

SOFTWARE-ASSISTED IMPROVEMENT OF SURGICAL MANAGEMENT AT CARLOS HAYA REGIONAL UNIVERSITY HOSPITAL IN MALAGA, SPAIN

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Abstract: This paper reports the features of a computer program (AQuA) developed to improve surgical management at the Carlos Haya Regional University Hospital in Málaga, Spain. Several factors have forced the development of this digital solution: i) our hospital is made of four buildings some 5 km apart, ii) there are 41 operating rooms attended by 319 surgeons and 72 anaesthesiologists and, most important, iii) some predefined pathologies are protected by law in our region and have a guaranteed limited waiting time (LWT) before surgery. In this complex milieu our program was conceived, developed and put to work. It has been running for just over a year with progressive implementation in surgical departments. Some facts that seem to indicate the usefulness of the program: the number of patients with diseases with LWT that have received operations has increased in 14 months from 1,145 to 1,564 patients/month (36.59% increase) and surgical performance has increased from 65.93% to 71.80% in the same period. Since all other conditions related to surgical activity have remained unchanged the improvement seems to be attributable to the AQuA program. AQuA is a comprehensive, flexible, friendly and open program capable of dealing with most hospital settings.

1 INTRODUCTION

The arrival of Information Technologies has provided a very powerful tool in many areas of society. In health services, where there is a permanent social demand to improve its quality, the application of information technology is one of the key elements that can help improve management, optimize resource utilization, better control of health spending and, consequently, offer better services to society. (Informe SEIS, 2010).

In the past 15 years, the Spanish health institutions have incorporated many experiences leading to an improvement in the know-how in technological terms. This strategy is just beginning to provide results. (Gutiérrez, 2009).

A successful implementation of these technologies will enable institutions to make significant steps towards achieving greater efficiency.

The hospital environment generates large amounts of information of different nature (clinical, administrative, management, etc.) which need to be processed.

The trend is to manage that information in a way that allows on one hand, increase process efficiency and on the other, making it available securely from any location. In addition, analysis of information is particularly useful for improving medical knowledge and making the most appropriate management decisions. (Informe SEIS, 2007).

Surgical treatment is not only vital to the achievement of the objectives of the hospital but is also the centre of many inter-related activities.

In addition, the resolute character of surgery makes it a first-rate care component being the operating room one of the more expensive and scarce resources of a hospital. The operating room, with its high concentration of technology and highly quali-

fied personnel, usually becomes the bottleneck of clinical practice.

But the surgical activity also creates a great demand and it is difficult to accommodate such demand at the optimum level required by the user, so the waiting lists generated must be controlled and monitored.

In-depth knowledge of the surgical activity becomes, therefore, the key to the hospital management. Two main elements form the backdrop: surgical waiting list and activity of operating rooms.

1.1 The Surgical Waiting List

In hospitals of the Andalusian Public Health System a computerized record system is in use since 2001 called AGD. It is configured to monitor the procedures covered by the "surgical delay time assurance program". These delay times were established taking into account the relative frequency of the relevant processes in the local population and their clinical relevance. Data recorded in this system is transparent for both the patients and the health authorities.

The AGD is therefore a list of users awaiting for a surgical intervention. The time in the waiting list is guaranteed by regional laws to a maximum of 180 days. Meeting this deadline has proved to be a difficult task. (SAS, 2010).

1.2 The Activity of Operating Rooms

The operating rooms are one of the areas that generate the largest costs to a hospital as they consume about 15 percent of the budget. (Quecedo, 2009).

It has been estimated that the optimal occupancy rate of surgical block should be around 85 percent and that every unit of percentage below 85 costs €10,000 per operating room and year. In other words the drop of surgical rate in one unit means losing 11 surgical interventions per operating room per year.

Therefore, the surgical block inactivity causes a loss of considerable economic and social opportunity, so it is essential to increase production capacity and performance of the surgical block through knowledge of the actual time of use of operating room and their shortcomings for efficient management.

1.3 The Need for a Change. AQuA, not to Sink but to Float

Until recently the Carlos Haya Regional University Hospital in Malaga was not supported by any computer application that integrates the four key aspects of the surgical schedule:

1. Waiting list (AGD) and some other processed outside the AGD.
2. Management of operating rooms assigned by the Medical Director.
3. Anaesthesiologists Planning.
4. Preoperative visit carried out by the anaesthesiologist.

The computer application covered by this paper aims to improve the efficiency of the operating room, assisting the surgical schedule to sort out the availability of operating rooms. This action will prevent a bottleneck. (Ramolla, 1999).

