

21. BÖLÜM / CHAPTER 21

ECONOMIC EVALUATION OF REMOTE HEALTH SERVICES, COST EFFECTIVENESS, ANALYSIS AND REIMBURSEMENT

UZAKTAN SAĞLIK HİZMETLERİNİN EKONOMİK DEĞERLENDİRMESİ, MALİYET ETKİNLİĞİ, ANALİZ VE GERİ ÖDEME

Ahmet Bilge SÖZEN*

*Istanbul University, Istanbul Faculty of Medicine, Department of Cardiology
E-mail: absozen@istanbul.edu.tr

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ABSTRACT

Due to the payment of some fees of remote health service (RHS) by the supporting institutions, progress has been made on many issues, such as the prevalence, adoption, convenience, cheapness, distance, waiting time, reimbursement, and others. With the growth of market, there is an increased need to make some analyzes before investing. Some of these analyses are cost analysis, cost-effectiveness analysis, cost minimization analysis, benefit-cost analysis, efficiency analysis, paybackperiod analysis, and profitability ratio analysis. Although cost analysis is a good starting point that is common to all economic evaluation methods, it excludes program results and limits the information provided to decision makers. For this reason, additional methods which enable evaluation to be made from many aspects such as effectiveness and efficiency should be used to examine data such as real cost, high return on investment, high net present value, high internal rate of return and short payback period. In order to convert RHS into income, it must be paid back in some way. The process of converting the RHS into income will start only after the legal basis is established, and the prices are determined by the SSI (Social Security Institution). For this reason, RHS must also be supported by a repayment system that will pay for itself and convince stakeholders to make new investments. Once the legislation for the RHS is prepared and enforced, the state's reimbursement will probably be in the form of one of the subgroups of service procurement through SSI, namely global budget, payment per capita, package price, case-based payment, salary, payment per service or a combination of these. Reimbursement of RHS costs to the service provider by private insurance companies will be in the form of conventional payment.

Keywords: Remote health service, cost-effectiveness analysis, financial analysis, conversion to income, reimbursement

ÖZ

Uzaktan sağlık hizmeti (USH) ücretlerinin bir kısmının destekleyici kurumlar tarafından ödenmesi nedeniyle yaygınlık, benimsenme, kolaylık, ucuzluk, mesafe, bekleme süresi, geri ödeme ve diğerleri gibi birçok konuda ilerleme kaydedilmiştir. Pazarın büyümesiyle birlikte yatırım yapmadan önce bazı analizler yapma ihtiyacı da artmıştır. Buanalizlerden bazıları; maliyet analizi, maliyet-etkinlik analizi, maliyet minimizasyon analizi, fayda-maliyet analizi, verimlilik analizi, geri ödeme süresi analizi ve karlılık oranı analizidir. Maliyet analizi, tüm ekonomik değerlendirme yöntemlerinde ortak olan iyi bir başlangıç noktası olmasına rağmen, program çıktılarını dışarda tutar ve karar vericilere sağlanan bilgileri sınırlar. Bu nedenle, gerçek maliyet, yüksek yatırım getirisi, yüksek net bugünkü değer, yüksek iç verim oranı ve kısa geri ödeme süresi gibi verileri etkinlik ve verimlilik gibi birçok açıdan değerlendirmeye olanak tanıyan ek yöntemler kullanılmalıdır. Uzaktan sağlık hizmetinin gelire dönüştürülmesi için bir şekilde geri ödenmesi gerekir. Uzaktan sağlık hizmetinin gelire dönüştürülmesi süreci ancak yasal zeminin oluşturulmasından ve fiyatların SGK (Sosyal Güvenlik Kurumu) tarafından belirlenmesinden sonra başlayacaktır. Bu nedenle USH'nin kendi kendini amorti edecek ve paydaşları yeni yatırımlara ikna edecek bir geri ödeme sistemi ile de desteklenmesi gerekmektedir. SSK mevzuatı hazırlanıp yürürlüğe girdiğinde, devletin geri ödemesi muhtemelen SGK aracılığıyla hizmet alımının alt gruplarından biri, yani küresel bütçe, kişi başına ödeme, paket fiyatı, vaka bazlı ödeme, maaş, ödeme hizmet başına veya bunların bir kombinasyonu şeklinde olacaktır. RHS maliyetlerinin özel sigorta şirketleri tarafından hizmet sağlayıcıya geri ödenmesi geleneksel ödeme şeklinde olacaktır.

Anahtar Kelimeler: Uzaktan sağlık hizmeti, maliyet etkinlik analizi, finansal analiz, gelire dönüştürme, geri ödeme

1- The basic features of healthcare, problems, the concepts of justice and equity, the duties of the state in delivering healthcare services to those in need.

Being healthy, improving their health, and reaching adequate and effective health care services when necessary are among the fundamental rights of all people. However, the health sector, where the service is provided by the people with the longest and highest level of education using the highest level of technology, is a very expensive sector due to its structure and features, and it has to be so. Health spending is high in almost all countries. The share of health expenditures allocated from the budget varies between 4% and 12% of GDP across countries (lowest with 1.3% East Timor Democratic Republic and highest with 19.7% Tuvalu), and future projections are not promising. World health spending is expected to reach 11 trillion USD in 2030. It is believed that the increase in the level of welfare, the health awareness that develops in individuals thanks to the internet and the media, and in addition to this, the rapid progress in medical technology will increase the average lifespan of human beings to over 100 years of age. Unfortunately, the increased average lifespan, as well as the frequency of chronic illness, will bring a huge workload on hospitals and healthcare professionals and an unbearable cost burden on national economies (Tezcan, 2016).

Let's consider a structure where there are no government and other financing institutions, only out of pocket payments. In such structure, people need to save money to use in case of need, but since health is also competing with other needs, these accumulations will generally not be possible except for people with high income levels (in fact, the same situation is partially present today). Moreover, one of the most important features of the health sector is the randomness of demand, that is, not knowing when the demand will occur. Because of the high cost of the sector, it is not possible for many people to cover all of their treatment expenses even in planned treatments, in case of catastrophic spendings (more than 40% of households' payment capacity), i.e. a sudden serious illness, traffic accident etc., most people will be helpless. Apart from these, the money required for the treatment of overly expensive diseases such as cancer may be even higher than the payment capacity of the people who have high income (Wakerman et al., 2008). Therefore, they should be supported externally if needed. This is primarily the duty of official institutions. For this purpose, the states can allocate some of the taxes they collect to health financing or can collect insurance premiums through institutions like Social Security Institution (SSI) and support the people who need it. For this purpose, the states can allocate some of the taxes they collect to health financing or can collect insurance premiums through institutions like SSI and support the people who need it.

