

# Real-Time Remote-Health Monitoring Systems: a Review on Patients with Chronic Diseases

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## Abstract

The aging society are causing complicated problems from chronic diseases such as diabetes, heart disease in aged patients. Recently Covid pandemic swept across global aging societies and put aged people with chronic disease more vulnerable to morbidity. Therefore, from view of preventive and precision medicine, remote monitoring an aged people with chronic disease is an important issue than ever. Smart health care systems as remote monitoring is so called telemetry system which enable doctors or health care providers to manage remotely to consult, diagnose and treat patients with chronic disease and infectious disease as well. The goal of telemetry system is to meet timely medical need in aged patients in distant place through communication technologies. Through technological breakthrough, particularly in real-time health care industry, Telemetry system with realtime monitoring of heart rhythm and blood glucose level can play an important role in managing healthcare services in aged patients. This report introduces a comprehensive and inclusive review on the usefulness of realtime patients monitoring with wearable sensors in telemedicine applications. The findings of this report are as follows: (1) The advantage of real-time monitoring and blood glucose level and biofeedback based on visual data (2) The advantage of realtime-monitoring heart rhythm coupled with blood glucose level. (3) There is an additional need to produce a digital imaging from portable diagnostic devices such as X-ray and ultrasound.

### Key words :

aging society, smart health care, remote monitoring, island Real-Time Remote-Health Monitoring Systems: a Review on Patients with Chronic Diseases

## Introduction

### Ageing society

The recent increase of aging population are becoming important than ever. [1] Aging society have been making complicated problems, which cause as striking growth of chronic diseases related with age and socioeconomic burdens as well. [1,2,3]. In the near future, the healthcare system is supposed to be saturated with many problems from the ageing population [1,2,3].

Serious problems in chronic diseases are related to heart failure, diabetes, and infection such as Covid-19 in ageing population[4,5]. Global pandemic of Covid-19 are making the aging population with chronic disease exclusively vulnerable to the morbidity from virus[4,5,6]... Moreover, many aged people with chronic disease are living on remote island, Therefore they are exposure to great challenge in the midst of Pandemic disaster[7].

Based on above situation, Healthcare professionals have great challenge to develop new healthcare system to overcome the increasing system burden. Recent breakthrough of ICT technologies enables healthcare providers to investigate how to enhance healthcare service systems responding to the ageing-population issue[7,8]. In the basis of the smart health care and new innovations, home care technology such as remote monitoring system is becoming new complimentary solution to transforming the healthcare industry(Fig 1).

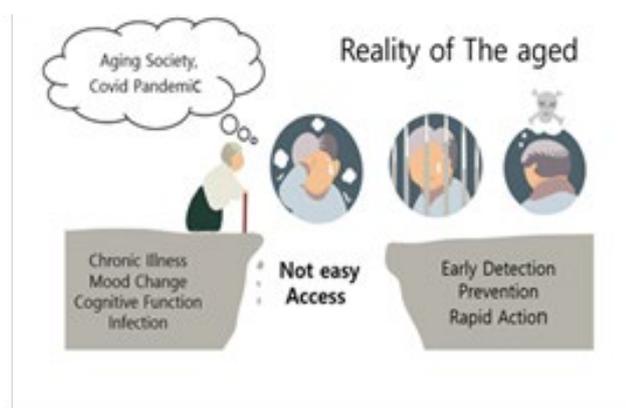
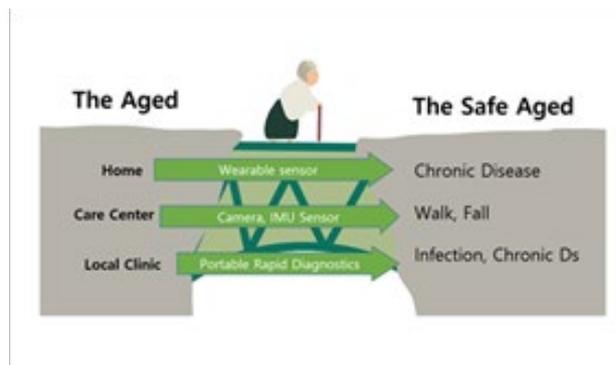


