community, for example, by conducting post-natal/surgery reviews via video instead of in person.

3. **Decreased waiting times for secondary care.** Preliminary research would suggest that virtual consultations in secondary care (e.g. for appointments made through referrals by primary care physicians) helps to reduce overall waiting times for treatment. This leads to increased patient turnover.

Virtual consultations will bring additional benefits to the three above. The main benefit will be increasing the access (and more importantly right time access) of patients to healthcare expertise – this has been incorporated in the quantification of 5G's benefit through a growth rate proportional to the use case's adoption.

On top of this, virtual consultations will also aid in the early diagnosis of certain diseases (e.g. skin cancers and other dermatological conditions). This not only has impacts in terms of patient health (with the disease not developing into a more serious or life-threatening manifestation), but again allows healthcare providers to be more proactive – catching diseases early, managing them correctly, and preventing any complications, which would otherwise lead to more expensive and time-consuming treatment options.

3. Connected ambulance

Globally, there is pressure on hospitals and healthcare providers to perform more efficiently and effectively. This pressure is especially present within ambulance and emergency services, where more stringent targets are being set on response times and accident & emergency (A&E) department delays. For example, new targets in the UK set out in 2018 state that all ambulance trusts should, on average, respond to category 1 (life threatening) calls within 7 minutes. This represents a decrease in average response time of a minute (or 12.5%) compared to the previous targets.

Some suggest that "connected ambulances" could help emergency services meet these more stringent targets. A connected ambulance and its crew act as a means to collect and transfer information on the patient, either through wearables, sensors, or streaming of HD video/body cameras, back to hospital A&E departments while the patient is being transported. This way hospital staff have a better understanding of a patient before they arrive. In some situations, specialists can
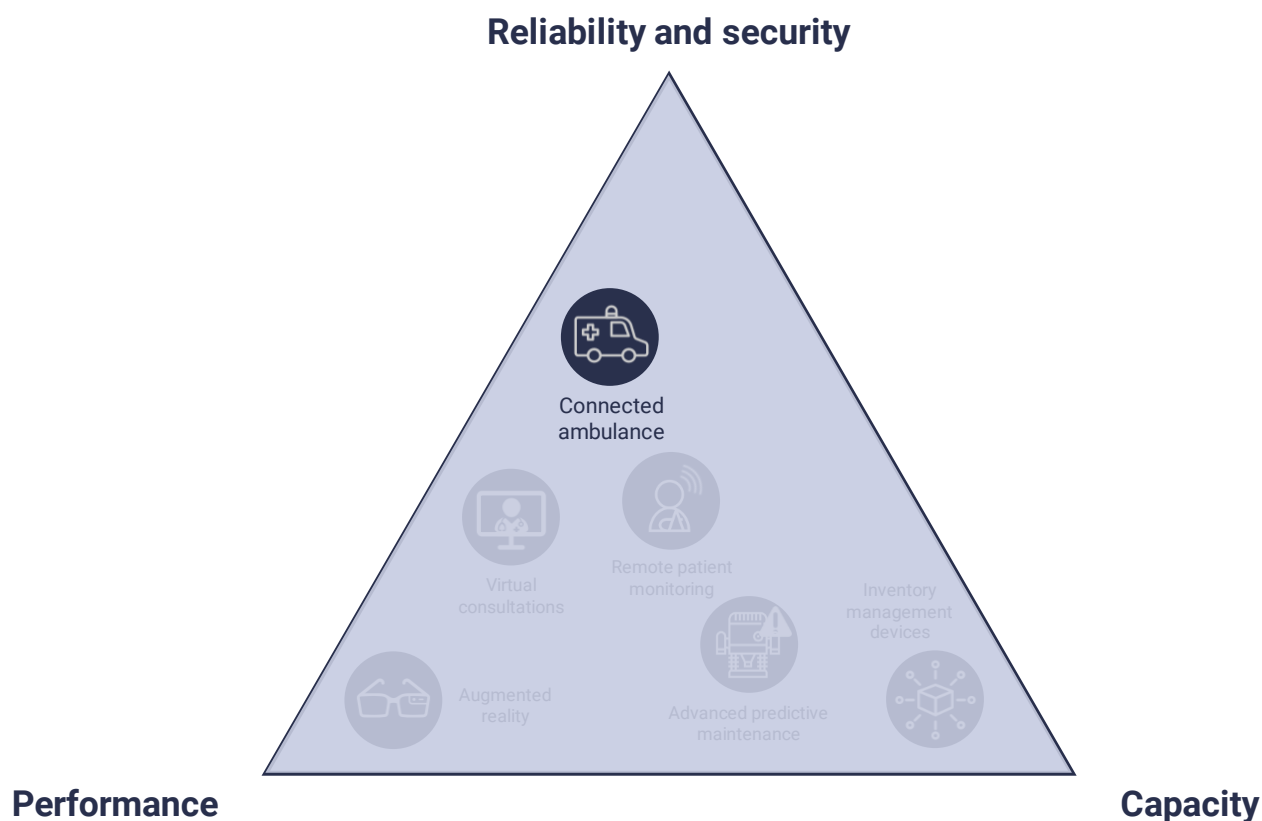
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[19] https://www.england.nhs.uk/statistics/statistical-work-areas/hospital-activity/quarterly-hospital-activity/qar-data/

