

Operating Room Information Systems Adoption by Portuguese Clinical Users

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Abstract - This research aims to assess the impact of the adoption of Information Systems by clinical users in the Operating Room. This is an empirical and qualitative research, to find a complete and comprehensive understanding of the phenomenon under study. A sample of Portuguese Anesthesiologist have been invited from public and private hospitals. Through the application of the Delphi method, with surveys online it is expected an interactive and systematic approach to estimate the impact of the adoption of these systems, based on the experience of several independent clinical users (experts).

Keywords — Clinical Information Systems, Delphi Methodology, Operating Room, Technology Acceptance.

I. INTRODUCTION

Healthcare organizations aggregate highly complex systems that interact with multiple entities and manage numerous amounts of information. The Information Systems (IS) support not only the clinical aspects, but also administrative, financial and stocks.

Currently the IS are not limited to data collection or documentation of clinical process, these systems are progressing in the patient management field - decision making systems. [1]

According to [2], [3], [4] the main activities of the healthcare industry are:

- Strategic management: financial decisions or investments, and critical issues such as security of confidential data;
- Operational needs: administrative daily procedures, supply management change, decision supports;
- Clinical applications: support patient care by providing the appropriate information in real time.

Hospitals and Institutions are constantly faced with lack of resources in critical care areas, particularly in the Operating Room (OR). Some authors agree [5], [6] that these facilities are considered to be the most costly. They can consume more than 9% of a Hospitals budget [6]. The adoption of a system of

this type may be the beginning of the resolutions of this issue [7].

Normally Clinical IS are characterized by ample diversity of applications that work in isolated environments [8]. The OR are commonly seen as islands in relation to the remaining departments of the Health Institutions. It is vital to have interoperability with other hospital systems, preferentially using the same communication protocol. The IS in the OR may improve the competitive and financial viability, reduce costs, increase efficiency and improve the health care quality [9], [10].

Given the political, socio-economic, scientific and technological changes in the recent years, for the success and survival of organizations it is essential to project the future and knowledge is a critical determinant of competitiveness [11]. Therefore, the use of analyzing tools are increasing, for example, analyzing the external environment, research trends in order of planning long term and guide organizations to achieve their objectives.

Since 1998 the Portuguese Ministry of Health affirms that: "a good information system is an indispensable tool that can be used to make right decisions at all levels of the health system (...) It is necessary to interconnect and coordinate the multiple pieces and existing resources in a system of health information ..." [12].

Reducing bureaucratic process and facilitating rapid access to information, may obtain a significant improvement in health service quality. To provide better and more rapidly service to citizens, the key is the utilization of technologies and the inter-communicability between the systems, enabling higher information.

The main objective of this paper is to share and increase scientific knowledge related to the impact of the adoption of Information Systems by clinical users in the Operating Room. Therefore, this paper is composed by the following sections: Present section I, Introduction; section II a background on Clinical Information System in the Operating Room; section III Acceptance of Information Systems in Clinical

environment; section IV, explanation of the Methodology & Materials used in the research; Section IV, results obtained from the two round of surveys; section V, discussion of the results, and respective Conclusion.

II. CLINICAL INFORMATION SYSTEM IN THE OPERATING ROOM

After the First World War (1914 -1918), the OR was considered a specific unit in the hospital. The operating units associated to other services of the hospital with their own access/ circuit, have been reorganized throughout time. It follows the current concept of centralized OR, that consists in, rooms of different specialties with specific equipment. Nowadays, all areas that include patients that are submitted to surgery or invasive procedures are called Surgical Department [13].

According to same author [13] the OR is an organic-functional, highly differential unit that requires specialized professional preparation that provides anesthetic / surgical care. It aims to save, care and improve the quality of life of patients submitted to surgery.

Other definitions are oriented to an economic dimension, assuming the OR as a service that has a significant weight in the performance and production costs. The findings show that in Portugal, OR assume a business management type and are administered by their own regulations.

