ICTs in Ophthalmology: its impact on physician's communication and daily training

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Abstract

The purpose of this article is to report the use of new applications in Information and Communication Technologies (ICTs) that have impacted on the way physicians train and communicate with each other regardless of their geographical location. In order to facilitate instant communication (audio-video) between attending and consulting physicians at the different institutional sites, the use of videoconference solutions, Remote Computer Access Software (RCAS) and voice over IP (VoIP) was implemented. Slit lamps were fitted with dynamic IP video and digital cameras. Videoconference capability was assured by both computer videoconferencing software and VoIP freeware, with the aid of cameras. RCAS enabled both the attending and consulting physicians to have complete control of the personal computer (PC) and view images or video, regardless of their location. Therefore, real-time consultations and telementoring could take place on demand, avoiding unnecessary patient or physician transfer, as well as helping reduce the carbon footprint. ICTs have empowered our eye care by enhancing the efficiency and productivity of our daily work. Therefore we can continue providing high quality eye care services regardless of the geographic barriers of physicians and patients, as well as contributing with the protection of our environment.

Key words: *Information Technology; Medical Informatics; Health Services; Ophthalmology; Videoconferences; Telemedicine; Remote Consultation; Telecommunications; Computer Communication Networks.*

Resumen

Las TICs en Oftalmología: su impacto en la comunicación y entrenamiento diario del médico

Este artículo se propone relatar el impacto del uso de las nuevas Tecnologías en Información y Comunicación (TICs) en el quehacer diario del médico, sin importar su ubicación geográfica. Para facilitar la comunicación instantánea (audio-vídeo) entre los profesionales médicos de los distintos sitios institucionales, se utilizaron soluciones en videoconferencia, software para Acceso Remoto de Computadoras (RCAS) y voz por IP (VoIP). Las lámparas de hendidura fueron provistas con cámaras digitales y videocámaras con IP dinámicas. Por medio de videoconferencias y con el uso de RCAS que permitieron controlar las personal computer (PCs) remotamente, se visualizaban los vídeos o imágenes desde cualquier ubicación geográfica. Por lo tanto, se realizaron consultas o entrenamientos en tiempo real y a demanda, evitando los traslados innecesarios de los pacientes y/o médicos; a su vez, reduciendo la tasa de emisión de gases tóxicos al ambiente. El uso de las TICs ha contribuido con la eficiencia y productividad del trabajo diario, permitiéndonos no solo continuar brindando servicios de calidad en salud visual sin importar las barreras geográficas, sino también ayudando a cuidar el medio ambiente.

Palabras clave: *Tecnología de la Información; Informatica Medica; Servicios de Salud; Oftalmología; Videoconferencia; Telemedicina, Consulta Remota; Telecomuncaciones; Redes de Comunicación de Computadores.*

Resumo

As TICs em Oftalmologia: seu impacto na comunicação e treinamento diário do médico

O objetivo do presente artigo é relatar o impacto do uso das novas Tecnologias da Informação e Comunicação (TICs) no dia a dia do médico, independentemente da sua localização geográfica. Para facilitar a comunicação instantânea (áudio-vídeo) entre os profissionais médicos dos diferentes centros institucionais, foram utilizadas soluções em videoconferência, software para Acesso Remoto de Computadores (RCAS) e voz por IP. As lâmpadas de fenda foram equipadas com câmeras digitais e vídeocâmeras com IP dinâmicas. Através das videoconferências e com o uso de RCAS que permitiram controlar os computadores pessoais (PCs) remotamente, vídeos e imagens eram visualizados de qualquer lugar. Por tanto, foram feitas consultas e treinamentos em tempo real e sob demanda, evitando deslocamentos desnecessários dos pacientes e/ou médicos; ao mesmo tempo que é reduzida a taxa de emissão de gases tóxicos no meio ambiente. O uso das TICs tem contribuído para a eficiência e produtividade do trabalho diário, nos permitindo não só continuar oferecendo serviços de qualidade em saúde visual independentemente das barreiras geográficas, mas também ajudando a cuidar do meio ambiente.