be engaged to help guide paramedics through certain procedures without the need to travel to the hospital, creating efficiencies across the emergency services.

Unlike the other use cases, connected ambulances are not being widely explored or implemented today as the use case cannot be realised without the capabilities that 5G brings (Figure 10).

BT in the UK is currently running 5G tests for connected ambulances in Birmingham[20]. There have been limited trials with Satellite enabled ambulances[21], however, these do not appear to have taken off in terms of adoption which may be due to prohibitive costs.

Figure 10: Mapping connected ambulance to 5G's capabilities

Reliability and security

Performance   **Capacity**

Source: STL Partners

The estimated impact of connected ambulances

Connected ambulances will impact three key metrics for healthcare providers (see Figure 11).

1. **Fewer patients conveyed to the hospital.** Reporting by the NHS shows 4 types of ambulance action, each requiring more input by ambulance crews than the last, and therefore consuming more resource:
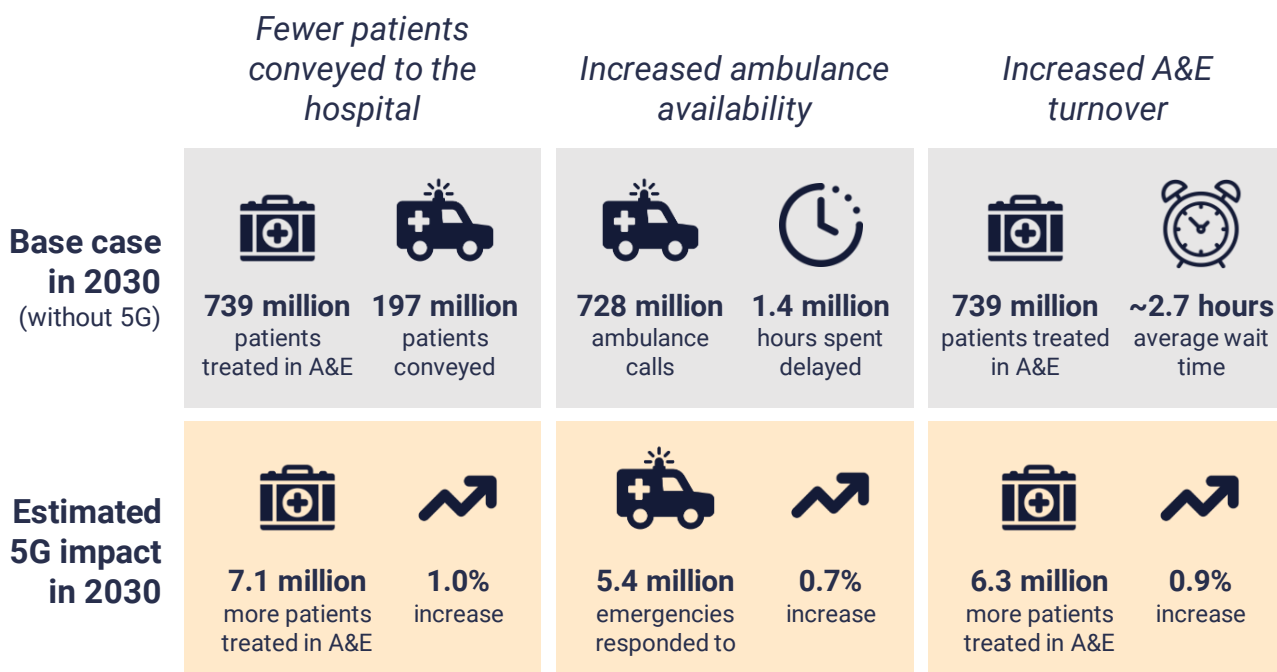
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[20] BT connected ambulance
[21] SatCare

- **Calls** – the patient emergency is deemed as not needing further treatment or referral.