Several descriptions of IS can be found. Some authors emphasis on the technological component, others on the organizational component. According to [14], IS are defined as an interdependent component, equipment, software, telecommunication, database and other information processing technology, used to collect, process, store and distribute information to support decision making and control in the organizations. For [15], the IS are composed of a group of people and procedures that are involved in the collection, processing and delivery of information for the organizations. For [16], perceive IS as systems that aggregate, store, process and provides information relevant for an organization or society, to make it accessible and useful.

The first Clinical IS for OR date the beginning of the eighties / nineties. These systems had the main objective of capturing data from the different equipment that was connected to the patient. Currently a large portion of these systems are not limited to data collection and documentation of clinical progress, but to make suggestions concerning the patient management.

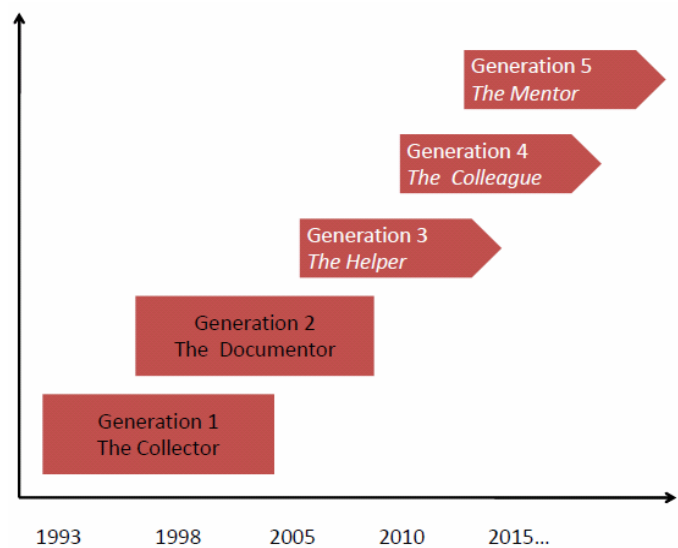


Fig.1 Evolution of computer-based patient record systems
Source: Adapted from Gartner (2008)

A clinical IS allows to aggregate, record and analyze information about the evolution of the patient's condition and provided care, therefore permitting the orientation of clinical activities to be undertaken in accordance with care plans, already approved.

In environments so demanding, obtaining the right data, understanding and subsequent use for decision support, is essential, to fulfill the goals of modern health facilities:

- Efficiency in provision care;
- Improvement of clinical results;
- Adequacy for financial requirements.

By automating the collection of clinical data from patient monitors, ventilators and other equipment connected to the patient, it is possible to optimize the workflow of professional healthcare, to minimize manual input errors and allowing professionals to concentrate on what is the main function: the provision of healthcare [17].

Among health professionals it is consensus that the clinical IS is important. For decision making at clinical and administration level, the system can provide reliable indicators. Example of some indicators that are commonly found in the OR context are:

- Patients age and sex;
- Patients admitted for surgery;
- Surgical procedure time;
- Surgery type;
- History of anesthetics acts;
- Anesthesia type;
- Surgery duration;
- Mortality rate.

Using IS ensures the standardization of terminology of diagnoses and medical and nursing procedures, contributing to higher quality indicators. Besides being advantageous in terms of indicators, such systems allow the automatic collection of data and the electronic recording; guarantying the reliability, integrity, confidentiality and maintenance of data, and consequently reducing redundancy in data collection.

III. ACCEPTANCE OF INFORMATION SYSTEMS IN CLINICAL ENVIRONMENT

Frequently the IS are developed in a technological perspective and not in the usability and ad equability of the systems for final users. Any IS that is not use-friendly and that does not satisfies the final users needs, difficultly will be accepted by the users.

