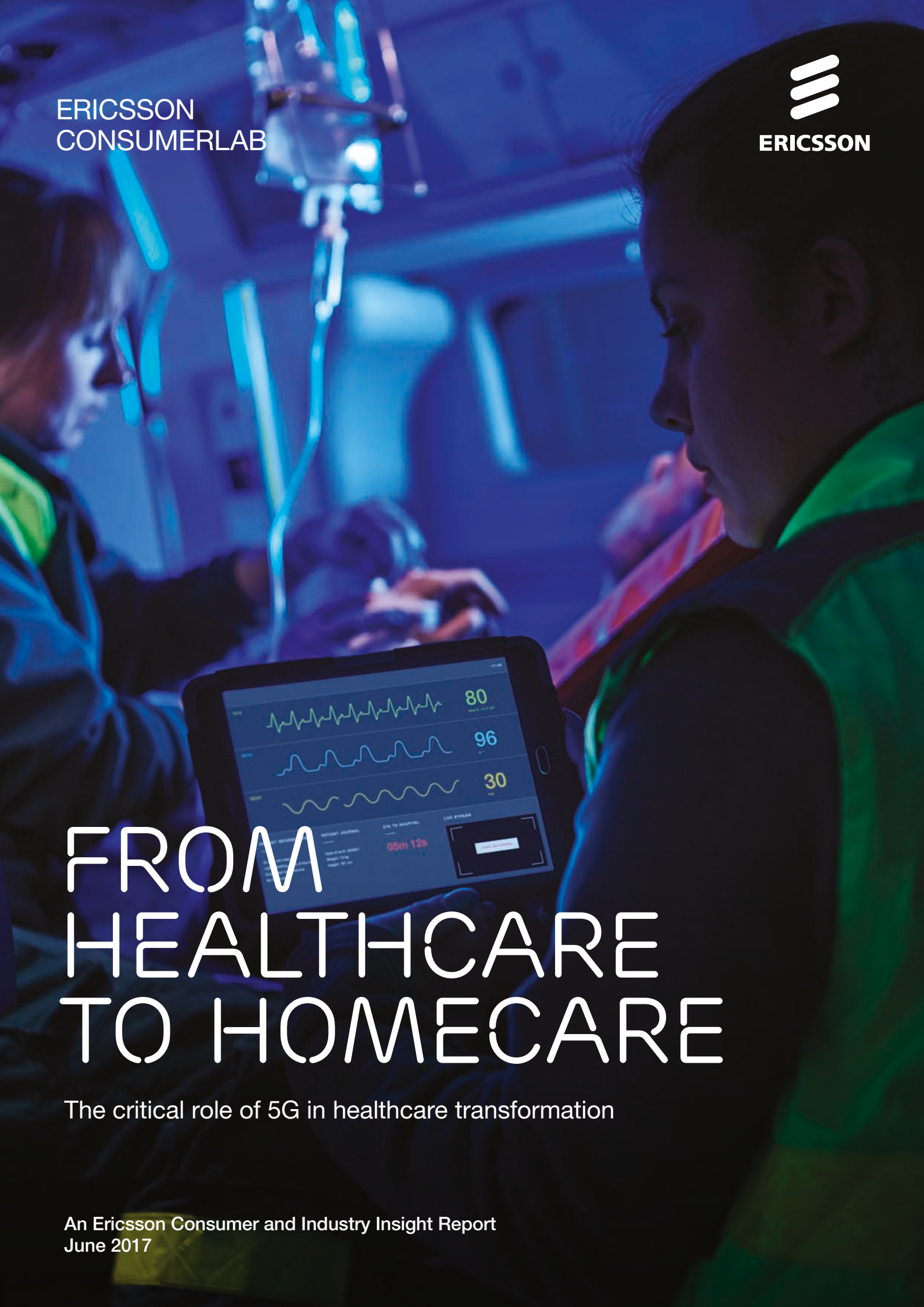
ERICSSON
CONSUMERLAB

ERICSSON



FROM HEALTHCARE TO HOMECARE

The critical role of 5G in healthcare transformation

An Ericsson Consumer and Industry Insight Report
June 2017

CONTENTS

METHODOLOGY

Quantitative study

This report presents insights from an online survey of 4,500 advanced smartphone/mobile broadband users aged 18–69 carried out in February 2017. The respondents were based in Germany, Japan, South Korea, the UK and the US.

Respondents were smartphone users on mobile broadband, who have higher than average use of fitness trackers, smart watches, and health apps to monitor their health. Although this represents only 16 percent of the total population of over 650 million living in these 5 countries, the health monitoring behaviors of these respondents help us predict future trends in healthcare evolution.

