

Prospective Applicability of E-Health Services: An Overview of Advantages of Telemedicine and Telenursing

Aplicabilidad prospectiva de los servicios de salud en línea: una visión general de las ventajas de la telemedicina y la telenfermería

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ABSTRACT

In this paper, we review the prospects of applicability of the expected services of E-Health in large cities, in order to assess the possible advantages and notable virtues which might be consistent with the ongoing intrinsic economic and social factors. We have paid attention to the mechanisms of the E-Health and how it can be crucial or also, be still premature to be implemented since it depends of logistic, budges, specialized professionals, and high level equipment. To illustrate all that, a scenario where E-Health target to improve the quality of life of diabetic patients, which are already starting with irreversible complication because the uncontrollable evolution of glucose and others diabetic indicators, is presented. From this review, one can find that there is notable featuring the implementation of E-Health services which can be implemented in large cities. However, restrictions of the applicability might degrade the quality of service of the E-Health service.

KEYWORDS: Telemedicine, telenursing, electronic health.

RESUMEN

En esta investigación, revisamos los prospectos de aplicación de los futuros servicios de salud electrónica en las grandes ciudades. Hacemos esto con el fin de tener una idea clara de las posibles ventajas, además de las consistencias con los aspectos sociales y económicos. Así nos hemos enfocado en los mecanismos de la salud electrónica y cómo esto puede ser crucial o quizás aún prematuro con respecto a su implementación en sus diferentes aspectos: logística, presupuestos reales, búsqueda de profesionales idóneos y un alto nivel de equipos. Todo esto se ilustra con un ejemplo de aplicación de los sistemas de salud electrónica para mejorar la calidad de vida de los pacientes con diagnóstico de diabetes mellitus tipo 2. En particular, con aquellos que podrían estar iniciando serias complicaciones a causa de la pérdida de control de los valores esperados de glucosa. A partir de aquí proponemos la implementación de los servicios de salud electrónica en las grandes ciudades, considerando también las posibles restricciones de su uso, que podrían degradar las principales virtudes de los servicios.

PALABRAS CLAVE: Telemedicina, telenfermería, salud electrónica.

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1. INTRODUCTION

During the last decade, various efforts have been done to improve the public health of developing countries, such as the ones located in South America, Asia and Africa (1). It was done from different perspectives. Mainly, the applied methodologies have consisted in the implementation of projects which have been conceived under the vision of the classic medicine or also called the conventional medicine, where patients perform interviews with doctor and nurses (2). Normally, these interviews are carried out inside the running framework of the health system which is supported through norms and rules in accordance to the main policy of health. Commonly, patients are expected to recover their health in the middle and short term. Those patients would require of special services because the seriousness of the diseases or the apparition of complications. Such recovery involves the conjunction of several components: capabilities of the medic center to attend wide range of diseases, excellent response to attend patients, rapid response of the medic system for urgencies, adequate infrastructure, optimal system of pharmacy, and pertinent decisions in the side of the management of the medic center. All these aspect might be improve with the advent of the so-called Telemedicine of E-Healthcare (3,4,5,6), whose end is that of complementing the services of health to those patients which might require of special attention while most of them are under social and economic disadvantages and with high risk situations of disease complication in some cases.

In this way, we present a review of the main virtues and expectations of the E-Health inside the scheme of public health in their main forms: applicability, usability, prospectiveness, by which it would be consisting with the current disease such as the type 2 diabetes.

