

Preface

Heart failure is one of the most severe and frequent dysfunctions. It is often cause of death, especially if not early diagnosed. Thus the diffusion of instrumental methodologies, through telemedicine such as the digital tele-echocardiography, to investigate heart failure is today an important challenge for the National Health Care System (NHCS).

Digital tele-echocardiography could be very useful both in remote areas and in emergency care, where both the time for patients transferring and costs are very critical. The difficulty to exchange large data through (not suitable) networks hampered in the past its use and diffusion. Today's technology, such as the low-cost wideband communication channels and the compression techniques allow the implementation of low-cost and clinically accurate digital tele-echocardiography. Digital tele-echocardiography has thus the potentiality to change the life of the citizens and the health care organization in the world. However the digital tele-echocardiography systems are designed during national and international discontinuous projects through discontinuous funds. Aspects correlated to innovative technologies and research are usually privileged in these projects. Other aspects such as the quality of the application itself or the interoperability with other existing telematic infrastructures are often faced in these projects. However these are basic issues for the introduction of an application in the NHCS. In particular when a digital tele-echocardiography application is going to be introduced in the NHCS it is imperative to plan:

- *reliable methods for the assessment of the diagnostic accuracy of the transmitted exams to assure the effectiveness of the digital-tele-echocardiography application;*
- *designing of a tele-echocardiography clinical service around the application;*
- *a study of health technology assessment (HTA) of the application itself; aspect that today is considered basic not only for the acceptance of a new product/service in the NHCS but in every branch of the Public Administration.*

The study starting from a review, explores some significant experiences in tele-echocardiography which considered as a whole face all the above mentioned issues.

The first work entitled "Digital tele-echocardiography: a look inside" is a review on the progress of the digital tele-echocardiography with particular consideration to the last ten years. This progress has been particularly accelerated by the wide development of information technologies, such as the availability of the transmission of wide-band channels and of new compression algorithms for digitalization of echocardiographic exams. The review enlightened the lacking of specific methodologies for HTA in digital tele-echocardiography and of automatic tools for the assessment of the image quality with a low operative cost.

The second work entitled "Assessment and analysis of territorial experiences in digital-tele-echocardiography" focus to digital tele-echocardiography territorial experiences. In particular it is a review of the experimental projects carried in Lombardy, meant to support the work of specialists by means of second opinion and telemedicine services. The paper showed that while on the medical point of view digital-echocardiography is a widely used activity where operators are perfectly accustomed to do repetitive operations and steps, digital-tele-echocardiography introduced new methods and technologies into stable and everyday medical practice, causing disruptions either on the side of the specialists' way of working or on the new opportunities and services. The paper showed that a basic issue to introduce such a service meant to properly model it in order to reduce the changes in the operators' way of working while maximizing the benefits.

The third work entitled "Determination of the acceptable MPEG-4 quality for clinical real-time tele-echocardiography services" faces a validation of the digital tele-echocardiography imaging based on MPEG-4 algorithms on specific clinical heart disease. MPEG-4 in fact, thanks to its flexibility to channels with a low band-width and the high compression factors shows to be very interesting in telemedicine services requiring real-time transmission and interpretation. In particular in this study it has been assessed the clinical adequacy of the MPEG-4 for real-time studies. Results showed high acceptance of MPEG-4 and suggested that MPEG-4 was adequate for digital real-time T-E and most important that 256 kbls were

reported as adequate for the analysis of the kinetic of the left ventricle.

The fourth work entitled "Routine tests for both planning and evaluating image quality in tele-echocardiography" is focused on the role of system administrator in the network. A study on the practicability and the effectiveness of the use of objective methods based on automatic tools for improving the routine tests designed to tuning the image quality in digital tele-echocardiography over the network has been performed. As the use of tests on video quality assessment through the human assessment (based on subjective methods) is obviously limited from the high number of needed resources (persons, laboratories and time) the use of valid objective methods is thus desirable. The study reviewed different tools with this specific aim. One of the more suitable tools was found to be represented by a software package designed by the Institute of Telecommunication Sciences and the National Telecommunication and Information Administration, the NTIA/ITS VQM tool. This tool gives back objective-quantitative data as outcomes, however embeds model emulating the subjective perception. The study successfully reviewed and analyzed in deep the functionalities of the tool in tuning the image quality in TE over the network. The tool was also found to be suitable for a more general process of TE assessment, from a HTA perspective.

The fifth work entitled "Web based health technology assessment in tele-echocardiography: the experience within an Italian project" is a study on the HTA

applied on digital-tele-echocardiography. It introduces a methodology for the qualification and HTA specific for the digital-tele-echocardiography evolution of a study conducted as a part of the project *ERMETE 2001-2004*: (e.R.ME.TE. Regioni per la Medicina Telematica; Italian Regions for Telematics in Medicine, the Italian Ministry of Health). The HTA has been applied to the Italian application echocardioweb designed by CEFRIEL (www.cefriel.com). The assessment based on the HTA was arranged in two phases: phase I was focused on data acquisition and preliminary evaluation; phase II was focused on evaluation of the digital-tele-echocardiography application. A technical file and an assessment checklist were used as a tool to assess the telemedicine application in this phase. The HTA system assured also the definition of standardized quality levels for the application. The first level represents the minimum level of acceptance; the other levels are accessory levels useful for a more accurate assessment of the product. The application reached a high level of standardized quality. The study presented in this paper can be useful for promoting the use of standardized telemedicine applications, and therefore speeding up their integration process in the national health service.

Daniele Giansanti and Sandra Morelli

Dipartimento di Tecnologie e Salute,
Istituto Superiore di Sanità, Rome, Italy