Expert interviews

An online survey of 900 decision makers across 6 industries – healthcare, insurance, medical technology companies, telecom operators, app developers/aggregators and government regulatory bodies – was carried out in Germany, Japan, South Korea, the UK and the US.

Qualitative study

Two consumer focus group discussions in the US and the UK, plus in-depth interviews with 6 post-operative care patients and 17 industry decision makers from 6 industries were conducted across Japan, South Korea, the UK and the US in August 2016.

Definitions used in the study

Preventative healthcare: People maintaining a healthy lifestyle for themselves and their family by being proactive about their health.

Routine patient care: Care for those who are already diagnosed with chronic health issues (such as diabetes or asthma) and are on medication.

Post-operative care: Care for patients who are recovering from surgery, but may need unscheduled emergency care.

THE VOICE OF THE CONSUMER

Ericsson ConsumerLab has 20 years' experience of studying people's behaviors and values, including the way they act and think about ICT products and services. Ericsson ConsumerLab provides unique insights on market and consumer trends.

Ericsson ConsumerLab gains its knowledge through a global consumer research program based on interviews with 100,000 individuals each year, in more than 40 countries and 15 megacities – statistically representing the views of 1.1 billion people.

Both quantitative and qualitative methods are used, and hundreds of hours are spent with consumers from different cultures. To be close to the market and consumers, Ericsson ConsumerLab has analysts in all regions where Ericsson is present, developing a thorough global understanding of the ICT market and business models.

All reports can be found at:
www.ericsson.com/consumerlab

TRANSFORMING CARE

Today, consumers have the power to take control of their health through smartphone apps, wearables and other connected devices – and it has never been easier to lose weight, improve sleep, count calories and get fit. This kind of simple, immediate access is also changing consumer attitudes and expectations when it comes to healthcare.

However, consumer needs differ from healthcare industry priorities. While consumers are frustrated with doctor wait times, the industry is becoming a victim of its own success – a history of improved care has led to more patients, rather than fewer, and the emergence of increasingly complex ailments. In order to keep up, the healthcare industry needs to reduce costs and improve efficiency. Information technology holds the promise of reducing costs by providing care away from hospitals and closer to home; whereas increasingly detailed data can move from patients to centralized healthcare repositories, allowing for efficiency gains in diagnosis and treatment.

Next-generation networks will be pivotal in this transformation, providing transmission efficiency in an ecosystem of feedback and alerts, mobility and low latency. They will become a vehicle for a range of applications, including remote monitoring through medical-grade wearables, virtual doctor-patient interaction, and remotely operated robotic surgery.

Here we explore the transformation across three healthcare situations: preventative, routine and post-operative care.

KEY FINDINGS

1. Healthcare becomes decentralized, moving from hospitals towards homes

- Consumers are frustrated with inconveniences and doctor wait times; 39 percent of chronic patients prefer online consultations to face-to-face meetings
- Close to two in three consumers say wearables that monitor and administer medication are important to better manage chronic ailments, leading to reduced visits to the doctor
- More than half of cross-industry decision makers feel decentralizing healthcare to local centers will improve efficiency and address resource scarcity

2. Patient data is centralized, turning hospitals into data centers

- 35 percent of consumers say that online access to a central repository of medical records will help them easily manage the quality and efficiency of their care; 45 percent of cross-industry experts consider the central repository as a breakthrough in healthcare provisioning
- Access to patient data is considered important to improve healthcare. Doctors will become data scientists and data security will become paramount, as 46 percent of cross-industry decision makers already consider data security to be an issue

3. Increasing dependence on wearables and remote treatments makes 5G essential to provide reliable and secure services

- 56 percent of consumers worry about their wearable health patches running out of battery; 42 percent of cross-industry decision makers expect devices connected to 5G networks to consume less power
- 61 percent of consumers say remote robotic surgery is risky as it relies on the internet; and 35 percent of cross-industry decision makers expect 5G to provide reliable low-latency connections
- 47 percent of telecom decision makers say that secure access to an online central repository is a key challenge and expect 5G to address this

CLOSER HEALTHCARE

Where have all the doctors gone? What will become of multistory hospital buildings? These are all questions that we could be asking in the not-so-distant future.

Consumers are demanding greater control over when, where, how and whom to engage for their healthcare needs. With increased smartphone app usage and shared experiences through social media, this is a change that is gaining momentum.