Fig 1. A Reality of The aged



B The role of smart health care on the path for easy access

## Transforming paradigm of Remote Home Care telemetry system.

Home care telemetry system provide an complimentary alternative to other conventional healthcare services, such as nursing homes and silver town. Smart home health care services can effectively compensate traditional healthcare[9,10]. Telemetry system such as real-time ECG monitoring and blood glucose monitoring facilitate the exchange of digital biomarkers via virtual communication system, between patients and physicians[11,12,13,14]. Measuring digital biomarkers of ECG and Blood glucose via an app installed on phone helps patients to visualize the life-log date during usual life and to modify their life style based on biofeedback of digital data from home care sensors(Fig 2). .

Moreover, we understand that health-related quality of life in patients with chronic disease in communication solutions. Often, patients may empowered by digital biofeedback by constant monitoring technology, such as wearables and smart home care devices. Advancements of home telemetry system that monitor blood glucose and heart rate enable health care providers become proper action planer at the first emergent sign of heart disease and at the life style modification in diabetes(Fig 3).



Fig 2. Remote Monitoring care system from local clinic to home.

### Potable diagnostic devices in both homecare and care center

In the field of home care diagnostics, we observe AI-powered diagnostic technologies such as portable X-ray and ultrasound are becoming challenge for patients in uneasy accessible area in home, isolated facilities, and even silver town as well[15,16,17,18]. An Innovative technology to produce diagnostic digital images form potable devices which healthcare providers carried out can be effectively transferred to not only local network but also to distant hospital, Therefore can be connect digital images with appropriate healthcare professionals when needed. AI-powered digital image technology is specifically promising in early detection; intelligent platforms can assist in decision support and help recognize acute conditions in patients with fatal infectious disease just like Covid-19(Fig 3).

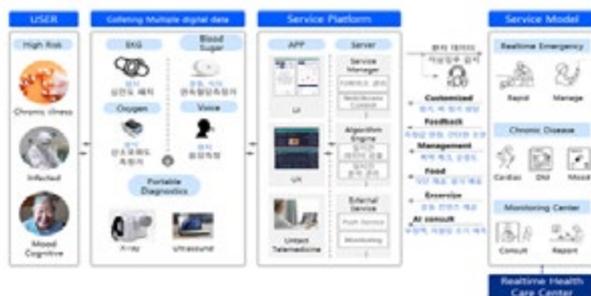


Fig 3. Remote Monitoring care system for aged people with chronic disease

### Digital literacy of aged people

Modern home care technology promises a world of accessible innovation, especially people in medical need from remote area such as island, quarantine facility as well. As we know, the primary barrier to application of technology is still challenging. Health care provider must consider user experiences and interaction from view of aged people with chronic disease. Therefore, it is pivotal to establish digital phenotyping of aged people in regard with simplicity and functionality. The age people could suffer from a lack of digital experiences, impairment of cognitive function[19,20].

### Conclusion

Smart health care applications, especially in term of remote patients' monitoring, are becoming increasingly important. These technologies from smart health care provide useful opportunities for real-time patient's monitoring resources and services. The portable diagnostic dievices are used to take digital images of patients with infectious disease and cardiopulmonary disease. The wearable sensors are used to get digital signals from both care center and home that multiple decision-making problems are enabled by medical doctors. As a result from breakthrough of smart health care, using portable devices and sensors as a solution for monitoring chronic diseases. we found that current technologies can be used in the old patients within home.

