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Challenges and Possibilities for the Household Medicine Lease System: Continua-Certified Devices assisted Community-Based Self-Medication

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Abstract

This paper reports the follow-up research of “Challenges and Possibilities for the Household Medicine Lease (HML) System Viewed in light of CRM,” presented in Conf-IRM 2009. With the ongoing insufficiency of medical services, the traditional Japanese business model of household medicine lease (HML) system has now been successfully implemented in the Association of Southeast Asian Nations. However, because of the rapidly aging population, Japan has currently been suffering from difficulties in coping with the rapidly increasing demand for medical services. Our study aims to design a system of everyday healthcare in combination with the HML system and medical monitoring system based on international standard and provides an interoperable platform that meets various conformity requirements. This study presents features of the self-medication system based on data from monitoring devices certified by Continua Health Alliance, and then presents the concept and challenges of community-based self-medication designed to suppress increase in nationwide healthcare costs.

Keywords:

household medicine lease (HML), everyday healthcare, Continua Health Alliance, community-based self-medication, customer relationship management (CRM).

1 INTRODUCTION

Japan, the fastest aging nation in the world, faces a serious challenge in coping with the constantly increasing demand for medical services. As a countermeasure to this challenge, there are two strategies: productivity measures for medical services and demand restraint measures. Focusing on the latter, this study clarifies the system’s functions and its effective and efficient implementation of a daily healthcare system. This daily healthcare system combines the business model of the household medicine lease (HML) system, a traditional Japanese healthcare system, and a medical monitoring system based on an international standard; thus, the system provides an interoperable platform that conforms to various requirements.

Previous studies have clarified the following: 1) the Japanese traditional business model of the HML system has been successfully implemented in Mongolia (Furukawa and Takashima, 2009); 2) telecommunication can play an important role in improving the efficiency of doctors’ medical services (Furukawa and Takashima, 2009); 3) information and communication technology (ICT) can facilitate remote health monitoring important to medical services (Carroll et al., 2007; Case, 2012; Lee, 2013).

Moreover, recently, full-scale activities of Continua Health Alliance (hereafter, Continua) have begun. Continua was established to provide interoperability of information systems and services in health and medical care that enable high-quality services, for instance, “health proactive management,” “chronic disease management,” and “self-reliant life support.” Continua’s main role is standardization of data formats, including telecommunication. In this study, we first focus on the use of devices that conform to the standard of Continua (Continua-certified devices), and then, we propose a concept—its effectiveness and challenges to the implementation of a self-medication system that is a combination of the HML system and Continua-certified devices (Carroll et al., 2007; Lee, 2013).

2 PREVIOUS WORKS AND RESEARCH QUESTION

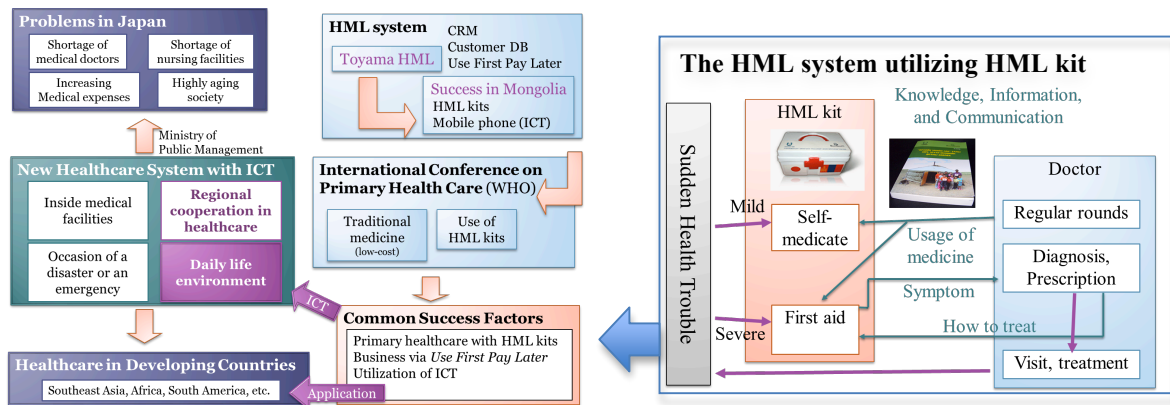


Figure 1: Scheme and Summary of the previous work (Furukawa and Takashima, 2009): the HML system utilizing HML kit for all who need healthy-lives in the world.