2. BASICS OF E-HEALTH

The concept of the so-called E-Health or electronic health is related to current technologies such as electronics, communications, internet, etc. Thus, E-Health can be defined as: the service of health which involves the patient, the doctor and at least a tool of electronics in their different manners. The E-Health service holds with all requirements of the health system which are the technical norms that would inhibit of possible hazard in humans. The E-Health system is namely composed by the following elements:

- (1) Patient
- (2) Doctor or Nurse (or other health professional)
- (3) Technician
- (4) Classical Medical Tool
- (5) Electronics
- (6) Software
- (7) Communication

Possibly, one can find others elements or components that constitute the entire body of a system of E-Health, however, exists there a wide diversification of the different methodologies for establishing in situ a E-Health lab running

continuously. In the other hand, the applicability of a real-time E-Health system would demand the measurement of the local impact in both: sustaining as well as availability, which means that the role of an E-Health system is focused in the improvement of the health in all spaces of a society. It also mandatory that the management of the consequences of an E-Health system after the resulting examinations from the auditory about the occurrence of hazard events or injuries. An expected E-Health system is mostly that holds positive roles in its integration of already known public health. It means that the possibility of being a modernized system of health is actually substantial. In the graphic below we can understand the role an E-Health system when it is operating under standard circumstances:

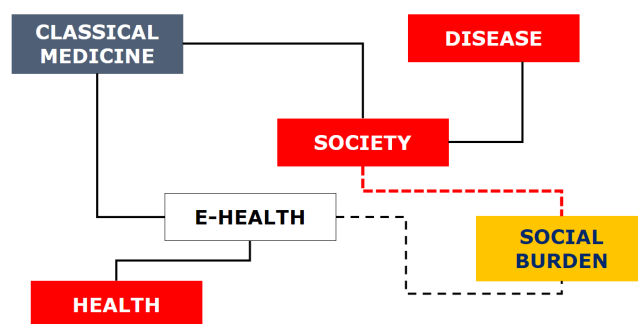


Fig. 1. A possible scheme of the impact of the synergy between classical medicine and e-health in society.

A rough idea of the possible effects of the implementation of an E-Health system is seen in Fig. 1. For instance, the society is linked a public system guided by classical medicine essentially. Society is also affected by the apparition of new diseases (AH1N1, ZIKV, etc.). The point here is the emergence of E-Health as a new player in this context. E-Health not only is targeting to improve the health of people, but also the direct relationship of it with the expected social burden that normally is attached with the apparition of new diseases or illness. So that, social burden might be interestingly modified by the synergy with E-Health and classical medicine. Under this view, the role expected to be played by the E-Health platform is much simplest than the concept which involves definitions plagued of technologies which are not still available in some human groups. Thus, primogenital idea of the implementation of E-Health in developing cities is conceivable and congruent to the local social and economic growth of countries.

3. EXAMPLE OF THE APPLICATION OF AN E-HEALTH PROTOCOL

Currently, the disease of type 2 diabetes is unexpectedly increasing in Latin American countries, reason for which various local public health systems have triggered several strategies being the most relevant that of the implementation of alimentary healthy habits.

Even though, the apparition of diverse illness can be understood as a warning to take actions in the short term. When patients have had the diabetes diagnosis, normally all of them can take the following routes:

- (A) Follow a determined pharmacology based on metformin
- (B) Follow a pharmacology together with a defined surveillance
- (C) Follow a pharmacology with continue medical advisory
- (D) Uncertain (no precise knowledge is assumed)

Under this scheme, let us to test the implementation of a possible intervention of an E-Health system based in the following algorithm:

- Selectivity of the software
- Identification of weakness of patients
- Construction of the strategy of E-Health
- Expectations of the outcomes after the E-Health implementation

Route of Application

Consider the interface of software with the necessity of the following items: (i) connectivity real-time, (ii) nominal value of broadband, (iii) channel of selectivity, (iv) data (past and present), (v) potential to process data in real time and make simulations for future. For instance, let's take the patient with the next characteristics: age, number of years living with diabetes, possible levels of worsening, history of glucose during the last year, number of cardiovascular events, number of registered depress episodes, and level of self-care. Normal praxis of medicine (i.e. classical consult) accommodates the medical routine as established by the local health services, and makes much more fluent the reception and interviews of patients since in public hospitals exists there a great demand of health professionals. The case of a possible implementation of an E-Health system operating under same conditions of a classic system, might be beneficial for both: patient and health system. Below in Fig. 2, is displayed a computational simulation which would indicate the advantages of an E-Health system allocated together a public system with ordinaries consults. The simulation has assumed the following items:

- Initial number of patients: 310
- Patients which have had a recent diagnosis of type 2 diabetes
- Evolution is dictated under three scenarios: patients are only following the prescription of (i) metformin, (ii) metformin and consult, and (iii) metformin and tele-consult.

