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Review Paper

Current Status and Potential of Health Care with Technology-Health care through the use of PHR

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ABSTRACT

Currently, "improving the squeeze on healthcare costs" and "extending healthy life expectancy" are major themes in many countries around the world. Worldwide, healthcare costs have continued to rise, finally exceeding US$6.5 trillion in 2012. This is due to the increase in the rate of medical and long-term care visits caused by the aging of the world population. In order to reduce medical costs, it is necessary for Each individual to manage his or her own health and monitor his or her own physical condition, thereby extending healthy life expectancy and reducing unnecessary medical visits. The effective way to achieve this is to manage health through personal health records (PHR), which is currently attracting a great deal of attention in the healthcare market, and is a field that many companies are focusing their attention on. The secondary use of a variety of time-series data related to individuals in industry and academia will accelerate efforts to elucidate factors that contribute to the onset and severity of diseases and to search for biomarkers that contribute to patient stratification, thereby enabling the efficient and effective discovery of new evidence that will lead to prevention, early diagnosis, treatment, and prognosis. This will accelerate the search for biomarkers that can contribute to prevention, early diagnosis, treatment, and prognosis. In particular, the pharmaceutical industry is expected to contribute to the higher quality of medicine and healthcare through the discovery of drug targets and the development of new solutions that contribute to preventive and preemptive medicine. This study investigates the impact of PHRs on extending healthy life expectancy and reducing healthcare costs, as well as the status of PHR diffusion and its challenges in the world.

Keywords: Healthy life expectancy, Frail, Lack of exercise, PHR, EHR

What is healthy life expectancy?

Healthy life expectancy is calculated by subtracting the "unhealthy period" from the average life

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expectancy. In Japan, there are three definitions of "unhealthy period": "average time of independence," "period with no limitations in daily living," and "period during which one perceives oneself as healthy. Of the three definitions, "average time of independence" and "period of no limitation in daily living" are calculated based on the level of nursing care required, while "period of perceiving oneself as healthy" is calculated based on responses to a questionnaire survey. In this study, we investigated the possibility of extending healthy life expectancy by focusing on the level of care required, which is used as one of the definitions of the unhealthy period, and the relationship between the causes of the need for nursing care and exercise habits, Dementia, frailty due to old age, bone and joint diseases, and falls are the most common causes.

Looking at the relationship between exercise habits and these diseases, we first look at the relationship between exercise and lifestyle-related diseases. When examining the association between exercise and hypertension, diabetes, and dyslipidemia, which are known risk factors for cerebrovascular and cardiac diseases, respectively, the authors found that exercise was associated with the prevention of the onset and severity of these diseases in all cases. On the other hand, however, some of the papers also stated that exercise can have negative effects on the body and that one should choose appropriate exercise according to one's personal health condition (Table 1).

Table 1: The relationship between exercise habits and diseases

	Thesis
High blood pressure and exercise	1. Physical exercise has beneficial effects on metabolism and hypertension (Korsager Larsen M, 2016) 2. Aerobic exercise lowers blood pressure in resistant hypertensive patients (Dimeo F, 2012)
Diabetes andexercise	People who spent less than 30 minutes a day walking may have a higher rate of diabetes compared to those who walked more than two hours (Kabeya, 2016).
Dyslipidemia and exercise	A meta-analysis of the effects of aerobic exercise on HDL showed that while regular aerobic exercise increased HDL-C levels, aerobic exercise results varied widely depending on exercise program and baseline subject characteristics (Kodama, 2007).

The relationship between exercise habits and frailty

Next, the relationship between exercise habits and frailty will be discussed. Frailty is a state of reduced energy consumption due to decreased muscle strength and muscle mass caused by aging and other factors that reduce the amount of activity. In addition, the person's appetite is reduced and food intake decreases, resulting in a state of low nutrition due to insufficient intake of protein and other nutrients. Continued under-nutrition leads to weight loss and a decrease in muscle strength and muscle mass. This vicious cycle is called the "frail cycle," and it is said to increase the likelihood of falls, fractures, and the worsening of chronic diseases that lead to the need for nursing care. However, it is believed that maintaining muscle mass through physical activity and other exercise habits may prevent people from falling into this frail cycle (Table 2).