Usually the IS contribute to improve the doctors performance, however, may simultaneously impair the monopoly of knowledge and measure standards or indicators of the performance of their work. Therefore, doctors sometimes offer resistance in adopting IS. The fear of the impact of IS are more visible than in other medical professionals for two reasons:

- The number of existing hierarchies in health organizations and medical knowledge are divided between them;
- Knowledge is shared not only among the medical profession, but also by other health professionals, which somehow removes autonomy [18].

The acceptance of the IS, by the clinical staff is essential for its successful implementation. According to [19], the health professionals autonomy can be threaten and this characteristic can affect the acceptance of IS.

For [20] an investment in the Clinical IS area can only be returned if the users remove the capital gains that the system can provide. According to this author the acceptance by the health professionals is extremely necessary however, it is known to be a slow process.

Several studies have been done in the acceptance area of IS, such as, the study by [21] about acceptance of the IS by the physicians in the telemedicine context. The authors responsible for this study obtained results that suggest that this type of professionals have different stages of acceptance of the IS. These differences occur from the specialized training, work organization and autonomy of these individuals. Similarly, the study by [22], about the adoption of telemedicine, found that physicians consider the trust issue a fundamental condition for the adoption of these systems.

The study assessing the interaction of users with clinical IS, supported by models of human-computer interaction [23] identified seven variables that influence this interaction:

- Acceptance;
- Satisfaction;
- Emotional response;
- Success System;
- Assessment in general;
- Impact;
- Adaptability technology.

IV. METHODOLOGY & MATERIALS

Given the nature of the problem of our investigation, the research methods used should focus on empirical and qualitative research, looking for the absolute and wide-ranging understanding of the phenomenon under study.

The Delphi method is a method of qualitative research that aims to obtaining a qualified opinion about certain issues, from a group of selected individuals. This method was put in

practice in the '50s by the Rand Corporation. It is used in particular to obtain consensus opinions of a group of specialists, through questionnaires providing feedback and results of responses to the participants between rounds [24].

According to the same authors [24], this method is applied in several fields: including the paucity of historical data; planning for budget distribution ; exploring urban and regional planning options; planning university campuses and their curriculum development; models construction; delimitation of the pros and cons associated with political options; development of causal relationships in complex economic or social environments and, to distinguish and predict human motivations, prioritize personal values and overall objectives. Therefore, this method becomes extremely useful for qualitative analysis of market trends and enables project. J. Bordas [25] states that through knowledge, experiences and reflections of the experts, they can predict long-term changes. Sometimes they are themselves directly involved in the matter under study. Thus, this method besides being predictive it also is subjective.

Currently the Delphi method exists in two distinct ways, a more conventional paper and pencil called the "exercise of Delphi" and a version identified by "Delphi Conference", where questionnaires are available online allowing a rapid interaction between the parties involved in the process [24].

When the choice relies on this of method, it is necessary to clearly define the object of the study. It is essential to ensure anonymity, explain the time frame and type of results most wanted. The feedback with the results of the responses of the group is crucial before starting the next round.

Advantages of the Delphi Method applied online

Due to the several advantages, the surveys online have become increasingly common in data collection for research. According to Giovinazzo & Fischmann [26] the factors that contribute to the use of Delphi in electronic format are:

- Eliminates the costs associated with printing, paper and mail, no longer necessary to print the questionnaires, as well as promotional material. There is no need to use the post office, reducing the cost of sending the forms;
- Eliminates average time of send out and reception of response by sending electronic questionnaires, not only reducing the time of transmission, but also the time of receipt, having access to the data more rapidly;
- Reduces time and errors in recording the results, since the forms are received in electronic platform, no longer required the manual input of data, thus avoiding typing errors in them. The data is automatically redirected to files, which allow the processing of information.
- Prevents loss of interest by participants, as there is a earlier feedback,
- Facilitates the completion of the questionnaires, it is possible to take advantage of platform features that support the questionnaire and make the process more enjoyable and efficient.

According to Mehta & Sivadas [27,] when the questionnaires are available in electronic platform, it improves

the quality of the response, especially if they have open-ended questions.