The chance of access to health is not fairly distributed in any country of the world. The reason for this is predominantly geographical in some countries and inequality in income distribution in some countries. Many reasons can be found at the same time in some countries. For instance, in the examinations, it was determined that the death risk of a child born in a developing African, Asian or Latin American country before reaching his 5th birthday is 10 times higher than that of his peer in North America or Western Europe. It is also seen that the highest disease rate and the heaviest patients are in the poorest groups in the same society. For example, one-third of Australians live outside their city, and thus their chances of accessing healthcare are lower than those living in the center. In addition, those living in rural and decentralized areas are generally poorer than those living in metropolitan areas, and the rates of death, illness, and hospitalization increase as they move away from large cities.

It may be thought that making health care equally accessible to all segments of the society is one of the basic duties of the state, but it is practically impossible to provide equal health services to all citizens. Because it is not reasonable to establish a full-fledged hospital in every village, a medical school in every province, and to treat every patient by an associate professor or a professor, and it is not viable and sustainable even if the state transfers all its resources to health. For this reason, the state tries to provide health services to some extent

and in the way its resources allow. In other words, it cannot establish a state hospital in every village but at least it can establish a health center, create a referral chain to meet the needs of the patient, ensure that the roads are open and the number of ambulances is sufficient, and keep the devices and materials of state hospitals always working and accessible. Maybe it cannot open a university hospital in every city or have a professor or an associate professor to examine every patient, but can ensure that the university and research hospitals that established in certain regions have enough experts and/or academicians to meet the need. Provide the highest quality health service possible and enable students to be educated. As a result, it tries to create a fair environment where everyone can access to health services.

Unfortunately, providing equitable access to health care is not enough or even wrong. Because justice is to give Caesar's share to Caesar, and in order for justice to be established, people with more income and naturally paying more taxes should benefit from health care more than people who are poor and pay less tax, which means that justice leads to injustice. For this reason, what is more important than the provision of justice in health is the provision of equity. In other words, it is necessary to ensure that health care is not given to everyone equally or at the tax rate (fair), but less to those who need it less, and more to those who need it more (in accordance with equity). However, studies have shown that the rich use hospitals and public health services more than the poor. To put it simply, there is a very strong correlation, fairness, so to speak, even between the rates of vaccination, which we think will be equal because it is done by the state and is free of charge, and the household income level. Here is the problem: The poor themselves and their families need health care more, but they have difficulty in accessing it. The wealthy, on the other hand, can reach and benefit from the health center as soon as possible by using a helicopter or private plane, if necessary, even if they are close to the health center when they need it. Extremely wealthy families can establish their own hospitals or university hospitals, and they can also earn money thanks to these hospitals. Moreover, since they establish these universities as Foundation Universities, they benefit from tax advantages. As a result, it is not enough to create an equal opportunity for everyone to reach health, it is necessary to allow them to use this chance, to make positive discrimination, and to provide health services in accordance with equity. Even this is not enough; there must be a transfer of resources from the rich to the poor. For this reason, the state receives more tax from the rich and less from the poor by applying a tax on income. With the share it allocates from these taxes for health, it tries to provide more services to the poor and those who need health services more, and to establish equity to some extent.

The point that should not be overlooked here is that if we try to fully comply with fairness, we may harm effectiveness. Because putting the health facility and its officials wherever possible to ensure that people can access health may cause such high costs that the states cannot afford even in cases where the possibilities of frothed, unconscious, and excessive demand are ruled out. That's why it's important to keep the balance in the fairness/effectiveness seesaw. Allocating a very high share to health in the budget will mean that the share to be allocated from the budget for the other needs of the society, which are at least as important as education and security, will be reduced. Undoubtedly, the costs of these will be as heavy as the costs of not paying attention to fairness, maybe even more. For this reason, the state cannot and does not fully establish justice, and even if it wants to, it cannot afford it, it does what it can. In this case, municipalities and charities step in to close the gap and to ensure equity. However, their efforts are not enough, and some of the gap is filled by private insurance companies and financial institutions. Municipalities and charities try to do their part in establishing equity, but for those who are not public or charitable institutions, private insurance companies do not have any concerns about equity, justice or even equality. Like any private company, their concern is lowest cost, maximum revenue and maximum profit. Private insurance companies do not receive more premiums from the rich and less than the poor like the state; they receive a premium based on the calculated risk (actuarial). It is known that in every society, in general, the rich are healthier, and the poor are more unhealthy. For this reason, the rich need less health care services and the poor need more. Therefore, the rich have a lower risk of getting sick, and the poor have a higher risk. Since private insurance companies calculate the amount of premium to be paid according to the actuary, naturally the insurance premiums of the rich should be low and the premiums of the poor should be high, which is unfair. The poor do not have the money to pay these premiums anyway.

That is, one party has money but does not need it, the other does not have money. If private insurance companies pay the health expenses of the poor, who do not have the chance to pay high premiums, but need health care more, their profits will decrease. The first way to compensate for this loss is to increase the premiums of the poor, in which case the poor do not take out private insurance because they cannot pay their premiums, and the company loses customers. The second way is to increase the premiums of the rich, but this time the rich are not willing to pay high premiums for the health care they need less. If companies force them, they will lose rich customers this time. Companies cannot afford to do this either, and they do not increase their premiums in order not to lose their rich customers. As a result, it is not possible for the poor to be covered by private insurance, they have to be content with state protection, which causes a high share of the government's budget for health. Apart from

these, financial institutions operating only in the country or all over the world also act as an intermediary in the transfer of resources between the service recipient and the provider. The institutions that these financiers will be are determined according to the health policies of the relevant state.

If we summarize what has been written in the section so far:

a) Health sector is a very expensive sector; it should be made cheaper by making use of the developments in technology.

b) The rich use this service more even though they need it less, while the poor, on the contrary, use it less even though they need it more. Fairness must be ensured.

c) It is almost impossible to ensure fairness. The wealth of the state is not enough, and private insurance companies have no such concerns.

d) In order to deliver the service closest to justice to every segment of the society as much as possible, it is necessary to take and share a part of this burden from the state.