Palavras-chave: *Tecnologia da Informação; Informática Médica; Serviços de Saúde; Oftalmologia; Videoconferência; Telemedicina; Consulta Remota; Telecomunicações; Redes de Comunicação de Computadores.*

INTRODUCTION

HEALTH ON THE XXI CENTURY

Argentina is a large enchanted land with huge contrasts. It is a country touched by globalization living in the middle of this new digital era, the Information Society (IS). The most important feature of this era is the generation, distribution and handling of information and knowledge for society, as it happened in the past with goods produced and services offered at Industrial and Post-Industrial times, respectively. In this new situation, sectors related to Information and Communication Technology (ICT) play a particularly important role. Also, from the standpoint of contemporary globalized economy, information society grants ICTs the power of becoming the new drivers of development and progress. [1]

This new social model is generating deep changes in human beings since it has broken old paradigms on communication and information access in order to welcome new concepts on instantaneous, multi-directional, interactive and global communication. Social networks and virtual communities are currently dominating the different scenarios of society, such as education, work, family, entertainment or free time. We are communicating and interacting with our peers, friends or even with people we do not know in an almost intuitive way through cell phones or computers with Internet, thanks to interactive and collaboration platforms such as: chats and instant messengers, web meetings, blogs, *Facebook*, *Linkedin*, *Twitter*, or even through videoconferences, *Skype* etc. Technological and social convergence of the current moment is bringing a revolution into our lifestyle and its impact will not go unnoticed.[2]

This is why large industries are taking ownership of these new technologies and using them in their enterprises, understanding them as part of their critical mission, in order to increase the efficiency and productivity of their companies at a time of globalized crisis. This situation is not different for the health care sector. The main advantage of being able to access information instantaneously at the moment of need, regardless of its type or place, is that it allows us to be better trained, improving the accuracy of diagnosis and making more timely and precise decisions. As a consequence we have higher efficiency of the treatment provided and better results. All this contributes to patient satisfaction not only because they receive a good quality treatment but also because even when their physician is far away, he/she is able to deal with the problem.[3]

As a consequence, specialized care becomes an extremely important issue on places or regions with difficult access to hierarchical health services due to factors like large population, inflationary costs, uneven geographical distribution of medical professionals, etc. In fact, this has been described as the most important challenge faced by telehealth as a new subject and used as a basis for its further development.[4]

METHODS

AN INTEGRAL NETWORK AND ITS TOOLS

At the moment of sharing information among colleagues and/or different institutions, the use of different emerging technologies on computing and communication makes easier the information flow from one location to another. This is why Zaldivar Institute implemented the use of videoconference and voice over IP (VoIP) technologies in order to optimize not only communication among its medical staff at the different institutional branches but also as an educational and training tool for physicians taking part in the Ophthalmology Residency Program, in addition to its contribution to the environment. All this is possible thanks to the design of a hybrid telecommunication network with its central headquarter located in the city of Mendoza in Argentina connected to another one located at the Autonomous City of Buenos Aires in Argentina; and both of them linked to Dr. Zaldivar center in the city of Asunción in Paraguay through an IP network (Figure 1).

The backbone is made up of a Virtual Private Network which Multi-Protocol Label Switching (MPLS) architecture supports 1.5 Mbps. The MPLS represents the concept of an IP private network that combines the flexibility of point to point communications or Internet with the reliability, quality and safety of Private Line, Frame Relay or Asynchronous Transfer Mode services. It offers differentiated performance levels and prioritization of data traffic together with voice and multimedia applications; everything on one single network. Additionally, Zaldivar Institute has exclusively dedicated connectivity for videoconferences through digital telephone services with 6 Integrate Service Digital Network (ISDN) lines (384 Kbps) and another one of public IP (512Kbps).

