



Telehealth Technology, Service, and Research Trends: “Hospital in the home” Telemedicine based on the Internet with Ultra High Definition Television technologies

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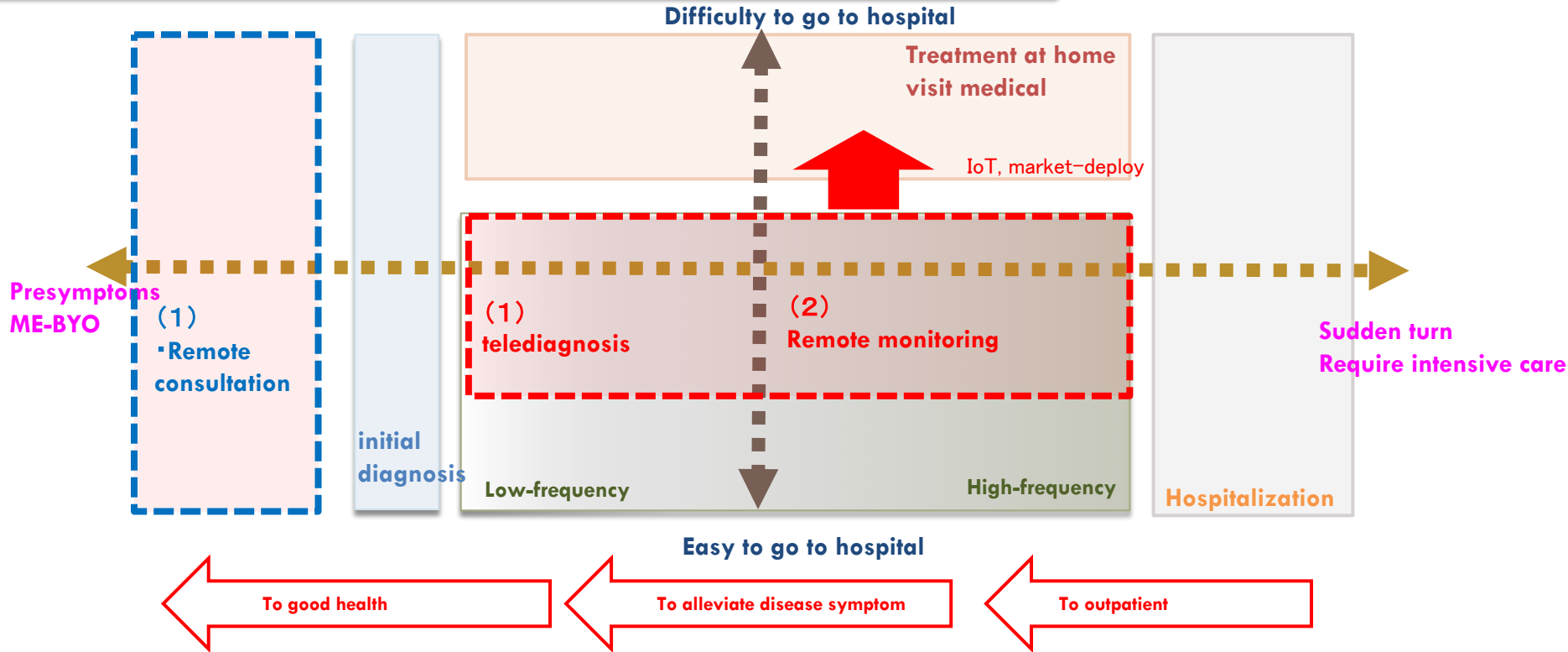
Outline

- “Well-being”, “Active ageing”
- Trial and demonstration of an environment where some functions of hospitals are extended to homes
- Challenge to replaceable advanced telemedical system from a system to complement face-to-face medical examination

*Design and practice of concept “future hospital” : Verification and brush up at **actual medical examination***