Figure 1 shows schematically that past successes in HML-based self-medication and/or healthcare provide us with clues for addressing healthcare problems facing today’s aging society. Therefore, the system might likely be not only directly introduced into developing countries but it might also adapt to the needs of present-day Japan through the utilization of ICT. This new ICT-assisted HML model, in turn, can prove useful in tackling problems that have long burdened developing countries. Due to the page number limitation, omitted further explanation of Figure 1. See Furukawa and Takashima (2009).

Here, from the CRM perspective, let us redefine the HML system's "customer" and "mission." Then, let us project this business's future of utilizing the household medicine system. To this effect, we use CRM terminology.

The implementation of an ICT-based information system has difficulties; for example, a communication gap between engineers and end-users, the time required for end-users' mastery of changes, and the resistance of end-users to changes, which has long been discussed in social sciences (Laudon and Laudon, 2000). Under such circumstances, the use of Continua-certified devices can potentially lower the hurdle of information system implementation. Therefore, this study discusses the implementation difficulties and strategies to overcome them, specifically in everyday healthcare.

"Let's redefine the customer and mission of the HML system. Then, let's draw the future of the business utilizing household medicine." This is our study's consistent stance. The HML system (Right side of Figure 1), illustrates support for needed self-medication, which reduces demand on medical services. We assume that the broad spread of Continua-certified devices can suppress increasing demand by lowering the implementation challenges of information systems.

Therefore, based on this assumption, let us define the mission of the HML system as "supporting and promoting everyday needed self-medication," and its customers as "all those who seek a healthy life."

This definition of the "customer" is in accordance with the Declaration of Alma-Ata (PHC, 1978), which was adopted at the International Conference on Primary Health Care, Almaty (formerly Alma-Ata), presently in Kazakhstan, 6–12 September 1978. It expressed the need for urgent action by all governments, all health and development workers, and the world community to protect and promote the health of all the people of the world. It was the first international declaration underlining the importance of primary health care. The primary health care approach has since been accepted by member countries of WHO as the key to achieve the goal of "Health for All."

The study's objective is to clarify the concept—its effectiveness and challenges—and the procedure for implementing the self-medication system. Next, we discuss these challenges and verify the following points:

- 1) The HML system is effective in suppressing medical costs as they continue to increase with society's aging.
- 2) The use of Continua-certified devices, in regard to cost and saving time, is efficient for implementation of the HML system.
- 3) The knowledge of social science as a method for successful, planned change in an organization applies to the HML system's implementation.

3 ALLIANCE WITH CONTINUA-CERTIFIED DEVICES

3.1 Overview of Continua Health Alliance

Continua Health Alliance is a nonprofit organization that gathered leading companies in the technology and healthcare industries to achieve better home healthcare. Globally, the number of overweight adults is 1 billion; patients with chronic diseases, 86 million; and people over 60 years old, 6 million. Chronic diseases account for 75–85% of the medical expenses. Therefore, Continua defines its mission as "realization of the interoperable home healthcare ecosystem for enabling people and organizations to manage their health and healthcare more effectively," and it declared its method to be "standardization of the interface for connecting the computer and healthcare devices of various vendors, publication of guidelines for the connection, and connection certification of the devices to be supplied to the market" (Carroll et al., 2007; Lee, 2013).

"Connecting" here means ease in connecting these devices to computers for exchanging data and utilizing the data gathered from devices such as blood pressure and blood glucose monitors and scales. For example, imagine trying to connect devices like mouse, keyboard, and flash memory to a personal computer (PC). Imagine that in one system, the universal serial bus (USB) connector is compatible

with the PC and other devices, but, in another system, it is not compatible. A USB connector, if compatible with all devices, does not require extra cost and time for connection. Continua aims to establish an international standard for the connection method between devices to ensure certified devices regardless of whether the respective device conforms to the standard.

