

# An Experience of Microbiological Data Sharing for Transplantation Treatment Improvement

A. Nappo, M. Giacomini

*Depart. of Communication Computer and System Science – DIST – University of Genova*

## Introduction

The control on viral and bacterial infections and on the resistance against antibiotics in hospital bacteria is a matter of vital importance in the follow up of transplant patients. There are many reviews in literature that indicate the importance of infections for the morbidity and mortality in the transplanted subjects [1-4]. For instance: the cause of death, based on a review of medical records and autopsy reports in 23 year history of renal transplant was classified as infection in 69.6% of cases (58.0% by bacteria and 6.2% by viruses) [2]. The danger of infections remains for a significant amount of time: the 15% of bone marrow transplant recipients death for late infection (about after 1 year from the transplantation) [1]. A regular way to obtain speedy and reliable referrals can save several human lives. This work starts from an agreement between three institutes: the laboratory Bioengineering and Medical Informatics (MEDINFO) of the Department of Communication Computer and System Science (DIST), the section of microbiology of Department of Specialist Surgery, Anaesthesiology and Organ Transplant (DISCAT) at San Martino hospital in Genova and the transplant centre of the same structure. At present, referral making at the microbiology section of DISCAT is based on an obsolete system that guarantees the memorisation of only their referrals as a whole. This system doesn't permit searches based on the name of the patient or searches based on the data of the referral but just starting from the progressive number by which the referral is catalogued. Even if everybody recognises the obsolescence of this system, the organization of the referral making system can't be modify because of some constraints that do not depend on the individual's will. Due to this situation, an agreement has been stipulated between three parties: the two medical sections and the laboratory MEDINFO of DIST, with the aim of creating a system of translation of data (also

historical) from this structure to a system which should guarantee: a more correct and quick transmission of data about analysis results, a system of storage which reduces the possibility of errors, a smoother manipulation, consultation and updating of data and, at least, a simple way to compute the cost of the analysis required to the microbiology section, on the base of the costs determined by national's DRG, and, mainly, the possibility to classify them in accordance with the requiring divisions. During the development of this project the need of assuming a standard for the communication of data, so that the interface could be used by the whole hospital information system, is becoming more and more demanding. For this reason a HL7 output has been chosen, to conform to the international standards. Moreover, standardization of referrals in microbiology guarantees more continuity in patient care, and can be a significant step in the direction of a true and portable health record which is becoming more and more a requirement in telemedicine, and also to reduce the possible errors that could occur with an incorrect interpretation of data.

The purpose of our work is to produce a semi-automatic program which, at midnight, loads data elaborated during the day, coming from the old system and translates them into a relational database, producing a standardized output according to the standards decided by HL7 organisation.

## Methods

### *Database Translation*

The database on which the medical staff of the microbiology laboratory works and on which the translation has been based on is an old VMS system which had showed immediately its deficits: it is a non-relational hierarchic structure, which causes an unavoidable redundancy of information and a loss of security (for

example private data of the patient are visualised without protection to anyone who opens the DB, not in agreement to privacy laws). Afterwards, the translation of this obsolete format in a more structured relational database has been carried on (the chosen DBMS for the prototype is Access 2000) with a standalone program (implemented in Visual Basic [7]) which fills tables with data coming from a text file with a fixed lengths of fields and records. There are two databases for the separate sections of the laboratory: Virology and Bacteriology.

*Patient and Sample Identification*

Trigger event is composed by a new hospitalization in the transplant division after which the information about the patient like name, surname, sanitary code, and division, are recorded. Besides the message “do trigger” is sent to the presented system and so the interface answers with an acknowledgement message and records this information in the database. For each sample of the transplant division, all four patient data are controlled and, if anything doesn’t match, the acknowledgment

isn’t automatically sent and another exception (see below) is memorized. The samples that are sent to the laboratory are numerated with the so called, internal progressive number and physically there is a bar-code which reproduces this number on the test-tube. These practices enhance the reliability of patient and sample identifications.

*Structure of proposed HL7 output*

We intend to propose an approach of communication based on the HL7 standard [5-6]. To represent our messages and segments we have been inspired by the HL7 version 2.5.

The presented system has two possible input messages: A01 ADT/ACK message (patient’s hospitalization in the transplant division) and U03 SSU/ACK message (the deliverable of one sample collected in the same division). These messages can be sent by Transplant Centre in two different moments. Our system answers to all messages with an acknowledgment if errors are absent. The structure of these messages is described below.