Table 2: The relationship between exercise and frailty

Thesis
Frailty is associated with not performing daily physical activity, differentiation activity, and community activity, and the risk of frailty tends to increase as the number of activities that are not carried out increases (Yoshizawa, 2019).
Elderly people who do not exercise habits are more likely to develop frailty with reduced motor, cognitive, and social indicators (Uehara, 2017).
According to a systematic review of exercise interventions for the prevention of frailty, none of these reviews discussed the findings separately related to the interventions delivered in groups and separately (J. Apostolo et al JBI Database system Development Rep, 2018).
A systematic review of RCTs on the effects of exercise interventions in frail older adults found evidence that physical exercise has a positive effect on frail older adults, but there is diversity in studies on sample size, degree of weakness, types of interventions, and types of assessments, and further research is needed to determine the most effective exercise program (de Labra et al BMC Geriatrics, 2015)

As a matter of fact, some papers have shown a link between frail and exercise, indicating that those without exercise habits are more likely to develop frail conditions and that frail may be preventable. On the other hand, evidence has not yet been gathered on individualized support of exercise intervention for frail in relation to healthy life expectancy, and although exercise intervention itself is important, it is also considered to be a future challenge to accumulate research on what kind of programs have a positive impact.

Physical inactivity in the world

Having explained how exercise affects our health, the World Health Organization (WHO), in a study of about 2 million people in 168 countries who actually do not exercise or are inactive (using the GPAQ (Physical Activity Questionnaire from WHO, the IAPQ (International Standardized International Standardized Physical Activity Questionnaire (IAPQ), etc.), the study analyzed data obtained between 2001 and 2016 and estimated that 27.5% of the world's adults (aged 18 years and older) are inactive, or more than 1.4 billion people.

Inactivity, or inadequate physical activity, is defined as adults "not meeting WHO recommendations," meaning at least 150 minutes per week of moderate-intensity physical activity, or 75 minutes of vigorous-intensity physical activity, or an equivalent combination of the two. Limitations of this study, however, include the fact that data were available in some countries and not in others, the same questionnaires were not used, sample sizes in each country were different, the years of data obtained varied, and some countries adjusted for urban and regional data, while others presented only urban data, Itis difficult to make international comparisons of the proportion of people who are inadequately active. Figure 1 below shows the country prevalence of inadequate physical activity among men in 2016, with darker red indicating countries with higher rates of inactivity, particularly in Germany, Brazil, and Saudi Arabia, where the rate is in the 40th percentile.

Fig. 1 below shows the country prevalence of inadequate physical activity among men in 2016.

