Robotized tele-echography – TecnoSalud Experiment  
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Teams involved:
- Prisme laboratory (robotic team), University of Orléans, France – P Vieyres, C Novalès
- Health Technopole CENGETS PUCP*, Pontifical Catholic University, Peru – L. Vilcahuamán, R. Rivas, D. Paz, J. Luis, A. Agapito.
- Belenpampa Health Center***, Cusco, Peru - A. Escalante, R. Guillén
- Lima Chamber of Commerce-CCL****, Peru - J.Lockett, P. Ramirez
- Telefónica del Peru, Lima, Peru ***** - I. Meléndez

Rationale:
Access to a health care system remains a difficult task for many patients whether they live in developed or underdeveloped countries. In developed countries, experts are usually performing their medical acts within a main hospital center mainly as an economic strategy of costs reduction. For the underdeveloped countries millions of people do not have access to a regular healthcare offer. In both case, the number of medically isolated areas increases and patients found themselves remotely located from a given medical expert.

The robotized tele-echography approach brings one type of solution to provide patients leaving in these isolated areas (rural, mountain areas, secondary hospitals, dispensaries...) with prediagnosis capabilities. It is geared to patients in need for an ultrasound scan for a preliminary diagnosis; this concerns mother-to-be, fetus growth follow-up, elderly persons, emergency cases (accidents, earthquakes, cruise ships....).

The proposed telemedicine system:
Prisme laboratory and its robotic team has been developing for the last 15 years various robotic prototypes, within national and European projects, to perform an echography at a distance; It has been proven based on over 500 volunteered patients the reliability provided by such a tele-operated robotic system in terms of diagnosis performances. The robotic system is designed to hold any standard ultrasound probes; this light-weight system is positioned on the patient’s body by a paramedical assistant. Using a dedicated “joystick”, the medical expert controls, from his/her main hospital center, the remotely located robot via any type a communication links (internet, satellite..).
The 2009 TecnoSalud Experiment: A telemedicine premiere on the American continent.

Under the framework of the exchanges and interventions done since 2006 about Clinical Engineering and Health Technology Management between the Chamber of Commerce of Lima-CCL and Health Technopole CENGETS PUCP lead by MSc. Eng. Luis Vilcahuamán and MSc. Eco. Rossana Rivas, CENGETS coordinated an institutional exchange and later an invitation from CCL to PRISME team, to participate on an expert presentation on “TecnoSalud-2009” at the Chamber of Commerce of Lima, and set up a robotized tele echography demonstration between Lima TecnoSalud conference center and Belenpampa Health Center, Cusco, Peru.

The robotic prototype used was developed within a French national project called PROSIT. The logistic for the communication link was provided by Chamber of Commerce of Lima-CCL and Telefónica del Perú; that is the link for the videoconference system that gives a direct interaction between the doctor and his remotely located patient and also that provides the patient ultrasound images in real time, and the link for the robotic system data exchanges.

Successful tests linking Cusco-Peru and Paris-France were done in Belenpampa Health Center, Cusco, Peru with the collaboration between the Regional Health Department, Ministry of Health of Peru: Dr. Adolfo Escalante, Eng. Ricardo Guillén and the collaboration of Health Technopole CENGETS PUCP, MSc. Eco. Rossana Rivas. However on the date of the presentation due to difficult meteorological conditions within Cusco area (strong dry thunderstorms), several tests conducted on standard Internet lines between Cusco and Lima revealed a lack of robustness for the data transmission. The tele-echography test was decided to be performed within Lima Area, between the hospital center and Tecnosalud conference center.

With the collaboration of the partnership: Health Technopole CENGETS PUCP and Instituto Nacional Materno-Perinatal-Maternity of Lima, a pregnant patient volunteer could be part of the investigation under the supervision of the Instituto Nacional Materno-Perinatal-Maternity of Lima experts: Dr. Pedro Mascaro, Dr. Julio Portella, Dr. Walter Castillo and the INMP-Telemedicine team: Eng. Enrique Valdez, Eng. Roberto Valverde and Eng. Freddy Ingar; Health Technology Management and Clinical Engineering Unit-UGTS team supported also the network: Eng. Dustin Paz, Eng. Jaime Luis with the participation of PUCP Eng. Alonso Agapito. Dr. Walter Castillo was briefed by Prof Vieyres and Novales on how to control the robotic system; it took only 20 minutes for the ultrasound expert to be able to control the remote robot positioned on the patient and to provide a diagnosis based on the fetus images and the Doppler signals. For a better understanding during the presentation, two screens were showing the robotic system and the ultrasound images.