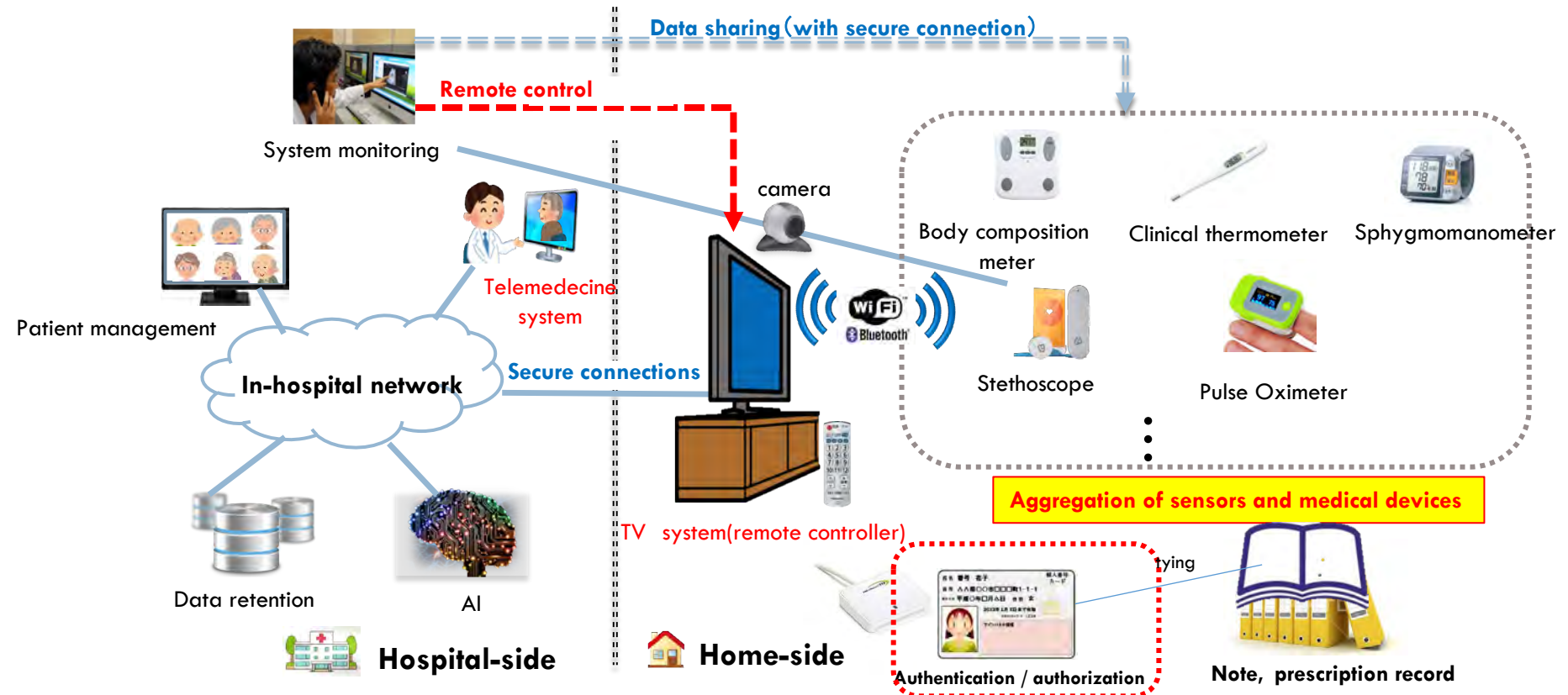
TARGETS

- (1) Remote consultation
 ME-BYO(people with difficulty to a clinic)
- (2) Teliagnosis, remote monitoring
 (stable)inpatient, outpatient who visit hospital frequently



Overview: Telemedicine platform with UHDTV

TV interface & affordance : for all generations



Field-trials

1. Pre-clinical trial of telemedicine

- Trial by real patients of “Shonan Keiiku Hospital” in patient’s home
- Divide 30 into 2 groups: face-to-face 15, telemedicine 15
 - Comparison on waiting time and outpatient burden
 - Approval by the Ethics Committee

2. Comparative demonstration on the quality of picture(camera and display)

- Demonstration environment in guest house @ Keio university
- 3 types of demonstration system with 10 subjects(experimental collaborators)