This growing consumer need for control is further augmented by three developments in the healthcare field: the use of wearables to monitor health and administer medication remotely; the rise of online consultation; and the use of remote procedures (such as robotic surgery) performed at local hospitals closer to patients.

Gaining control over health

Consumers want to stay healthy through preventative measures such as regular health check-ups, daily exercises and a healthy diet. Over 60 percent of surveyed consumers are ready to use wearables as a preventive measure for checking abnormalities and countering chronic ailments, including heart diseases, cancer and diabetes. In addition, consumers say wearables will lead to healthier lifestyles, and personalized care (Figure 1).

Although consumer-grade wearables are being widely used for preventative measures, 55 percent of healthcare decision makers from regulatory bodies say these devices are not sufficiently accurate or reliable for diagnosis. In addition, for liability reasons it will be very difficult to rely on patients' smartphones for connectivity.

To reliably measure biomedical signals – such as ECG, EEG, blood pressure, blood sugar, body temperature and stress – medical-grade wearables will be required. Such devices could also automatically dispense medicine and offer convenience to those recovering from surgery. Last year, the US Federal Drug Administration (FDA) approved the first automated medical device that monitors the blood sugar levels for type 1 diabetes and automatically injects a dose of insulin.[1]

To manage chronic ailments, close to two in three consumers would like to monitor their health and ensure that they take medication on time. The openness of the industry to use medical wearables is evident; half of cross-industry decision makers interviewed say that wearables could replace routine healthcare services with automated solutions and help bring care closer to patients. However, at the same time, constantly being monitored is a concern for half of all consumers surveyed.

Figure 1: Consumers' perception of how wearables can improve preventative care

62%
Agree that wearable devices will put people in control of their own health

58%
Agree that wearable devices with feedback and alerts will provide personalized care

60%
Agree that wearable devices will lead to a healthier lifestyle

Source: Ericsson ConsumerLab, From healthcare to homecare, 2017
Base: 4,500 smartphone mobile broadband users, across Germany, Japan, South Korea, UK, US, aged 18-69

> "Imagine something measuring my blood pressure and sending the data automatically to an app that my doctor and I can easily access. That would have saved me from visiting the emergency room and paying out of my pocket. And if that could be made as a portable device, it would be more convenient for me."
>
> **Pregnant woman, US**

[1] Source: www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm522974.htm

IMMEDIATE, ATTENTIVE CARE

With the rise of consumerism in healthcare, there is an increase in the number of choices available to the consumers. Insurance and healthcare providers are now operating in a more competitive environment. Consumers are no longer satisfied with being passive – patients are demanding quick, personalized attention.

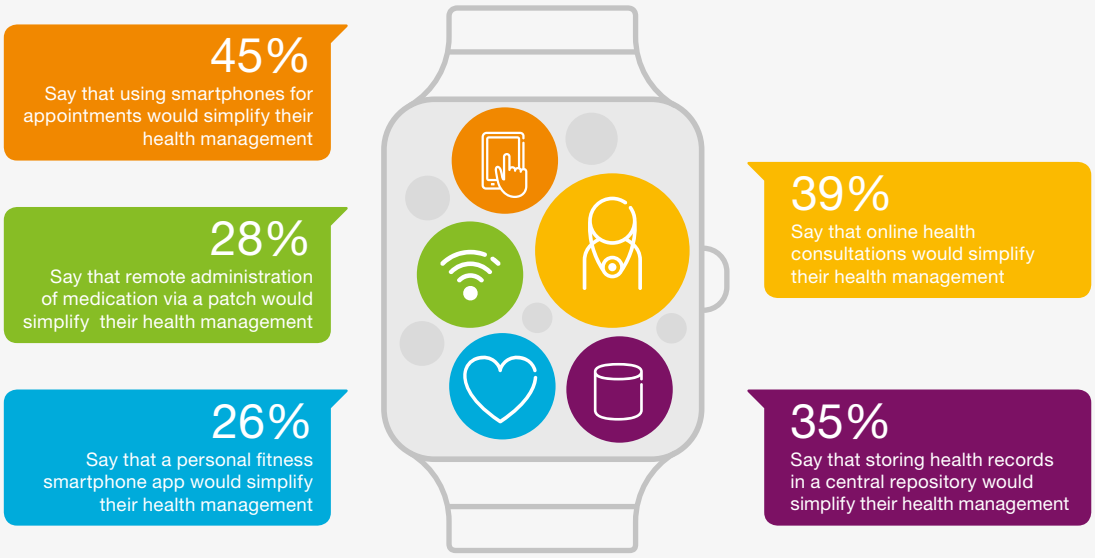
Currently, more than one in two patients with chronic ailments are frustrated by long appointment wait times, their inability to get a convenient appointment and non-availability of doctors of their choice. Consumers are also frustrated by the inability to get personalized attention from doctors. In light of this, the internet is helping to reduce in-person visits to doctors. Some 39 percent of chronic patients say online consultations with doctors will make it easier to manage their health compared to face-to-face meetings.