According to Santos & Amaral [28], others factors are based on the reuse of technology support costs, example costs that are associated with technological support, can easily be reused in other studies. This method has no constraints of geographic location, proximity or time zone.

Concerns of the Delphi Method applied online

On the other hand some limitations should be stressed:

- The setup time of the form online has to be considerate, since it is more time consuming then the traditional paper questionnaire.
- Eventually if there is a mistake, sending / receiving the questionnaires, or creating keywords for the experts it is indispensable knowledge in Information technology.
- When the questionnaires are applied online, it limits the number of rounds to two because a greater number becomes unattractive for the participants. Although most of the time two rounds are sufficient to reach consensus, if consensus is not this obtained, the subject of the study is brought to discussions in workshops.

Throughout the investigation the following steps of the method were considered:

A. *Select the panel of specialist;*

B. *Design the questionnaires on an electronic platform that already exists on the market;*

C. *Submit questionnaire:*

- 1) *to the specialists by email; collect the responses, process and analyze data; develop new questions for the 2nd round, send the results of the 1st round and submit questionnaire;*
- 2) *Collect the responses, process and analyze data; general conclusions and final report.*

V. RESULTS

The first survey was divided into four areas:

- A** - Data Related to the Experts;
- B** - Data Related to the Structure and Organization of the OR;
- C** - Factors that justify the adoption of an IS; and
- D** - Features that the Clinical IS must support.

The results obtained so far are presented in the following lines.

A - Data Related to the Experts.

Age:

- < 30 years - 5,3%;
- 30 to 40 years – 10,5%;
- 41 to 50 years – 10,5%;
- 51 to 60 years – **68,4 %**;
- > 60 years – 5,3%

Sex:

- Female – 47,4 %
- Male – **52,6%**

City of professional practice:

- Aveiro - 5,26 %
- Coimbra - 15,8 %
- Lisboa - 31,6 %
- Porto - **36,8 %**
- Santarém - 5,26 %
- Vila Real - 5,26 %

Place of professional practice:

- Public Hospital – **89,5%**
- Private Hospital – 10,5 %
- Health Centre – 0,0%
- Clinic - 0,0%
- Other - 0,0%

Internet users:

100% of the experts consider themselves internet users.

B - Data Related to the Structure and Organization of the OR.

Total number of OR:

- Less than 5 Operating Rooms - 26,3%
- 5 to 10 Operating Rooms - **42,1 %**
- 11 to 15 Operating Rooms - 5,3%
- More than 15 Operating Rooms - 26,3%

Location of the OR:

- Centralized - **63,2%**
- Decentralized - 10,5%
- Other - 26,3%

Induction Room:

- With induction room - **63,2%**
- With out induction room - 21,1%
- Other - 15,8%

The management of the OR is under the responsibility of:

- Surgeon – **57,9%**
- Anesthetist – 21,1%
- Both - 5,3%
- Committee – 5,3%
- Without formal management – 0,0%
- Others – 10,5%

The OR has a Clinical Information System?

- Yes – **72,2%**
- No – 27,8%

When the answers was **yes**:

- 7,71% has a software developed and configured by the users of the institution;
- 78,6%** has a software that exists in the market and subsequently configured to the needs of service and users

7,71% has a software that exists in the market with no additional configuration
 7,71 % Other

Inside the OR, when needed in real time, additional medical information, the experts usually use:

Colleague or handbook - 52,6%
 Electronic device - **68,4 %**
 Memory and experience – 26,3%
 Other – 10,5%

Typing errors are common, particularly for example, transcribing the patient Id. In 10 surgeries, how often do these kinds of errors happen in the OR:

1 to 2 times - **61,1 %**
 3 to 4 times - 5,6%
 4 times - 5,6%
 Others – 27,8%

Inside the OR, how often do physicians experience lack of knowledge about drugs, medical conditions and/or specific anesthetic considerations?

