



Introducing U-Health in Korea for Aging Population

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This report conducts a cost-benefit analysis of u-health project in Korea. It first defines what u-health is. There are several assumptions to conduct a CBA of introducing u-health in Korea. First, we only focus on u-silver, which is a part of u-health that focuses on elderly people. Second, it is a 30-year-span project starts from 2015. Third, all policies are already compatible with the U-health, so that there is no cost of changing laws and regulations. Fourth, there is a constant growth rate (3.7%) of aging population (people over 65) in Korea.

Through conducting a CBA for this project, we find out that it is beneficial to introduce

u-health system in Korea. The NPV with our set condition reaches 127,658,464,137,246 won/ approximately US\$ 127 billion and all sensitivity analysis suggest positive NPVs in all cases. For the secondary market, we consider transportation market and labor market of related industries. There is no significant change in transportation market, while the demand of related industries' labor market increases.

In Benefit analysis, we identified 5 different benefits from the introduction of U-Health in South Korea. They are reduction of transportation cost, time saving for patients, reduction of national health insurance expenditure, reduction in health care expense paid by patients, and improved efficiency of hospital and health care practice. All the benefits are analyzed and calculated per elderly person per year. The total benefit per person from the introduction of U-health is 1,551,247 won/ approximately US\$ 1.5 thousand per elderly person per year. To obtain the total benefit, we multiply the benefit per person with population number each year.

After analyzing the benefits and costs of introducing U-health, we can calculate the Net Present Value (NPV) of the project. Using social discount rate of 5.5%, population growth of 3.7%, and timeframe of analysis of 30 years, we derived the NPV to be 127,65 trillion won/ approximately US\$ 127 billion. We also want to see how the NPV responds to changes in these three parameters. We try changing the social discount rate (3%, 9%, and 12%), population growth (1% and 6%), and time frame (15 years and 45 years). In all of the cases, we still find the NPV to be positive. When we change the parameters altogether (best and worst case scenario), we also find the NPV to be positive. This result suggests that the introduction of U-health in South Korea will bring rather immense social surplus to society.

The social cost for the U-health system includes three major costs: the cost for the government, for the hospital, and for the individual elderly people. The government is supposed

to invest in the initial stage for the research and development of the U-health related information technology and for the initial introduction of the system to the general public through campaigning. These two costs are considered to be incurred for initial three years only. The cost for the hospital and the individual is the rental cost. The rental cost is considered to be paid to the private firms that are providing equipment and services to the hospital and individuals. In this study, we adopted the initial government investment as 6,348,309,550,000 won/ approximately US\$ 6 billion per year for elderly people. Similarly, we adopted the aggregated rental cost of hospital and individual as 332,500 won/ approximately UD\$ 330 per person per year. Finally, we designed the media campaigning and estimated the campaigning cost as 23,428,279,258 won/ approximately US\$ 23 million for first two years and 46,856,558,561 won/ approximately US\$ 46.5 million for the final third year.

For the secondary market, we consider the transportation market and labor market in IT industry as the secondary markets. The introduction of u-Health is expected to reduce the amount of visit to hospitals. Therefore, it reduces the quantity demanded for public transportation service as well. However, its impact is almost zero since the change in demand is very little compared to the whole market size. For labor market, 2209 new jobs will be created in Korea by u-Health project.

1. Introduction

2.1. What is U-Health?

Ubiquitous-Health (u-Health) system is a health and medical care system that is done by using ubiquitous information technology (UIT). UIT includes radio transmission technology as well as wire communication system; therefore, u-Health is a system that uses IT to make people easily access to all types of health care services including preventive treatment, diagnosis

process and receiving a prescription without considering time and circumstances.

U-Health shares three types of health care system. First type is ‘u-Medical’, which improves the effectiveness of medical care and makes easier access to the medical center. Second type is the ‘u-Silver’, which focuses on people with chronic disease and elderly people. Third type is ‘u-Wellness’, which focuses on the improvement of health care in general. The figure 1 shows how the u-health works.