We must also mention the point in time where this program has been implemented. One of the barriers that traditionally stood in the way of progress for implementation of information technology was the health staff. (Riesgo, 2007). Currently, this staff has evolved and is now more receptive to new information technologies.

Among them, the "doctors", which have traditionally been the major obstacle, now show a more positive disposition towards informatics. This positive attitude is a conditioning factor for the implementation of medical bioinformatics since they now accept that their role goes beyond the cure.

2 MATERIAL AND METHODS

2.1 The Structural Complexity of our Hospital

Carlos Haya Regional University Hospital is a public institution belonging to the Andalusian Autonomous Community. For historical reasons it is organized in four major buildings some 5 km apart from each other, three of them with surgical activity. All 4 buildings are under the same management and cover for the health needs of the east of Malaga (348,656 inhabitants). In addition it is "reference for the province" (1,517,523 inhabitants) for obstetrics and paediatrics matters and "reference for the region" in 5 surgical and 6 medical specialties, including transplants.

The main building (A) has 590 beds, 15 operating rooms and 141 surgeons. It houses the most

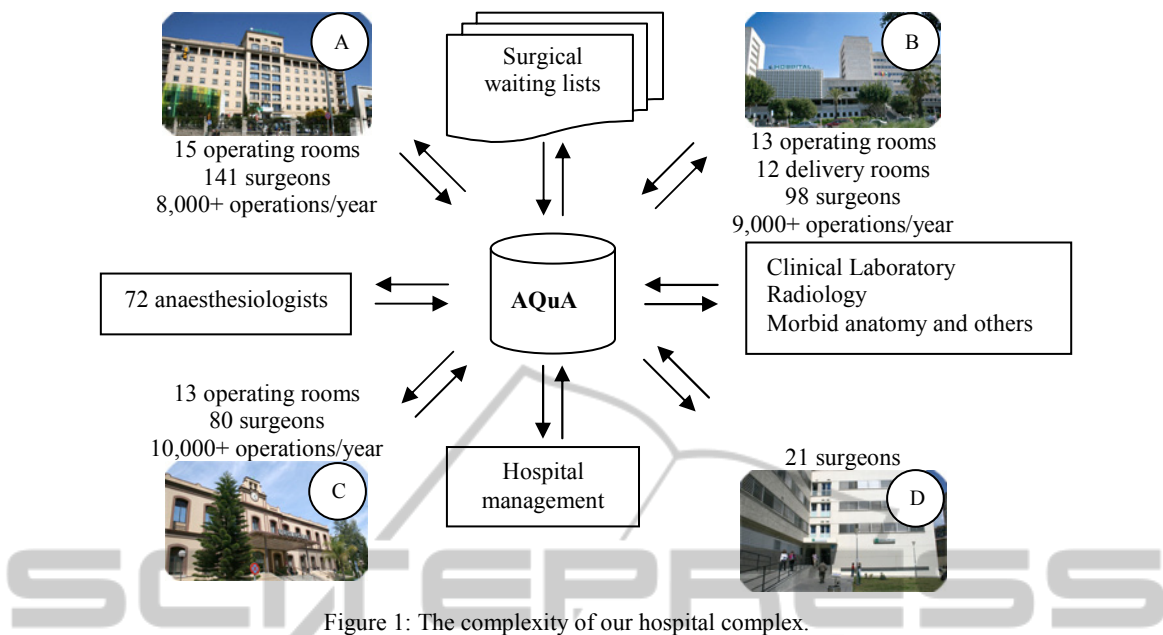


Figure 1: The complexity of our hospital complex.

complex medial and surgical specialties. Building B (women and children) has 520 beds and 13 operating rooms. Building C has 147 beds and 13 operating rooms. The activity of this building focuses on alternatives to traditional hospitalization such as major ambulatory surgery and short stay surgery. Building D is a high-resolution outpatient service.

The name given to the program presented in this paper is AQuA (Actividad QUIrurgica Asistencial = Surgical Care Activity) and its task is to facilitate the flow of patients awaiting for surgical intervention taking into account all these factors, allowing simultaneously complete freedom to clinicians to introduce exceptions whenever necessary, as outlined in figure 2.

Once the relevant surgical specialist has decided to operate the patients enter an unique waiting list but with some privileges, i.e., some predefined pathologies are protected by law in our Autonomous Community and have limited waiting time (LWT) before surgery.

Two categories of LWT exist, 180 and 120 days.

The system is so strict that if the public social security hospital does not meet the corresponding LWT the patient is free to seek care at a private hospital and pass the cost to the Social Security administration.