In addition, the prolonged wait time for meeting a specialist is a well-known healthcare industry challenge.

For example, in 2014, the average wait time from assessment to treatment in OECD countries was 88 days for cataract surgery and 42 days for coronary bypass.[2] Fifty-six percent of consumers say robotic surgery would reduce wait times for surgical operations, while 48 percent say it could increase access to specialist care. In addition, remote procedures will help move care closer to where patients live; if not into their homes, then at least to local healthcare centers. More than one in two consumers are open to remote robotic surgery in emergency situations.

> “It [remote robotic surgery] means you don’t have the whole waiting thing. You could plan things now because you know, ‘right, that’s going to get done’. Otherwise you have to put it off.”
>
> **Female, UK**

Figure 2: Consumers’ perception of activities that simplify health management



Source: Ericsson ConsumerLab, From healthcare to homecare, 2017
Base: 4,500 smartphone mobile broadband users, across Germany, Japan, South Korea, UK, US, aged 18-69

[2] Source: OECD November 4, 2015. www.oecd-ilibrary.org/social-issues-migration-health/health-at-a-glance-2015/waiting-times-for-elective-surgery_health_glance-2015-43-en

STAYING CLOSER TO HOME

The world population aged 60 and above is projected to reach 2 billion by 2050, and among them 21 percent are likely to be aged 80 or above.[3] Caring for the elderly is a challenge; as an example, in the last decade, there has been a 9 percent decline in the number of skilled nursing homes in the US due to escalating costs and scarcity of resources. Meanwhile, elders want to stay at home longer and be independent, due to which over 70 percent of consumers worry about elderly patients being left unattended – exposed to in-home slips and falls, and not taking prescribed medicines.

Medical wearables can be a boon to elderly or homebound patients, and help with remote monitoring and medication. Some 48 percent would like to have home sensors that monitor the elderly, detect emergency situations and send alerts that dispatch ambulance services when required.

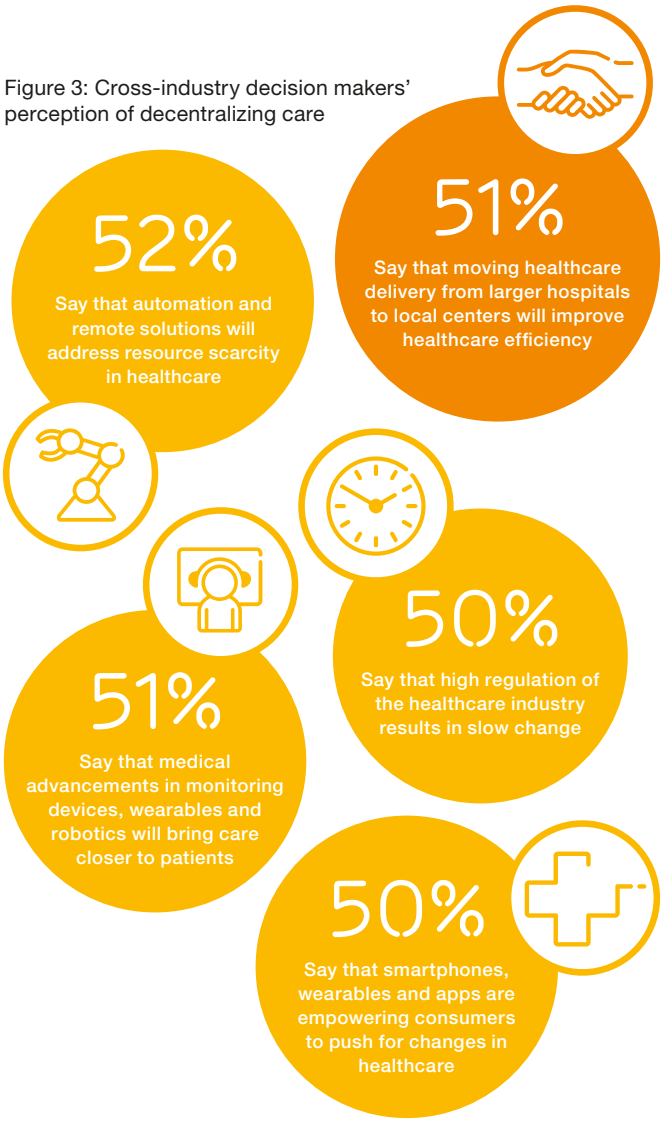
Decentralizing care

Both consumers and the industry expect care to move out of centralized hospitals, but for different reasons; patients primarily think about convenience, whereas the healthcare industry considers cost savings. Seventy percent of consumers with chronic ailments feel care closer to home gives quicker access to care and helps manage health conditions better. At the same time, 51 percent of cross-industry decision makers say that moving care from larger hospitals to local healthcare centers can reduce costs and improve overall efficiency.