Figure 1. The circulation of the u-health system.



2.2. Overview of the Project

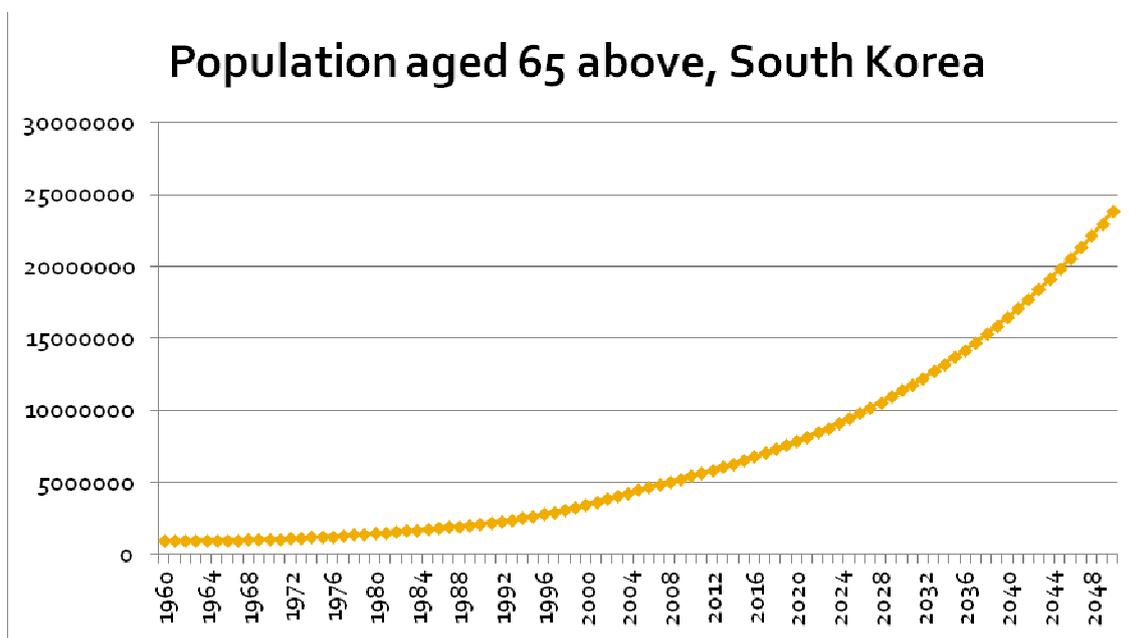
Since u-Health system is regarded as a policy rather than a project, it is difficult to conduct CBA for the all related field. In this paper, we only focus on ‘u-Silver’ to make our CBA simple and to suit to the mini project. We assume the follow conditions.

- ① U-Health is a 30-year-span project which starts in 2015.
- ② All policies are already compatible with the U-health, so that there is no cost of changing laws and regulations.

③ There is a constant growth rate (3.7%) of aging population (people over 65) in Korea.

The figure 2 shows the growth rate of aging population in Korea between 1960 and 2050. We get this trend by conducting a projection based on the available number of elderly population between 1960 and 2010.

Figure 2. Population of elderly people in Korea.



Because of the aging population and the development of IT, u-Health seems to yield a huge benefit to the health and medical care service by cutting people's unnecessary costs. The Ministry of Health and Welfare of the Korean government set a goal to expand u-Health system not only to yield social benefits but also to expand the related industries. IT industries have already worked on developing equipments of u-Health and they have expanded their business in this field. The Korean government had assumed that the net social benefits by reducing the costs for medical care by applying u-Health system would reach at 1.4 trillion won/ approximately

US\$ 1.4 billion in the year 2006. Based on this government data and other precedent researches on u-health, we will figure out how beneficial u-health is for Korean society and its related industries.

