

Original Paper

Telemedicine as an Alternative Model for Delivering Healthcare Services: Preliminary Results of the MultiMED Project

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REZUMAT

Telemedicina ca model alternativ de furnizare a serviciilor medicale: rezultate preliminare ale proiectului MultiMED

Obiectivul general al proiectului îl constituie dezvoltarea unui serviciu de diagnostic și tratament multidisciplinar de tip telemedicină.

Metode: Proiectul a fost dezvoltat acoperind concomitent două aspecte, cel al aparaturii și cel al comunicării. Aparatura a avut și ea două aspecte, cea medicală și cea IT. Partea de comunicare a fost de fapt partea inovativă, aceasta presupunând crearea de la zero atât a unui soft care să manipuleze informațiile culese de diversele aparate de la pacient și să le poată transmite conform cerințelor, cât și imaginarea unui algoritm de comunicare, colaborare și feed-back a panelului de specialiști on-line.

Concluzii: Proiectul contribuie la îmbunătățirea calității vieții pacienților prin umplerea unui gol de servicii medicale pentru care exista cerere și care acum este parțial satisfăcută de serviciile de urgență medicală, care astfel sunt deturnate de la scopul lor de a salva vieți, consumând timp în deplasări la domiciliu pentru solicitări ce nu întrunesc criteriile unei urgențe medicale.

Cuvinte cheie: telemedicină, aparatură medicală, IT, comunicare, calitatea vieții

ABSTRACT

The primary objective of this project consists in developing a telemedicine type multidisciplinary diagnostic and treatment service.

Methods: The project have been developed concomitantly covering two categories, of equipment and of communication. The equipment also covered two issues, the medical one and the IT components. The part concerning communication was in fact the innovative approach, involving both the building from scratch of a software able to manage the information retrieved from different patient devices and to send it according to requests, and the origination of an algorithm for communicating, collaborating and feeding-back for the on-line panel of specialists.

Conclusions: The project contributes to an improvement of the quality of patients' lives by filling a gap of medical services with existing demands and which is now partially covered by emergency services, that are thus embezzled from their purpose of saving lives, consuming time for home travels for requests that do not meet the criteria of a medical emergency.

Key words: telemedicine, medical equipment, IT, communication, quality of life

INTRODUCTION

According to the formal definition of the profile American association, the term of telemedicine involves the use of medical information sent between two or more sites via electronic communication means, having as an ultimate goal the improvement of patients' clinical condition. After already four decades of development and practical use of this diagnostic and treatment modality, with demonstrations in hospitals extending their remote healthcare services, the use of telemedicine extended rapidly, now being integrated in different current operations in hospitals, specialty departments, home care agencies, private practice offices, and also in different workplaces or residential sites, benefiting nowadays of a variety (constantly increasing) of applications and services using bi-directional video broadcasts, e-mail services, smart phones, wireless devices and other forms of telecommunication technology.^{1,2}

OBJECTIVE

The present project, first of its kind in Romania, created by Gnosis Evomed and initiated in the autumn of 2013, was entitled „Integrated service of multidisciplinary diagnostic using a telemedicine platform” (acronym MultiMED, ID 1714), being co-funded via the European Fund of Regional Development, according to the funding agreement with the Ministry of National Education having the quality of Intermediate Organism, in the name of and for the Ministry of Economics having the quality of Management Authority.³

The primary objective of the project is the development of a diagnostic and treatment service originated in the patent registered at OSIM under no. A/00630/30.08.2012 and entitled „Metodă de diagnostic complet prin integrarea on-line a unui panel de specialități medicale ce interacționează în timp real și sistem necesar pentru implementare”, internationally registered at WIPO with the title "Complete diagnostic method and implementation system by on-line integration of a real time interacting panel of medical specialties", no. PCT/RO2012/000029.³

MATERIAL AND METHOD

The project have been developed concomitantly covering two issues, of equipment and of communication. The equipment also covered two categories, the medical one and the IT components.²

The part concerning communication was in fact the innovative approach, involving both the building from scratch of software able to manage the information retrieved from different patient devices and to send it according to requests, and the origination of an algorithm for communicating, collaborating and feeding-back for the on-line panel of specialists. In this respect there were

acquired hemogram, biochemistry, immunology and urine analyzers, ultrasound equipments (with convex, linear, heart, endolumenal, and 4D probes), EKG devices, EKG and NBP Holters, a cardiocotograph, EEG devices, spirometers, dermatoscopes, a laryngoscope.^{4,5,6} It was also made the design and it was manufactured a cart, with wheels that allow climbing up and down the stairs, meant for transporting the equipment (excepting the analyzers). For this purpose it was featured an ergonomic design of the workbench in the vehicle transporting the entire equipment.⁶ UV sterilization of the vehicle environment and general air conditioning were also made. A circuit for waste storage was created.