As communication tools, the organization has videoconferences room equipments such as [Polycom VSX 7000 - Polycom, USA; TANDBERG 1000 - TANDBERG,

USA-Norway], for offices [Polycom VSX 3000; TANDBERG 500; D-Link® DVC-1000 i2eye - D-Link, Taiwan] and software for videoconferences from computers whether PCs or Laptops (Polycom PVX). It also integrates the use of voice over IP and instantaneous internal messaging technologies using freeware programs like Skype™ [eBay Inc., USA] and Spark® [Jive Software, USA], respectively to connect all its end users. There is also PBX over IP [NEC NEAX 2000 IPS – NEC Corp., Japan] and the use of all cell phones for mobile telephony [Movistar, Telefónica Empresas, Argentina] including BlackBerry® devices [Research In Motion Ltd, Canada] synchronized with the Microsoft Exchange Server [Microsoft, USA] of the organization.

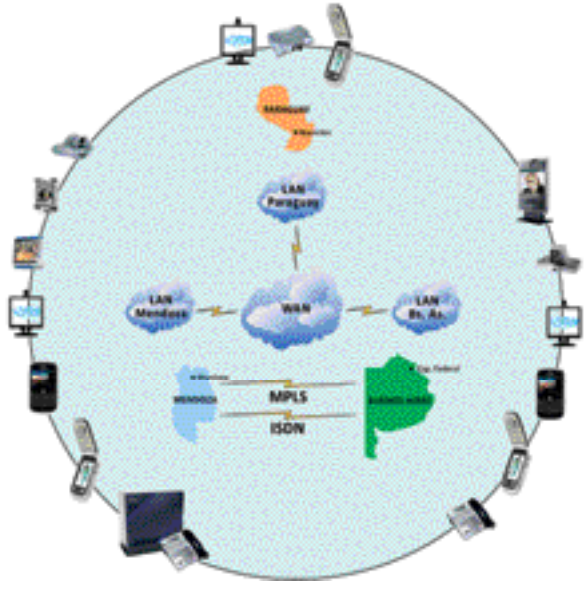

Figure 01 - Diagram of the telecommunication hybrid network of the Zaldivar Institute, showing the three sites, their links and communication tools.

In order to implement teleconsultations the different "virtual settings" on every central office were wired and equipped. Doctor's offices, operating theaters and the conference hall are connected to a network (LAN 100Kbps). Digital cameras and video cameras with IP, audio and video outputs were added to the slit lamps, webcams were distributed for every computer and the corresponding software was installed. Finally, the staff received training on the use of new technologies through training classes and customized coaching delivered by the Computing Technology Management staff of the institution.

RESULTS

THE ZALDIVAR EXPERIENCE

As time passed, the use of ICTs at the organization has gradually become established to the extent that today there are different variants or services available to users. The most widely used service is the one for videoconferences for weekly medical lectures and Internal Medical Training classes that take place twice a week with members from the three sites (Mendoza, Buenos Aires and Asunción) joining the network to share and discuss the contents that were generated. The conference hall at the Institute in Mendoza is used as the center for these lectures since it has sound and simultaneous translation booth, multimedia projector, wide screen, videoconference equipment, electric blackboards and WIFI access. Each remote center communicates with the center in Mendoza and they exchange clinical-surgical experiences, second opinion cases, on-going medical training classes and the Ophthalmology Residency Program, as well as corporate and institutional training classes and sessions.

The second most frequently used service is videoconferences for teleconsultations, both for monitoring remote patients and for training medical residents. In these cases, patients are present together with one of the physicians of the central locations who require a consultation with the specialist in Mendoza. Here, technological innovation on the capturing elements is fully visible, generating different types of settings: in some of them, (for example video cameras) they are already integrated into ophthalmologic diagnosis instruments and therefore are invisible for end users; and others where they had been incorporated through elbows, threads, etc, generating an extra interface with which the user has to interact (Figure 2).

Finally, we can mention the daily use of Skype™ and Spark® as instantaneous communication tools among colleagues or technical or administrative staff for specific consultations in order to solve difficulties or simply to share information. Both programs run on the network with the advantage that Skype™ enables to carry out IP video calls to those colleagues who are outside the Zaldivar network, and with whom there is quite a lot interaction frequently.