<b>ADT message</b>	<b>ACK message</b>	<b>SSU message</b>	<b>REF message</b>	<b>RRI message</b>
<b>MSH</b>	<b>MSH</b>	<b>MSH</b>	<b>MSH</b>	<b>MSH</b>
<b>EVN</b>	<b>MSH</b>	<b>[{SFT}]</b>	<b>[{SFT}]</b>	<b>[{SFT}]</b>
<b>PID</b>	<b>[{SFT}]</b>	<b>EQU</b>	<b>[RF1]</b>	<b>[MSA]</b>
<b>PV1</b>	<b>MSA</b>	<b>SAC</b>	<b>AUT</b>	<b>[RF1]</b>
<b>DB1</b>	<b>ERR</b>	<b>[{OBX}]</b>	<b>[CTD]</b>	<b>AUT</b>
<b>OBX</b>		<b>SPM</b>	<b>PRD</b>	<b>[CTD]</b>
<b>AL1</b>		<b>ROL</b>	<b>PID</b>	<b>PRD</b>
<b>DG1</b>			<b>[ACC]</b>	<b>OBR</b>
			<b>[{DG1}]</b>	<b>[{NTE}]</b>
			<b>[{DRG}]</b>	<b>PV1</b>
			<b>AUT</b>	
			<b>OBR</b>	
			<b>[{NTE}]</b>	

MSH is the segment that indicates the sending of a message, EVN of ADT message is the patient’s hospitalization segment with indications of the division, whereas SAC of SSU message indicates the date and the hour of sample collection.

There are two messages that are produced by this system: REF message for the referral delivery of laboratory tests in Virology and Bacteriology, and RRI system if the transaction of the electronic referral is successfully. If the transmission presents inconsisten-

cies (name, hospitalization division, sanitary code, etc...) we add also the ERR segment to RRI message. Our future aim on this subject is to implement the treatment of information about clinical data in dynamic modules based on XML. Moreover, we are working to create a Web Services in our laboratory to obtain automatic exchanges of information independently on transport protocol and platforms of implementation. We are interested to extend this project to the other structures of San Martino Hospital which need the microbiological referrals.

## Conclusion

An experimental prototype has been presented for a fast and certified delivery of an electronic format of the reports written by the microbiology division of DISCAT at the San Martino Hospital, Genoa towards the Transplant Centre of the same hospital. This prototype is now active only at an experimental level and it represents an alternative to sustain the paper documentation, which nowadays remains the only documental source accepted by the legislation on this subject. The hospital information system is in a constant updating situation with rumours of many types for possible solutions. For this reason an HL7 interface seemed the best solution. One of the aims that this work intends to reach is: to make data easily delivered to implement very stable procedures, even in the presence of external noise. Moreover, the security of electronically sent data is assured by the union of several factors. One of these factors is surely the protection at a low level of the ISO/OSI scale for the network structure involved in these sensible data transfer. At higher levels it is necessary to guarantee data quality as well as privacy, that can be assured by legalization of "strong" electronic signature as certification method and by the use of the cryptography [8] and different user-views which protect the programme and the data by possible unauthorized modifications.

## References

1. Roy V., Ochs L., Weisdorf D.: "Late infections following allogeneic bone marrow transplantation: suggested strategies for prophylaxis.", *Leuk.Lymphoma* (1997) 26(1-2): 115.
2. Reis M.A., Costa R.S., Ferraz A.S.: "Causes of death in renal transplant recipients: a study of 102 autopsies from 1968 to 1991", *J.R.Soc.Med.* (1995) 88(1): 24.7
3. Munoz P., Palomo J., Munoz R., Rodriguez M., Creixems, Pelaez T., Bouza E.: "Tuberculosis in heart transplant recipients" , *Clin.Infect.Dis* (1995) 21 (2): 398-402
4. M.M. McNeil, J.M. Brown: "The medically important aerobic actinomycetes: epidemiology and microbiology", *Clin.Microbiol.Rev*, 1994 Jul, 7(3): 357-417.
5. K.U. Heitmann, B. Blobel, J. Dudeck: "HL7. Communication standard in medicine", *Hundt Druck GmbH, Cologne* 1999
6. AA.VV. <http://www.hl7.org>
7. J.P. McManus: "Database Access with Visual Basic 6", *SAMS, Indianapolis* 1999
8. R. Bondi "Cryptography for Visual Basic", *Wiley* 2000