1. Pre-clinical trial of telemedicine



1. Remote call



2. setting(video and sound)

Pre-clinical trial of telemedicine



3. Telemedicine on the system



Home-side



Hospital-side

Comments from doctors

- I was not concerned about the delay of the network, I was able to do medical treatment that was not different from normal(F2F)
- When looking at a specific place such as throat, it takes time to focus/zoom operation(need more practice)
- Depending on the patient's illness, it is necessary to instruct the IoT device to be installed at the patient's house and to use it
 - ▣ The directions used periodically are desired for follow up the condition

Effect of telemedicine from the trial#1

1) Waiting time

	Waiting for examination	Waiting time for payment
F2F (n=15)	ave 15.5 min standard deviation 14.1	ave 14.0 min standard deviation 34.0
remote (n=15)	ave 10.2 min standard deviation 6.3	-

2) Burden of visiting to hospital

	average	Standard dev
Visiting time	77.5 min	54.6
Visiting costs	2063.3 JPY	1788.2
Waiting time from check in to examination	21.5 min	14.0
Time until out of the hospital from examination end	26.7 min	16.9

3) Comments from patients

Patients' comments from a questionnaire
It's a big advantage that there are no travel time to the hospital, medical examination waiting time and bill waiting time .
I'm happy that a medical examination can be received by the feeling that I relaxed .
Work (office work and house work) can be done in the waiting time.
Not to need to go to a hospital, I need neither time nor a cost, so it's profitable.
I think it's good for the household by which it has a child in particular. Children don't have wasteful sickness.
It's unclear whether a doctor grasps my condition.
I can use my time effectively without transportation issues

2. Comparative demonstration on the quality of picture

- Perform comparative verification with 3 patterns of telemedicine systems with different functions / quality
- Doctors in hospitals observe and compare 10 testers, each with different telemedicine systems



Shonan Keiiku Hospital

**10GbE
SFC Campus
Network**

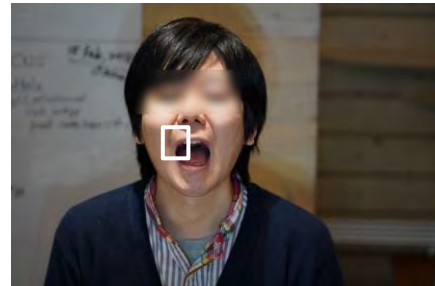


Guest house @ Keio university

2. Comparative demonstration on the quality of picture

1. Required quality and function for remote examination utilizing a telemedicine system
2. What can be used and expanded when **Ultra High Definition Television technologies** can be utilized (ex. 4K/8K quality)
→ *Effects of high resolution still images on examination (effective cases to be utilized)*

Difference in resolution(1)



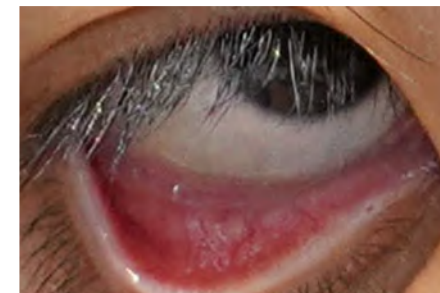
2K

4K

8K

As the state of the lips and the skin can be more clearly understood, it helps to grasp the nutritional status of patients and to identify rashes

Difference in resolution(2)



2K

4K

8K

Clearly see the state of the blood vessels of the conjunctiva and the boundaries of the eyes. It is considered to be useful not only for judgment of anemic condition but also for identification of anterior eye diseases such as conjunctivitis.