The use of software for the remote control of computers (RCAS) such as VNC [© RealVNC Ltd, UK] and Team Viewer [TeamViewer GMBH, Germany] deserves a special comment, since they allow all users to have remote control of their computers regardless of their geographi-

cal location. This tool has also proven to be essential for monitoring the work done by medical residents and for the technical staff in charge of the administration and maintenance of the network, because these programs generated a friendlier environment for following the users along their learning curve, that can only be managed using the positive aspects of this tool.

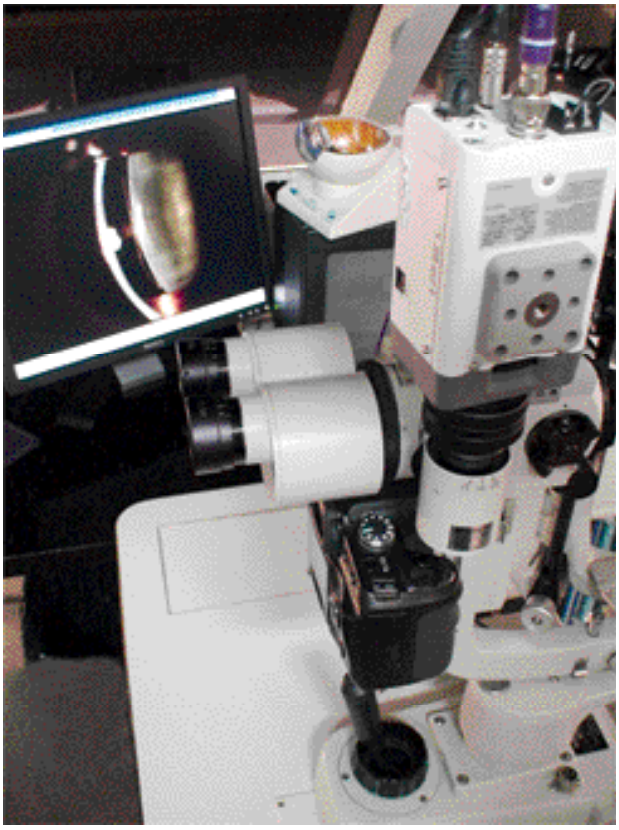

Figure 02 - Slit lamps equipped with dynamic IP Mpeg-4 videocameras and 10 Mpx digital cameras together with the software to carry out videoconferences from the PC with USB webcam.

DISCUSSION

WHY USING ICTs AS TOOLS?

It is a fact that the use of new information and communication technologies are having a deep impact on the daily routine of physicians and health professionals, both on the way they work and also on the way they communicate among themselves, regardless of time or distance barriers. This also applies to the community, because healthy or sick populations find new communication channels with their service providers and also among themselves, raising a countless number of virtual communities due to affinity of their members. The medical community must keep a close watch on these virtual communities of patients.[5, 6] Finally, there is an increasing "green" awareness on caring for the environment, where the impact of toxic gases emissions (CO_2) does not go unnoticed and corporations and industries are looking for solutions that will help them to reduce the amount of times their employees have to move from one place to another, among other things.[7]

This change of directionality on communication and the use of these new ICTs are some of the needed cornerstones to reach the reform of the health care model, so much wanted in this XXI century. Only then we will be able to aim to have a health care system with an integrated concept of the psychic, physical and social levels of the human being and where the health care model reaches the individual no matter where he/she is; different from what has been happening until now where it is the patient who has to go out looking for his/her health care service. Also, the ownership of ICTs by the medical practice makes easier the integration of the different stages of health care, such as prevention and assistance in order to rehabilitate and include the individuals when they get sick. Finally, these technologies can also be used as a base for creating strategic partnerships among all sectors related to health care, both public and private ones, including industry, the academic sector and opinion leaders.[3, 8]

In ophthalmology, the use of ICTs is experienced as something logic and even almost natural for the users because eye care physicians are used to deal with images, colors and moving objects, since one of our most precious senses, sight, has to do with all this.[9, 12] As a matter of fact, transferring and using technology belongs to the leitmotiv of our organization: advanced ophthalmology for the world.