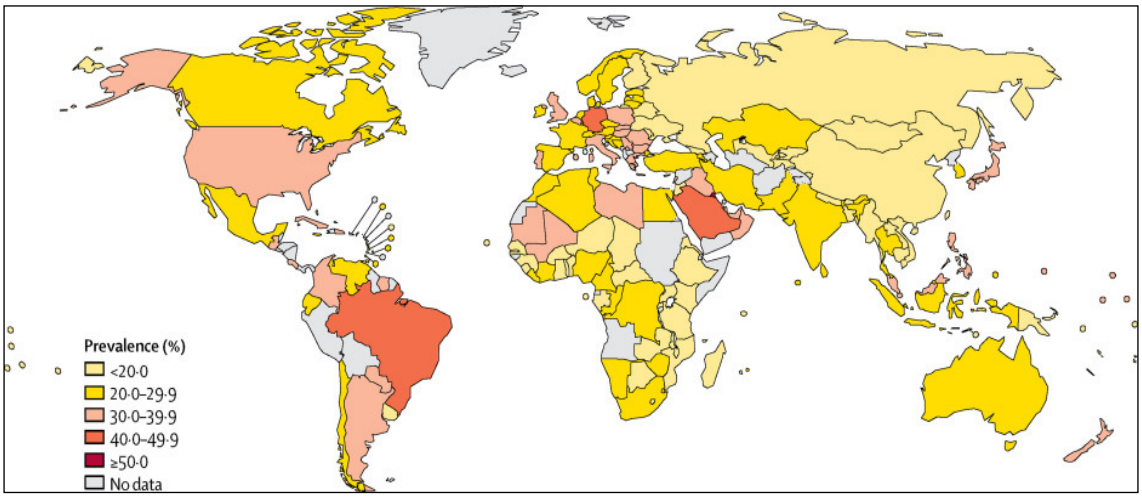

Fig. 1: Physical activity of men worldwide

Fig. 2 shows the country prevalence of inadequate physical activity among women in 2016, and shows that the percentage is higher in many countries than in the male counterpart just described.

In 159 of the 168 countries, the prevalence of inadequate physical activity was lower among men than among women, with a difference of at least 10 percentage points in 65 countries and more than 20 percentage points in 9 countries. In Japan, too, inadequate physical activity among women is conspicuous, with 33.8% of men and 37.0% of women, indicating a particular need to intervene to address inadequate physical activity among women.

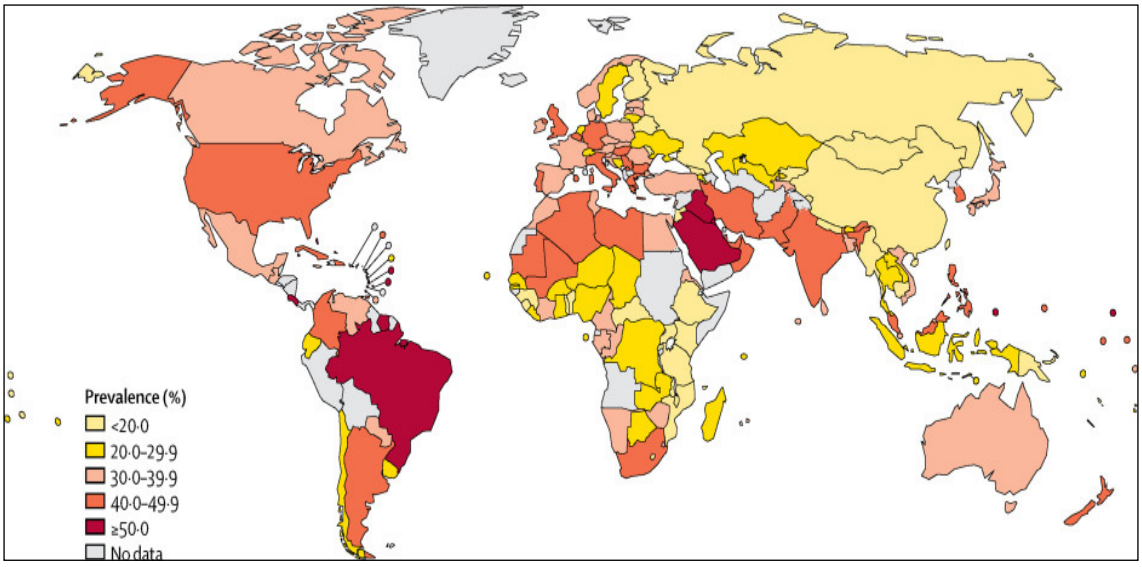

Fig. 2: Shows the country prevalence of inadequate physical activity among women in 2016

Two issues can be considered from what we have seen about the relationship between exercise and healthy life expectancy. First, there is a large gap between average life expectancy and healthy life expectancy, and second, there is a worldwide lack of exercise. Since there is a correlation between healthy life expectancy and exercise, it is necessary to encourage those who are inactive to exercise in order to solve the two issues and to eliminate them. So when should you start exercising? When considering this question, a useful reference point is a cohort study conducted in the United Kingdom. The purpose of the investigation in this study was to assess the predicted associations of baseline and long-term trajectories of physical activity with mortality from all causes, cardiovascular disease, and cancer among the subjects, who were men and women aged 40-79 years, and who had a study period of the study began with a baseline lifestyle survey from 1993 to 1997, including physical activity, followed by an examination and evaluation of the trajectory (transition) of the survey until 2004. Mortality was followed until 2016.