- **Hear, treat, and refer** – the patient emergency is resolved over the phone, either by verbal treatment by the operator or by referral to a specialist.

- **See, treat, and refer** – the patient emergency is resolved by ambulance crews (e.g. paramedics) who travel to patient site and treat or refer on location. Patients do not need to be transferred to hospital A&E departments.

- **See, treat, and convey** – the patient emergency is mitigated to the best of the emergency crew's ability, but patients require further acute treatment in the hospital. They are therefore taken and handed over to hospital A&E departments.

Connected ambulances, with HD video capabilities and some level of remote procedural equipment, allow more emergency crews to "see, treat and refer" patients in place of "see, treat, and convey". This brings benefits in terms of cost of the treatment and the dependencies on A&E department staff's time.

2. **Increased ambulance availability.** By connected ambulances streaming patient data to A&E departments, emergency services can update the necessary healthcare professionals on the patient's condition and ensure proper resource/protocol is allocated to their treatment. This means that delays in handovers between paramedics and in-hospital emergency departments can be reduced, and paramedics can be freed up to return to the road and respond to other emergency events.

3. **Increased A&E turnover.** Connected ambulances help the hospital A&E departments improve their patient turnover rates. This is due to both:

- The decreased number of conveyed patients as more cases are treated on patient location;

- The decreased time from admittance to discharge/transfer through better and earlier patient insight.

Figure 11: Estimated global impact of connected ambulances (2030)

	Fewer patients conveyed to the hospital		*Increased ambulance availability*		*Increased A&E turnover*	
Base case in 2030 (without 5G)	**739 million** patients treated in A&E	**197 million** patients conveyed	**728 million** ambulance calls	**1.4 million** hours spent delayed	**739 million** patients treated in A&E	**~2.7 hours** average wait time
Estimated 5G impact in 2030	**7.1 million** more patients treated in A&E	**1.0%** increase	**5.4 million** emergencies responded to	**0.7%** increase	**6.3 million** more patients treated in A&E	**0.9%** increase

Source: STL Partners analysis, STL Partners survey (August 2019), NHS reference costs, NHS quarterly statistics, NHS A&E activity, World Bank Data

The percentage increases in patients treated (shown in Figure 11) for connected ambulances may seem relatively small when compared across all use cases. However, a key benefit which has not been quantified is the positive impact to patient mortality rates. In emergency situations, every minute saved could be vital in saving a life - by giving greater power to the first responders and increasing the efficiency of emergency services, the time to respond and resolve life threatening situations can be reduced, increasing the patients' chance of survival.

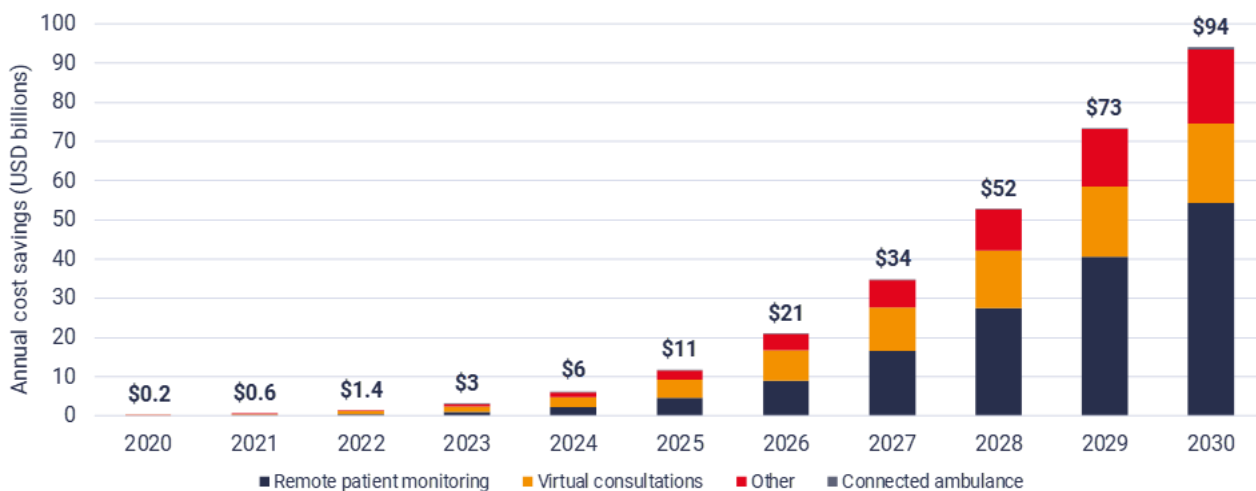# 5G could bring global savings of c. $90 billion in 2030

