

# Remote health care using 5G in Japan's mountainous areas for effective treatment

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A physical therapist conducts a remote medical interview at Shinshiro municipal hospital. Credit: Masaomi Saeki

Japan's population is rapidly aging. As a result, new challenges have emerged as an increased number of elderly people, many of whom live in isolated parts of the country, need medical and nursing care despite inadequate medical resources. Now, a group from Nagoya University in central Japan has found that in one remote community, using a high-

speed 5G network was effective in providing telerehabilitation and teletreatment.

Shinshiro in Aichi prefecture is a sparsely populated town located in the mountains of central Japan. Almost a third of its population is over the age of 65. A serious problem for its residents is the lack of doctors and [treatment options](#) because of the high cost of transporting medical personnel and equipment for home visits and rehabilitation. Such areas are, therefore, ideal for the introduction of telemedicine.

"While technological breakthroughs in the medical and nursing fields have brought many benefits to health care, the economic burden continues to increase," explains the lead author, Assistant Professor Masaomi Saeki.

"Japan has a noticeably aging population, and aging is a global phenomenon. It is currently happening in the countryside and in mountainous areas. We need a new way to provide health care in these areas. There is a need to reduce the demand for resources through [health management](#) and prevention by early intervention in health issues and to use medical resources effectively by improving work efficiency in medical and allied fields."

To investigate how 5G network telemedicine could contribute to medical care in remote communities, such as Shinshiro, a research group led by Saeki of Nagoya University Graduate School of Medicine, in collaboration with Nagoya University Hospital, RIKEN, and the telecommunications provider NTT, conducted telerehabilitation and telemedicine by operating a mobile ultrasound imaging system with 5G communications.

In recent years, there has been phenomenal progress in information and communication technologies such as 5G communication systems. These

are capable of high-capacity, high-speed communication with low latency, potentially revolutionizing telemedicine. The team of researchers sought to determine whether telemedicine and telerehabilitation were viable alternatives to in-person treatment by comparing the transmission of multiple high-definition images and [ultrasound images](#) using 5G and LTE (4G communications).

They published their results in the journal *Digital Health*.

For the telerehabilitation, the researchers observed gait training using two cameras: a fixed 4K [video camera](#), and a camera worn by the nurse who worked with the patient. Gait, walking speed, and joint positions were measured using motion capture as the patient performed muscle strength training of the lower limbs by walking, supporting their bodyweight with parallel bars.

Images were transmitted and monitored in real time by a physical therapist based at Shinshiro Municipal Hospital, who also provided guidance remotely to assist the nurse and the patient.

For telemedicine, the subjects underwent an abdominal ultrasound examination. The [medical staff](#) operating the probe wore a head-mounted camera, and transmitted the same images that they saw to Shinshiro Municipal Hospital in real time. A doctor at the hospital instructed the medical staff on how to conduct the probe.

"We found that 5G could transmit information, such as 4K images and ultrasound images, with high image quality and low latency," Saeki summarizes. "The difference between 4K images and ultrasound images transmitted by 5G and LTE (the 4G network) affected the subjective evaluation of doctors and physical therapists."

The difference between 5G and 4G was apparent. In the

telerehabilitation group, more physical therapists in the 5G group said the video quality was "good" and the delay was "acceptable", also reporting that they were able to communicate as normal. In the telemedicine group, participants in the 4G group said that delays caused by the network were unacceptable, whereas the 5G group reported them as acceptable.

Furthermore, although some patients said that they felt anxious before their first experience with telerehabilitation and telemedicine, none reported such concerns after their second experience in the 5G group. Several people, in fact, said they would prefer remote contact with a doctor in the future.

"Besides representing a breakthrough in advanced medicine, we expect this to reduce regional disparities in health care," concludes Saeki.

"Telemedicine allows patients to receive high-quality medical services without having to leave home or travel and to efficiently use medical resources. In addition, in combination with the Internet of Things, we expect it to help us diagnose health conditions from the predisease stage, which will contribute to preventive medicine and reduce the burden on medical resources. Telerehabilitation and [telemedicine](#) using mobile ultrasound systems with a 5G communication system will provide a useful resource for health care in aging and depopulated mountainous areas."

**More information:** Masaomi Saeki et al, Demonstration experiment of telemedicine using ultrasonography and telerehabilitation with 5G communication system in aging and depopulated mountainous area, *DIGITAL HEALTH* (2022). [DOI: 10.1177/20552076221129074](https://doi.org/10.1177/20552076221129074)

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