3.2 Cooperation with the HML System

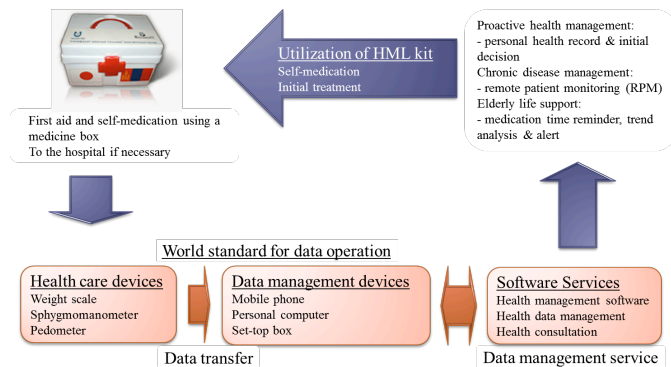


Figure 2: Collaboration with HML Kit and Continua-certified Devices.

Source: Revision to (Carroll et al., 2007; Lee, 2013).

“World standard for data operation” in Figure 2 illustrates the services that Continua-certified devices provide via connectivity. Through standardization of communication procedures and methods for connecting health monitoring data from healthcare devices, which function as sensors to data management devices, such as PCs, the connectivity for programming and data conversion is more efficient than that of the prestandardized customization essential for each device. Consequently, the cost and time to construct a system can be substantially reduced.

Health proactive management	Monitoring of health data. Achievement of personal goals. Use and accumulation of personal health data management. Performance management.
Chronic disease management	Efficient cooperation of patients, families, and doctors. Effective disease management. Reasonable medical expenses. Improvement of quality of life of (QOL)
Independent living (IL) support for the elderly	Ties with family. Care from remote location. Integrated management. Early detection. Reasonable medical expenses.

Table 1: Application Functionality of Continua-Certified Devices

Source: (Carroll et al., 2007; Lee, 2013).

Incidentally, the demand for medical and healthcare services in people’s life is continuous from cradle to grave. Table 1 illustrates the categorized application functions of Continua-certified devices for suppressing the demand for medical and healthcare services required over a lifetime, such as health proactive management, independent living (IL) support for the elderly, and chronic disease management. Not only medical and nursing care staff but also end-users themselves can use the health monitoring information acquired from Continua-certified devices.

Information on an individual’s health condition is monitored by the sensors of Continua-certified devices and stored in data management devices. If this health monitoring information is available and if software services, such as health consultation by medical providers or a knowledge base as an alternative, are available in every home, appropriate self-medication is possible. In other words, properly matched health monitoring information and efficacy of medicinal treatment enables appropriate everyday healthcare. Figure 2, as a whole, illustrates this concept.

4 CASE STUDY OF CONTINUA-CERTIFIED DEVICES IMPLEMENTATION

Utilization of Continua-certified devices facilitates installation of healthcare devices (Figure 2) into multiple locations—clinics, nursing care homes, schools, and private homes—in a short time and at low cost. However, because of the doctor shortage (that is, limitation in the number of doctors), one doctor is held responsible for multiple, distant medical locations.

Physical constraints for this need are the space (or distance) between multiple locations and the time that doctors can use freely for medical examination, consultation, and prescription. ICT releases doctors from the constraints of time and space (HML system in Figure 1). Furthermore, this concept's utility is demonstrated in the following case of Continua-certified devices utilization.

After the Great East Japan Earthquake of 2011, Dr. Nanaomi Kario (Professor of Jichi Medical School) was worried about the rise in victims' heart disease. For the victims sheltered in Minami Sanriku, Miyagi Prefecture, he requested A&D Co., Ltd., an electronic medical equipment manufacturer, to develop a remote monitoring program. Consequently, the Disaster Cardiovascular Prevention (DCAP) system was developed for monitoring the blood pressure of victims who were housed in a shelter at a remote location without medical care service. The use of Continua-certified devices enabled low cost and rapid construction of a monitoring program for the prevention of cardiac-related diseases (DCAP). It saved the lives of many victims' (Case, 2012).