The results of the study showed that, with respect to physical activity, increased energy expenditure due to physical activity was inversely related to mortality, independent of baseline physical activity level. In addition, performing a minimum level of physical activity and maintaining at least that level of physical activity prevents 46% of the deaths associated with inadequate physical activity. The minimum here is based on the WHO guideline of 150 minutes/week of moderate-intensity physical activity. This indicates that regardless of past levels of physical activity, the middle-aged and older adults studied in this study could achieve longevity by becoming more physically active.

While physical activity is important regardless of past level of physical activity, the hazard ratio indicates that physical activity from an earlier age is also associated with longer life expectancy. Based on the above results, it seems that while physical activity from an early age is of course important, intervention in middle-aged and older adults to reduce physical inactivity may be particularly effective in extending healthy life expectancy.

Self-management through the use of PHR

Therefore, health and exercise management through PHRs may be effective. A PHR (Personal Health Record) is an application that allows individuals to manage and utilize their own health, medical, and long-term care information, The main benefits of PHRs are as follows:

1. Checking physical activity: By adding a pedometer or activity meter function, it is easy to determine whether one's physical activity is high or low, which can be combined with the medical check function.
2. Improved patient engagement: having information and tools to manage their health and the ability to track their health over time can help engage patients in their own healthcare. In addition, many of the Things patients do for their health often take place outside of the clinic, and PHRs allow patients to document these events.
3. Improved access to patient information: PHRs can help ensure that health information is available whenever it is needed, such as during emergency transport or when patients are traveling.
4. Improved management of information from multiple providers: PHRs can help patients manage information from a variety of providers and help improve coordination of care.

5. Reduction of administrative costs: PHRs reduce the burden on healthcare organizations and reduce the time medical staff spends searching for information requested from patients and answering patient questions.
6. Improved communication between patients and healthcare providers: PHRs can improve communication between patients and physicians by providing a direct and safe method of communication.
7. Ability to manage family health care: PHRs help caregivers, including family members, better manage and coordinate patient care with other caregivers.

PHRs are said to have these benefits, and the ownership rate of smartphones, the main device for PHRs, is 67.6% in Japan (2019), and according to Strategy Analytics, a US research firm, the population of smartphone users worldwide has reached 4 billion, the number of people using smartphones worldwide has reached 4 billion, according to Strategy Analytics, a U.S. research firm, and is increasing for all ages. In recent years, smartwatches and other devices have been used to provide personalized health care information, such as exercise and diet recommendations.

Furthermore, by utilizing AI such as Chat GPT, it is expected that it will be possible to manage health and exercise in a conversational manner, making it easy for elderly people who are considered to have low digital literacy to use it.

In recent years, PHRs can also be connected to smart-watches and wearable sensors, making it possible for users to use them without feeling burdened.

PHR penetration around the world

Looking at PHR diffusion rates around the world, France and Germany in Europe, where, like Japan, the super-aging society is progressing and there are concerns about increasing social security costs, are making national efforts to diffuse and introduce PHR systems. In Asia, Singapore, where the population is also aging, is said to be considering the introduction of a government-run PHR service. In the U.S., ICT in healthcare and the utilization of information are considered as part of economic measures, and ICT has been rapidly promoted under the HITECH Act (The health information technology for Economic and Clinical Health), and furthermore, the "Blue Button The government is also promoting the dissemination of a PHR for veterans, called the "Blue Button.

The type and level of penetration of government-led PHRs vary depending on the background of the country's health care system and its health insurance system. In addition, government-led PHR systems are often operated and managed in countries with relatively small population sizes, such as Finland and Singapore. If a government-led PHR system were to be established in Japan, a database accessible by 100 million people would have to be built, which would be very difficult from both an operational and cost perspective. For example, in the Scandinavian countries called "welfare powers" such as Finland and Denmark, the health literacy of the people is said to be relatively high, and the introduction of EHRs and PHRs has been smooth. Table 3 below shows the status of PHR diffusion in major countries around the world.