Comments from doctors

Quality and function of movies required for examination

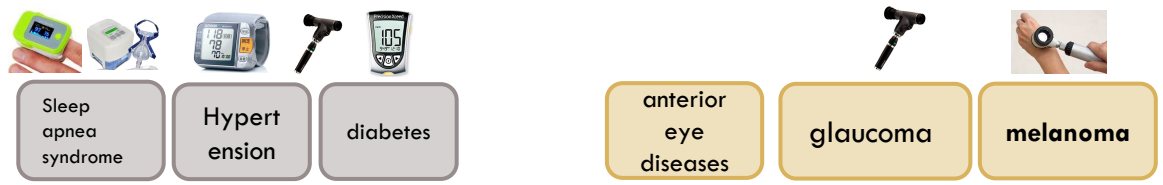
- Regarding image quality, High definition(2K) image quality is reasonable for follow-up of chronic disease
- If it is less than HD in quality, can be used for non smoking guidance and mental illness counseling
- Remote control(PTZ) of the camera is useful for examinations
 - Patient cooperation is also necessary (literacy)
 - More convenience will be achieved if LED illumination and fine angle of view can be adjusted
 - Regarding color balance, doctors do not care much if they can grasp the trend

Quality and function of pictures required for examination

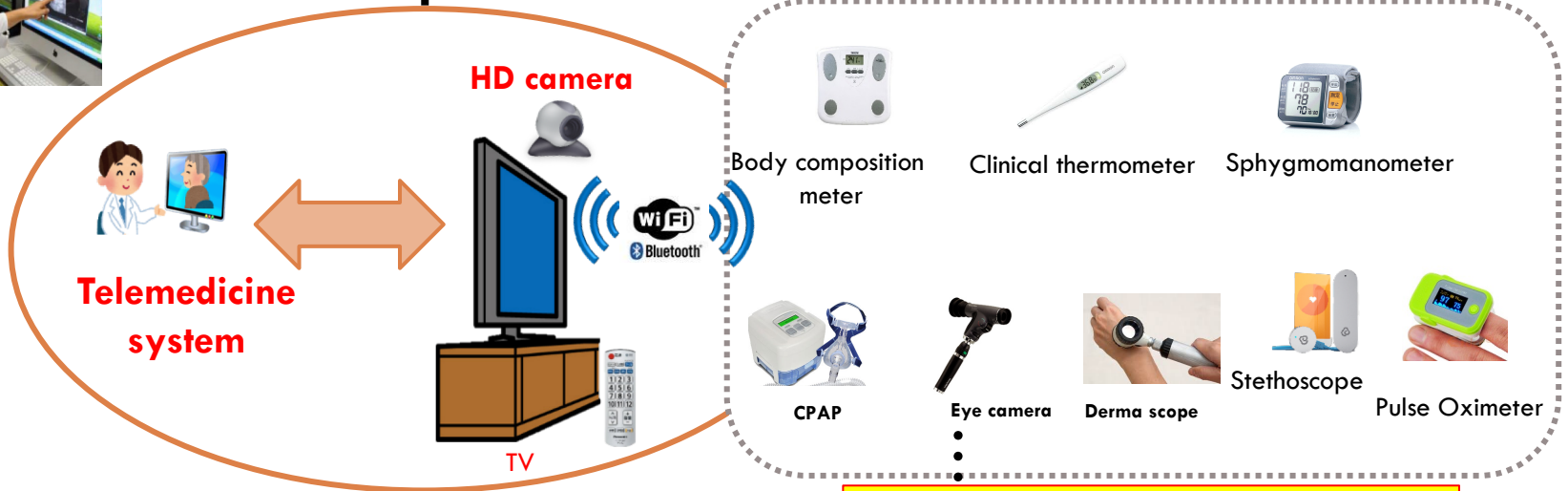
- More than Ultra-HD(4K) image quality is image quality that can be a reference for diagnosis
- 8K image quality certainly shows difference in examination of dermatology, etc.
- The value is increased by storing and consolidating images
 - Historical data analysis
 - Machine learning/deep learning

Future view/work for deploy

Use appropriate medical sensor device / resolution depending on disease



High Def Ultra-High Def



Hospital side



Home-side

Aggregation of medical sensors and devices based on patient-centric design

**THANK YOU FOR
YOUR
KIND ATTENTION**



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Introduction of “Hospital in the home” & field trial
Project Associate Professor, Masaaki SATO, Keio university