Once a day - 26,3%
 Once a week - **36,8%**
 Once a month - 21,1%
 Once a year - 0,0%
 Very rarely - 15,8%
 Others - 0,0%

100% of the experts would like to have available written algorithms on a screen in front of them.

In the past have you committed medical errors during anesthesia due to lack of medical information that can be found in a handbook.

Yes - **47,4%**
 No - 36,8%
 Do not know -15,8 %

When the answers was yes:

Once a day - 0,0%
 Once a week - 11,1%
 Once a month - 22,2%
 Once a year - 0,0%
 Very rarely - **55,6%**
 Others - 11,1%

Having a source of medical information online in the OR is:

Not important - 0,0%
 Important -38,9%
 Very Important - **61,1 %**
 No opinion - 0,0%

C - Factors that justify the adoption of an IS.

TABLE I
 FUNCTIONALITIES THAT THE CLINICAL INFORMATION SYSTEM SHOULD ALLOW

	Description	%
1°	Automatic data collection from medical devices, example: monitors, ventilators, others.	88.9
2°	Interoperability with other systems, example: pharmacy system, laboratories system, others.	83.3
3°	Remote access to clinical process.	77.8
4°	Analysis and statistical treatment of data.	72.2
4°	Assessments and records of treatments.	72.2
6°	Automation of the Patient Summary.	61.1
7°	Correlation of data through customizable views.	55.6
7°	Alerts for outstanding tasks and new results.	55.6
8°	The automatic calculation of water balance.	50.0

D - Features that the Clinical IS must support.

TABLE II
 CAPITAL GAINS OF CLINICAL INFORMATION SYSTEM - RANKING

Description	Pos.
Optimize the work-flow of information enabling greater agility and organization.	1
Flexible, adapting working methods of each of the Operating Room.	2
Increase of time of professionals, for tasks not related to the registration of data.	2
Reduced operating costs / administrative and productivity gains.	4
Increase standardization of terminology of diagnoses, medical procedures / nursing	5
Reduction of redundancy in data collection.	6
Gain real-time access to medical files of patients	7
Guarantee of reliability, integrity, confidentiality and data maintenance	8

Sort by increasing order of (1-8) the importance of capital gains on a scale of importance, where **1** is the most important and **8** is less important

TABLE III
 CAPITAL GAINS OF CLINICAL INFORMATION SYSTEM - PERCENTAGE

Description	1	2	3	4	5	6	7	8
“Optimize the work-flow...”	33.3 %	6.7 %	20.0 %	13.3 %	6.7 %	0.0 %	13.3 %	6.7 %
“Flexible, adapting ...”	5.6 %	27.8 %	27.8 %	0.0 %	16.7 %	5.6 %	5.6 %	11.1 %

“Increase of time...”	26.7 %	26.7 %	6.7 %	6.7 %	6.7 %	13.3 %	6.7 %	6.7 %
“Reduced operating...”	20.0 %	6.7 %	13.3 %	20.0 %	6.7 %	6.7 %	13.3 %	13.3 %
“Increase standardi...”	0.0 %	0.0 %	6.7 %	20.0 %	40.0 %	13.3 %	6.7 %	13.3 %
“Reduction redundancy...”	5.9 %	17.6 %	0.0 %	11.8 %	11.8 %	23.5 %	17.6 %	11.8 %
“Gain real-time...”	0.0 %	6.3 %	18.8 %	12.5 %	6.3 %	18.8 %	25.0 %	12.5 %
“Guarantee reliability...”	20.0 %	20.0 %	6.7 %	13.3 %	0.0 %	13.3 %	6.7 %	20.0 %

Sort by increasing order of (1-8) the importance of capital gains on a scale of importance, where **1** is the most important and **8** is less important

In the physicians opinion what factors contribute to resistance to the adoption of the Clinical Information System?