According to the participating companies' estimates, from concept design to actual application in the shelter, the DCAP program took about two weeks and 12 person-weeks and cost 2.5 million yen. However, it is assumed that if interoperability has not been secured with Continua-certified devices, it would have required 12 weeks and 72 person-weeks and cost about 15 million yen. According to this assumption, the adoption of interoperable technology has reduced development time by 84%, that is, it shortened the time by 10 weeks with a cost savings of about 12.5 million yen (Case, 2012).

The effectiveness of this case is as follows: Continua-certified devices enable realization of medical care systems in a short time with low cost to support remote patient monitoring. Thus, this system can be remarkably effective in emergencies.

5 CHALLENGES OF NEW TECHNOLOGY IMPLEMENTATION

5.1 Phased approach for adaptable change

Since 2009, Continua-certified devices have been displayed at a booth at CEATEC JAPAN, a large international exhibition of video, information, and communication technology held at Makuhari Messe International Convention Complex, Japan, every autumn. According to the interviews for exhibitors every year since then, the functions shown in Figure 2 have already been enabled, but their dissemination has not progressed. Health monitoring using Continua-certified device is, of course, a type of information system. In general, "information system failure" refers to a situation in which data is used in unintended ways. The main problems occur in operation, design, data, and cost. These problems are based on not only the technological features of the information system but also the nonprofessional features. In fact, most of these problems arise from human and organizational factors (Laudon and Laudon, 2000).

The health monitoring system using Continua-certified devices, based on data gathering and graph displays for monitoring, is an information system with a very simple structure. However, it is not well known. Despite the system's precise design—its functionality, security, and data structure—end-users such as healthcare workers and patients do not easily accept the system. Thus, apparently this system is not widespread because of nonprofessional concerns.

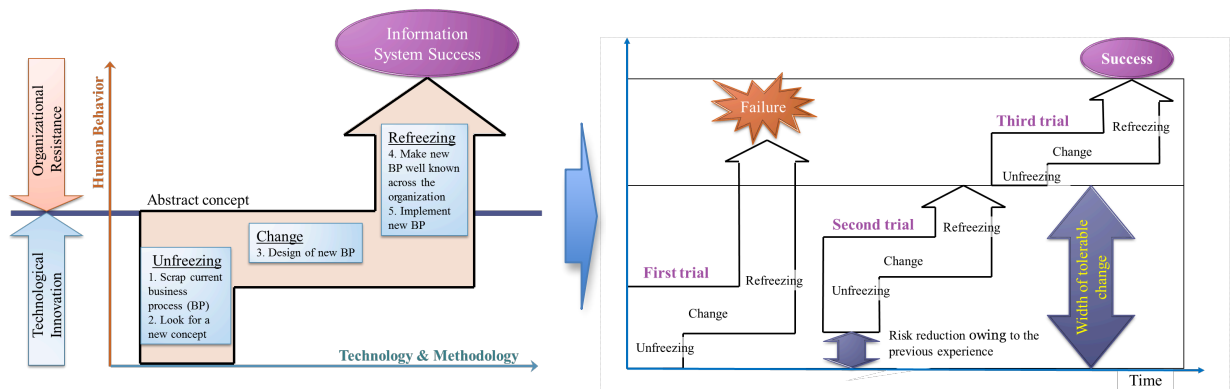


Figure 3: Implementation of Technological Innovation and Resistance from the Organization: Revision of Furukawa and Minami (2013), which illustrates organizational resistance and change in business-process-reengineering based on the Lewin and Schein model (Keen, 1981).

As a general rule, most causes of failure in intentional organizational change, that is, in a new system's implementation, arise not from technological issues but from social science issues, in other words, issues of concern by end-users and organizations (Laudon and Laudon, 2000).

Thus, this study focuses on human and social matters—on resistance from end-users due to change caused by new, unfamiliar technology implementation (in this case, installation of the measuring devices and their connectivity with a management computer).

Left side of Figure 3 illustrates a strategy for achieving information system success when implementing innovative organizational changes. As shown, to achieve “information system success,” an adaptive information system function needs to be designed to utilize the “Unfreezing” to “Change” process. Then, the system must be introduced and implemented during the “Refreezing” process for its proper use. Refreezing is believed to be a required, essential step for the success of the information system.