Dr C Novales acting as a paramedical to position the robot on the patient

The experimental set up with the 2 screens
Conclusion

The experiment performed by PRISME laboratory, Health Technopole CENGETS PUCP, Chamber of Commerce of Lima-CCL, Centro de Salud Belenpampa, Cusco, Peru and Telefonica del Peru, was successful. The medical expert was able to perform a remote tele-echoography and provided a diagnosis after a mere 20 minutes tutorial by the PRISME team. The communication links (internet) used were robust to provide stable and good quality images. However, Cusco experiment could not be performed, as it required a stronger communication link such as a point-to-point satellite link. This type of satellite communication link was successfully used by the Marte consortium (PRISME lab, Cyprus university of technology team and Tototohe satellite provider), in later experiments between a French hospital center in Bourges (France) and a ship cruising in the Mediterranean Sea.

This type of satellite communication link should be tested within the Peruvian geographical conditions and also within the telemedicine network already existing within some Peruvian hospitals; this can provide the backbone for a routine robotized tele-echochography application.

Health Technopole CENGETS – PUCP*, is the National Center for Clinical Engineering and Health Technology Management, serving the Ministry of Health, based out of the Pontifical Catholic University of Peru. CENGETS- PUCP is co-led by Luis Vilcahuamán, clinical engineer, and Rossana Rivas, health economist; both are co-founders of CENGETS. These partnerships have produced a series of events that have helped establish CENGETS as a national and regional resource, acknowledged by Health Ministries of 6 countries and PAHO, including: Co-organizing several international activities, building and supporting institutionalization of Clinical Engineering-CE, Health Technology Management-HTM, Health Technology Regulation-HTR and Health Technology Assessment-HTA in Peru and for other countries of Latin America region, Improving Peruvian knowledge of the best CE, HTM, and HTA global practices through a sustained technology transfer (education, trainings, methods, etc.) with a key collaborators’ network, Training and Education at undergraduate and postgraduate levels on CE, HTM and HTA topics in the context of multidisciplinary and global models. Eng. Dustin Paz, Eng. Jaime Luis, Eng. Alonso Agapito, members of Health Technopole CENGETS PUCP.

Maternal Perinatal Institute-INMP**, Since its origin, as the Maternity of Lima, this institution took as its mission the care of women during childbirth, particularly those with fewer resources, while one started to form educated in art and science of helping bring new lives into the world, giving to this place to an attitude of constant innovation in institutional activities. This factor made it the cradle of Obstetrics in Peru and, later, gynecology and neo-natology, as a result, we performed the first Caesarean section in the country and began the study of specialization in Gynecology and Obstetrics. Eventually, in 1992, the Maternity Hospital of Lima gave rise to the Maternal Perinatal Institute- Instituto Nacional Materno Perinatal-INMP, offering specialized and highly specialized care in reproductive health as well as high-risk neonate. Is categorized as level III-2 and qualified to perform functions Obstetric and Neonatal Intensive, the role of National Institute offers field. Has constant contact with health facilities and specialized institutions nationally and internationally. It also carries out research and teaching activities at national level. Dr. Pedro Mascaro, INMP-Director, Dr. Julio Portella, INMP-Executive Director, Dr. Walter Castillo, INMP; Eng. Enrique Valdez, Eng. Ricardo Valverde, Eng. Freddy Ingar, INMP-Health Telemedicine Unit.

Belenpampa Health Center***, it is an institution member of the Health Regional Office-DIRESA, Cusco, Ministry of Health of Peru; Health Network: North-Cusco and Health Micro Network: Belenpampa. Is categorized as level I-4 and qualified to bring health services through the following centers: “Independencia”, “Zarzuela”, “Dignidad Nacional”, “Occopata”, “Ccorca” and
“Belenpampa” to more than 70,000 persons. Dr. Adolfo Escalante, Belenpampa Health Center Manager, Informatic Ricardo Guillén, Belenpampa Health Center’s staff.

The Lima Chamber of Commerce-CCL****, founded in 1888, is a private non-profit organization with a national and international level. It brings together individuals and companies engaged in trade, production and services. We are an association of businesses and entrepreneurs, established in Peru, to contribute our share of development. Principal functions of Lima Chamber of Commerce are: Exercise the representation and defense of business interests before the national authorities and national and foreign entities. Promote the market and free enterprise with social responsibility, and fair competition and honest within a set of values and ethical principles. We encourage domestic and foreign trade, promoting good business practices. “Tecnosalud” is the specialized event in the health sector in Peru, supported by Lima Chamber of Commerce. Eng. Julian Lockett, Health Committee President at Lima Chamber of Commerce, Eng. Pablo Ramírez, Lima Chamber of Commerce, Informatic Manager.

Telefónica del Perú***** The aim of this new role is to support the new strategic stage of the company, raising the institutional role of Telefónica, making it more comprehensive, more powerful and more resonance among the various audiences they are going, being the nexus of our trademarks and brand that unites us all. In the last fifteen years, Telefónica del Peru has boosted transcendental telecommunications in Peru installing more than two million telephone lines, eight hundred thousand broadband connections to the Internet and more than fifteen million mobile phones. Eng. Iván Meléndez, Telefónica del Perú-Manager.