Table 3: Shows the status of PHR diffusion in major countries around the world

Country	Population	Medical delivery system	Medical Insurance System	Widespread use of EHR	Widespread use of PHR
USA	331 million	Private entity	Private entity	80%.	Now being promoted by Blue Button
Mexico	127 million people	Public entity	Public insurance	Under development and promotion	Under development and promotion
Finland	5.5 million people	Public entity	Medical insurance for the whole nation	100	60-70% (%)
Singapore	545,000	Public entity	Medical insurance for the whole nation	Approx. 10% (100% for EMR)	70-90% of the total
United Kingdom	67.1 million	Public entity	Medical insurance for the whole nation	97%.	Under way
China	1.41 billion people	Public and private	Public insurance	Under development	Under development
Japan	126 million people	Public entity	Medical insurance for the whole nation	50-60	Approx. 10%
India	1.41 billion people	Public and private	Public entity	Under development and promotion	Under development by Health Stack
Australia	24.99 million	Public entity	Medical insurance for the whole nation	90%.	90%.

The "Blue Button" in the U.S. is a measure that strongly promotes the adoption of PHRs for veterans, but the actual PHR services are provided by private medical institutions, etc. As of 2012, PHR software in the U.S. PHR market generated revenues of $312.2 million, and is estimated to be growing at a CAGR of approximately 6%. As of 2012, PHR software in the U.S. PHR market generated revenues of $312.2 million, with an estimated compound annual growth rate (CAGR) of approximately 6%. The penetration rate of PHRs in the U.S. was projected to be 75% of adults using PHRs by 2020, but the current situation is that PHRs are not yet that widespread. In addition, the level of privacy protection applied to PHRs in the U.S. with respect to regulation varies, and PHRs provided by physicians or insurers are subject to stricter privacy laws and regulations than private sellers; PHRs provided under the administration of HIPAA (Health Insurance Interoperability and Accountability Act) services are subject to privacy provisions, but those not covered by HIPAA are not. In addition, each state in the U.S. may have different laws and regulations, and each state has a different idea of privacy protection.

Flow of PHR introduction

In addition, in order to realize a PHR that includes individual medical data, it is first necessary to promote ICT in hospitals, and it is necessary to develop EMR (Electronic Medical Records), followed by EHR (Electronic Health Records) that enables information sharing among hospitals and facilities. Most countries have begun to consider the introduction of PHRs as part of this process. The general flow is as follows (Fig. 3).

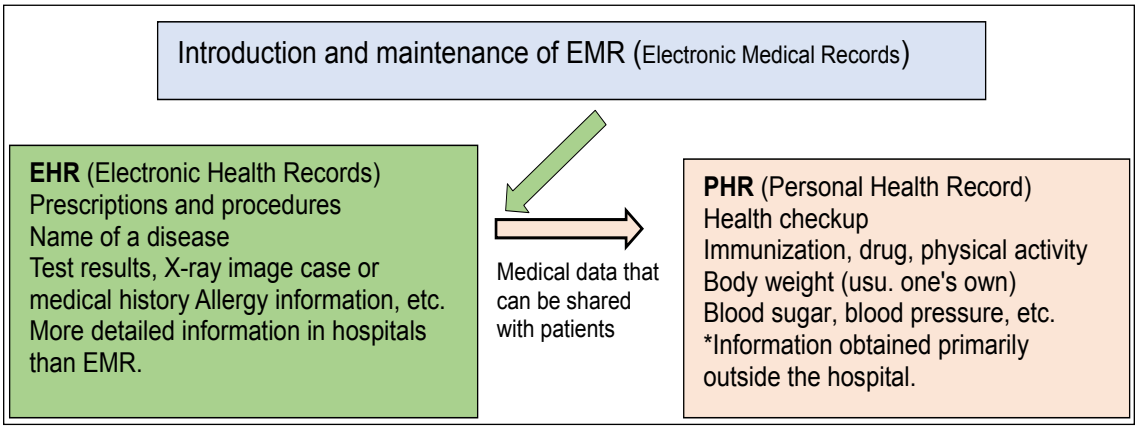

Fig. 3: Main flow until the introduction of PHR

It is also important that a national ID be introduced that can be utilized in the medical field. Without a numbered ID for all citizens, it would be difficult to collect data generated in hospitals and other facilities, but it is said that there are many challenges to realize this goal due to privacy issues.