The quantified benefits of each use case were modelled based on data from the UK. By taking these benefits, extrapolating them globally (based on total population and healthcare spend per capita), and forecasting them across a 10-year period (based on use case adoption rates and growth in healthcare spend), we estimate the global impact of 5G in 2030 for each use case. These are laid out in Figure 7, Figure 9, and Figure 11.

Looking at an aggregated view, we estimate that 5G could bring savings to the industry of $94 billion USD in 2030 (see Figure 12). This includes an assumption that other 5G-enabled use cases that apply to the healthcare industry (which we have not modelled in detail) will make up circa 20% of total benefit.

Most of the value in 2030 will come from 5G-enabled remote patient monitoring, accounting for 56% of total benefit derived. This is because the ability to monitor chronic patients remotely in real-time, and therefore remove the need for doctors to schedule and conduct routine appointments, will create efficiencies across many departments and practices in the healthcare system. However, our forecasts

suggest that up until 2026, it is 5G-enabled virtual consultations that will provide the lion's share of the benefits.

Figure 12: Global impact of 5G on healthcare (annual cost savings USD billions)

Source: STL Partners analysis

This is because virtual consultations leverage enhanced mobile broadband (eMBB), a 5G capability which is being rolled out in some markets today. By contrast, remote patient monitoring also relies on more machine-machine type communications (mMTC). We have forecasted that this capability will only be available by 2021 in developed markets. This means that adoption of 5G-enabled remote patient monitoring will start off slower than virtual consultations but, through fast growth, will catch up quickly.

Connected ambulances, which will rely more heavily on the ultra-reliable low-latency communication (URLLC) aspects of 5G, will not kick in at scale (even in developed markets) until 2023. Furthermore, given the need for an established and relatively sophisticated ambulance service as a starting point, connected ambulances will have limited impact in developing markets until the final years of the 10-year period.
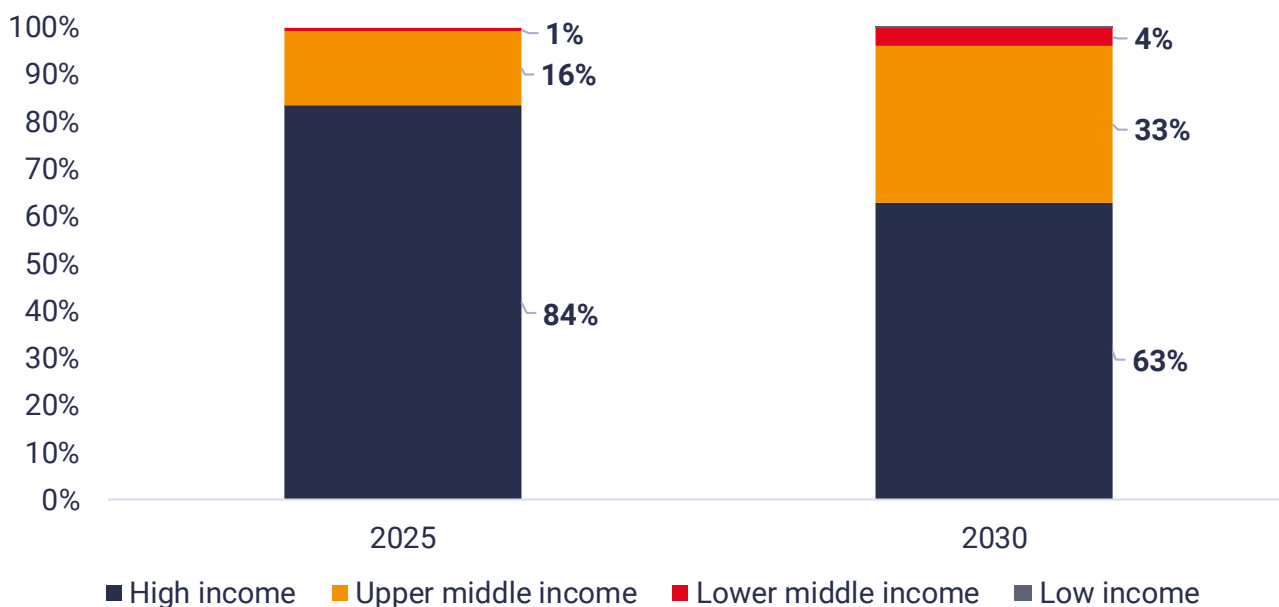
In healthcare, it's not all about the money