A resistance factor that hinders dissemination of Continua-certified devices, for example, might be an elderly patient who rejects wearing a certain measuring device for privacy reasons. This individual might accept one-time hospital examination but hesitate on long-term monitoring for such reasons as quality of life.

This kind of resistance arises from the magnitude of change being greater than the end-user's allowable limit. On the basis of this assumption, Right side of Figure 3 demonstrates a strategy for achieving the goal while repeating small-step changes. When implementation of the new technology might inhibit occupational benefits, political resistance appears remarkable. However, in some cases, implementation might require a step-by-step approach, for instance, precoordination of organizational interests.

5.2 Phased approach for successful system

Constraints of a phased system implementation approach are as follows: 1) extended time and significant cost for step-by-step implementation tailored to the end-user's learning progress; 2) the difficulty of IT infrastructure preparation, which enables phased system implementation easily, quickly, and inexpensively (that is, required cost and time for change is minimal) (Furukawa and Minami, 2013).

When using Continua-certified devices in the self-medication system with household medicine, as illustrated in the HML system (Figure 2), this computer-based information system can be readily implemented, and its changes can be relatively quick and cheap. Needless to say, disseminating this system nationwide at once is not realistic and practical because of the expected friction and resistance.

However, if this system is implemented successfully in organizations, such as a governmental body or a company, then, when a confirmed effect is shown (for example, reduced absenteeism or strengthened finances of the health insurance union), successful cases can be effectively used as enlightenment material for transitioning resistant and potential end-users to the Healthy Company-based strategic health management of employee (Wilson et al., 2004; Ward, 2010), Healthy Community, Healthy Country (which is the goal of our study), and Healthy World as the goal of the Declaration of Alma-Ata. Success stories can lower people’s uneasiness about changes in communities and organizations. Such a procedure is also a form of the step-by-step implementation approach.

Needless to say, the orthodox steps of problem solving should be used: identification of constraints on implementation, organization of causes, and emphasis-oriented application of countermeasures. Furthermore, the authorized organization’s role in promotion, such as support by senior executives in a corporate organization, is also essential.

5.3 Diffusion policy and confirmation of the goal

Here, we reconfirm the terms: self-help, mutual help, and public help.

Developed in the 1980s, the paradigm of community-based rehabilitation (CBR) aims to provide people with disabilities access to rehabilitation in their own communities, predominantly using local resources (Kuipers and Doig, 2010). Mendis (2000) proposed making CBR more effective by encouraging such people to abandon exclusively depending on medical care and acquire an orientation toward IL with minimal help from the community.

Japan’s rapidly aging society has been troubled by the shortage of medical doctors and nursing facilities for the aged as well as for many other medically related problems. There is concern that these problems will become increasingly serious. This state of affairs calls for shifting the paradigm of healthcare from utter dependency on institutional medical care to needed self-medication, preferably community-backed and hospital-monitored with ICT. Let us call it “Community-based self-medication (CBSM),” fashioned after CBR. CBSM essentially means that people in a local community will be encouraged to help each other take their medications correctly and regularly. In this sense, we employ “mutual help.” Table 2 summarizes the problems and new orientations of this type of healthcare.

Healthcare Type	Problems and New Orientations
Public help Dependency on medical care	Shortage of medical doctors Shortage of nursing facilities for aged people Increasing medical expenses
Self help Individual self-medication	“Protect your life by yourself” Utilization of HML kits, handbooks, and ICT
Mutual help Community-based self-medication (CBSM)	IL with minimally necessary help from your community People encouraged to help each other in medicating themselves Utilization of HML kits, handbooks, and ICT

Table 2: *Paradigms of Healthcare. Source: Revision to (Furukawa and Takashima, 2009, Table 4).*

Developing “individual self-medication” into “CBSM” is a significant idea, particularly for a rapidly aging society such as Japan’s. CBSM may well serve the purpose of managing “regional cooperation” and “daily life environment” components in an integrated way, as imagined by the government-

sponsored study mentioned above. In plain words, CBSM has the likelihood of securing people an independent, carefree daily life, with the support of their immediate communities.