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## References

1. Klimova, B., Mobile health devices for aging population groups : A review study, pp. 295–301, 2016.
2. Chung, Y., and Liu, C., Design of a Wireless Sensor Network Platform for tele-homecare. pp.:17156–17175, 2013.
3. Sun, J., and Guo, Y., X. Wang, and Q. Zeng, “BmHealth For Aging China : Opportunities and Challenges,” 7(1):53–67, 2016.
4. Tsang J, Dobaño C, VanDamme P, et al. Improving vaccine-induced immunity: can baseline predict outcome? Trends Immunol 2020 April 8
5. Vaduganathan M, Vardeny O, Michel T, McMurray JJV, Pfeffer MA, Solomon SD. Renin–angiotensin–aldosterone system inhibitors in patients with Covid-19. N Engl J Med. DOI: 10.1056/NEJMSr2005760.
- 6 Wayne C. Koff, Ph.D., and Michelle A. Williams, Sc.D. Covid-19 and Immunity in Aging Populations; A New Research Agenda N Engl J Med 2020; 383:804-805 August 27, 2020
7. Hollander, J. E.; Carr, B. G. Virtually Perfect? Telemedicine for Covid-19. N. Engl. J. Med. 2020, 382, 1679–1681.
8. Barbera, J. A., and Macintyre, A. G., Medical surge capacity and capability : A management system for integrating medical and health resources during large-scale emergencies. Washington, DC: US Department of Health and Human Services, 2004.
9. Salman, O. H., Rasid, M. F. A., Saripan, M. I., and Subramaniam, S. K., Multi-sources data fusion framework for remote triage prioritization in telehealth. J. Med. Syst. 38(9):103, Sep. 2014.
10. Kiah, M. M. et al., Design and develop a video conferencing framework for real-time telemedicine applications using secure group-based communication architecture. J. Med. Syst., 2014.
11. Damiano ER, McKeon K, El-Khatib FH, Zheng H, Nathan DM, Russell SJ: A comparative effectiveness analysis of three continuous glucose monitors: the Navigator, G4 Platinum, and Enlite. J Diabetes Sci Technol 2014;8:699–708.
12. Pleus S, Schoemaker M, Morgenstern K, SchmelzeisenRedeker G, Haug C, Link M, Zschornack E, Freckmann G: Rate-of-change dependence of the performance of two CGM systems during induced glucose swings. J Diabetes Sci Technol 2015;9:801–807.
13. B. Yu, L. Xu and Y. Li: Bluetooth Low Energy (BLE) Based Mobile Electrocardiogram Monitoring System , Proceeding of the IEEE International Conference on Information and Automation Shenyang, China, June 2012: 1-6
14. AdemAlpaslam ALTUN and Nusret Bascifci “A wireless sensor network based on Zigbee for ECG Monitoring” 5th International Conference on Application of Information and Communication Technologies (AICT), 2011; 1 - 5.
15. Eisenhuber E, Schaefer-Prokop CM, Prosch H, Schima W. Bedside chest radiography. Respir Care 2012;57:427-443
16. Mentrup D, Jockel S, Menser B, Neitzel U. Iterative scatter correction for grid-less bedside chest radiography: performance for a chest phantom. Radiat Prot Dosimetry 2016;169:308-312
17. Mjølstad OC, Dalen H, Graven T, et al. Routinely adding ultrasound examinations by pocket-sized ultrasound devices improves inpatient diagnostics in a medical department. Eur J Intern Med 2012; 23: 185–191.
18. Mulvagh SL, et al. Handheld ultrasound devices and the training conundrum: how to get to seeing is believing. J Am Soc Echocardiogr 2014; 27: 310–313.
19. Lion KC, Brown JC, Ebel BE. Effect of telephone vs video interpretation on parent comprehension, communication, and utilization in the pediatric emergency department. JAMA Pediatr. 2015;169(6):1117-25
20. Voils CI, Venne VL, Weidenbacher H, Sperber N, Datta S. Comparison of telephone and televideo modes for delivery of genetic counseling: a randomized trial. J Genet Couns. 2018;27(6):339-48

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