Needless to say the complexity of organising the surgical activity in such a complex multi-building hospital with the legal limitations of maximum LWT for many pathologies.

In this setting AQuA was conceived, produced and put to work with a great success as outlined below.

2.2 The AQuA Program. Applied Technology

AQuA has been designed for ORACLE database, with client-server technology, and developed in a modular programming in Object-Pascal language under the Delphi platform, making the maximum use of object-oriented paradigm, and the environment Fast Reports generator.

The general features of AQuA are:

1. Capture and transfer of data daily from the patients' waiting list, with control and error correction, allowing automatic loading system that coordinates the input and update of new data on patients enrolled in the centralized waiting list (AGD). This allows simultaneous and permanent updating in AQuA of local data. Any discrepancies in patient identification, diagnostic code, procedure or prescribing physician, is detected and corrected immediately. In addition to CIE9MC encoding, simultaneous descriptions of diagnostic and procedures with terminology of the relevant department can be used.
2. Multifunctional management of waiting lists by the relevant services. Complete treatment in a single screen of pa-

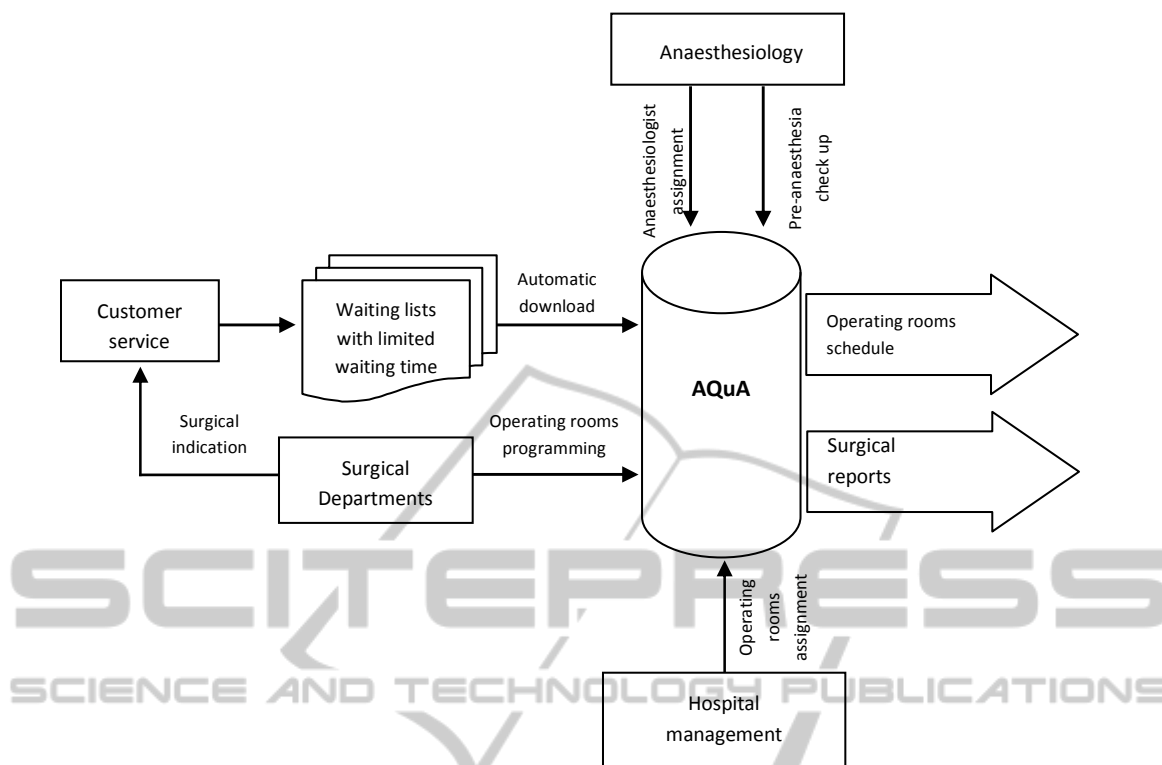


Figure 2: AQuA general's scheme.

tients' waiting list for every department, with interactive upward and downward classification of any column.

Classifications and searches can be done using multi-filters with more than 10 different criteria simultaneously, that allow shortening the list by physicians, diagnostic procedures, anaesthesia and waiting times.

It includes two main choices:

- Current status of approval by the anaesthesiologist
- Date of appointment for the Pre-Anaesthesia check.

The possibility of filtering and sorting data provides a transcendental tool not only for printing but also for exporting information to spreadsheets for further internal or external treatment.