Since all information, whether images or data can be captured and broadcasted from one place to another through ICTs, the institutional network was re-designed bearing in mind the new profiles and expectations of its users, being able to integrate them from their work places on the new sites that had been open inside the country and abroad, always trying to satisfy their new demands for knowledge and training. Thus, the connection of the three national and international central sites through videoconferences services made real time interaction easier, offering a differentiated value for the organization. [13, 14]

CHALLENGES TO INNOVATE

The whole technological innovation process was possible thanks to the commitment made by the Top Management of the Institution, since adopting emerging technologies in a daily workflow or process can be very disruptive sometimes. Deep changes are required on the organizational culture that has to follow the re-engineering process in order to overcome the resistance to change felt by most people affected by the new situation. A good dose of patience and good will is needed together with the investment on time and resources that this type of change imposes. At the same time, hiring staff who like to work with ICT (called "local champions" in some places) at each level of the organization is a priceless strategy to guarantee the success of the technological ownership. It is them who act like goodwill ambassadors establishing a link with end users paving the way and spreading their enthusiasm to the rest of the personnel. Additionally, customized training is a key element when we want to carry out a technological transfer of such magnitude.

Another critical factor was the learning curve required to show patients on videoconferences where mastering concepts such as: production or staging of the virtual office and the involved personnel, the good use of body language, the adequate handling of capturing instruments and the need for a timed coordination among the different locations, can mean the difference between the success or the failure of a teleconsultation. Once again, being near the user following his/her learning experience and also showing the commitment of the leading team at all times (from the starting point of design, during the implementation and then managing the change), are critical factors at the moment of predicting good results.[15, 16]

In our medical undertaking we had not only to overcome the resistance to change but also the fear of the lack of confidence in using the tools due to the lack of experience, together with old concepts or mental models on ethics and legality related to treating the patient with these applications, both at the educational process and on the assistance level. The same happened during the process to incorporate the use of electronic medical records in the daily routine of medical professionals.[17]

It is important to remember that the physician-patient relationship goes beyond a screen or a video camera. This relationship is based on the empathy and trust established between these two players, regardless of the place where they meet: at the doctor's office, on a stretcher in the emergency room, at home or why not, at a telemedicine session. Some people postulate that computers and technology can make people nervous, less spontaneous or without physical contact. However, if we look at it from another point of view, we have a unique opportunity to reduce time and distance barriers that separate us from that professional who can solve our doubts and to whom we can only have access through a teleconsultation.[18, 19]

Similarly to what happens at the educational level when we get in touch with someone who is going to offer his/her wisdom and knowledge, we start to trust and respect this professional. These feelings together with the sensation of safety, privacy and confidentiality that ICTs offer are key elements for the success of this relationship or gathering which goes beyond the diagnosis, the lesson taught or the place where we are, whether virtual or traditional. This is why, ethics has to be always the same on this new inter-relationship; there is only one ethics and conscience, regardless of the means or settings we use.

CONCLUSIONS

SPECIALIZED HEALTH FOR ALL

We can only hope that the globalized use of ICTs may contribute to the health care reform, being able to generate a new paradigm of care with universal access to medical services and high quality health with low costs with simple and easy to adopt procedures, allowing the system to increase its effectiveness, efficiency and productivity in a sustainable way over time. In order to achieve this creativity, inventiveness and experience are essential elements when choosing the most adequate solutions for each scenario or need.

We would like to finish saying that the use of ICTs in our daily practice has had a positive impact, bringing us together and allowing us to meet the demand, regardless of our physical or geographical location. The quality of videoconference sessions, whether at the conference hall, at doctor's offices or at operating theaters, provided us a unique experience. Also costs related to time and moving medical and technical staff – between buildings or central offices - has been remarkably reduced; not to mention the impact on climate change due to the reduction of toxic gases (CO_2) emission rate.

Therefore ICTs allowed us to continue offering quality and added value eye care services regardless of the time or distance barriers, at the same time we are taking care of the environment.

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