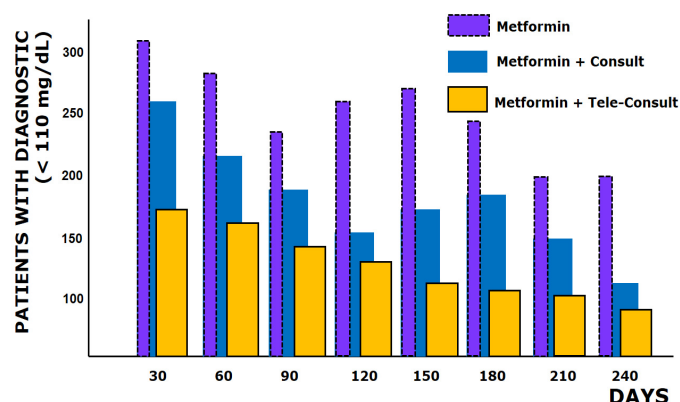


Fig. 2. Simulation of the possible evolution of patients with recent diagnosis of type 2 diabetes for the scenarios with intake of (a) metformin, (b) metformin and ordinary consult, and (c) metformin and tele-consult.

In our example, the Fig. 2 can be explained as follows: we suppose that patients have learned their current situation with respect to the diagnosis of type 2 diabetes. Commonly, endocrinologist makes the recommendation of the intake of metformin (1000mg, 850mg, or 500mg). In addition, another component such as vidagliptin is also a valid prescript. According to the education with respect to the self-care actions, patients might not be well managers of their prescription which is manifested as the abandon of the pharmacology. It clearly indicates the possible fail of patient to face the progress of the disease. From the simulation, one can expect that the initial number of type 2 diabetes maintain the same amount until after 240 days, or translated in numbers of 310 to 215 patients which have achieved down the glucose values only with metformin. The next scenario, which accounts the fact that the patient is attending to the classic interview turns out to be positive in the sense that the medical professional carries out a plan of surveillance. Mostly, nurses are in charge of controlling the glucose levels in patients. In this point, we found some controversial aspects:

- Patients require of continue surveillance as to put down the glucose high levels (3)(4).
- Relatives of patients require updated information about the ongoing activities between nurse and patient.
- Relatives of patient require of training for performing successively measurements of glucose continuously (5).
- Patients are enforced to hold with the already established program of diets in order to be an important complement to the pharmacology.
- Continuous check out of glucose's history in time, and appropriate identification of fluctuations and rapid growth of average values of glucose.

Mostly, nurses are in charge of controlling the glucose levels in patients. In this point, we found some controversial aspects: due to reasons of budgets and locations, nurse are not available to be controlling the recovery of patient. Although certain improvement can be seen, it is most possible the fluctuations of the behaviour of patient to face coherently the stability of glucose, even with the pharmacology and tests of fast glucose. From an initial amount of 255 to 125 it is easy to see an important reduction of order of 50%.

We review now the third scenario, which is given when the patient carries a routine composed by the assistance of the E-Health system. Here from 170 to 85 indicates a dramatic reduction of order of 50%, by which it anticipates efficient applicability of the E-Health system.