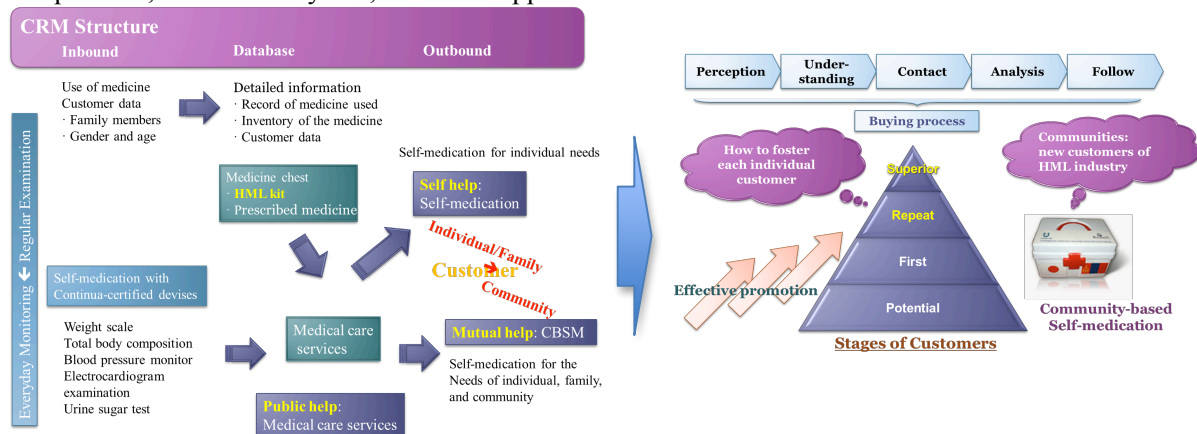


Figure 4: Self-medication in the light of CRM

Left side of Figure 4 illustrates the flow of self-medication from the perspective of customer relationship management (CRM), consisting of Inbound, Outbound, and Database, as Evans (1999) described. And, “self-help” means individual self-medication, and “mutual help” means community-based self-medication (CBSM), in which residents help one another to keep their community healthy. “Public help” cannot supply enough medical care services; neither can “self-help.” Recently, therefore, the importance of “mutual help” has been attracting attention. According to the considerations on “mutual help” via CRM, customers should be considered a “community that can practice CBSM.”

By segmenting customers into the four stages of “potential,” “first-time,” “repeat,” and “superior,” business CRM fosters customers and elevates them to the upper stage; to cultivate customers’ loyalty, CRM makes individually appropriate promotional efforts (Right side of Figure 4). This suggests that to ensure the sustainability of healthcare and/or medical systems in a rapidly aging society, the challenge for us is, in a manner of speaking, to foster “customer communities” toward practicing CBSM. CBSM-oriented communities may be considered potential markets for the HML system.

The self-medication systems shown in Figure 2 must work effectively and reliably in the community through repetition of appropriate promotion, while repeating the customer development procedure described as “Unfreezing, Change, and Refreezing” in Figure 3. Social communities where CBSM should be implemented are not organized like corporate organizations where people are motivated to pursue a common goal. When community residents are organized to act toward the common goal of an everyday healthy life, it is possible to apply the knowledge of system successes and failures that has accumulated over the years in our management information systems (Authors, 2013).

6 CONCLUSION

This study presented the following: 1) Definition of the mission of the household medicine lease (HML) system as “supporting and promoting everyday self-medication,” and the definition of its “customer” as “all those who seek a healthy life.” 2) Introduction of Continua Health Alliance and the effectiveness of the Continua-certified devices for everyday health monitoring. 3) The system concept of community-based self-medication (CBSM) where customers mutually cooperate using the HML system and Continua-certified devices. 4) New definition of “customer,” that is, the “community that can lead CBSM.” 5) Vision and challenges toward the Healthy Company, Healthy Community, Healthy Country, and Healthy World where CBSM is realized. 6) In recent years, the world has focused on IoT. However, IoT also will need to follow the same procedure as Continua-certified devices. *This work is supported by JSPS KAKENHI Grant Numbers K21530354 and K26330380.*

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