At the same time, each patient record is interconnected with the applications that provide their medical history, radiology and laboratory tests and an intercom service between relevant hospital areas dealing with major events related to that patient.

3. Control of pre-operative anaesthesia appointments.

Daily or periodical planner of pre-operative anaesthesia appointment, (from where allocation is channelled approval of anaesthesia) or any other important fact about the patient. Access to patient history and tests is also allowed from this position.

Scheduled assignment of anaesthesiologists to relevant surgeries. It is carried out by the head of department of anaesthetics. Through a simple drag-and-drop system, anaesthesiologists are assigned to an operating room on any date. Holidays, sick leaves, and others, are taken into account by the program.

4. Management of surgical lists

This process allows a fast programming of any surgery once the operating room features and type of activity are configured.

The user just "captures" the patient from the Department's waiting list (or from any other Dept, privileges necessary).

After that, simply assign the surgical team, intervention order and any necessary endorsement, as blood supply, reserve bed in intensive care or preparation of special instruments needed.

It allows the immediate transfer of the patient from an operating room to any other

available operating room, provided the current user has the relevant privileges to access it.

The surgical list is now ready for printing and copies of it (hard or soft) will be distributed to the different areas involved: operating rooms, general services, blood bank and hospital management, amongst others.

5. Operating Room Module

It is a window that shows the surgical activity scheduled for that current day. It allows navigation between operating rooms and patients. Information can be classified by both criteria and reports permanently in a colourful fashion of the situation of every patient.

This module is the gateway to the "Management of Surgical Intervention" or the form based on the WHO's "Surgical Safety Checklist" (World Health Organization, 2008).

6. Management of surgery in all aspects and professional areas: Medical, Nursing, Anaesthesiology.

It is a complete record of the events that occur and actions taken during surgery.

Collects information produced by the anaesthesiologist, surgeons and nurses, allowing a reconsideration of the original diagnoses and procedures, as well as adding secondary diagnoses and procedures.

The result is the dynamic creation of a report that finally becomes the "discharge report" in patient undergoing major ambulatory surgery and the "surgery report" in the rest of patients.

This report is supplemented with many auxiliary procedures: contextual help in drafting parts of the report, issuing labels, generation of department-specific documents, direct access to the patient's history, processing of urgent intra-operative biopsies, registration of any prosthetic implants used, etc.

If circumstances had forced the deprogramming of an intervention the AQuA program requests accurate information about the causes involved enabling a later analysis of the situation.

Every department involved can create a set of complementary documents that can be retrieved from this screen in a privilege-dependent fashion.

7. Patients' module with full integration with the relevant hospital applications.

A powerful search engine provides access to the patient's administrative data, from which the medical history, the waiting list, additional tests, and others, can be accessed.

Some other documents can easily be generated within AQuA, i.e. the patient's written consent.

Urgent surgery can be directly entered indicating the appropriate operating room. The patient's surgical history and the relevant reports can be seen from this screen.

8. Management of patients already operated

AQuA is connected with the hospital centralized program dealing with "appointment for surgery". When surgical intervention is completed or a definitive deprogramming takes place the patient is withdrawn from the waiting list for that particular surgery. Other possible surgeries in the waiting list for the same patient are not affected.

This process also allows for the gradual implementation of the program because it will temporarily close a surgical intervention to provide statistical information immediately, without having to fill in all the clinical information of the intervention.

9. Total security management.

Management of events (logs) with users maintenance, access profiles and access control to the program and/or each of the options that have been considered necessary to control.

10. Statistics module

Large catalogue of statistical modules. Dynamic listings and 100% integrated exportation of data to Excel, Dbase, Paradox and text formats.

2.3 Results

The AQuA program has been designed and developed to work in and within our hospital. Nonetheless a great effort has been made to produce an open program adaptable to a variety of settings. The aim of presenting it in this HEALTHINF 2011 Conference is to seek suggestions to improve a final version able to fully accommodate to any demands.

The program used has been implemented progressively in different hospital departments as it was produced. Many changes, improvements and corrections have been made along the way. It has been a difficult task, not only by the intrinsic complexity of surgical activity but also by the multi-building lay-

out of our hospital. But today we are proud of presenting a comprehensive program covering any possible aspect of surgical activity.

If there is a point that reflects the usefulness of a program, beyond the obvious result, that is its acceptability. This program has spread along the hospital with a tremendous avidity. Its easy friendly use and the fact that many users had had the opportunity to introduce or change an aspect concerning their particular activity has paved the way to success.