TABLE IV
RESISTANCE FACTORS TO THE ADOPTION OF CLINICAL INFORMATION SYSTEM - RANKING

Description	Pos.
Solution Cost	1
Waste of time in recording information	2
Inadequate working practices	2
Lack of clinical knowledge, by those who support	4
Lack of computer knowledge, by the clinical users	5
Institutions not oriented to technologies	6
Interface not use friendly	7
Resistance to change	8

Sorted by increasing order of (1-8) the factors that contribute to the strength of the systems on a scale of importance, where **1** is the factor of greatest resistance and **8** is the factor of least resistance.

TABLE V
RESISTANCE FACTORS TO THE ADOPTION OF CLINICAL INFORMATION SYSTEM - PERCENTAGE

Description	1	2	3	4	5	6	7	8
Solution Cost.	37.5 %	18.8 %	6.3 %	0.0 %	6.3 %	0.0 %	0.0 %	31.3 %
“Waste of time ...”	18.8 %	12.5 %	12.5 %	18.8 %	0.0 %	12.5 %	12.5 %	12.5 %
“Inadequate working...”	12.5 %	12.5 %	18.8 %	18.8 %	25.0 %	6.3 %	6.3 %	0.0 %
“Lack of clinical ...”	6.7 %	6.7 %	20.0 %	6.7 %	20.0 %	26.7 %	6.7 %	6.7 %
“Lack of computer..”	0.0 %	18.8 %	0.0 %	31.3 %	6.3 %	18.8 %	18.8 %	6.3 %
“Institutions not...”	11.1 %	0.0 %	5.6 %	5.6 %	33.3 %	0.0 %	27.8 %	16.7 %
“Interface not use ...”	0.0 %	25.0 %	18.8 %	18.8 %	6.3 %	31.3 %	0.0 %	0.0 %
Resistance to change	11.1 %	16.7 %	16.7 %	5.6 %	5.6 %	5.6 %	22.2 %	16.7 %

Sorted by increasing order of (1-8) the factors that contribute to the strength of the systems on a scale of importance, where **1** is the factor of greatest resistance and **8** is the factor of least resistance.

The second survey was also divided into four areas:

- A** - Data Related to the Experts;
- B** - Factors that justify the adoption of an IS;
- C** - Data Related to the Structure and Organization of the OR; and
- D** - Improved the adoption and use of the Clinical IS.

Below are presented the results obtained for this phase.

A - Data Related to the Experts

Years of professional practice:

- <5 years - 6,7%
- 5 to 15 years - 13,3%
- 16 to 20 years - 6,7%
- 21 to 25 years - 33,3%
- >25 years - **40%**

B - Factors that justify the adoption of an Information System

TABLEVI
FUNCTIONALITIES THAT THE CLINICAL INFORMATION SYSTEM SHOULD ALLOW - RANKING

Description	Pos.
Analysis and statistical treatment of data.	1
Assessments and records of treatments.	2

Sorted by the importance of the functionalities on a scale of importance, where **1** is the most important and **2** is the least important.

TABLEVII
FUNCTIONALITIES THAT THE CLINICAL INFORMATION SYSTEM SHOULD ALLOW - RANKING

Description	1	2
Analysis and statistical treatment of data.	60.0%	40.0%
Assessments and records of treatments.	42.9%	57.1%

Sorted by the importance of the functionalities on a scale of importance, where **1** is the most important and **2** is the least important.

TABLE VIII
FUNCTIONALITIES THAT THE CLINICAL INFORMATION SYSTEM SHOULD ALLOW - RAKING

Description	Pos.
Preparation of trends and variables selected by the user.	1
Alerts for outstanding tasks and new results.	2

Sorted by the importance of the functionalities on a scale of importance, where **1** is the most important and **2** is the least important.

TABLE IX
FUNCTIONALITIES THAT THE CLINICAL INFORMATION SYSTEM SHOULD ALLOW - PERCENTAGE

Description	1	2
Preparation of trends and variables selected by the user.	64.3%	35.7%
Alerts for outstanding tasks and new results.	40.0%	60.0%

Sorted by the importance of the functionalities on a scale of importance, where 1 is the most important and 2 is the least important.

