Chapter 48
Mobile Health Applications and Cloud Computing in Cytopathology:
Benefits and Potential

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ABSTRACT

Modern cytopathology labs offer an outstanding portfolio of important testing services that must be of high quality and credibility. Over the last decade, clinical cytopathology was influenced by the wide implementation of computer sciences. Cytopathology labs wishing to achieve a seamless workflow process have successfully adopted automation and information management systems. Innovative information technologies, including e-health, constitute a valuable tool for interlaboratory collaboration and quality improvement. Cloud computing will enhance the opportunities in cytological data management and sharing. The authors present thorough research of mobile applications related to cytopathology and try to foresee applications that may benefit modern cytopathology. Also, the feasibility of such applications for inter-laboratory comparisons, proficiency testing, and diagnostic accuracy validation is examined. Finally, the role of mobile applications for providing and/or enhancing the laboratory capabilities through educational training and other research activities is investigated.

INTRODUCTION

During the last decades, medical data deriving from the analysis of patient samples were stored in medical laboratories and was provided to physicians manually (Brender & McNair, 1996). The absence of an integrated laboratory information system was making medical data transfer slow and possibly ineffective while results inquiry/control and quality control (QC) was a rather expensive and time-consuming process (Kubono, 2004).

Over the last decade, the practice of clinical cytopathology was dramatically influenced by the wide implementation of informatics and computer sciences in the everyday laboratory workflow. The wide 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).

Laboratory information systems have been implemented in many medical laboratories wishing to improve their quality standards. A laboratory information system (LIS) is a valuable tool for medical professionals in order to manage complex processes, ensure regulatory compliance, promote collaboration between departments of the same or different laboratories, deliver detailed reports, and enhance the laboratory networking capabilities. That results in better data management and sharing between the laboratory and its clients (laboratories, clinicians or examinees) (Brender & McNair, 1996).

Cytopathology laboratory services are essential for patient care and include arrangements for examination requests, patient preparation and identification, collection, transportation, storage, processing and evaluation of clinical samples, together with subsequent interpretation, reporting and advice.

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. A well-written and well-implemented LIS software can improve the diagnostic accuracy of this method by introducing new emerging technologies. Pap smears screening, and cytological diagnosis provision for the vast majority of the female population requires a large number of skilled cytotechnologists and cytopathologists. Since the number of these professionals is still inadequate, the development of automated laboratory instruments and screening systems may provide a practical and satisfactory solution. Laboratory informatics are regarded nowadays as an essential tool for the laboratory's quality assurance (QA) and improvement due to its key role in the pre-analytical, analytical and post-analytical diagnostic phases. A well-written and well-implemented LIS software can use medical data for the documentation of QC measures and the improvement of the laboratory's performance.

Mobile Health technology is changing the way enterprises, institutions and people understand and use current software systems. It allows imaging flexibility and may be used for creating a virtual mobile workplace. Security and privacy issues have to be addressed in order to ensure the wide implementation of Mobile Health technology shortly.

Cloud services (in modern tech jargon often referred as "the cloud") refers to a network of servers connected by the Internet or another network that enables users to combine and use computing power on an as-needed basis. Cloud computing is a novelty that rapidly showed tremendous opportunities for application in medicine and health care improvement (Eugster, Schmid, Binder, & Schmidberger, 2013; Glaser, 2011; Kuo, 2011; Lupse, Vida, & Stoicu-Tivadar, 2012; Mirza & El-Masri, 2013; Patel, 2012; Rosenthal et al., 2010; Waxer, Ninan, Ma, & Dominguez, 2013; Webb, 2012). It is forecasted that there will be an increase in the US cloud computing market for medical images from $56.5m in 2010 by 27% in 2018 at a Compounded Annual Growth Rate (CAGR). That is mainly due to the growing volume of medical images and the increasing costs of the ownership for owning Picture Archiving and Communication Systems (PACS) (GlobalData, 2012).

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