2.3. Objective of Introducing U-Health

Korea is one of the leading countries of information technology so that it would be a good precedent example of implementing u-Health system in other countries. The degree of development of information technology would reduce its costs. Based on the increasing concerns of the aging society and well-being, the government assumes that the costs of health and medical care will increase continuously. It points out the importance of implementing u-Health system in the future.

There are four major general benefits of introducing u-health system in the society. First, it improves people's Quality of Life (QOL). Second, it also reduces health care cost. Third, it helps hospital have efficient operation. Fourth, it prevents medical errors. On top of that, u-health system helps improve not only individual's quality of life but also society in general by yielding benefits in related industries.

2. Benefit and Cost analysis

In this section, we will analyze the benefits and costs related to the introduction of U-Health system in South Korea. The summary of benefits and costs is shown in Table 1. We identified five benefits, which are reduction of transportation cost, time saving for patients, reduction of health insurance expenditure, reduction of health care cost paid by patients, and increased efficiency of hospitals. Cost components are divided into three; initial investment cost by government, rental cost of equipment, and campaign cost to introduce the program to public.

Table 1: Benefit and Cost components

Benefit	Cost
Reduction of transportation cost	Initial Investment Cost
Time saving for patients	Rental Cost of Equipment
Reduction of health insurance expenditure	Campaign Cost
Reduction of health care cost paid by patients	
Increased Efficiency of Hospital and healthcare practice	

All of the benefit components and rental cost of equipment will be analyzed and monetized in terms of per person per year. Therefore, it is necessary to multiply each component with population number each year. Elderly population in South Korea is increasing rapidly, with growth rate of 3.7% per year. It is projected that by 2050, population above 65 years old will reach 24 million people, which is four times current population of 5.8 million people. Therefore, we expect an increasing benefit each year as well as increasing cost.

3.1. Benefit Analysis

3.1.1. Reduction of transportation cost

The introduction of U-health is expected to reduce the amount of visit to hospital, both frequent and emergency. According to Johnston (2000), U-health can reduce patients visit by around 27%. Average round trip cost to hospital in South Korea is estimated around 8,349 won/ approximately US\$8 (Kang Sung et al, 2007). Moreover, it is estimated that elderly people visit hospital for health check-up 14.7 times on average (Kang Sung et al, 2007). Using this information, we can calculate the reduction of transportation cost using the formula,

reduction of transport cost = round trip cost X annual visit X reduction of visit

We find that annual reduction of transportation cost will be 33,137 won/ approximately US\$33 per person per year.

3.1.2. Time saving for patients

The introduction of U-health is also expected to save time for the patients. Using online and distant monitoring, they can free up time that would otherwise be used for commuting to hospitals, waiting for doctors and physicians, and other administrative issues. It is the convention of Inter American Government Bank to value time as half of minimum wage in that country. Using this convention, we can also value the time of the elderly. Current minimum wage in Korea is 4,110 won/ approximately US\$ 4 per hour. We can use the same information as above for average annual hospital visits (14.7 times) and reduction of visits if U-health is introduced (27%). If we assume that the elderly spends in total 4 hours per visit, we can calculate the value of time saving for patients using formula,

Time saving

$$= \frac{\text{annual visit X time spent per visit X reduction of visits X minimum wage}}{2}$$

We find that the annual time saving for patients from the introduction of U-health system is 32,625 won/ approximately USD\$ 30 per person per year.

3.1.3. Reduction of national health insurance expenditure by government

The biggest benefit that comes from introduction of U-health is in the form of reduction of government expenditure on national health insurance. In 2010, government of South Korea spent 13.78 trillion won/ approximately US\$ 13 billion on national health insurance for elderly, which is around 30% of the total national health insurance expenditure. The elderly population in South Korea was 5,446,365 people in 2010. By dividing these

numbers, we know that Korean government spent 2,530,991 won/ approximately US\$ 2.5 thousand on health insurance for one elderly people in 2010. Assuming the amount spent per person health insurance constant, we can calculate the reduction of health insurance expenditure per year. According to Johnston (2000), U-health system can also reduce the general cost of health care expenses by 27%. Using these figures, we can calculate the reduction of health insurance expenditure using formula,

$$\text{reduction of health insurance expenditure} \\ = \text{health insurance expenditure per person} \times \text{reduction of health care cost}$$

We find that annual reduction in healthcare expenditure by government is 683,367 won/ approximately US\$ 680 per person per year.