Interestingly, the impending decentralization will likely lead to centralization of resources. Specialists and medical experts will increasingly be located in central hospitals, while funding will be directed towards equipping local healthcare centers with infrastructure and equipment – which will in turn be operated by the experts from central locations.

However, the costs involved in equipping local centers to enable remote procedures, along with non-availability of physicians trained in the new technology, can act as barriers to these changes.

Figure 3: Cross-industry decision makers' perception of decentralizing care



Source: Ericsson ConsumerLab, From healthcare to homecare, 2017
Base: 900 cross-industry decision makers across, healthcare, insurance, regulatory bodies, app developers, telcos and medical-technology companies

[3] Source: www.un.org/en/development/desa/population/publications/pdf/popfacts/PopFacts_2014-4Rev1.pdf

DATA-BASED HEALTHCARE

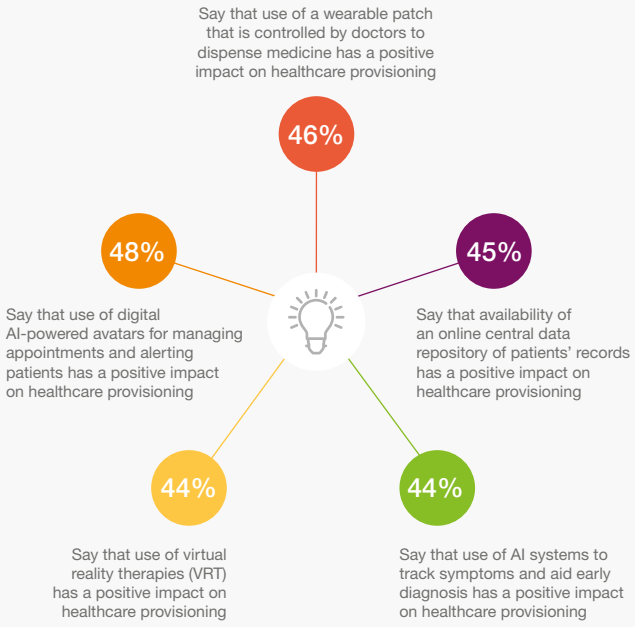
As care moves away from hospitals, increasingly detailed patient information will in fact flow back to the hospitals. Increased use of wearables, sensors and other connected devices will generate large volumes of diagnostic data, which need to be combined with electronic health records (EHRs) from clinicians and stored at a secured central location.

Paradoxically, as improved healthcare helps people live longer, healthcare systems come under increasing pressure as older patients need more care. The resulting resource shortage is forcing the industry to become more and more dependent on automation, remote treatment and artificial intelligence (AI).

AI systems have the potential to provide physicians and researchers with clinically-relevant, real-time information from centralized data repositories. Forty-four percent of cross-industry decision makers feel that insights based on analysis of such complex data will speed up diagnosis.

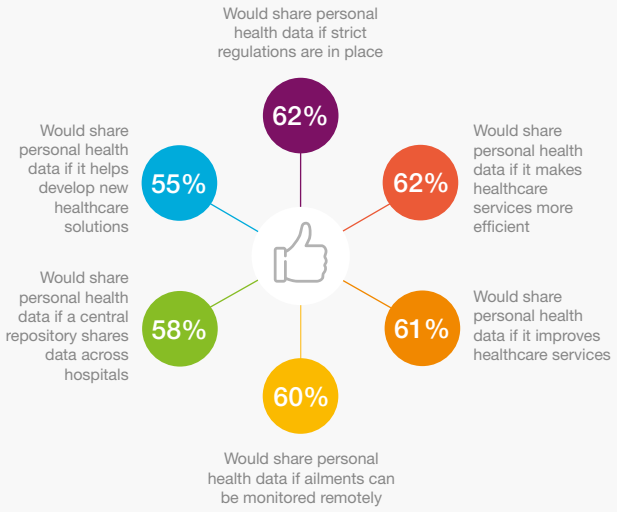
Access to patients' health records during routine consultations can improve diagnosis and reduce medical errors during emergencies. Although doctors are physically away from patients, their data offers a closer view than ever before. Over 40 percent of cross-industry decision makers say dispersed patient data is a serious concern in the current healthcare system, while 45 percent feel giving doctors online access to centralized patient data will positively impact healthcare services (Figure 4).