TABLE X
CAPITAL GAINS OF CLINICAL INFORMATION SYSTEM - RANKING

Description	Pos.
Flexible, adapting working methods of each of the Operating Room.	1
Increase of time of professionals, for tasks not related to the registration of data.	2

Sorted by the importance of the capital gains on a scale of importance, where 1 is the most important and 2 is the least important.

TABLE XI
CAPITAL GAINS OF CLINICAL INFORMATION SYSTEM - PERCENTAGE

Description	1	2
Flexible, adapting working methods of each of the Operating Room.	66.7%	33.3%
Increase of time of professionals, for tasks not related to the registration of data.	35.7%	64.3%

Sorted by the importance of the capital gains on a scale of importance, where 1 is the most important and 2 is the least important

C- Data Related to the Structure and Organization of the OR

The OR has a Clinical Information System?

Yes – 73,3%

No – 26,7%

TABLE XII
FACTORS OF RESISTANCE TO THE ADOPTION OF CLINICAL INFORMATION SYSTEM - RANKING

Description	Pos.
Inadequate working practices	1
Waste of time in recording information	2

Sorted by increasing order of (1-2) the factors that contribute to the strength of the systems on a scale of importance, where 1 is the factor of greatest resistance and 2 is the factor of least resistance.

TABLE XIII
FACTORS OF RESISTANCE TO THE ADOPTION OF CLINICAL INFORMATION SYSTEM - PERCENTAGE

Description	1	2
Inadequate working practices	46.7%	53.3%
Waste of time in recording information	50.0%	50.0%

Sorted by increasing order of (1-2) the factors that contribute to the strength of the systems on a scale of importance, where 1 is the factor of greatest resistance and 2 is the factor of least resistance.

D - Improved the adoption and use of the Clinical IS.

Only users that have experience with Clinical IS in the OR, answered the questions regarding the different points of view:

- Service Management,
- Clinical,
- Quality Management and Auditing Quality.

TABLE XIV
SERVICE MANAGEMENT POINT OF VIEW - RANKING

Description	Pos.
Planning	1
Cost Reduction	2
Productivity gains	3

Sorted by the importance of the Service Management point of view on a scale of importance, where 1 is the most important and 3 is the least important.

TABLE XV
SERVICE MANAGEMENT POINT OF VIEW - PERCENTAGE

Description	1	2	3
Planning	63.6%	9.1%	27.3%
Cost Reduction	0.0%	50.0%	50.0%
Productivity gains	27.3%	45.5%	27.3%

Sorted by the importance of the Service Management point of view on a scale of importance, where 1 is the most important and 3 is the least important.

TABLE XVI
CLINICAL POINT OF VIEW - RANKING

Description	Pos.
Minimize errors	1
Accessible information for research	2
Facilitate decision	3

Sorted by the importance of the Clinical point of view on a scale of importance, where 1 is the most important and 3 is the least important.

TABLE XVII
CLINICAL POINT OF VIEW - PERCENTAGE

Description	1	2	3
Minimize errors	63.6%	9.1%	27.3%
Accessible information for research	9.1%	54.5%	36.4%
Facilitate decision	20.0%	40.0%	40.0%

Sorted by the importance of the Clinical point of view on a scale of importance, where 1 is the most important and 3 is the least important.

TABLE XVIII
QUALITY MANAGEMENT AND AUDITING QUALITY POINT OF VIEW - RANKING

Description	Pos.
Collecting and evaluating information in real time	1
Reliability and confidentiality of data	2
Quality of care	3

Sorted by the importance of the Quality Management and Auditing Quality point of view on a scale of importance, where 1 is the most important and 3 is the least important.

TABLE XIX
QUALITY MANAGEMENT AND AUDITING QUALITY POINT OF VIEW -
PERCENTAGE

Description	1	2	3
Collecting and evaluating information in real time	63.6%	0.0%	36.4%
Reliability and confidentiality of data	9.1%	63.6%	27.3%
Quality of care	27.3%	45.5%	27.3%

Sorted by the importance of the Quality Management and Auditing Quality of view on a scale of importance, where 1 is the most important and 3 is the least important.