3.1.4. Reduction of health care cost paid by patients

In South Korea, not all of the health care cost is paid by government through health insurance. The reduction of health insurance expenditure by government we have from above is 55% of the total health care cost. The other 45% of the health care cost is paid by each individual in the form of monthly insurance premium as well as payments for every visit to hospitals, including consultation fee, administrative fee, drugs, and so on. If 2,530,991 won is 55% of the total health care cost, the other 45% of the cost is around 2,070,807 won per person per year. Using the same formula as the previous section, we find that annual reduction of health care cost paid by patients to be around 559,118 won/ approximately US\$ 550 per person per year.

3.1.5. Increased efficiency of hospital and health care practices

Other than benefiting patients and government through reduction of unnecessary costs, introduction of U-health can also benefit hospitals through increased efficiency. For example, it is estimated that around 60% of clinicians and nurses' time is spent on searching and looking for

patient's data (Gartner, 2009). We cannot find any report or research conducted on monetizing the impact of introduction of U-health on increased efficiency in South Korea. Doing calculation by ourselves will also be difficult given the time constraint and difficulty of identifying what components of hospital practices are improved, let alone monetizing them. Therefore we rely on market analogy based on a study done in Europe for E-health system in euro zone.

The studies was done by Swedish ministry of Health and Social Affair in 2008 and published in 2009. The study was conducted for six European countries; Sweden, Spain, France, Netherland, United Kingdom, and Czech Republic. It identified increased hospital efficiency and improved healthcare practice with the introduction of E-health, such as reduced time on administrative issues, reduced hospitalization bed days, reduced medication error and adverse drug events, saving lives in some emergency case, and so on. The value of this increased efficiency is estimated to be around 135 EUR per person per year. Using this value, we can convert it to Korean won with exchange rate in 2008, which was 1 EUR = 1800 won, and get the increased efficiency of approximately 243,000 won/ approximately US\$ 240 per person per year.

3.2. Cost Analysis

3.2.1. Initial Investment

The initial investment by government for this project is assumed to be only the research and development investment in information technology. Other required infrastructures, for example, internet network have supposed to be already installed for other purposes and no further investment is required for this specific project. It is estimated that South Korean government is investing \$151.5 billion in health related information technology development in

three years starting 2012 (Tyler, 2010). This investment is considered as this project's initial investment, which is divided equally into three initial years for 11 % elderly people as 6,348,309,550,000 won/ approximately US\$ 6 billion per year using following relation:

$\$151.5 \text{ billion}/3*0.11 = \$5,555,000,000 \text{ per year}*1142.81\text{won} = 6,348,309,550,000 \text{ won per year}$

3.2.2. *Rental cost*

The rental costs include the rent that should be paid by the user of this service and by the hospital to the private firms that are providing u-health related equipment to the individual users and related setup including training for the health professionals in the hospitals. According to a study conducted in South Korea, the aggregated rental cost is estimated to be 332,500 won/ approximately US\$ 330 per person per year (Kang Sung Uk et.al, 2007). This cost includes the individual as well as hospital rental costs. This per capita rental cost is multiplied by respective elderly population of specific year to get yearly rental cost of that particular year.

3.2.3. *Campaign costs*

Since the U-health is a new system, it should be well introduced to the public through campaigning. The easy and effective way of introducing the new program may be to use media as means of campaigning. in South Korea based upon its higher access of individual South Koreans to the internet and electronic media, it is designed to introduce the u-health system to the public by using social media and electronic media campaigning for the initial three years.

