

# Impact of Internet on Cytology Information Management

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**Abstract.** Internet technologies and services impose global information standards in the sphere of healthcare as a whole, which are then implied and applied in the domain of cytology laboratories. Web-based operations form a significant operating segment of any contemporary cytology laboratory as they enable operations by the use of technology, which is usually free of the restrictions imposed by the traditional way of business (geographic area and narrow localisation of activities). In their operations, almost all healthcare organisations currently create and use electronic data and documents, which can originate both inside and outside the organisation. An enormous amount of information thus used and exchanged may be processed timely and in a high-quality way only by integrated information systems, given three basic safety requirements: data confidentiality, integrity and availability. In the Republic of Croatia, integration of private and public healthcare information systems has been ongoing for several years but the private healthcare does not yet operate as an integrated system. Instead, each office operates using its own separate information system, i.e. database. This paper elaborates the argument that the sample private cytology laboratory possesses an IT system that meets current market and stakeholder needs of the healthcare sector in Croatia, given that private doctors' offices/polyclinics use IT technologies in their operations but make only partial use of Internet capacities in the segment of communication with their business associates and patients, implying the need to continue the research on a statistically relevant sample of EU countries.

**Keywords:** Internet, Cytology Laboratory, Management Information Systems

## 1. Introduction

The Internet currently stands for a global multimedia distributed information system encompassing almost the entire world and enabling not only access to spatially distributed multimedia content, but also generation of specific business/medical content tailored to specific user queries in an interactive operating regime, such as requests by patients and/or doctors' offices/polyclinics for cytology test results. Accordingly, this paper aims to present the impact of Internet technologies on the management of business and health information in a cytology laboratory, given the increasing importance of Internet worldwide, to which Croatia is no exception. This paper intends to clarify the functioning of the IT system of a private cytology laboratory in Croatia observed in terms of studying the impacts of informatization, and how well the observed laboratory has adapted to using the Internet to meet its stakeholders' needs.

The paper focuses on exploring the implications of the Internet on the implementation of an integrated IT system in private healthcare institutions in Croatia, as seen in the practice of medical laboratories, on the example of the three currently

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operating private cytology laboratories, in which 90% of the throughput consists of pap-smear analysis (gynaecological cytology). This is owing to the fact that private gynaecology clinics in Croatia by far outnumber cytology laboratories and increasingly seek collaboration with them, mainly to ensure operational transparency, but also to allow for faster turnaround time compared to results obtained from a state-owned laboratory. In light of these facts, it is clear that there is an outspoken demand for fast turnaround time. However, the speed of processing should not impair the quality of analysis and of medical data processing. In the sample laboratory studied for this paper, all specimens are analysed personally by medical experts – cytologists, who perform the analysis in person by use of microscopy as well as the most recent technologies and make their conclusions based on their own knowledge and experience as well as team consultations. The performance standard of the laboratory requires that all received specimens be processed within a maximum of 2 work days, which fulfils the market requirements in terms of turnaround. Improvement of turnaround time and the quality of results/medical data are the main reasons why the management of the observed private laboratory decided to design and implement an integrated business-medical information system, with an imperative to meet the laboratory's operating standards as well as requirements of both corporate and individual clients.

## 2. Methods

Since our research topic, implications of Internet on the cytology information system, required us to draw generalizations (applicable in most private laboratories) from a specific case (model private cytology laboratory), as well as to apply general reasoning to specific cases, the paper relies on both inductive and deductive methods, but with a greater focus on inductive ones. Although the methods of analysis and synthesis work in different directions, they intersect and complement each other, which is why we have used both. In examining the observed implications of Internet we used the method of comparison and differentiation, which resulted in the description of the identified respondent groups. As a method of consolidating the data collected during analysis, synthesis has been used in the stage of summarizing the results, where we aimed to provide an appropriate graphic representation of the findings (shown below). A questionnaire has been used as a quantifying instrument for the research, which may be used as a control sample in further study. We divided a total of 14 questions into two groups, by the following two topics: (1) Harmonization of the business and medical information system, and (2) Use of Internet technologies in daily operations.

## 3. Results

This research was conducted in 15 doctors' offices/polyclinics out of a total of 40 with which the sample laboratory collaborates. This satisfies the criterion of Yin's<sup>2</sup> reflection of 'literal replication' in which all the cases are theoretically the same, which also fulfills the main aim of preliminary research.

The respondents were asked to circle the job they perform in the doctor's office/polyclinic. If they performed several jobs, they were required to circle the job

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<sup>2</sup> Yin, R. K., *Case Study Research: Design and Methods*, Newbury Park: Sage Publications, 1989

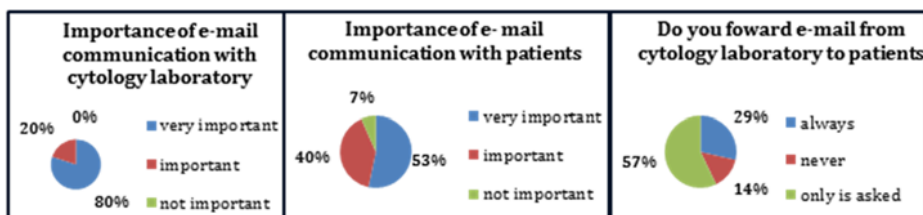
which they think they perform most of the time. Out of all the respondents that completed the survey, 46% were physicians, 27% managers, 20% nurses and 7% administrative staff. Selected results are shown in Table 1.

