Chapter 14
The Evolving Landscape of Cytopathology Labs: Telemedicine, Cloud Computing, and Personalized Care

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ABSTRACT

A modern cytopathology laboratory is offering various examinations with vital clinical significance. The wide application of computers and information systems successfully operates in modern cytopathology laboratories. Over the last decade, clinical cytopathology has been influenced by the broad implementation of telemedicine and cloud-based applications. New innovative information technologies, including e-health and telemedical applications, constitute a valuable tool for interlaboratory collaboration and quality improvement. New applications, especially in cloud computing, have enhanced the opportunities for improvement in cytological data management and sharing. In this chapter, the author presents a thorough research of telemedical and cloud-based applications related to cytopathology and tries to foresee applications that may improve cytopathology laboratories' diagnostic services relating to population health management, pharmacogenomics and patient-centered care.

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INTRODUCTION

During the last decades, the practice of clinical cytopathology was dramatically influenced by the broad implementation of informatics and computer sciences in the everyday laboratory workflow. The comprehensive implementation of laboratory information systems became a necessity dictated by the need for real-time results and the increasing role of laboratory medicine in therapeutic decisions (Georgiou & Westbrook, 2006).

The main cytological examination, the well-known Papanicolaou test, consists of a widely applied, cost-effective screening method for the early detection of cervical dysplasia and cancer. Pap smear screening and cytological diagnosis provision for most females requires many skilled cytotechnologists and cytopathologists. Since the number of these professionals is still inadequate, the development of automated laboratory instruments and screening systems has provided a practical and satisfactory solution. Telemedical applications are regarded as essential for laboratory quality assurance (QA) and improvement due to their crucial role in the pre-analytical, analytical and post-analytical diagnostic phases. Mobile Health technology is changing how enterprises, institutions and people understand and use current software systems. It allows imaging flexibility and may be used to create a virtual mobile workplace. Security and privacy issues must be addressed to ensure the wide implementation of Mobile Health technology in the near future.

Cloud computing is a novelty that rapidly showed tremendous opportunities for application in medicine and health care improvement (Eugster, Schmid, Binder, & Schmidberger, 2013; Kuo, 2011; Lupse, Vida, & Stoicu-Tivadar, 2012; Mirza & El-Masri, 2013; Patel, 2012; Rosenthal et al., 2010; Waxer, Ninan, Ma, & Dominguez, 2013; Webb, 2012).

The purpose of this chapter is to present our experience on the application of telemedical and cloud-based applications to Cytopathology Laboratories and on the possible ways telemedical interlaboratory comparisons can encourage or facilitate the implementation of ISO 15189:2022 specific requirements concerning every laboratory aspect and process.

Within this chapter, we analyze state-of-the-art related to the application of telemedical and cloud computing services for cytopathology, identify and propose potential applications, explore possible solutions for potential problems and finally promote the benefits of transforming the traditional application of the cytopathology lab into cloud based-services.

Furthermore, we examine the feasibility of applying telemedical and social media applications for medical inter-laboratory comparisons, proficiency testing, and validating the accuracy of cytological diagnoses.