① Social Media

Social media generally include Facebook, twitter, LinkedIn, YouTube, Blog etc. that

can be used for campaigning the u-health system. The cost for this is the initial development cost that is said to be fixed and one-time cost and the monthly service charge. The social media campaigning firms are available to handle this kind of campaigning. The rate that is found to be suitable is taken as \$ 5000 as initial cost and \$2500 per month the service charge (www.virtualsocialmedia.com). The per year social media cost, supposed to be equal for three years, is calculated as 39,998,350 won as follows:

$$\text{Per year social media cost} = \$5000 + 12 * \$2500 = \$35,000 = 39,998,350 \text{ won}$$

② Electronic Media

The other popular method used for campaigning is use of electronic media. There are 4 national and 11 regional television channels and 7 national and 13 regional radio channels to use in this campaigning. The Korean Broadcasting Advertising Corporation has published the advertising rate of each individual channels those rates have been used to calculate the electronic media costs. Furthermore, it is assumed to broadcast once a day per TV/Radio station in prime time (20.00- 23.00 pm) for the first two years and twice a day per TV/Radio station in prime time for the third year. The per year cost for the first two years is 23,428,279,258 won and for third year is 46,856,558,561 won as computed in the following table:

Channel	Type	Number of channels	Rate	No. of times per day	Days	Total \$
TV	National	4	9918	1	365	14480280
		4	9918	2	365	28960560
	Regional	11	1060	1	365	4255900
		11	1060	2	365	8511800
Radio	National	7	516	1	365	1318380
		7	516	2	365	2636760
	Regional	13	94	1	365	446030
		13	94	2	365	892060
First Two years per year rate				\$ 20,500,590		23,428,279,258 won
Third year Total				\$ 41,001,180		46,856,558,561 won

Data Source: Korean Broadcasting Advertising Corporation

Hence the total campaign cost is calculated using following relation:

$$\text{Campaign cost} = \text{Social media cost} + \text{Electronic media cost}$$

The first two years' campaign cost is calculated as 23,468,277,608 (39,998,350 + 23,428,279,258) won per year in each year and third years' campaign cost is computed as 46,896,556,911(39,998,350 + 46,856,558,561) won. (Dollar values are available in the table above)

4. Net Present Value and Sensitivity Analysis

4.1. Net Present Value

After analyzing the benefits and costs of introducing U-health in South Korea, we can derive the Net Present Value (NPV) of this program/project and decide whether this program is worth investing. Table 2 gives the summary of all the benefits and costs of introducing U-health. As is mentioned in previous section, to get the NPV, we will multiply all the benefit components and rental cost of equipment with population number each year and add it together. We use the population growth rate of 3.7% which is the growth rate of elderly population in South Korea from 1960 to 2010. We also use social discount rate 5.5% when calculating the NPV because 5.5% is the official discount rate used by the government to assess government projects. We also use 30 years as our framework of analysis. Using this information, we calculated the NPV of introducing U-Health in South Korea to be 127,658,464,137,246 won (127.6 trillion won/ approximately US\$ 127 billion). Since the NPV is positive, we can say that introducing U-Health in South Korea will give positive social surplus and thus worth investing.

Table 2: Benefit and Cost Analysis summary

Benefit	Cost
Reduction of transportation cost: 33,137 won / person / year	Initial Investment Cost: 6,348,309,550,000 won / year (3 years)
Time saving for patients: 32,625 won / person / year	Rental Cost of Equipment: 332,500 won /person / year
Reduction of health insurance expenditure: 683,367 won / person / year	Campaign Cost: 23,428,279,258 won (1st & 2nd year) 46,856,558,561 won (3rd year)
Reduction of health care cost paid by patients: 559,118 won / person / year	
Increased Efficiency of Hospital & healthcare practice: 243,000 won / person / year	

(Dollar values are available in sentences above)

4.2. Sensitivity Analysis

Even though the number NPV is positive, we also want to see how the NPV changes as we change our assumptions or variables of interest. In this analysis, we are interested in looking at changes in three variables, which are the social discount rate, population growth, and timeframe. The result of this analysis is summarized in table 3.

