IS DIGITAL HEALTH COST EFFECTIVE

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Abstract: *The goal of this paper is to outline in brief the achievements in the field of digital health economics and answer two questions: 1. Is digital health cost effective? 2. Is it possible to evaluate the potential monetary effect of digital health application priory its implementation?*

ИКОНОМИЧЕСКИ ЕФЕКТИВНО ЛИ Е ЕЛЕКТРОННОТО ЗДРАВЕОПАЗВАНЕ

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Резюме: *Целта на статията е да обобщи постижения в областта на икономика на електронно здравеопазване и да се опита да отговори на два въпроса: 1. Икономически ефективно ли е електронното здравеопазване? 2. Възможно ли е предварително да се оцени потенциалният финансов ефект от въвеждането на електронно здравеопазване преди внедряването му?*

Introduction

The total health expenditure, i.e. the sum of public and private health expenditures of all countries, as a percentage of their Gross Domestic Product, varies from country to country reaching ~12% in some countries. Globally the total health expenditures have gradually but steadily increased during last decades and soon will reach the level when the burden of these costs will be no more bearable.

One of the strategic promises of digital health is to increase the efficiency in health care, i.e. to ensure high quality medical care 24 hours a day, 7 days a week to all citizens, no matter where they are and at the same time decreasing the total health expenditure.

The wide application of digital health solutions, especially during and after the COVID pandemic, is advertised as the way to achieve better healthcare for all citizens and to approach the Universal health coverage goal. Yet, before applying digital health more widely, politicians and decision makers would like to know whether this is economically feasible.

The debate whether digital health applications are cost effective or not is of high importance as digital health developments and widespread applications are part of the strategy of many local governments as well as international bodies such as WHO, ITU, the European Union. The issue of cost effectiveness is vital. A correct, non-biased answer will allow the decision makers to make a final choice in favor or not of a digital health implementation.

The Goal

The goal of this paper is to summarize in brief the latest achievements in the field of digital health economics and to answers two questions:

- Is cost effectiveness a specific characteristic of digital health?
- Is it possible to evaluate the potential monetary effect of digital health application priory to its implementation?

Digital Health Economics

The role of digital health economics is to assess the costs and benefits of digital health initiatives over time and for several stakeholders, including citizens, patients, careers, healthcare professionals and other workers, healthcare provider organizations and payers.

The cost effectiveness is evaluated in two ways.

The first method is by applying modeling. Usually, the modeling steps on an evaluation of the effects of already performed patients' studies. The economic effects are calculated as disability adjusted life years (DALYs). There are many doubts about this approach despite of the fact that the authors recommend to assess the uncertainties using probabilistic sensitivity analyses with Monte Carlo simulation [1–2]. At present, this method is not widely used.

The second way to access the economic effects of digital health is based on evaluation of real applications of digital health services. The limitation of this method is that the analysis of data, especially if the sample size of patients is big, needs lots of efforts, time and staff. Yet, this is the most reliable approach in digital health economics. The examples and the discussion below is based on this method.

Initial studies on cost effectiveness [3–4] were quite conclusive: there is no good evidence that digital health is a cost effective way to deliver healthcare. Some authors are even underlining that the costs are greater for remote consultations than for conventional outpatient appointments, although they supported the hypothesis that losses in productivity are lower.

Data from more recent publications focusing on large-scale studies (i.e., based either on a large number of consultations or years of experience), although very rare, are just the opposite, to cite some:

- In India, the incremental cost per DALY is evaluated comparing the application of the Reducing Maternal and Newborn Deaths (ReMiND) intervention to routine maternal and child health programs. The enormous benefit of this study is that its sample size exceeded 317,000 patients and covers a period of 10 years, i.e. 2011–2020 [5]. The findings of the study suggest strongly that the digital mHealth intervention, as part of the ReMiND program, is cost saving from a societal perspective. The implementation of the ReMiND intervention resulted in a reduction of 312 maternal and 149,468 neonatal deaths. From a health system perspective, ReMiND incurs an incremental cost of 12,993 Indian rupee (INR), i.e. about USD 205 per DALY averted and INR 371,577 (USD 5865) per death averted. The authors concluded that the ReMiND intervention is definitely cost effective and should be considered for replication elsewhere.
- A Japanese study, examined the long-term effects of the use of digital health on the residents of Nishi-aizu Town, Fukushima, Japan for a period of eight years. The authors compared medical expenditure and days of treatment between telecare users and non-users when chronic diseases (stroke, hypertension, heart failure and diabetes) are concerned. Applying rigorous statistical methods, including system generalized method of moments, they have revealed that digital health users require fewer days of treatment and lower medical expenditure than non-users [6].
- A detailed survey revealed the outcome of a five-year period of tele-pediatric consultations. The authors underlined that the total cost of providing 1,499 consultations was $ 955,996 (Australian dollars). The estimated potential cost of providing an outpatient service to the same number of patients at the Royal Children's Hospital in Brisbane was $ 1,553,264; thus, digital pediatric services resulted in a net saving of approximately $ 600,000 to the health service provider [7].
- A strong evidence for the efficacy of digital health in clinical outcomes comes from home-based monitoring of chronic disease management, hypertension and diabetes. There is also reasonable evidence that digital health is cost saving and with an equal quality to face-to-face care in emergency medicine, and is beneficial in surgical and neonatal intensive care units, as well as patient transfer in neurosurgery [8–10].