Concerning the software, in the first stage of the project it was accomplished the conversion of the data delivered by each device and their acquisition (images, test results, physician's conclusions) in the vehicle's central computer, in forms easy to be sent to remote specialists. The algorithms for communication between specialists had been then established, and they were consequently transformed in electronic data sheets, the later being integrated together with the data collected at patients' home.⁶

From the implementation of the multidisciplinary protocol conceived in the research phase of the project resulted a telemedicine system, named MultiMED, that allows the accomplishment and the interpretation of medical analyses and results collected at homes by a multidisciplinary team of remote specialists, that are using a specialized application working on any mobile device for viewing, interpreting and commenting the results of medical investigations and analyses, and for establishing a consensus diagnostic and an appropriate treatment^{7,8}, presently the system consisting of 8 teams for mobile intervention, 1 call center scheduling and organizing the medical activity and 1 team of physicians. The study of the applied technical solutions, the research-development and reports and the casuistry resulted from the complex data sheets of clinical examination made for 40 patients in the development phase and for 50 patients during the phase of results dissemination (close to conclusion), and also the market research made for telemedicine are, all led to the certification of the expected project's results, namely:

a) An approved multidisciplinary medical protocol, ensuring for a patient a quick and complete diagnosis by using a multidisciplinary physicians team remotely and simultaneously working in real time, using telemedicine equipment operated by a physician at patient's home, the data being sent and analyzed continuously at a virtual decision center (coordinating physician and a multidisciplinary team);

b) Making available on market of a certified and authorized telemedicine system, reliable and modern, as a result of protocol implementation;

c) 8 new workplaces for young physicians, being

thus trained in the future area of telemedicine;

d) An alternative to the present Romanian medical system, based on medical acts that are not made at homes but scarcely, via family physicians, who nevertheless do not have the digital mobile investigation equipment proposed in this project and thus can't conclude the necessary investigations unless they use referrals to hospitals and specialized medical laboratories.

The first stage of testing the new system focused on proving the viability of the communication algorithm and of the software that made it possible.^{4,5} For those 40 patients examined worked together the solicitor physician (accomplishing anamnesis, clinical examinations and investigations, acquiring and sending data) and at least a remote specialist participating in establishing the final diagnosis and the treatment course. Also, the data flow and the communication between the physicians were accomplished by a process coordinator physician. The system proved to be functional and the hard-IT component managed the dataflow ensuring a lossless and uninterrupted data transmission^{7,8,9,10}.

In the second stage of the project there were taken more complex requests, both from the point of view of the analyses made (biochemistry, immunology) and of the imaging investigations (heart ultrasound exams, EKG Holters). The objective of this second stage was to prove the feasibility to accomplish the medical act, with diagnoses and treatment indications, in any situation and at any request.^{6,9,10,11,12}

RESULTS

Concerning the number of calls, 21 were due to cardiac symptoms/hemodynamic events such as angor, hyper/hypotension, headache, recent collapse, vertigo), 12 for lumbar/abdominal/pelvic cramps, 6 for other types of pain or recent trauma, and 3 for a control or a second opinion. All the cases finalized with a precise diagnosis and a indication for treatment. In 3 of the cases, the urine culture, in one case EKG Holter examination determined changes in treatment few days later, and in 2 other cases re-assessments after a variable period of time.

DISCUSSIONS

At the national level, the applications for this platform are numerous, first due to the usefulness as an alternative to the public or private health providers in the areas where there is a lack in availability of clinics or they are insufficient or less equipped. Furthermore, the access to care is facilitated for a special category of patients such as those with difficulties in locomotion (elderly or persons with a locomotor disability). In this case, this innovative service brings an considerable enhance in quality of life.^(13,14) Furthermore, in our pilot project the service proved to be beneficial for the patients with concomitant

co-morbidities in which the therapeutic decision needs the quick opinion of the specialists in different medical specialties.⁽³⁾

The studies suggest that tele-consultation is acceptable to patients in a variety of circumstances, but issues relating to patient satisfaction require further exploration from the perspective of both clients and providers. ⁽¹⁵⁾

The emergence of new topic areas in this dynamic field is notable and reviewers are starting to explore new questions beyond those of clinical and cost-effectiveness. ⁽¹⁶⁾ Most reviews have concluded that there is not much difference in the cost-effectiveness when delivering health services via telemedicine or by conventional means ⁽¹⁷⁾ It becomes useful an economic evaluation framework as a way of offering decision makers ⁽¹⁸⁾. There are also differences in the demographic characteristics of those who ask for telemedicine services, for example younger persons who prefer it for convenience reasons ⁽¹⁹⁾, but also for lower transportation costs. ⁽²⁰⁾

The decision factors must take into consideration that investments in telemedicine wont bring clinical or economical benefits, most probably patients with a higher risk for a severe evolution would appreciate it. It is necessary that long term studies should demonstrate the persistence of the benefits proved in these limited studies. ⁽²¹⁾