Table 3: Sensitivity Analysis results

Variables	NPV
Discount rate 3%	201,432,604,358,523 won
Discount rate 5.5%	127,658,464,137,246 won
Discount rate 9%	71,537,178,603,625 won
Discount rate 12%	45,368,127,338,232 won
Population growth 1%	81,063,989,844,970 won
Population growth 3.7%	127,658,464,137,246 won
Population growth 6%	180,118,737,179,353 won
Time frame 15 years	63,797,470,569,362 won
Time frame 30 years	127,658,464,137,246 won
Time frame 45 years	177,420,508,601,574 won

(Dollar values are available in sentences below)

Firstly, we hold population growth and time frame constant at 3.7% and 30 years respectively, and see how changes in discount rate change NPVs. When we consider discount rate of 3%, the NPV increases substantially to 201.4 trillion won/ approximately US\$ 201 billion. When we increase discount rate to 9%, NPV reduces significantly, but still at a positive value of 71.5 trillion won/ approximately US\$ 71 billion. Lastly, if we use discount rate of 12%, which is the official discount rate for Asian Development Bank project in developing countries, the NPV is only 45.3 trillion won/ approximately US\$ 45 billion, even though the number is still positive.

Secondly, we want to see how NPV responds to changes in population growth rate. In this case, we consider changing it to two different rates, 1% and 6% rate. We also fix the value of discount rate and timeframe at 5.5% and 30 years. As can be seen from the table, when population growth is only 1%, the NPV is only 81 trillion won. But when population growth is 6%, NPV soars to 180.1 trillion won/ approximately US\$ 180 billion. This is in line with our expectation that U-health system will benefit more in society with aging population, as the cost

of health care increases very rapidly if we do not introduce the system.

Thirdly, we change our timeframe of analysis and see how much NPV is affected by it. By fixing discount rate and population growth rate at 5.5% and 3.7% respectively, we change our timeframe to 15 years and 45 year. The results for both cases are also positive with NPV of 63.7 trillion won/ approximately US\$ 63 billion and 177.4 trillion won/ approximately US\$ 177 billion for 15 year and 45 year timeframe.

Lastly, we want to see how NPV responds when we change three variables altogether by considering best case and worst case scenario. At the best case scenario, we change our variables to 3% for discount rate, 6% for population growth, and 45 years for the timeframe. We find the NPV to be enormously positive at 603.7 trillion won/ approximately US\$ 603 billion, which is almost five times the NPV using our base assumptions. When we consider the worst case scenario by setting discount rate at 12%, population growth at 1%, and timeframe at 15 years, we still find a positive but small result, with NPV around 21.7 trillion won/ approximately US\$ 21 billion.

Our results of sensitivity analysis by changing discount rate (3%, 9%, and 12%), population growth rate (1% and 6%) and timeframe of analysis (15 years and 45 years) suggest very resilient results showing that NPV for introducing U-health is positive in all cases. Other than the enormous benefit generated from the project, one of the factors that could be contributing this robust results is the fact that majority of the cost of the project is in the form of rental cost of equipment. This rental cost is paid in a yearly basis during the lifetime of the project (timeframe). Therefore, the cost components are also subject to discounting every year, which is rather unique case compared with many other government projects at which most of the costs are incurred at the early stage of NPV analysis.

5. Secondary market

5.1. Transportation market

As discussed in Benefit Analysis part, the introduction of u-Health is expected to reduce the amount of visit to hospital, both frequent and emergency. Therefore, with project, the quantity demanded for public transportation service for round trip from homes to hospitals will decrease.