Figure 4: Cross-industry decision makers' perception of key applications that positively impact healthcare



Source: Ericsson ConsumerLab, From healthcare to homecare, 2017
Base: 900 cross-industry decision makers across, healthcare, insurance, regulatory bodies, app developers, telcos and medical-technology companies

Figure 5: Consumers' reasons for sharing personal health data



Source: Ericsson ConsumerLab, From healthcare to homecare, 2017
Base: 4,500 smartphone mobile broadband users, across Germany, Japan, South Korea, UK and US, aged 18-69

Consumers also support this data-centric development. Three in five are open to sharing data with healthcare providers and making it available in a central repository – if it improves the healthcare services they receive, helps monitor chronic ailments, and improves the quality of diagnosis and reduces wait times (Figure 5).

However, 61 percent of patients with chronic ailments feel concerned about data from health patches being used without their permission. Some 46 percent of cross-industry decision makers agree that data security is an issue for online and remote healthcare services.

Although a centralized repository can be used to make informed clinical decisions and provide remote care when needed, any sudden outage, such as a connectivity failure, can make patients feel unsafe. For instance, human error recently caused the outage of Amazon Web Services (AWS), resulting in disruption of many websites' services.[4] Such an outage in the healthcare system could have fatal implications – meaning that, as care moves closer to patients and data moves to central repositories, high-availability networks and data centers become critical.

[4] Source: BBC, February 28, 2017, www.bbc.com/news/world-us-canada-39119089

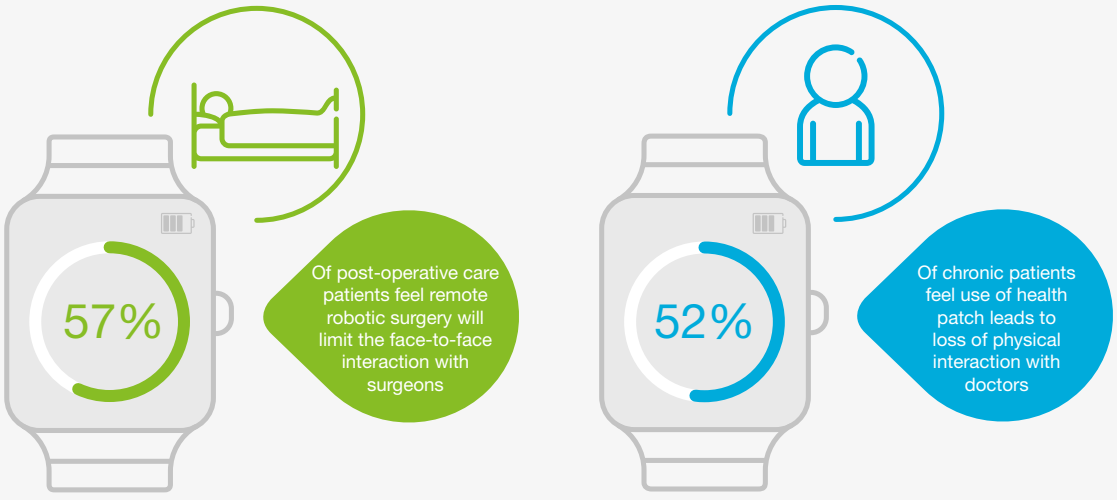
LOSS OF HUMAN INTERACTION

As care moves closer to patients' homes, the industry will face new challenges. The transformation will make online interactions more common, which threatens a crucial human element of care: the doctor-patient relationship.

Some 52 percent of patients with chronic ailments are concerned that the use of health patches will lead to loss of physical interaction with doctors. Being in a hospital post-surgery makes it possible to get opinions from a variety of experts on the best treatment options. Unsurprisingly, 57 percent of consumers receiving post-operative care feel remote robotic surgery will limit face-to-face interactions with healthcare experts.

While centralized health records help to provide personalized patient care, they can also lead to dehumanizing the patient. A patient may become just a record in the database leading to a doctor failing to establish an emotional connection with the patient. Increased use of automation and reliance on remote technology in healthcare may also make it difficult and expensive to have physical access to a doctor. This could potentially lead to a class divide where the rich would be able to afford face-to-face interactions with doctors, while the poor would be relegated to automated healthcare services.

