

# Chapter 15

## Static Telecytological Applications for Proficiency Testing

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### ABSTRACT

*In recent years, informatics and computer sciences have changed dramatically the practice of clinical cytopathology. New types of cameras and microscopes, connected to computers made possible image capture and transmission (telecytology). The wide implementation of telemedical systems in the field of cytopathology became a necessity dictated by the need of real-time results for therapeutic decisions. A telemedical application is a valuable tool for cytopathologists in order to manage and promote inter-laboratory collaboration. The result is better cytological data management and sharing. ISO 15189:2007 for medical laboratories requires successful participation in proficiency testing programs. This chapter emphasizes on the necessity of developing a proficiency test for cytopathology labs wishing to be accredited according to ISO 15189:2007, and examines the feasibility of using low cost telemedical applications and solutions for this purpose. Furthermore, this chapter gives clear and comprehensive guidance concerning various financial, legal, professional, and ethical problems in this field.*

### INTRODUCTION

Accreditation is the process by which a certified organization or agency recognizes that a facility or service meets specific pre-established standards (Pantanowitz et al., 2009). ISO 15189:2007 constitutes an international accreditation standard, which can be used by medical laboratories wishing to improve their quality standards (Archondakis et

al., 2009). ISO 15189:2007 requirements consist of a group of general guidelines that will help laboratories establish and enhance their quality systems (Pantanowitz et al., 2009). There is an ongoing demand by all interested parties, such as regulators, laboratory accreditation bodies and customers for implementation of more measures that increase confidence in cytological laboratories performance.

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According to ISO 15189:2007 requirements, one of the greatest challenges facing cytopathology laboratories today is the design and implementation of a board certified external quality control program (proficiency testing). The purpose of the adopted program should be to ensure that microscopic (cytological) findings are correctly identified and interpreted by laboratory personnel (Pantanowitz et al., 2009).

During the last three decades external control measures have been proposed for quality control and quality assurance purposes, in order to monitor and further improve cervical screening diagnostic accuracy and reliability (Husain et al., 1974; Melamed, 1976; Mitchell et al. 1988; Koss, 1989; Lundbergh 1989). External quality control includes mainly proficiency testing programs and special workshops or courses (Davey et al., 1993; Thompson, 1989; Plott et al., 1987; Valente & Schantz, 1992). Typical purposes for a special proficiency test in the field of cytopathology include:

- Evaluation of the performance of laboratories for specific tests.
- Monitoring of cytological laboratories performance.
- Identification of problems in laboratories.
- Initiation of actions for improvement.
- Establishment of the effectiveness and comparability of test or measurement methods.
- Education of participating laboratories based on the outcomes of such comparisons.
- Identification of interlaboratory differences.
- Validation of uncertainty claims.
- Production of reference materials and assessment of their suitability for use in specific procedures.

Telecytology can be defined as the process of diagnostic cytopathology performed on digital images, transferred via telecommunication net-

works from one site to another. Telecytological diagnosis can be achieved either with the use of cytological pictures viewed in real time from the microscope (dynamic telecytological systems), or with the use of cytological pictures that are first captured in a digital format and then transmitted to distant observers (static telecytological systems) (Weinstein et al., 1997; Georgoulakis et al., 2010).

Static image capture and transfer is the most straightforward method. It only requires the capture of cytological images via a digital camera and their transport for remote evaluation. Dynamic telecytology systems require a real-time ability to move about the specimen, focus, and change magnifications, via remote robotic or local control. In whole-slide scanning and transmission systems, entire cytology slides are captured at high resolution and the data can be transmitted and manipulated from one site to another.

Telecytology is mainly used for obtaining expert opinions on difficult cases and for educational purposes (Archondakis et al., 2009). However, little information exists about its probable use for the development of proficiency testing programs in the field of cytopathology. Most of the current studies have found a high (90%–95%) concordance between telecytological and glass slide diagnoses but they are referring to a small number of cases (Archondakis et al., 2009; Della Mea et al., 2000; Briscoe et al., 2000; Raab et al., 1996).

A digital cytological image is mainly composed of a two-dimensional array of numbers (bitmap or raster image), each element of which represents a pixel (Pantanowitz et al., 2009). Digital images size can be compressed for transmission or storage purposes via “lossless” (no loss of data) or “lossy” (some detail is lost, compression algorithms (Pantanowitz et al., 2009).

The purpose of this chapter is to examine the feasibility of developing an external quality control program for cytopathology labs wishing to be accredited according to ISO 15189:2007, by using low cost telemedical applications and solutions. Furthermore, we present our own experience from the experimental use of a low

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