Figure 13 shows how the impact of 5G-enabled use cases varies by country income level in 2025 and 2030. It is clear that high income countries, as defined by the World Bank[22], capture most cost savings derived from 5G (84% and 63% in 2025 and 2030 respectively). The main reason for this is the significant differences in healthcare spend per capita between countries with different income levels. Even between high and upper middle income countries, there is a 6 times difference in average

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[22] World Bank income level classifications

healthcare spends per capita. This reflects the lack of healthcare infrastructure outside high income countries, as well as the relatively small percentage of the population with access to that infrastructure.

Figure 13: Relative impact of 5G by country income level in 2025 and 2030

Source: STL Partners analysis

However, what is also clear in Figure 13 is that, as the forecast progresses, the proportion of total cost savings being captured in high income countries decreases. This reflects not only the increase in healthcare spend per capita in developing markets over time, but also an **increase in the percentage of populations with access to healthcare**. As adoption of remote patient monitoring and virtual consultations increases, more of the population who otherwise would not have been treated (due to difficulties travelling for example) can now access healthcare expertise. This is a significant impact which is realised primarily in developing markets (with the exclusion of heavily rural high income countries such as Australia and Canada) where population with access to healthcare is low.

This raises an important point that, in healthcare, it's not all about the money. Although we have forecast annual cost savings of $94 billion in 2030, the real value comes from reallocating this resource to treating more patients and increasing the reach of healthcare expertise overall. **This will lead to almost a billion extra patients treated globally each year by 2030.** Figure 15 (overleaf) shows the global impact of 5G on increasing the number of patients treated annually (patient throughput) by region across four key healthcare contact points[23].

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[23] The four key healthcare contact points provide an aggregated view of the metrics detailed for each use case.

5G and sustainable development goals (SDGs)

On top of the benefits to both costs and patient throughput, 5G brings other socio-economic benefits which we have not quantified in this report. The use cases cited will also reduce mortality rates across the globe and increase well-being of patients suffering from non-communicable diseases (NCDs).

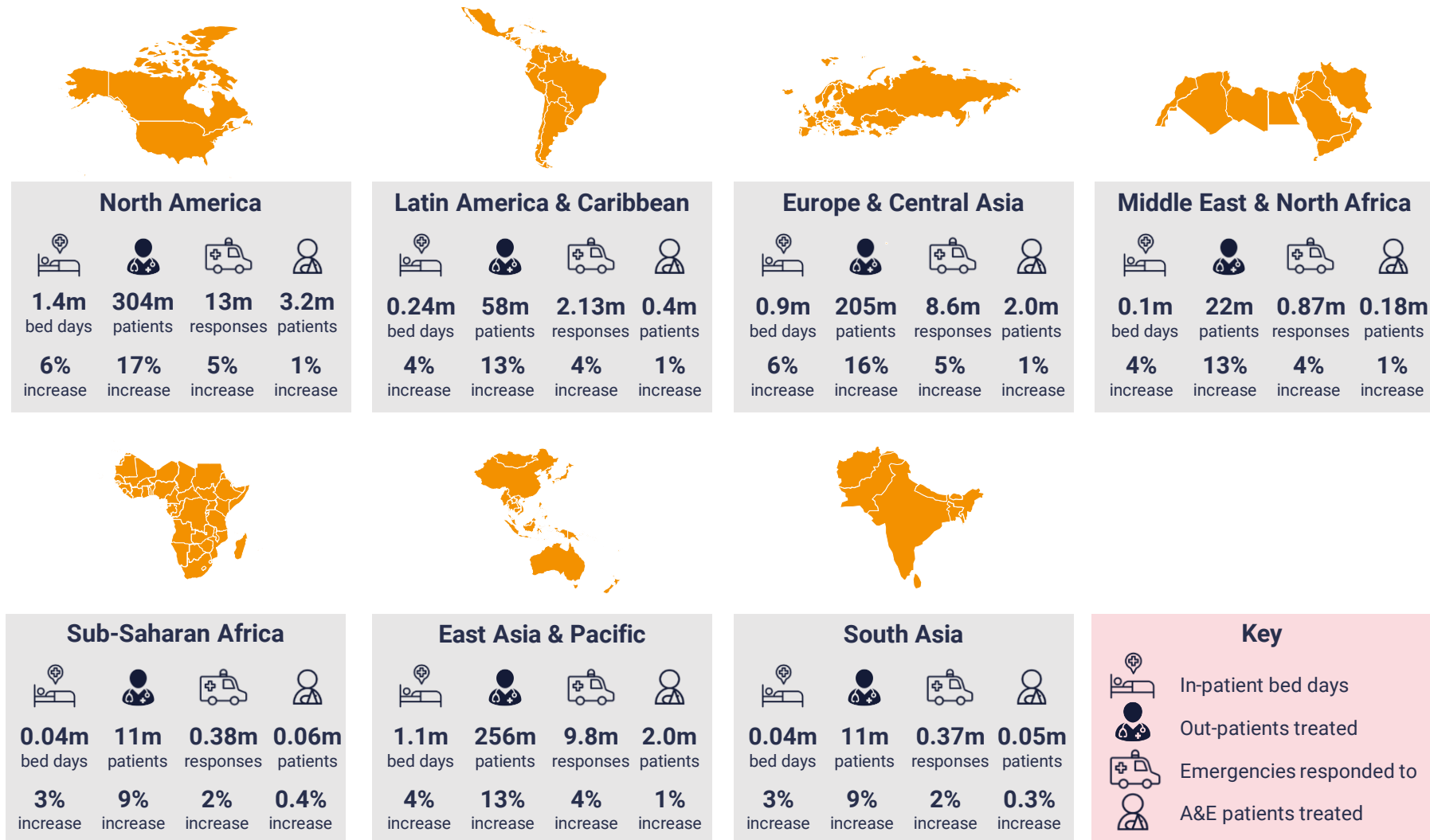These socio-economic benefits map onto the sustainable development goals (SDGs) as laid out by the United Nations (see Figure 14)[24].