The transportation fee reduced by u-Health system
194,304,201,764 won/ approximately US\$ 194 million
= 8,349 won (the average of round trip costs to the hospital)
*14.7 (the average of visiting medical centers per year)
*0.27(the effects of u-Health system)
* 5,863,631(population of the elderly people)

The change in quantity demanded for public transportation service for round trip from homes to hospital can be calculated as

$$\Delta Q = 14.7 \text{ (the average of visiting medical centers per year)} * 0.27 \text{ (the effects of u-Health system)} * 5,863,631 \text{ (population of the elderly people)} = 23,272,751$$

For the whole transportation market, the market is very large.

$$Q^* = 49,779,000 \text{ (population of Korea)} * \text{(the average use of public transportation per person)} = 49,779,000 * (14.7 + \text{other use of transportation})$$

Comparing the size of whole transportation market and the change in quantity demanded, the change in demand is very small. Therefore, the decrease of demand for the round trip from homes to hospitals has very little influence on the price of fare of public transportation.

Besides, the price of fare for public transportation is constant because the government regulates it. If the price does not change in secondary market, it is not necessary to consider. There is no price distortion between primary market and transportation market.

5.2. Labor market in IT industry

Introduction of u-Health system in Korea would create jobs in IT industry. So, with project, the quantity of labor demanded will increase by number of local people employed by the IT companies, which produce medical equipment related u-health during and after the project. The main private companies concerned are GE, Phillips, IBM and so on.

Worldwide, the u-health market is expected to increase 15% or more annually by 2013, from US\$ 1.057 trillion in 2007 to \$ 2.537 trillion in 2013. It is anticipated that u-health services for elderly people, especially services for remote monitoring, will earn US\$ 1.2 billion of net income annually. This market will grow from US\$ 1.4 billion in 2010 to US\$ 2.6 billion in 2014; this means a 12.5% increase every year¹. In addition, it is expected that new job opportunities will exist for 39,000 people by 2014².

In an effort to maximize on the benefits of U-health, it is extremely crucial that the South Korean government actively pursue a healthcare system that is deeply anchored in Healthcare IT (HIT). Frost & Sullivan research revealed that the software applications within the Health care IT segment in South Korea is currently earning USD 92.8million revenue in 2009 and is expected to expand its market size to USD 147.3million by 2016³. Therefore, we

¹ Lee YT, Kim MS, Kim SH, Kim SY. A study of business strategy on U-health industry. Cheongwon, KR: Korea Health Industry Development Institute; 2010.

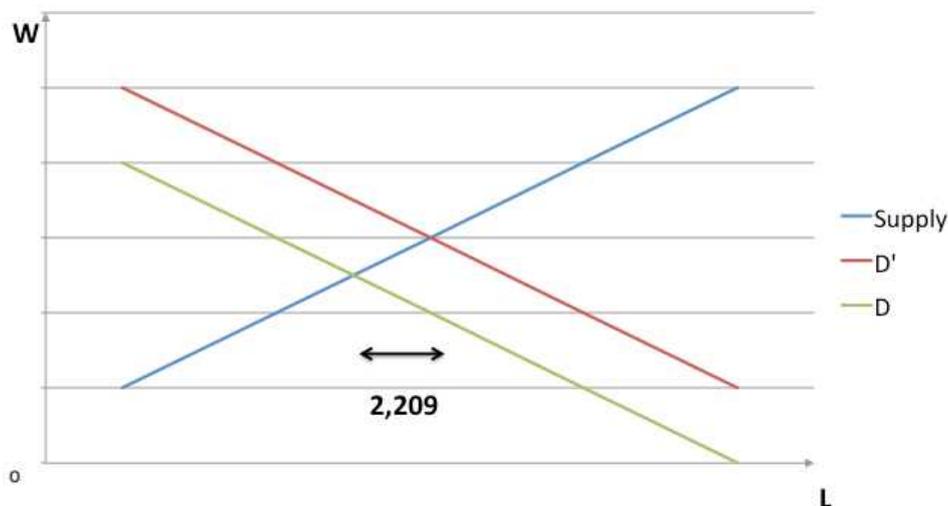
² Tae-Min Song, Seewon Ryu, and Sang Ho Lee, "U-Health Service for Managing Chronic Disease: A Case Study on Managing Metabolic Syndrome in a Health Center in South Korea", *Healthc Inform Res*, 17(4), 2011, pp.260-266., available at <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3259561/#B5>
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3259561/#B5>