In order to reduce the burden of the health system on the end user and the state, new initiatives that also use technology are required. This new initiative should be such a system that (Langabeer et al., 2016);

1 - Must be adopted by all parties

2 - It should be easy to be learnt and used even by people with low education level

3 - It should enable remote diagnosis, initial treatment, maintenance treatments, elderly, disabled and home care services,

4 - It should enable even patients or their relatives to perform first aid.

5-It should eliminate regional differences, eliminate or reduce distance, transportation, accommodation and time problems, and give everyone the same chance to access to health services.

6 - Should take at least some of the investment costs from the state

7 - Should increase efficiency and avoid duplication

8 - It should cover the investment costs within a reasonable time and make the investor profit

9 - Personnel should reduce overtime, treatment and hospitalization expenses, and reduce the cost of service

- 10 - It must be sustainable
- 11 - Must be adopted by the state (Social Security Institution, SSI) and private sector (private insurance companies) and be covered by reimbursement
- 12 - Should facilitate data storage and access when needed
- 13 - It should increase service quality, reduce or eliminate human errors,
- 14 - Should shorten the patient waiting times
- 15 - Should facilitate the transition from hospital-focused patient service to patient-centered service
- 16 - It should shorten the length of hospital stay by enabling early diagnosis and treatment.
- 17 - It should enable access to health education in situations like quarantine application due to earthquake or epidemic disease etc. that may reveal the possibility of preventing access to health services.
- 18 - It should be used in the fields like teleconsultation, telepsychiatry, telesurgery etc.
- 19 - Applications to doctors and hospitals should be reduced
- 20 - It should reduce health expenses
- 21 - It should be able to generate data outside of working hours or during sleep.

There is not yet a system that can fully meet so many expectations, but the best example of a system that can meet most and partially is the Remote Health Service (RHS), which is being used more and more today. In order to avoid unnecessary repetitions, how and to what extent the RHS meets the above expectations is explained in the text when appropriate.

European Union Health Commission defines the concept of e-Health as “prevention, diagnosis and treatment, monitoring and management of health through the use of information and communication technologies (network connections, mobile software, robotic applications, smart devices, databases, video conferencing, etc.) in health services” (Kılıç, 2017).

The Turkish Ministry of Health defines it as “Using all functions of information and communication technologies to improve the health of citizens and patients, to increase accessibility to health services, and to provide quality, efficient and effective services to all stakeholders in the health sector”.

As can be understood from the definitions, e-Health is a general concept and consists of various sub-units. Telemedicine is sending, storing, and providing health services for the purposes of diagnosis, treatment, follow-up and evaluation by using information and communication technologies between distant centers. These services are called telehealth if they include clinical and non-clinical services in the fields of education, administration, research (Işık and Güler, 2010).

In this article, the term RHS generally refers to the concept of e-health.

2- A method that can be used to provide cheap and equitable health care: Remote health service

a) General benefits of RHS

Remote health service generates great hopes in reducing the burden of the health system which has become an increasingly heavy burden to the end user and the state. Today, thanks to the applications that are installed on the smartphones of almost everyone and that work with very simple commands such as “start, finish, send”, and therefore can be learned in a very short time and can be used easily, many data for example; “How many steps were taken per day, how many calories are spend or heart rate, blood pressure, blood glucose level etc.” can be measured instantaneously, and if desired can be sent to doctor. In these applications, pictures or symbols can be used instead of writing so that even the elderly who are illiterate or who cannot adapt to technology can be used. In addition, these applications provide invaluable data that doctors cannot obtain in the outpatient clinic environment by making continuous measurements not only during working hours, but also outside working hours, not only while awake, but also during sleep, calm or stressful environments. Apart from these, thanks to the software that professionals can use, remote home care, remote examination, remote surgical applications, remote medical education applications, and medical consultation services can be provided.

These data can be saved in a central computer, and instant or long-term information about the person and the society can be obtained. They can be accessed and used quickly when necessary, shared with the relevant authorities, may be analyzed and used to form health policies. Since these data are sent online, the patient often does not need to go to the hospital, there is no travel cost, no waiting in the hospital, and also creates a chance to intervene early in case of emergency by activating an alarm. Moreover, some of these services are paid by the supporting institutions. Thus, prevalence, adoption, convenience, cheapness, distance, waiting time, payback, etc. Many of the conditions listed above are met. Improvement is not only

limited to these, but also seen in health outcomes. For example, in the Netherlands, which has one of the best Health and e-Health systems in the world, 50% of patients with mental disorders are diagnosed and treated with the “tele-medicine method (video conference)” without going to the hospital. In this branch, there are significant improvements in patient waiting, hospitalization and healthcare costs. In addition, a review by the New England Healthcare Institute, Massachusetts Technology Collaborative and Health Technology Center found a statistically significant decrease in mortality and length of stay in hospitals and intensive care units (ICUs) with improved RHS structure when compared to similar ICUs (Kouskoukis and Botsaris, 2016).

Moreover, the benefits obtained through RHS are not limited to the field of health. In Table 1, various equivalents of savings created by RHS in various items are given as examples (Kouskoukis and Botsaris, 2016; Navjit et al., 2017, Aydoğdu and Aydoğdu 2013).

Table 1: Various equivalents of savings created by RHS in various items	
Savings Item Amount	Saved
Average per tele ophthalmology review	1007 Canadian dollar
Telemedicine wound therapy	37 days
Telemedicine wound therapy (per patient)	4583 Euro /9 months
Telemedicine service: Distance	5345602 miles/17 years
Telemedicine service: Duration	8,96 years /17 years
Telemedicine service: Cost	2882086 US Doları /17 years
Telemedicine service: CO2 emission	Annual emissions of 271 households
Paper consumption per transaction	2-18 Dolar
Administrative costs	%30

Apart from these, individuals or institutions can conduct research using electronic health records and large databases, provided that they comply with the principles of confidentiality. This also brings benefits by increasing the speed of production and sharing of information.

b) Economic benefits of RHS

The effects of RHS vary according to perspectives (Table 2). For example, patients, especially those who live far from the health institution, will benefit greatly from the benefits of early diagnosis and treatment and reduced travel time and costs.