In addition, the global personal health record software market size is projected to be approximately US$70.7 billion in 2020, and the market is expected to expand at a healthy growth rate of more than 9.90% during the forecast period of 2021-2027, making it an area that is expected to develop globally in the future (Fig. 4).

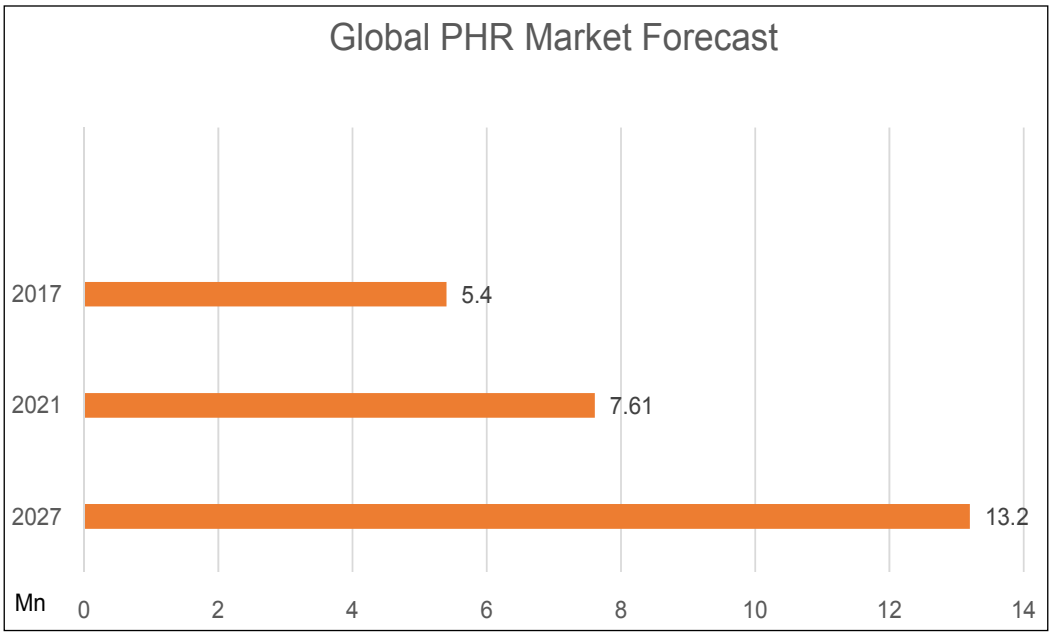

Fig. 4: Global PHR Market Forecast

CONCLUSION

Although ICT and EHR are necessary for the introduction of PHRs, it is expected that the widespread use of PHRs will help individuals to grasp and manage their own health status and physical activity, thereby reducing unnecessary medical examinations, medication, and treatment, which will eventually have a positive impact on reducing medical costs. However, while other countries are actively promoting the use of PHRs, the utilization rate of PHR is not increasing simply by being able to check medical information.

So, can we create benefits beyond health maintenance that can be gained by using PHR (e.g., discounts on premiums, points awarded)? (e.g., discounts on premiums, points awarded, etc.) It is essential to create an easy-to-understand system that is easy for even the elderly to register and use, and to ensure strong security because the system contains sensitive personal information and is supposed to be used via the Internet. In some cases, it may be necessary to link PHRs to universal health insurance, thereby making the use of PHRs mandatory to some extent.

In addition, PHRs themselves are still not well known, and the challenge is how to make them known to the large number of people.

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