Figure 6: Consumers' perception of remote procedures and online consultations



Source: Ericsson ConsumerLab, From healthcare to homecare, 2017
Base: 4,500 smartphone mobile broadband users, across Germany, Japan, South Korea, UK, US, aged 18-69

5G: DECENTRALIZING CARE, CENTRALIZING DATA

The proliferation of machine-type IoT sensor communications poses the challenge of connecting many devices communicating at low-data rates.

For instance, in remote health monitoring, wearable devices – such as heart monitors and glucose monitors, require high frequency updates of the central data repository at low-data rates. Experts say that existing networks cannot provide the desired quality of support while connecting a large number of such devices, and they believe that 5G can address this challenge.

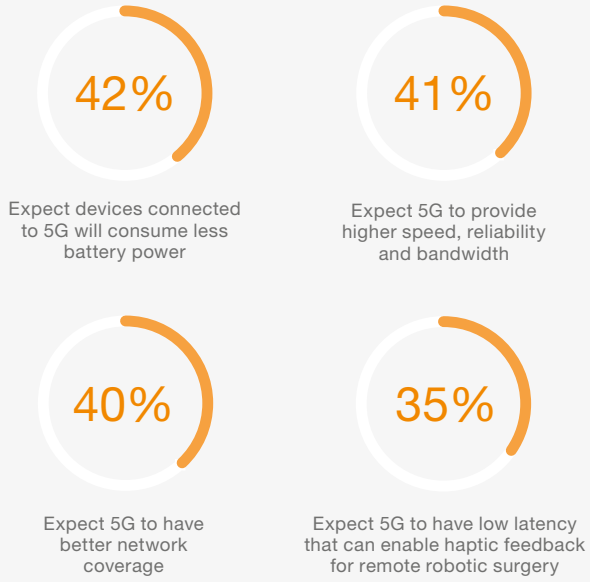
As healthcare becomes more dependent on wearables and connectivity, consumers express concern about reliability. In fact, 59 percent of consumers say that they are concerned about poor connectivity affecting data transmission. Battery charging is another issue – 56 percent of consumers with chronic ailments worry about their health patches suddenly running out of battery. Forty-two percent of cross-industry decision makers expect devices connected to 5G networks to consume less power, reducing the frequency of recharges.

Telecom operators could enable medical grade devices that connect directly to the internet rather than relying on the patient's own smartphone.

Use of a centralized repository to store patient health records will expose healthcare to data breaches. Forty-seven percent of telecom decision makers say that developing secure networks to access an online central repository is a key challenge. 5G networks are expected to be secure enough to adhere to sensitive patient data regulations.

> "As long as the patient stays within connectivity range, it will work – but what happens when she goes into a black spot with no connectivity, no mobile signal?"
>
> Telecom decision maker, UK

Figure 7: Cross-industry decision makers expect 5G to be a key enabler of transformation



Source: Ericsson ConsumerLab, From healthcare to homecare, 2017
Base: 900 cross-industry decision makers across, healthcare, insurance, regulatory bodies, app developers, telcos and medical-technology companies

In addition, 5G is also expected to significantly improve connectivity. For instance, 35 percent of cross-industry decision makers expect 5G to provide reliable and sub-1ms latency connections, which enable haptic feedback to underpin surgeons' capabilities to carry out remote robotic surgery.

Providing low latency over long distances is a challenge due to the constraints imposed by the laws of physics. Although fiber can deliver low latency connectivity, experts say 5G would be preferable for availability reasons. While optical fiber is used for backhaul network, 5G is most likely to provide the last mile connectivity which is also mobile. Flexibility in terms of moving equipment around to locations where fiber is not available might be a reason for higher preference for 5G over fiber.

Furthermore, highly-immersive virtual simulations are increasingly used to train healthcare professionals in critical medical procedures, while remote procedures such as robotic surgery will be conducted in a virtual environment. Like haptic feedback, virtual reality demands low-latency and high-bandwidth communication for effective operation.

INDUSTRY DISRUPTION

Evolving consumer expectations, anytime patient data access, and increased internet use – all of these are making way for non-traditional players to disrupt the healthcare industry.