Medical personnel can easily access to the network where RHS data are uploaded, recognize patients earlier, evaluate and follow up as soon as the complaint occurs. These can increase patient satisfaction, thus increasing the number of private patients. Because RHS reduces the

number of hospitalizations, this is attractive for the reimbursement institutions, but may result in loss of income for the healthcare provider (e.g. hospital). However, especially in institutions where the Diagnostic Related Groups (DRG) system is applied, the institution providing the service will gain an advantage due to the shortening of the hospital stay and the same payment with less cost. There are virtually no fixed costs for these institutions, especially those remote implantable device management. No additional investment is required due to available computer terminals and internet access. The main cost is related to the personnel who monitor the device. However, because remote monitoring is more efficient, it has the potential to be economically attractive to doctors and hospitals. However, the adoption of remote device tracking requires a learning curve to use this new approach.

For device manufacturers, the cost of the transmitter hardware is only a fraction of the total cost. In addition, it is necessary to calculate the cost of maintaining the server database, communication costs and personnel of the technical support hotline. The increase in the number of RHS patients is not likely to reduce total service costs as it will proportionally increase services, but it will reduce product unit cost.

The main challenge for reimbursement institutions, such as SSI and private insurance companies lies in providing better health care without an increase in the cost of service (cost savings). In cases such as device implantation, long-term cost savings can be achieved due to the reduced frequency of hospital admissions.

Thanks to the algorithms and software in RHS, the service quality also increases, which also creates additional savings. For example, by switching to the web-based e-prescription system established between hospitals, physicians, and pharmacies in Sweden, a great increase in prescribing quality, reduction in prescribing errors and time savings were achieved. The total benefit of the system was estimated to be 330 million euros in 2008 prices. It is estimated that the electronic patient registration system established by the Curie Institute of France and the information search engine called Promethee will provide an annual benefit of 30 million euros (Özata, 2009).

Table 2: Effects of remote health care from different perspectives (Burri et al., 2011)

	Accessibility	Quality	Productivity	Costs	Financial incentives
Patients	Increased, especially if the patient is distant	Better care Increased life quality Decreased mortality and morbidity	Less travel, Less wasted time	No extra fees	Less cost to patients and their relatives (travel, food, accompaniment, loss of workforce, etc.)
Medical personnel	Increased access to patient data	Better care, increased satisfaction	Faster tracking Less ineffective treatment more flexibility, Less administrative work	No extra fees	Possibility to increase the total number of followers
Hospital	Inclusion of patient data in the network	Reputation, Increased staff satisfaction	More efficient use of hospital resources	Transmitter acquisition, Data analysis, patient education	Shorter hospital stay for the same DRG
Device Manufacturers	Data centralization	Product quality increases	Increase	Transmitter, Telecommunications, Database service, Hotline, Scientific studies	Marketing value
SSI, Private insurance companies	Data on the use of health services	Better patient care	Healthcare management system	Transmitter	Cost control, Less costly clinical events
State	Increasing access to patient care	Better public service	Healthcare management system	Transmitter	Cost control, Less costly clinical events

3- Evaluation of remote health service from an economic point of view

a) Difficulties in the economic evaluation of remote health care

Because many countries do not require evidence of cost savings for health reimbursement, cost analysis of the RHS was not performed in these countries in the early days. In addition, there was no need for randomized controlled studies showing the efficacy and effectiveness of RHS. But as time passed and the market grew and more and more private companies became interested in the field, the need to do research before investing increased. As the researchers studied the subject, they realized that they were in a very different world.

The healthcare industry is a unique industry. The rules of the economy do not operate as $2 \times 2 = 4$ in this sector where equality and even justice are insufficient and fairness must be ensured as much as possible. At first glance, although it may be thought that it may be evaluated like economically evaluation of other investments, the differences that come from the special structure of the health sector create difficulties in the application of the traditional formulas in the field of health economics. So, in order to make an economic evaluation in the field of health economics, it requires different perspectives. As a part of the health sector, RHS too also carries these problems genetically. Some of these problems in the economic evaluation of RHS are:

- (1) Performing analyses based on assumptions reduces the robustness of analyses due to insufficient data on clinical efficacy, efficacy, and costs,
- (2) The multiplicity of parameters affecting the cost and the inhomogeneity of these parameters (for example, differences in distances traveled, different reimbursement policies, etc.),
- (3) Differences in the performance of economic models,
- (4) The fact that medical devices and communication technology are in continuous development makes medium or long-term cost estimations difficult.

Because of these and many other difficulties, it is not correct to evaluate the RHS from a single perspective; it should be evaluated differently for the patient, the service provider, the reimbursement institution, and each of the stakeholders.

b) Methods used in the evaluation of remote health care

In order for the benefits of RHS to be even greater, RHS needs to become widespread. However, this has an investment cost, and in order to be willing to share this cost, it must be adopted and invested in this area by both patients and their relatives, service institutions, and stakeholders. The state, which is expected to make the biggest investment in this field, of course will decide whether to invest or not after researching the cost, efficiency, cost effectiveness, and payback period of the possible investment. But the state has to pay attention to concepts such as equality, justice, and fairness while providing services to the public. For this reason, it tries to maintain a balance between economic benefit/cost and social benefit, if necessary, it can ignore profitability and cost effectiveness.

The situation changes if the private sector is also asked to step in. The health sector is not independent of the realities of the economy. Yes, the healthcare system is and has to be an expensive sector, but there is also the other side of the coin: There are people who finance

this expensive sector (tax-paying citizens, investing state and private sector, customers paying their premiums, shareholders, capital owners, partners. .) and they rightly question what the money they give is spent on, whether it is used efficiently as it should be, and whether it is wasted. In any industry, no one can use someone else's money as they wish. This is also valid in the health sector. Therefore, in order to invest in RHS, end users, service providers (hospitals), payers (government and private insurance companies), and stakeholders (device and software manufacturers) must find it logical to invest in this area. The investment they make should pay for itself as soon as possible and then generate a profit. Before making such an investment, private companies do not only take into account the parameters that the state examines, but also investigate their profitability ratios, the size of the market, the direction of growth, and the share they will get from the market.

As in other sectors, many analysis methods are used to evaluate the accuracy of the investment made or to be made in the health sector. Some of these are cost analysis (CA), cost effectiveness analysis (CEA), cost minimization analysis (CMA) and cost benefit analysis (CBA), efficiency analysis, payback period (PP) analysis, and profitability ratio analysis.

Below, some of the analyses that need to be done in order to see whether RHS is attractive for investment will be briefly mentioned.