Figure 14: 5G's impact on SDGs for healthcare

SDG	Impact
1 NO POVERTY	**MEDIUM** • Proportion of population living with **access to basic services** and **socio-economic resources** – such as healthcare infrastructure • The use of mobile technology (e.g. through remote patient monitoring and virtual consultations) helps **increase healthcare access**
3 GOOD HEALTH AND WELL-BEING	**HIGH** • **Reduce preventable incidences and mortalities** across both acute and chronic diseases • The **richer patient insights** provided by technology offer the opportunity to **improve treatment processes** and patient management

Source: UN SDGs

Figure 15: Estimated global impact of 5G by region across key contact points

North America

1.4m bed days	304m patients	13m responses	3.2m patients
6% increase	17% increase	5% increase	1% increase

Latin America & Caribbean

0.24m bed days	58m patients	2.13m responses	0.4m patients
4% increase	13% increase	4% increase	1% increase

Europe & Central Asia

0.9m bed days	205m patients	8.6m responses	2.0m patients
6% increase	16% increase	5% increase	1% increase

Middle East & North Africa

0.1m bed days	22m patients	0.87m responses	0.18m patients
4% increase	13% increase	4% increase	1% increase

Sub-Saharan Africa

0.04m bed days	11m patients	0.38m responses	0.06m patients
3% increase	9% increase	2% increase	0.4% increase

East Asia & Pacific

1.1m bed days	256m patients	9.8m responses	2.0m patients
4% increase	13% increase	4% increase	1% increase

South Asia

0.04m bed days	11m patients	0.37m responses	0.05m patients
3% increase	9% increase	2% increase	0.3% increase

Key

- In-patient bed days
- Out-patients treated
- Emergencies responded to
- A&E patients treated

Source: STL Partners

Next steps for the healthcare industry

To implement these 5G use cases, many technological requirements must be met. For example, remote patient monitoring relies heavily on advanced analytics capabilities and M2M type communications networks, and connected ambulances will only bring real value when ultra-reliable 5G connectivity/coverage is truly ubiquitous.

In addition, there is a need for coordination between many players – governments, insurers, healthcare professionals, administrators, patients and so forth. Many of these may resist such transformative change.

Members of the healthcare ecosystem must play their part to create a fertile ground for transformation. For example, enterprises should look for opportunities to partner in order to co-create applications and use cases, accelerate the creation and permeation of standards for technology in the industry, and tie together the necessary technological capabilities to deliver each use case.

The potential roles of two key segments of the healthcare ecosystem, regulatory bodies and the telecommunications provider, are detailed in the sections below.