Why are there such contrasting views of digital health cost effectiveness? The answers are:

- Limited data or analyses based on articles published predominantly in English and based on studies of the English speaking communities;
- Small sample sizes – the majority of the studies are based on samples with less than 100 participants;
- Less than 30 % of the studies reported the time frame, which is an essential parameter in determining long-term cost benefits;
- Poor evaluation tools and lack of well accepted methodology;
- Long time to breakeven point;
- Constant technology and cost changes.

How to Evaluate the Economic Effect

It is necessary to underline that there is no a well-accepted and recognized methodology to estimate the economic effect of digital health implementation [8].

One of the easiest ways is to calculate the return of investment (ROI). ROI is a performance measure used to evaluate the efficiency of an investment or to compare the efficiency of a number of different investments. To calculate ROI, the benefit (return) of an investment is divided by the cost of the investment; the result is expressed as a percentage or a ratio.

Another, and probably a better way to judge the economic efficiency, especially in the most widespread cases – those of introducing distant consultations and/support, is by taking into consideration:

- The number and distance for referrals, personal and transportation costs, depreciation, taxes and insurance of vehicles and communication costs;
- The additional administration, technical, clinical staff and communication costs;
- Considering in addition all costs to operate the system plus depreciation and capital ones and dividing this sum by the number of activities developed.

Thus, it is possible to calculate the digital health unitary activity cost.

In addition, the digital health activity efficiency, defined as the percentage of avoided referrals thanks to the use of digital health application in relation to the total number of referrals, can also be calculated.

While comparing costs to benefits, it is possible to establish the minimum number of digital health activities (breakeven point) needed for the system to become economically viable and to evaluate the savings [11].

Yet another relatively easy way of estimating the economic effect is proposed in Brazil [12]. The method is derived from enormous pool of digital health interventions – over 33 000 teleconsultations and 850 000 distant ECG analyses provided in 86 municipalities during a period of 5 years. The authors take into consideration the unitary referral variable cost (RVC) and referral distance (D):

(1) $RVC = a.D,$

where “a” represents transportation cost per kilometer.

It is necessary to underline that only the variable cost is applied in this analysis. The reason is simple – digital health applications do not reduce 100% of the referrals and consequently the fixed costs, such as personal and depreciation, are kept and the savings are based only on variable cost.

The saving (S) of digital health, applications have to be calculated as:

(2) $S = \eta . RVC = \eta . a.D,$

where η is the digital health activity efficiency which is the percentage of avoided referrals thanks to the use of digital health in relation to the total number of referrals. Thus, for a unitary digital health activity (UAC) to be economically efficient its cost has to be at least equal to the saving (S) or

(3) $UAC = \eta . a.D$

Based on this simple equation, the minimum distance for cost effectiveness has to be:

(4) $D_{min} = UAC/\eta.a$

If the referral distance for a specific city/medical practice/municipality, calculated as weighted average of number and distance of referrals, is greater than D_{min} the implementation of the system will result in savings for that particular city/medical practice/municipality.

Based on their experience, the authors had calculated that the minimal distance for economic feasibility is 20 km, i.e. introduction of digital health applications that will reduce referrals further than

20 km is economically feasible. In addition, it has to be noted that as the activity efficiency increases or the unitary activity cost decreases even short references distances makes the system economically acceptable.

The authors continue their cost evaluation studies [13–15], designed especially for municipalities in low resource areas in order to allow their health managers to evaluate in advance the effect of digital health application on municipal health budget.

They underline that as most of the referral costs, especially in the field are of digital health consultations, are related to patient transportation, knowing (a) the distance to the referral centers and (b) the average number of patients referred from one city is possible to pre-calculate the economic aspects of introducing specific digital health applications in every single case.

Conclusions

Today, many countries are facing serious problems in adapting the health care system and securing adequate health service for all, 24/7. Digital health care becomes paramount.

Unfortunately, most of digital health studies reported findings that are skewed towards improving the effectiveness of the intervention via digital applications. There are considerable gaps on evidence on digital health cost efficiency. That is why it is essential to pay special attention to the available large-scale studies, no matter from which part of the world they originate.

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