Cost analysis: This type of economic evaluation allows the cost of resources that will need to be used to deliver a particular service to be calculated and compared with opportunity costs. Opportunity cost refers to the value of the next best option for the use of resources. Here, the costs of a method are compared with the costs of alternative methods that are thought to lead to similar results. The aim is to make the least possible investment to obtain the highest possible benefit, or in other words, to obtain the greatest possible benefit at the least possible cost.

There are different costs for each of the RHS recipients, service providers, and stakeholders. The cost categories of different groups are given in Table 3 (Torre-Dí'ez et al., 2015; Kouskoukis and Botsaris, 2016; Langabeeret et al., 2016).

Table 3: Cost Categories of Telemedicine Programs		
Client / patient	Supplier	Stakeholders
	Fixed costs	
Time required for training Medical expenses (out of pocket; consultation cost) Devices that enable the use of telemedicine application (mobile phone, tablet or PC) and paid software Insurance premiums that may increase due to widespread services	Equipment (Facilities, devices / technology (capital investment) to be built to produce RHS compliant new technology devices) Depreciation Facilities (office space)	State's infrastructure investment, personnel training cost and loss of workforce during training. Extended coverage to taxpayer and payment of telemedicine services by GSS, Costs reflected to private insurance companies from the extended insurance coverage, Customers who may escape in case of an increase in insurance premiums Cost of workers' training programs for the employer, loss of productivity (unemployment) from low production participation in the training process
	Variable costs	
Monthly fees for software	Maintenance and repair Telecommunications costs (connections, etc.) Administrative support and supplies Staff and user regular training, Fees payable to technicians Staff Fees Other expenses	Regular payments to be made by state and private insurance institutions to intermediary / service provider institutions.
	Other costs: Program installation	
	Travel (transportation, accommodation, subsistence; travel time) Education Other expenses (promotion of the program, etc.)	

From a client/patient perspective, participating in a telemedicine program results in less opportunity cost in terms of absenteeism from school or job. Additionally, it may result in less out-of-pocket costs (such as transportation to the facility implementing a telemedicine program or medical consultation) for the client/patient. Out-of-pocket expenses can be significant in rural or remote areas of developing countries where telemedicine services are not reimbursed by health insurance. In many countries, telemedicine services are either not covered at all or only partially covered. In some countries, only certain applications or geographic areas are refunded.

Supplier perspective: Suppliers sometimes bear the heaviest economic burden of implementing telemedicine programs because fixed costs, such as infrastructure investment can be

very high. In some cases, the expense of additional equipment and personnel required to run the telemedicine program can greatly reduce revenue from telemedicine initiatives.

Maintenance (generally considered 5% of the equipment cost) costs, technician fees, training, repair, and administrative and telecommunications expenses are considered variable costs. In addition, additional costs such as data collection, travel costs, local training, and initiatives to promote the program and increase customer participation are also considered variable costs if the program is set up and supported on site.

Other stakeholders: An economic assessment should also consider the economic costs of all stakeholders (e.g. employers, taxpayers, private insurers) other than customers/patients and suppliers. However, these costs are rarely included in telemedicine's economic assessment.

If the cost analysis is done only by calculating the probable cost, RHS may be seen as an investment that is difficult to pay off even in a long time, but a detailed analysis may show the opposite. For example, a decrease in production as a result of workers absenteeism due to participation in a telemedicine training will be the employer's loss. But, despite such productivity costs, telemedicine programs often result in increased productivity and therefore increased income, as patients often travel less to a healthcare facility.

While inclusion of telemedicine services in the scope of insurance may lead to an increase in the amount of premium payers and an increase in private insurance premium incomes, the expansion of the scope of the service will increase the expenses of private insurance companies and the state.

As can be seen, additional costs arise for each stakeholder, including the user, employer, service provider and device manufacturer companies, public and private insurance institutions at the beginning. There may be additional costs during use, but the system pays for itself over time and it is both cost-effective and beneficial for all parties. It can increase the quality of life and production by shortening the quality, accessibility, and time to reach the service.

RHS is a very useful and desirable system, especially for the state. Because the countries that have started to install the NHS are investing in health technologies instead of building larger hospitals. On the one hand while these investments reduce the cost of initial investment including buildings, health equipment etc., on the other hand, they help to deliver health services to wider segments and farther. In this respect, today's healthcare approach has started to evolve rapidly from the traditional approach (hospital-oriented healthcare delivery) to patient-oriented service. Thanks to the sharing of physical investments by the suppliers and

the decrease in the share of the state, this saved amount can be channeled to other important areas by the state.

Apart from all these, increasing accessibility and service quality enable the state to get closer to the goal of equitable health service delivery.

Although widely used in economic evaluations of the telemedicine, as it can not show the all results or economic benefits of the telemedicine program, cost analysis is alone significantly limited. Therefore, more comprehensive analyses are needed. Two of the most common economic evaluation methods are cost-effectiveness analysis (CEA) and cost-benefit analysis (CBA).

Cost effectiveness analysis: CEA is a more comprehensive method of economic evaluation that considers both the costs and outcomes of a program. It shows the extent to which the expenditure made is useful in achieving the set goal. The main purpose of the CEA is to estimate the ratio between the cost of a health-related intervention and the benefit it produces. MEA is typically expressed as a ratio where there is health gain (eg, life expectancy) in the numerator and cost in the denominator. Today, the development of new e-health and m-health technologies will significantly increase the cost-effectiveness of a health system. Most cost-effectiveness studies show that telemedicine can reduce costs.

CEA is particularly used in health technology assessment. In health technology assessments, benefits are often expressed as qualified life years. The method basically compares the economic costs of a program with a non-monetary outcome (e.g. QALY, DALY) such as diseases gained or avoided over the years, and the findings are often expressed as cost per outcome unit. In the calculation of QALY (Quality Adjusted Life Year), full health is accepted as 1, death is 0, and points are reduced in the rate of decrease in health. A QALY is considered as 1 year spent in perfect health, and the equivalents of healthy periods are calculated. DALY (Disability Adjusted Life Year) is a measure of overall disease burden, expressed as the number of years lost due to poor health, disability, or premature death (Torre-Dí'ez et al. 2015; Kouskoukis and Botsaris, 2016; Langabeeret al, 2016).