- *When asked about the purpose of the information system:* 60% of the respondents answered that the purpose of the information system was monitoring the information flow, 73.3% of the respondents think that the purpose is connecting those who directly participate in the business process; 80% think that the purpose also includes connecting with clients and colleagues. In addition, 53.3% of the respondents think that the purpose of the information system is faster and better decision-making; while 46.7% of the respondents answered that the information system serves to meet only the basic business requirements.
- *When asked about the importance of information flow:* 66.7% of the respondents think that information flow is important for improving the operational efficiency of a doctor's office/polyclinic; 26.7% think it brings an increase in profitability; 86.7% think it contributes to customer satisfaction; while 6.7% of the respondents think that the information flow has no significant impact; 6.7% think that it is just an additional inconvenience.
- *When asked about the impact of the usage of information and communications technologies on the doctor's office/polyclinic operations:* 26.7% of the respondents answered that they consider them useful but not indispensable; 73.3% think that their work depends on them; 46% think that information technologies might influence the practice in the future; while 26.7% think that their usage is crucial for future business operations. Only 6.7% of the respondents consider information technologies a distraction and as something that slows down the work process.
- *When asked about computer skills and the importance of the Internet:* 40% of respondents answered that they have average computer skills; 33% of them think their computer skills are very good; 20% that they are excellent; and 7% that they are below average. When asked whether they use a computer in their everyday work, all the respondents gave an affirmative answer.
- *When asked about the importance of client communication via the Internet with their colleagues and patients:* 66.7% of respondents answered that communication via the Internet is very important to them, while 33.3% of them do not attach any importance to communicating with colleagues via the Internet. 60% of the respondents consider communicating with clients via the Internet extremely important, while 26.7% think it is important, and 13.3% think that it is not important at all.
- *When asked about using the Internet to receive medical reports from the cytology laboratory via email, 80% of the respondents said they consider it very important, and 20% that they consider it unimportant. 53% of the respondents consider using the Internet in forwarding medical reports via email very important for the patients; 40% of them consider it important; and only 7% unimportant.*
- *Importance of reports received from the laboratory in paper form via regular mail:* 46.7% of the respondents consider them to be more important than the reports received via email. This means that 53.3% of the respondents still

consider the printed medical report received 'on paper' to be more important than the one received via email.

- *Importance of reports sent to the patient in paper form via regular mail:* 46.2% of the respondents consider them to be more important to the patients and only 23.1% of the respondents consider the report received via email to be more important to the patients primarily because they can access the data faster.
- When asked how often they forwarded reports to the patient via email, upon receiving them from the laboratory in that form, only 29% of the respondents said they almost always forward the finished report; 57% only forward them if the patients request it themselves; and 14% never forward the report using the Internet (via email).

**Table 1:** Using the Internet to receive medical reports from the cytology lab via email and forwarding medical reports to patients via email.



## 4. Discussion

Analysis of the data obtained in the research of “implications of Internet on the cytology information system”, clearly shows that the researched polyclinics/doctors’ offices all have a basic form of healthcare information system. In practice, however, these systems differ greatly in terms of scope, usage, and integration via the Internet (particularly in the form of email). The reasons for this can be found in the economic maturity of a particular polyclinic/doctor's office and in the strategic direction of their management concerning the application of Internet in everyday business. Furthermore, it is evident that the healthcare information system of public institutions in the Republic of Croatia is compliant with the healthcare information systems of the most developed European countries, and we can see the areas for its further improvement in the private sector.

### 4.1. The usage of Internet in the sample cytology laboratory in Croatia

Since the cytology laboratory usually works with polyclinics and doctors’ offices, and not directly with patients, finished reports are sent to email addresses of the doctors’ offices with which the laboratory collaborates. In the case that the patient personally comes to the laboratory, the report is sent via email to the patient and to his or her home address via regular mail in paper form. With regard to archiving reports, it is important to mention that all laboratories in the Republic of Croatia have a legal obligation to keep the reports in paper form for 10 years. This includes microscope slides and the accompanying form, as well as a copy of the report. Colleagues often need a transcript of a report.

The report is then retrieved from the archives and an official transcript is created and signed by the cytologist. Likewise, reports need to be retrieved from the archives if the sample needs to be reanalyzed for any reason. The archives are also available in electronic form in a structured database. All patient data for every patient who was ever processed in the laboratory can be found in that database. The relevant report can be found by entering any single point of patient data. It is also possible to search by doctor's office ID number, patient name and surname, date, or laboratory notebook number. The laboratory information system provides access to a large amount of medical and personal patient information easily and quickly, and it can be accessed from any place that has internet access.

#### 4.2. Usage of Internet in cytology laboratories in EU countries

By using the inductive method of reasoning in the analysis of the results of research conducted in the sample cytology laboratory in Croatia, which we chose as our case study, it can be concluded that the healthcare sector in Croatia follows the trends of Internet usage in its operations, but it lags behind in using the Internet for communicating with patients who use laboratory services.

The continuation of research on the "implications of Internet on the cytology information system" is justified within the context of contribution to scientific findings, such as finding algorithms and variables which would allow us to describe more precisely the changes within the constructs of the simulation model, as well as the interactions of their elements: laboratory - polyclinic - doctor's office - patient, and for which a scientific study should be conducted on a large statistically significant sample of respondents that would include all stakeholders.

Further research on the "implications of Internet on the cytology information system" is also justified in the context of applying the mentioned model of integrated information systems in cytology laboratories in EU countries. It is beyond doubt that the effectiveness of the usage of the Internet technologies in the healthcare business operations as a whole lies in the synergistic communication of its nucleus – the patient as an end user of laboratory services. Undertaking further research in laboratories throughout Europe is also justified in the domain of management in healthcare institutions, where it can be seen in the context of rethinking management of polyclinics/doctors' offices through administrative use of Internet.

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