The role of governments and the power of incentives

Within the healthcare sector, many markets are publicly governed and managed. This means that healthcare providers are at the whim of governmental policies, budgets, and strategies, making the role of the government pivotal in driving transformation. It will decide, for example, the targets healthcare providers must meet, as well as which initiatives receive allocation of resources. It will, therefore, be an important stakeholder with which organisations across the healthcare ecosystem will need to engage.

In markets with greater private ownership the government still has an important role in regulation, however it may be the insurance industry, as the chief funder of health, which holds the majority of power in driving change. An example would be monetary incentives for physicians to conduct virtual appointments. In certain states in the USA, doctors who implement new technology driven use cases, such as virtual consultations, receive compensation per virtual appointment. Even if it is the government who pushes for this incentive structure, it is the insurer who holds the cash and makes the final decision.

The significance of such incentives can be clearly seen in the levels of adoption between the US and the UK, two high income and developed countries. In our survey, when asked about the adoption and implementation of remote patient monitoring and virtual consultations, respondents from the US who were already widely adopting the use cases significantly outweighed those from the UK (15% and 21% respectively for the US versus 3% and 8% respectively for the UK). According to the interviewees we spoke to as part of this project, at least part of this difference is attributable to incentives encouraging adoption in the US.

Collaboration with the telecommunications industry

The role of regulatory bodies

Given their power over spectrum licenses and auctions, telecoms regulatory bodies have much sway in accelerating or decelerating the roll-out of 5G. Traditionally, selling off spectrum has occurred through a bidding process, with the telco offering the greatest sum of money receiving the spectrum license. Although large spectrum licensing fees are attractive in the short-term, they potentially inhibit service innovation and roll-out. Telecoms operators, who are already capex constrained in most markets, must invest upfront to acquire spectrum, leaving less investment for service innovation and network roll-out. This slows progress.

In place of a traditional bidding war, regulators could choose to allocate spectrum based on a "beauty contest". Here, the telecoms operator would provide a proposal for what they would do with the spectrum and how they would do it, to meet criteria defined by the regulator. These criteria could involve network coverage (e.g. 90% 5G coverage by 2030) or capabilities (e.g. the network will provide <10ms latency on average in all urban areas). There is a role for healthcare developers and providers to input into these beauty contests, helping to define the criteria and requirements which telcos must meet to acquire spectrum.

Regulatory bodies will also have a role in defining the 5G technology standards and therefore the capabilities that telcos must develop each year.

More on the role of the regulator can be found in STL Partner's report 5G regulation: Ensuring Successful Industrial Transformation.

Meeting the necessary 5G standards

The main role of the telco will be in providing the connectivity layer and the 5G capabilities necessary to deliver the use cases at scale. Although most operators globally have some level of 5G ambition, and many understand the potential value 5G brings outside of their traditional markets (e.g. traditional enterprise Wi-Fi/broadband or consumer mobile plans), there are still barriers that may prevent healthcare providers from leveraging 5G's capabilities.

- **Hindered roll-out:** operators are struggling to fund the investment required for 5G given the amount of capital expenditure that is needed, combined with the fact that telecoms operators' revenues are not growing proportionally to the rate of data growth.

- **Coverage:** telecoms operators will target major cities for 5G so they can maximise population coverage, however much of the benefit from healthcare use cases comes from reaching those in remote areas. Encouraging faster roll-outs to rural areas is therefore important.

- **Standards are still being set:** although targets have been defined (see Figure 16), the telecommunications standards body 3GPP is still in the process of defining the standards for the next release of 5G. This is important because it means that the 5G that has been launched so far by operators does not include the enhancements that will enable ultra-reliable low latency applications. This may slow 5G enhancements/upgrades.

Figure 16: Table of 3GPP 5G standards releases

Release 15	Release 16
2018	2019-2020
• Enhanced mobile broadband (e.g. mobile video streaming): speed, bandwidth, capacity • Fixed wireless access (using cellular technology for fixed broadband)	• Massive machine type communications (i.e. IoT): number of connections, low cost devices, low power, increased battery life • Industrial IoT • Ultra-reliable low latency (e.g. mission critical applications, augmented reality): reliability, latency • V2X (i.e. vehicle-to-anything: communications): connected/autonomous car use cases such as platooning, automated driving

To help accelerate roll-out and overcome the barriers mentioned above, industry players should seek to influence and input into the standards for 5G. By informing the 3GPP standards forum of the industry requirements and needs to deliver use cases, healthcare bodies can help to speed up the process of defining the standards, as well as remove unnecessary technological stipulations on the telco (which should help to speed up roll-out and increase coverage).