Considering both the costs and outcomes of telemedicine, CEA, a fairly comprehensive type of economic assessment, is one of the most widely used methods. An example of the application of CEA is an ophthalmology program used for low birth weight infants. The quality-adjusted lifetime cost (QALY), which was \$5617 with standard ophthalmoscopy, decreased to \$3193 as a result of the implementation of this program with telemedicine.

Although CEA is superior to a simple cost analysis, it has a significant disadvantage in that it limits the evaluation to a single result.

Cost-benefit analysis: CBA is the most comprehensive type of economic assessment and provides an assessment of the common outcome of interventions that have multiple outcomes. It compares the economic costs of a program and its economic benefits, calculated in money, to determine whether a program is economically acceptable and better than alternative uses of the same resources. If we say in more clear terms, it serves to determine how much benefit is obtained at the end of the expenditure.

Because the costs and benefits of different applications are expressed in a common currency (e.g. TL) in the CBA method, it is possible to directly compare programs with different results. Therefore, the first step in doing a CBA is to clearly define all the relevant economic costs and results of the program i.e. the economic benefit achieved.

In the second step, the economic benefits of the program are calculated by converting them into monetary values using reliable monetary conversion factors. Ex: QALY or DALY is used to evaluate medical efficacy in a more general and comparable way. Adding a monetary value to health promotion measures requires an estimation of statistical survival as well as the calculation of value of a QALY. In a calculation made in the USA, the median value of a statistical life for an employee was approximately 7 million dollars for the year 2000. This estimated value is divided by the expected average life years and converted to the value of one life year. Multiplying the QALY increase achieved by the RHS by the value of one life year provides the monetary equivalent of the life value earned by the RHS.

After estimating the economic costs and benefits in TL, net benefit (total economic benefit - total economic cost) and benefit-cost ratio (total economic benefit / total economic cost) are calculated. A positive net benefit and a benefit/cost ratio greater than 1 indicate that the economic benefits are greater than the economic costs and that the program is worth implementing from a societal perspective.

At CBA, each specialty branch deals with unique diseases, specific clinical guidelines are followed, different telemedicine equipment is used, and different barriers to access are faced. It is therefore a particularly useful approach in telemedicine, where costs and outcomes can vary widely between specialties. However, despite being the most comprehensive type of economic evaluation, because of the dense and technically complex structure of the data, there are no guidelines or systematic procedures on how to apply CBA in the field of telemedicine have been published yet. Because of this, adequate CBA has not been done in the field of health in

general and in the field of telemedicine in particular (Da'valos et al., 2009).

As with other analysis methods, it would be useful to evaluate CBA from different perspectives.

Client / patient perspective: While performing CBA, many variables such as the medical effectiveness of the treatment on home blood glucose, HbA1c levels, blood pressure, mortality and activities of daily living can be examined through telemedicine. For example, patients participating in a telemedicine program that regulates drug compliance have a greater decrease in diastolic blood pressure than those who do not participate. Many variables are taken into account, such as the economic equivalent of the QALY obtained at the end of this success and the gained savings if the drug dose has been reduced.

During the CBA, not only the savings that the RHS has made in direct costs, but also the savings from indirect costs are taken into account. For example, the income of the work done by working at the workplace (during the trip which is not made) is also included in the earnings. Travel costs, overnight accommodation, and additional daily expenses (taxi, meals, etc.) saved by patients and their relatives may be calculated. In a study conducted in the USA, the amount of savings in transportation costs in 5 years thanks to the RHS varied between 1377 and 4113 USD depending on the distance. In a study conducted in Finland, it was determined that 524 Euros were saved per patient in 9 months from reimbursement for consultation, transportation (about 130 km away) and sickness allowance. When all these benefits are proportioned to the costs, CBA is made.

The service provider/supplier perspective: Most of the studies were conducted on health issues such as the number and duration of hospitalization, visits to the doctor's office, polyclinic, emergency room, patient visits at home, use of ambulance services, number of referrals, doctor's examination and consultation time and of laboratory tests show a decrease in the use of services. For example, the average cost per hospitalized patient in the United States in 2006 was estimated to be around \$1612. When these values are multiplied by the decreasing number of hospitalizations thanks to RHS, it can be easily calculated how much RHS saves from hospitalizations.

Perspective of other stakeholders: RHS prevents the loss of labor and production decrease due to the hospitalization, consultation, emergency polyclinic admission, etc. and causes increase in productivity. To measure this, hours of not lost work time are calculated. Thus, the savings made by the employer thanks to the RHS are also calculated.

An interesting finding is the savings created by the RHS in transporting prisoners to health centers. Due to safety concerns about transporting prisoners to health centers, overtime, safe and reliable transportation costs, and hospital fees for the guards accompanying the prisoner lead to very high costs. A study conducted in the USA revealed that RHS applications save approximately \$100.000 per year, out of \$450 per telemedicine intervention (Da'valos et al., 2009).

From the state's point of view, the RHS may be considered even more beneficial in those countries:

- 1- If the units where the RHS is given were far away from the center (Russia, Australia) ,
- 2- If transportation is difficult and expensive (Islands of Greece),
- 3- If the population living in the periphery is large (China, India, Australia) and,
- 4- If the incidence of disasters like Earthquake, epidemic disease, etc., which may prevent transportation (Turkey, USA, China, etc.).

The CBA's showed that even if the initial investment costs of the RHS are high (it will still cost less than opening a new hospital), the Payback Period (PP) may be short. As a matter of fact, in a study evaluating the RHS in Greece, where transportation is very costly because it contains many islands, it has been determined that the savings (i.e. annual cash inflows - annual operating costs) of the RHS investment, which includes otoscope, 12-channel electrocardiograph, ophthalmoscope, dermatoscope, computerized tomography equipment, office equipment, access control system and medical equipment (high resolution camera for macroscopic examination), digital stethoscope, rhinoscope, have increased gradually over a period of 5 years.

Similarly, when CBA of a study in which 5570 patients were treated with the RHS model in 12 months was performed, a 6.7% reduction in medically unnecessary emergency outpatient clinic admissions and a 44-minute reduction in ambulance transport times per case were detected thanks to RHS. In this study, the average cost of a RHS patient was \$167, which was \$103 lower than the control group. From a societal perspective, it has been seen that the NHS has saved 2468 US dollars per emergency outpatient visit and a total annual cost savings of US\$ 928000 (Langabeeret et al., 2016).