CONCLUSIONS

The project contributes to a higher quality of life through completing a lack of medical services for which there is a demand from the patients. This demand is now partially provided by the emergency services, which are discarded from their aim to save lives, in this way spending time in home visits for calls that don't fulfill the criteria for a medical emergency. MultiMED system could also be considered a humanitarian application for underdeveloped countries where there is a lack in the infrastructure, there are no money resources for building new hospitals or there are just a few doctors. In these cases, MultiMED could bring doctors in these areas with a minimum of human and financial investment, who could contribute to the elaboration of diagnoses at a distance. ^(3, 13, 14)

REFERENCES

1. What is telemedicine? American Telemedicine Association. Available at: <http://www.americantelemed.org/about-telemedicine/what-is-telemedicine#.VfmIZNLtmko>
2. Telemedicine A Guide to Assessing Telecommunications in Health Care Institute of Medicine (US) Committee on Evaluating Clinical Applications of Telemedicine; Editor: Marilyn J Field. Washington (DC)1996.
3. Programul Operational Sectorial "Cresterea Competitivitatii Economice" cofinantat prin Fondul European de Dezvoltare Regionala "Investitii pentru viitorul dumneavoastra". Comunicat de presa. Disponibil on-line la: <http://www.multi-med.ro/>
4. European Research in Telemedicine / La Recherche Europeenne

- en Télémedecine Volume 4, Issue 2, Pages 33-70 (June 2015)
5. Gemmill J. Network basics for telemedicine. *J Telemed Telecare*. 2005;11(2):71-6.
 6. Kjaer NK, Karlsen K. Telemedicine and general practice--future or present. Telemedicine, a way to strengthen the gatekeeper role? *Ugeskr Laeger*. 2002 Nov 4;164(45):5262-6.
 7. Blobel B. Results of European projects enabling secure regional, national and international health care networks. *Stud Health Technol Inform*. 1999;64:73-82.
 8. Heidenreich G, Blobel B. IT standards for applications in telemedicine. Towards efficient data interchange in medicine *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz*. 2009 Mar;52(3):316-23.
 9. , Allen A, Clemmer TP, Lindberg DA, Pedersen S. Telemedicine protocols and standards: development and implementation. Houtchens BA. *J Med Syst*. 1995 Apr;19(2):93-119.
 10. Dudeck J. Communication standards: problems and future trends. *Stud Health Technol Inform*. 1997;45:148-55.
 11. Blobel B. Comparing approaches for advanced e-health security infrastructures. *Int J Med Inform*. 2007 May-Jun;76(5-6):454-9. Epub 2006 Oct 30.
 12. A Steventon et al. Effect of telehealth on use of secondary care and mortality: findings from the Whole System Demonstrator cluster randomised trial. *BMJ* 2012;344:e3874 doi: 10.1136/bmj.e3874 (Published 21 June 2012)
 13. Anderson JG. Social, ethical and legal barriers to e-health. *Int J Med Inform*. 2007 May-Jun;76(5-6):480-3. Epub 2006 Oct 24.
 14. De Moor GJ. European standards development in healthcare informatics: actual and future challenges. *Int J Biomed Comput*. 1995 Apr;39(1):81-5.
 15. Mair F, Whitten P. Systematic review of studies of patient satisfaction with telemedicine. *BMJ*. 2000 Jun 3;320(7248):1517-20.
 16. Ekeland AG, Bowes A, Flottorp S. Effectiveness of telemedicine: a systematic review of reviews. *Int J Med Inform*. 2010 Nov;79(11):736-71. doi: 10.1016/j.ijmedinf.2010.08.006.
 17. Mistry H, Garnvwa H, Oppong R. May Critical appraisal of published systematic reviews assessing the cost-effectiveness of telemedicine studies. *Telemed J E Health*. 2014 Jul;20(7):609-18. doi: 10.1089/tmj.2013.0259. Epub 2014
 18. Le Goff-Pronost M, Sicotte C. The added value of thorough economic evaluation of telemedicine networks. *Eur J Health Econ*. 2010 Feb;11(1):45-55. doi: 10.1007/s10198-009-0162-5. Epub 2009 Jun 27.
 19. Mehrotra A, Paone S, Martich GD, Albert SM, Shevchik GJ. Characteristics of patients who seek care via eVisits instead of office visits. *Telemed J E Health*. 2013;19(7):515-519
 20. Stensland J, Speedie SM, Ideker M, House J, Thompson T. The relative cost of outpatient telemedicine services. *Telemed J*. 1999 Fall;5(3):245-56.
 21. McLean S, Sheikh A, Cresswell K, Nurmatov U, Mukherjee M, Hemmi A, et al. (2013) The Impact of Telehealthcare on the Quality and Safety of Care: A Systematic Overview. *PLoS ONE* 8(8): e71238. doi:10.1371/journal.pone.0071238



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