In fact, the notable virtues of the implementation of the E-Health system can be perceived in Fig. 2 where one sees that the initial number of patients which are decided by taking part of this novel system are obtained to down their glucose's values below 110 mg/dL (according to the simulation). The main virtues of a tentative location of an E-Health system would be the following

- Usage of an electronic centre
- Availability of data in real time
- Instantaneous communication between patient and health professional
- Processing in time of acquired data
- Tools of prediction in time for glucose and other diabetes complications
- Instantaneous availability of personal and reachability in real time

Under these considerations, in first instance one can observe that the E-Health system might be a tool which operates together to the patient with more hours per week in clear advantage than the previous cases. The main difference is the potential of this new system which uses not only software but also hardware (installed in PC or running servers) which would realize large jobs in short times. For instance, consider the case of a patient which is under clinic observation since its glucose's values are above 300mg/dL during the last two weeks. Then, nurse is applying constantly evaluation to systole blood pressure, among others measurements. That information goes through optical fibres in accordance to the internet capacity (depending upon the amount of data: text, pictures or video). It is actually interesting in those cases where the patient has lost mobility: adult patients above 80 years old with sequels of diabetic necrosis. Another example is the scenario where patient is unable to attend to the health centre but there is the necessity in the taking radiographic examinations: TB disease spread in small cities. As studied in (7), there is a clear urgent request to implement TB medical mobile stations in order to cover the attentions and interviews, as well as examinations in the places of the localizations of patients. It would avoid the translation unnecessary of TB patients to hospitals, by which

they are using public bus, and the probability for contagious is considerable.

Turning back to diabetes treatment with the E-Health system, which should remark two aspects in this last third scenario where patients are receiving the services of the E-health system:

- Continuity of the usability of the E-Health services: the case where the service is stopped for diverse factors (lack of resources and fail of robust management) (8)(9).
- Disconformity of the user for unexpected functionalities and wrong predictions (10,11,12).

Of great importance becomes the second item which is actually against to the successful aperture of the prospective application of the E-Health in cities where regulations might be not favourable with respect to the installation and beginning of the services in the middle term. Indeed, E-Health services might be seen as prototypes with trial period in order to evaluate the conformity of the users, as well. Furthermore, the applicability of the E-Health services is actually engaged to the internet features fact which might constitute a plus among others techniques of modern medicine. With the arrival late or early of the Internet of the Things it's very probable that the networking would improve quality of E-Health services (13,14).

4. APPRAISAL OF TELENURSING

As described above, the advanced requirements of electronics would be crucial for an efficient session of teleconsult. It would demand the inclusion of sophisticated concepts in the field of the modern nursing, such the Telenursing (15) that enables to nurses to use and manage the main tools which are expected to be part of the teleconsult. One of them is related to the broadcast of real time data, which is part fundamental of the computing for predictions. Again, we take the example of diabetes patient which is being monitored in its main variables: glucose, systole blood pressure. Telenursing will be capable to send all this data to a server whose main purpose is that of calculating predictions in time, in order to evaluate for further intervention if any. In this way, is clear the necessity of having well trained nurses in the following issues:

- Computing and basic concepts of programming understanding
- Electronics and calibration of medical tools
- Video and voice adjustments for tele-interview
- Empowering of abilities for rapid assistance

All these (at least one of them) points appear to be relevant in a new era where electronics is serious part of medic dynamics with excitant prospectiveness, in particular in that places where exist a great demand of professionals of health. In near future, the classic medicine might be so effective in various lines of application, especially in the lines crossing cases of diseases, cancer and others types of illness affecting vulnerable populations of large cities in Latino America.

5. CONCLUSION

In this paper we have reviewed the expectations of the prospective arrival of E-Health as an interesting complement to the classic medicine as to improve the necessities of public health in places with serious requirements of professionals of health. It is noted that the future implementation of the E-Health services might demand training in doctor and nurses, as well as to install software-hardware interfaces in health centres. All this package of modernisms would be favourable in patients in many aspects, being the most notable the quantitative expectations to decrease the number of diabetes complications through the applications of predictive systems as studied in (1)(2)(3).

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