The operating rooms' performance has increased progressively since the introduction of the program. The vertical dotted arrow in figure 3 indicates the point at which the program started running in two surgical departments and the continuous arrow indicates the point when 75% of the surgical activity was under the control of AQuA. As a whole, from launching in April 2009 to date the surgical performance has increased from 65.93% to 71.80%. Since any other conditions related to surgical activity have remained unchanged the improvement seems to be attributable to the AQuA program.

Figure 4 shows the percentage of patients operated on before 90 days of waiting time, from April 2009 to May 2010. As can be seen the percentage has increased from 54.06% to 67.13%.

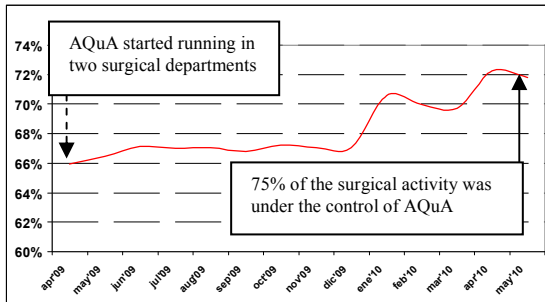


Figure 3: Operating rooms performance.

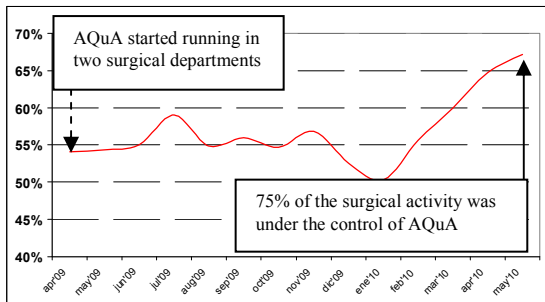


Figure 4: Patients operated within 90 days from diagnosis (%), from April 2009 to May 2010.

Finally, it is important to note that the number of patients with diseases with guaranteed limited wait-

ing time, that have received operation, has increased from 1,145 patients/month to 1,564 patients/month in 14 months, representing a 36.59% increase, as show in figure 5.

This result is complementary to those shown in Figure 4 and is a valuable piece of information since the surgical activity has been shifting gradually toward patients with maximum waiting time limited by law.

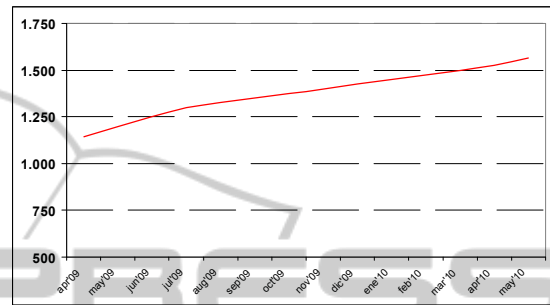


Figure 5: Number of patients protected by the "Limited Waiting Time law" operated from April 2009 to May 2010.

3 CONCLUSIONS

AQuA is a multitask computer program developed to improve surgical management in our hospital. It is running in all surgical departments in all 4 building of our hospital.

It receives input from patient's waiting lists, availability of operating rooms, surgeons, anaesthesiologists, and many other concepts.

The program has shown to be very valuable in the handing of patients on the waiting list with surgical pathologies covered by law by certain privileges i.e, depending upon the disease, some patients have the right to seek private attention and pass the bill to the social security administration after 120 or 180 days on the waiting list.

The introduction of AQuA in the Carlos Haya Regional University Hospital in Malaga has introduced a set of improvements in the management of surgical activity that can be summarized as follows:

- Real time monitoring of a set of quantitative indicators, such as, total number of surgical interventions carried out, operating room performance and use, deprogrammed surgical interventions, entries to, and exists from the waiting lists, and so on.
- Planning of operating rooms 15 days in advance.

- Improved control of pre-operative studies leading to a 20% reduction in the number of studies that are due to expire.
- The pre-operative anaesthesia appointment may obtain lists of patients as they are approaching the date of surgery.
- Surgical departments can perform a surgical schedule with updated information of patients, operating rooms, pre-operative anaesthesia and others.

In addition, AQuA, has helped unify two important aspects regarding the clinical documentation:

- Surgical schedule forms are now the same for all operating rooms of all 4 hospitals buildings. The change from the previous obsolete procedure to the actual one, handled by AQuA, was achieved in less than three months.
- Surgical reports have now the same format for all surgical departments. This has been achieved through the "intra-operating room module" a flexible piece of the program that allows adaptation of the report to different needs in the context of a general layout.

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