Medical technology manufacturers, aggregators and app developers already offer services that move healthcare away from hospitals. For instance, devices from Israeli start-up Tyto and Las Vegas-based MedWand Solutions allow doctors to remotely examine patients at home.[5]

Non-healthcare players, including app developers and telcos, already generate 13 percent and 9 percent of their respective total revenues from healthcare. Cross-industry experts say that by 2020 it is expected to reach 19 percent and 13 percent respectively. Additionally, over the last 7 years, digital health start-up investments have risen from USD 1.5 billion to approximately USD 7 billion.[6]

More sophisticated devices and applications are under development. As an example, Alphabet's Verily is introducing a smartwatch for medical research that tracks heart rate, body movements and ECG to detect heart problems.[7] Also, Swansea University in the UK is planning trials of smart 3D–printed bandages that use 5G wireless data and nano-sized sensors to relay health details, helping doctors to personalize treatment based on the progress of the wound.[8]

Telecom operators have an integral role to play in healthcare transformation – not only as a 5G network provider, but also as a service enabler and creator. Eighty-six percent of cross-industry decision makers feel telcos need to go beyond connectivity, assuming greater responsibility by providing system integration, and app and service development.

[5] Source: The Wall Street Journal, September 25, 2016, www.wsj.com/articles/new-gadgets-that-could-give-telemedicine-a-boost-1474855442
[6] Source: The Economist, March 2, 2017, www.economist.com/news/business/21717990-telemedicine-predictive-diagnostics-wearable-sensors-and-host-new-apps-will-transform-how?cid1=cust/ednew/n/bl/n/2017032n/owned/n/n/nwl/n/n/n/9012562/n
[7] Source: MIT Technology Review, April 14, 2017, www.technologyreview.com/s/604198/googles-verily-unveils-a-health-watch-for-research/amp/
[8] Source: Engadget, April 16, 2017, www.engadget.com/2017/04/16/smart-bandages-with-5g/

A need for collaboration

For this transformation to succeed, collaboration is necessary between different players. Cross-industry decision makers consider internet companies (such as Apple, Google, Microsoft and IBM), telcos and app developers to be the top three preferred partners for healthcare.

For wider adoption of wearables, the recommendations of doctors and acceptance from health insurance companies become key issues. For example, the UK's National Health Service (NHS) offers free apps and devices to manage chronic diseases, such as diabetes.[9] For remote treatment and surgery to become mainstream, insurance companies need to cover such treatments.

Healthcare is a highly regulated sector and the non-healthcare players must remember that on average it takes 10 years for a biotech firm to get product approvals, compared to just a 3-year investment cycle for an IT start-up.[10]

A recent high-profile failure of low-cost blood test provider, Theranos, has highlighted the need for technology companies to collaborate with healthcare providers to improve services.[11] As connectivity becomes important, hospitals will not be able to rely on consumer-grade devices or connectivity for liability reasons. Hospitals need to work in collaboration with medical technology companies and telcos to develop medical wearables that can connect to the internet independent of the patients' own smartphones.

In addition, a collaborative approach is needed to engage patients in setting health goals and action plans to attain them. The needs of the consumers in preventative, routine and post-operative healthcare situations are different and need to be resolved using different approaches. The transformation of care moving closer to home and data moving from patients to hospitals is going to be driven by the needs of patients with chronic ailments, and it is likely to benefit these patients the most.

> "If something goes wrong, which end of the communication will they go after? I can just see a whole industry of transmission forensics. Where did the signal slow down? Was that within their nominal parameters and if it isn't, was it negligence?"
>
> **Surgeon, US**

[9] Source: The Guardian, June 17, 2016, www.theguardian.com/society/2016/jun/17/nhs-to-offer-free-devices-and-apps-to-help-people-manage-illnesses
[10] Source: Harvard Business Review, May 2006, https://hbr.org/2006/05/why-innovation-in-health-care-is-so-hard
[11] Source: Wired, October 15, 2015, www.wired.com/2015/10/theranos-scandal-exposes-the-problem-with-techs-hype-cycle/

We are a global leader in delivering ICT solutions. In fact, 40 percent of the world's mobile traffic is carried over Ericsson networks. We have customers in over 180 countries and comprehensive industry solutions ranging from Cloud services and Mobile Broadband to Network Design and Optimization.

Our services, software and infrastructure – especially in mobility, broadband and the cloud –are enabling the communications industry and other sectors to do better business, increase efficiency, improve user experience and capture new opportunities.

Ericsson has one of the industry's strongest patent portfolios with a total count of over 42,000. R&D is at the heart of our business and approximately 23,700 employees are dedicated to our R&D activities. This commitment to R&D allows us to drive forward our vision for a Networked Society – one where everyone and everything is connected in real time – enabling new ways to collaborate, share and get informed.

Ericsson
Stockholm, Sweden
Telephone +46 10 719 0000
www.ericsson.com

GFTB 17:000075