³ Frost & Sullivan: South Korea's U-health Boosted by Health IT, available at

can calculate new job opportunities created in Korea using this formula,

$$\text{New Jobs in Korea} = \frac{u - \text{Health market size in Korea}}{\text{Worldwide } u - \text{Health market size}} \times 39000$$

We find that new job opportunities created in Korea is 2209.



Wage might change, but it is difficult to estimate, so we conclude that there is an impact on labor market by introducing u-Health system in Korea.

Regarding the labor market in medical industry, we conclude that demands of workers might not decrease based on studies and data we have referred to for this paper. Instead, because the project reduces waiting time of patients in hospital, workers in hospital can spend more time on each patient, and therefore, they can pay more attention to each patient. This is more efficient to the whole society. Moreover, one of the purposes of conducting u-Health project is to reduce wasted time of doctors and patients, and we showed benefits of reducing wasted time in the benefits part above. Therefore, this project does not reduce the demand of workers in hospitals, but allows them more time to use it efficiently. Conducting u-Health system improves efficiency

<http://www.frost.com/prod/servlet/press-release.pag?docid=219497956>

of both patients and medical workers. Based on the reason above, we conclude that this project does not affect the labor market in medical industry.

6. Conclusion

Through conducting a CBA for this project, we find out that it is beneficial to introduce u-health system in Korea. The NPV with our set condition reaches 127,658,464,137,246 won/ approximately US\$ 127 billion and all sensitivity analysis suggest positive NPVs in all cases. For the secondary market, we consider transportation market and labor market of related industries. There is no significant change in transportation market, while the demand of related industries' labor market increases.

The benefits are reduction of transportation cost, time saving for patients, reduction of national health insurance expenditure, reduction in health care expense paid by patients, and improved efficiency of hospital and health care practice. All the benefits are analyzed and calculated per elderly person per year. The total benefit per person from the introduction of U-health is 1,551,247 won/ approximately US\$ 1.5 thousand per elderly person per year.

For the cost analysis, we adopted the initial government investment as 6,348,309,550,000 won/ approximately US\$ 6 billion per year for elderly people. Similarly, we adopted the aggregated rental cost of hospital and individual as 332,500 won/ approximately US\$ 330 per person per year. Finally, we designed the media campaigning and estimated the campaigning cost as 23,428,279,258 won/ approximately US\$ 23 million for first two years and 46,856,558,561 won/ approximately US\$ 46 million for the final third year.

Using social discount rate of 5.5%, population growth of 3.7%, and timeframe of analysis of 30 years, we derived the NPV to be 127,65 trillion won/ approximately US\$ 127 billion. We try changing the social discount rate (3%, 9%, and 12%), population growth (1%

and 6%), and time frame (15 years and 45 years) for sensitive analysis. In all of the cases, we still find the NPV to be positive. When we change the parameters altogether (best and worst case scenario), we also find the NPV to be positive. This result suggests that the introduction of U-health in South Korea will bring rather immense social surplus to society.

Acknowledgement

This project has been carried out under the supervisions of Professor Yoshitsugu Kanemoto, Professor and Executive Advisor to the President, National Graduate Institute for Policy Studies (GRIPS).

This project report reflects the guidance, support, encouragement and patience of several individuals. First and foremost, we would like to thank to Professor Yoshitsugu Kanemoto for his thoughtful guidance, and giving us such opportunity to conduct a CBA project. Without his generous support and friendly attitude, we would not have accomplished our goals easily within the time available.

We also owe our indebtedness to all reputed authors whose writings have provided us the necessary guidance and invaluable materials for the enrichment of our report in all possible ways. Our thanks also go to all the individuals, official websites, and institutions that generously provided required information to us.

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