In addition, the value of the lives saved by remote and early interventions cannot be measured with money. Especially in situations such as earthquakes and quarantine due to epidemics, the RHS can produce benefits beyond financial savings. In addition, the fact that

there is no need for physical contact during the RHS will also be beneficial by reducing the transmission rate of epidemic diseases.

Developed countries, seeking a solution to the problem of bringing the service to people in need, have started e-Health applications that are more economically advantageous in some areas where it is not compulsory for physicians and health personnel to provide face-to-face service (for example surgery, invasive intervention, etc.). Moreover, these services cost the state and private insurance institutions even less than normal as they both reduce labor costs and minimize human-induced errors, thanks to robotic applications and artificial intelligence software. For example, insurance companies make up to 50% less reimbursement for branches using the e-Health system in the Netherlands.

Other analysis methods

Although cost analysis is a good starting point common to all economic evaluation methods, it excludes program results from the analysis and limits the information available to decision makers when deciding which programs should be implemented or expanded. For this reason, cost analysis is not done with a single method, different methods should be used to evaluate many aspects such as effectiveness and efficiency. Ex: Actual cost is an important factor to consider especially for small plants that require high Return on Investment (ROI), high Net Present Value (NPV), high Internal Profitability Ratio (IPR), high Internal Rate of Return (IRR) and short PP. ROI, NPV, IPR, IRR and PP are the economic criteria necessary to evaluate the effectiveness and efficiency of a project, and as a result, it allows to decide whether it is desired to invest in that area.

The higher the IPR of the project is, the more desirable it is to implement. The project with the highest IPR will probably be the first to be implemented.

PP indicates the number of years that a project or investment should be subject to depreciation. The best investment is the investment with the shortest PP.

NPV is a measure of profitability and is used to evaluate the potential ROI of the project. A positive NPV indicates that the returns from the investment exceed the expected costs. A project with a positive NPV will result in a net profit, and a project with a negative NPV will result in a net loss. The IPR is directly dependent on NPV and must be positive.

As mentioned several times above, health is a unique sector. It is not even possible to evaluate some results in terms of money. Ex. The product of a birth is a baby, and its value cannot be expressed in money. Likewise, there is no monetary expression for a person whose

heart has stopped to be brought back to life. Maybe the treatment expenses or the value of the services or goods that will be produced by that person's return to business life can be calculated with some formulas, but it is not possible to express the actual result in money. For this reason, the costs, profitability, payback periods, etc. of investments made in the field of health. It is possible to calculate many parameters, but it will never be possible to measure the real effectiveness and benefit of investments, to make some calculations properly such as cost-effectiveness analysis, cost-benefit analysis.

4- Why should RHS be included in reimbursement systems?

Before discussing how RHS can be converted into income, it is necessary to understand and discuss which services should be paid for, who or which institutions should pay this price, why they should make this payment, and finally what they will gain from it. Because no one or organization, except charities, wants to make a payment for something they will not receive any benefit from. Moreover, in order for this system to come into effect, it will be necessary to prepare the infrastructure first, which also has an investment cost. Those who build the infrastructure must incur this cost and make a profit on top of it. In order for the health system, which is already expensive by its nature, to integrate a newly emerging structure such as the NHS, which also requires new infrastructure investments, investors and the persons and organizations that will make the repayments must be informed. In order that they understand and accept the issue, they must be convinced that they will benefit from it. Actually, it is not that difficult. Innovations sometimes occur with demands from the user who feels the need, sometimes manufacturers make the end user think that they need that product (Ex: Apple and Steve Jobs applied this method on tablet computers), sometimes both trigger each other (such as mobile phones). As a result, if a product is introduced and demanded by the end user, the market grows slowly, rapidly, or exponentially (computer, mobile phone), and if there is no real demand, the product slowly or quickly disappears (tablets). RHS is also an area where there is demand from both the producer side and the end user. For example, these days patients may send their blood pressure, laboratory test results etc. data to their doctors via applications like WhatsApp etc. or may learn their diagnosis immediately. Many devices or software with network and sharing features started to take their place in the market. This reveals the necessity of financing and repayment of services or investments in order for it to become widespread (Isık and Güler, 2010). Table 4 summarizes some of the direct and indirect cost items that emerged in the RHS (Langabeer et al., 2016, Burri et al., 2011). For details see: Economic evaluation of Remote Healthcare, cost effectiveness, analysis

Table 4: Some direct and indirect costs related to remote

	Direct healthcare and investment costs	Indirect costs
Office, hospital	Nurse / doctor consultation Sickness allowance	Administrative work, scheduling, data entry to EMR, report preparation and mailing, invoicing transportation Accommodation, meals
Remote monitoring	Nurse / doctor consultation Home transmitter	Administrative work, scheduling, data entry to EMR, report preparation and mailing, invoicing
Infrastructure	Infrastructure production and investments, equipment, training	Care and replacement, education
Service providers and software manufacturers	Infrastructure production and investments, equipment, training	Care and replacement, education

EMR: electronic medical recording

5- Who or which institutions should reimburse the RHS?

NHS will be a system that will allow the end user to access health care services quickly and cheaper by using technology. The good thing is that the technology and the devices using this technology are getting cheaper, which will make the RHS both cheaper and more widely used in parallel. Although technology is getting cheaper, someone has to pay for the technology. However, as m-Health business models (server services, direct consumer services and clinical technology integration) are still open to development and maturation, it remains unclear who will pay the bill. This is why very few mobile health solutions are on the pay list of health reimbursers today. According to the report “Mobile Health: Who Pays?” by consulting firm A.T. Kearney, mobile health applications will not reach their maximum capacity unless they are included in the reimbursement program by government, reimbursement institutions, and health insurance companies (Kearney, 2011). Getting under the radar of reimbursement, institutions will be painful and take time until the effectiveness of mobile health applications is proven.

Below, we will try to analyze who should pay the RHS and how it can be paid in terms of different groups.

a) Service recipients

This group will naturally pay because it will now be getting the service cheaper, better quality, easier and without waiting. Apart from this, RHS will also save invisible costs such as travel, food, accompaniment, and loss of work force for both the patient and the patient’s relatives. In fact, since the current implementation of the RHS mainly covers outpatient ser-

vices, it is here that it saves the most. Payments to be made to the system by this party will be in two ways:

1- By purchasing mobile phones, tablets, computers, and software. They will not even notice the payment because they will very likely already have one or more of these devices. In other words, it will not make a separate expenditure only for the RHS. The software, on the other hand, will probably be free or inexpensive enough to afford, except for some very specific software.