Collaborate with telecoms operators

In most markets, telecommunications is not synonymous with the provision of healthcare and in most cases, the main role of the telco will be in enabling the connectivity layer (see "Network as a Service" below). However, within the healthcare ecosystem, telcos will be a lynch-pin in the implementation and adoption of new digital use cases and may move to play beyond connectivity (see Figure 17).

This is, however, telco specific. Different operators, depending on their specific markets, strategies and capabilities will want to play in different parts of the healthcare value chain (see Figure 18). For example, TELUS have developed a health exchange platform, designed to enable the sharing and **management** of information across multiple third-parties, while others such as Telia provide an end-to-end service for its customers, white labelling the **solutions and applications** developed by healthcare enterprises.

TELUS and Telia are good examples that telcos, in many markets (and especially developing markets), are trusted local brand names and heavily regulated organisations. This puts them at an advantage over cloud/global players in being the face of a new technological application/use case, delivering an end-to-end service to the industry and coordinating across a diverse ecosystem of many third-parties.

Given the lack of IT expertise in the healthcare industry, the ability to aggregate solutions and provide an end-to-end service is essential to create scale for use cases. This ties into a concept STL Partners has been exploring in detail in our research called the "Coordination Age".

Figure 17: Telcos will have a role beyond connectivity

Source: STL Partners

Enterprises should look to partner with the telco to extend their reach into new markets and help drive adoption of technology in the industry. More on these new telco business models and how enterprises could seek to collaborate more effectively can be found in STL's Partners report 1.4tn of benefits in 2030: 5G's impact on industry verticals.

Figure 18: Telcos can play further up the value chain

Solutions and applications	Provide custom end-to-end solutions for customers, includes consulting and advisory services, systems integration and applications	Telia — Analytics ML/AI
Application Enablement	Aggregate applications and data from multiple partners to multiple users e.g. data management & sharing, billing / transactions, app marketplace	TELUS — Management Data platforms
Network-as-a-Service	Manage custom networks in a cloud-like way, i.e. ability for customer to scale up and down, define parameters (e.g. latency), and add other functionality	vodafone — Connectivity 4G/5G/Wi-Fi

Source: STL Partners

Conclusion

- In this report, we have demonstrated that 5G has unique capabilities that can transform the healthcare industry. Through the introduction of new use cases, 5G can help the sector **make better use of limited resources** and deliver better care to a larger number of people.

- Through improvements in performance, capacity, reliability and security, 5G's capabilities can significantly **improve the end user experience** of new use cases and applications. This is important in driving adoption of technology in the healthcare industry where the end user (often the patient) is behaving more like a traditional consumer.

- In the report, we have detailed and quantified the benefit for three industry use cases:

   1. **Remote patient monitoring:** real-time streaming, analysis, and monitoring of patient data from e-health devices and patient wearables.

   2. **Virtual consultations via high-definition video:** HD, two-way video streaming between doctor and patient (e.g. for routine appointment) or primary care and specialist doctor (e.g. for a referral appointment).

   3. **Connected ambulances:** real-time streaming of patient data and information from sensors and high-definition cameras between ambulance crews and in hospital emergency departments.

- At an aggregate global view, these use cases (plus others which we have not quantified in detail but have assumed would make up c. 20% of total benefits) could bring **cost savings of almost $94 billion** to the industry in 2030

- However, in healthcare, **it's not all about the money**. Although we have forecast annual cost savings of $94 billion in 2030, the real value comes from reallocating this resource to treating more patients and **increasing the reach and access of healthcare expertise** across the globe. This will lead to a billion extra patients being treated globally per year.

- On top of the benefits to both costs and patient throughput, 5G brings other socio-economic benefits which we have not quantified in this report. The use cases cited will also **reduce mortality rates** across the globe and **increase well-being of patients** suffering from NCDs.

Key recommendations for the industry

- In order to take full advantage of 5G and the benefits it could bring, healthcare enterprises will need to take an active role in the acceleration of 5G roll-out and use case adoption, and the development of new services/solutions. This includes:

   1. Aiding the regulator in building key criteria and requirements for 5G spectrum "beauty contests"

2. Inputting into the development of 5G standards and regulation

3. Collaborating with the telecoms operator to co-deliver solutions and drive adoption of technology

STL PARTNERS

Research

Consulting

Events