VI. DISCUSSION

This research occurred during the months of April, May and June 2010. The survey was applied to 29 Portuguese Anesthesiologist that are working in public and/or private Institutions, following the Delphi methodology. Two rounds of questionnaires were applied receiving a total of 19 responses to the first questionnaire (I), a rate of 65.5%. Regarding to the second questionnaire (II), 15 answers were received corresponding to 78.9%. The second questionnaire was limited to the experts that responded to the first one.

After analyzing data from the questionnaire-I, it was necessary to repeat some questions in the second round to untie and meet consensus in the following topics:

- Functionalities that the Clinical IS should allow;
- Capital Gains of Clinical IS;
- Resistant factors that influence the adoption of Clinical IS.

The findings confirm that 100% of the experts consider themselves Internet users and the same 100% of the experts would like to have available written algorithms on a screen in front of them.

A curious fact detected, females believe that the main factor contributing to the resistance of clinical IS is the cost of the solution other than the male that considered this factor the least resistant.

In this research 100% of the physicians having private Institution has the main place of professional practice admit that in the past they committed medical errors during anesthesia due to lack of medical information that can be found in a handbook. The same question asked to the experts from public Institutions, only 41.2% admit having committed the error, but at the same percentage, physicians affirm that they never committed that mistake, the remaining 17.6% do not know.

When selecting the panel of experts, it was intended that this research included experts from different age groups. It was also intentional that some physicians use IS in the OR and physicians who have never experienced this reality. On the second questionnaire, only the experts who had IS in the OR would respond to the questions of different dimensions of clinical IS from dissimilar points of view:

- Service Management;
- Clinical;
- Quality Management/Auditing Quality.

Since 83.3% of experts with over 25 years of IS professional experience in the OR, responded to the different dimensions of clinical IS, giving statistically significance to the research.

Compared with other studies [29], data confirms that inside the OR, the Anesthesiologist experience lack of knowledge about drugs, medical conditions and/or specific anesthetic considerations, occurs more frequently (once a week - 36,8%).

Regarding to the same research, it demonstrates that 47,4%, of the anesthesiologists admit that in the past they have committed medical errors during anesthesia due to lack of medical information that can be found in a handbook, 36,8%, do not commit medical errors and 15,8 %do not know.

Inside the OR, when needed in real time, additional medical information, the experts usually use: Electronic device - 68,4%. The previous study obtained a different result, the physicians frequently use: Colleague or handbook – 68%.

In this study, it was confirmed that the main resistant factors for the adoption of Clinical IS, are:

- Solution Cost;
- Waste of time in recording information;
- Inadequate working practices;
- Lack of clinical knowledge, by those who support the system;
- Lack of computer knowledge, by the clinical users;
- Institutions not oriented to technologies;
- Interface not use-friendly;
- Resistance to change.

Compared to [30] the main barriers identified are:

- Complexity
- Health care environment,
- Standards,
- Cost,
- Management,
- Physician-system relationship
- Technology

The results corroborated previous empirical knowledge, for instance:

- The place of professional practice;
- The management of the OR is under the responsibility of a surgeon;
- Anesthesiologists have committed medical errors during anesthesia and having a source of medical information online in the OR is very important.

VII. CONCLUSION

This paper presented a study conducted on Operating Rooms (OR) in order to better know about the impact of the adoption of Information Systems (IS) by clinical users.

Although, among health professionals it is consensus that the clinical IS minimize errors, improves productivity and collects and evaluates data in real time, there are Institutions that do not have a clinical IS in the OR.

This research demonstrates that the main resistance factor to adopt a clinical IS is the solution cost.

Further work includes the elicitation of a set of technical and functional recommendations to enhance the IS for OR.

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