2- The cost of the health service received through RHS. This payment will be in two main ways. In the first form, payment will be made to the doctor who performed the remote examination or to the hospital where he works. This payment is most likely either credit card, etc., within the scope of out-of-pocket payment method. It will be paid by the person through online methods or via the insurance premiums required by the insurance system (SSI, private health insurance, etc.) in which the person is included. If the results of the blood pressure measurement done by himself or herself at home are sent to the doctor by phone, the patient will probably not have to make a payment.

Probably, there will be no need to make a payment for the service provider companies, because the existing internet and telecommunication infrastructure will continue to be used.

b) *Private sector: Private insurance institutions and private hospitals*

Private insurance companies are included in this group. Private insurance institutions are established to make profits by their nature, and they will want to know whether it is profitable to invest in this field, and they will analyze the issue from a financial point of view. Private insurance companies will also investigate the attractiveness of the market, apart from some analyses by the government. The attractiveness of the market is evaluated not only with its current situation, but also with the potential it promises for the future.

Future of the market

Besides the current size of a market, the course it will follow from now on is also very important. Firms invest in an area by calculating both the growth direction and rate of the market, their current positions, and where they will come next.

If we evaluate the market growth direction and speed of the NHS with an example, it will be seen that the world mobile health market, which is only a part of the NHS, is growing very rapidly. Ex: The market has grown by 237% in 5 years since 2008. The market size was predicted to reach 57 billion USD in 2020. Estimates are that growth will continue to increase

in the near future. In the same report, it is stated that the market is in its infancy, yet it has become a small-medium sized market. As can be seen, the growth direction of the market is upwards. Considering all sub-groups of RHS, it can be predicted that the market will be very large if the growth continues in this way. A company that enters the market today will have a very high probability of entering the group with at least a question mark in the matrix, and it is possible to become a star if there is a good strategic plan and financial support. For this reason, NHS is an area in which private insurance companies will be willing to invest.

Expanding the portfolio and client profile

Private insurance companies can benefit greatly by adding wearable technologies to their policies. By using these technologies;

- They get healthier and more loyal customers.
- They can use better risk management and maintenance models.
- They can cooperate more closely with health professionals.
- They can benefit from more specific, personalized diagnoses and treatments.
- They can expand their customer portfolio, reduce the risk of risk groups, reduce costs, and optimize revenues.

The main challenge for private insurance companies is to expand the service area without unacceptable increases in premiums, but this will not be a problem due to the expansion of the customer portfolio and the decrease in the costs of the service thanks to the cheaper technology provided. Studies show that even though the costs are high at the first moment, there is a decrease in the long-term. Such costs can be easily afforded for a growing market.

The RHS reimbursement of insurance companies will currently be in the form of reimbursement of classical health service costs to the service

There is no need to persuade the state. The government does not invest only for profit, like the private sector. Its aim is to provide as widespread as possible, as fair as possible health care, and if possible, not to harm in the meantime.

According to TUIK 2015 data, the ratio of the elderly 65 and over in Turkey is 8.3%, and it is currently the country with the lowest elderly population ratio in Europe, but this will not continue. As in every country, the proportion of the elderly population in Turkey will gradually increase. The increase in the elderly and lonely population creates the need for health and home care services. Treatment of chronic diseases puts a huge burden on health budgets.

For example: 70% of the health budget of European countries is allocated for the treatment of chronic diseases. Disabled individuals and veterans need technological and robotic tools (artificial leg, orthosis, prosthesis, sensory instruments, etc.) and home health services in order to meet their own needs. In addition, for the analysis and care of these patients, one or more relatives of the patients should come to the hospital or an ambulance should be sent for them, which increases the cost. Thanks to the RHS, making tests at home and sending them to the hospital online will reduce the suffering of the patients and their relatives on the one hand, and the burden of the hospitals and the cost of the state, on the other hand.

RHS is actually a system that will relieve the state's hand by distributing some of the burden of health care to users and stakeholders. Private hospitals will come into play when private insurance companies take RHS into the reimbursement plan, and governments will also benefit from this initiative as this additional capacity will provide solutions to public hospitals with a heavy patient load and to patients who receive surgery months later. In addition, the state hospital, etc. It will also enable it to use the savings it will gain from this area in other areas by reducing its initial investment costs.

It has been determined that the annual cost of MRI and computed tomography in Turkey is between 1.7 and 1.8 billion liras, and 10 percent of these are repetitive. Preventing duplicate examinations with RHS will lead to huge savings.

For these and many reasons described in previous chapters, RHS is something the government would like to have and spread. The government has already noticed this and started to work in the field of the NHS, decision support system (DSS), green card information system (Yeşil Kart Bilgi Sistemi, YKBS), organ bank, handicapped bank, doctor information bank (DIB), MEDULA, e-Pharmacy, e-Hospital, e-Applications such as Medical Materials Information Bank, smart card application, e-prescription have been put into service or are about to do so.

The most important task in the establishment and operation of the system falls to the state, because it is the duty and authority of the state to prepare and enforce all kinds of laws and other legislation. No matter how ambitious the private health insurance institutions are, it will not be possible for the system to start working and grow if the legislation does not allow it. As a matter of fact, this field could not develop as the SSI did not allow supportive insurance in health for years, and years later, the way for insurance companies was paved. Similarly, if the legal infrastructure is not prepared as it should be, the RHS will either be stillborn or remain dormant.

After the legislation for RHS is prepared and enacted, the government's reimbursement will probably be one of the sub-groups of service procurement through SSI, as it is now, namely global budget, per capita, package price, case-based, salary, per service or a mixture of these.

The process of converting RHS to income of institutions will only begin after the legal basis is established, and the prices are determined by the SSI. The prices will probably not differ much from the currently applicable service prices. Since the RHS basically transforms the patient's "physical transportation to the hospital" into "electronic access to the service" and the main savings item of the patient and their relatives and reimbursement institutions will be the savings from transportation costs. It may not be necessary to reduce the service unit prices. Since NHS does not reduce the number of health services and labor provided, but increases accessibility and service quality, the labor of the health institution and health workers will have to be paid in the same way. Health institutions may not demand to increase their unit service prices because they will save on fixed investments such as buildings and increase their profits due to the increasing number of patients. As a result, the NHS will be a system that increases savings and incomes in general.

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