A Patient Planning and Tracking System for a Cardiac Surgery Department

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Abstract

Patients undergoing cardiac surgery occupy a cascade of beds during their stay in hospital. The length of stay at each sub-department depends on many factors such as the condition of the patient, the performed therapeutic procedure and the attending staff.

The patient throughput therefore may be hampered in many ways and is subject to vast communication processes in which copying of information is a substantial component. In order to optimize this throughput a software package has been developed based on a computer model predicting the average stay of a patient on each sub-department, given the surgical procedure and his clinical condition. This way the overall flow of patients can be predicted and potential problems in patient logistics can be foreseen. Furthermore sharing of information will reduce the workload and the number of misinterpretations.

1. Introduction

The effective management of beds as a resource and the processes involved in admission, stay, transfer and discharge of patients, has always been an issue [1]. As the length of the waiting lists for operative procedures are unacceptable long, the need for quick insight in the daily operation capacity, bed availability and patient throughput, is apparently crystal clear.

The patient throughput may be hampered in many ways and is subject to vast communication processes in which copying of information is a substantial component [2].

The operation capacity in the Thoraxcenter of the University Hospital Groningen, where numerous thoracic procedures are being performed including congenital repairs and lung transplants, is, as in other cardio-thoracic centers, directly dependent on the number of available beds at the Intensive Care Unit (ICU).

This number of ICU beds in turn, depends on a lot of other factors, such as the condition of the patient, the performed procedure, the attending staff and the number of unoccupied beds on the nurse department or the coronary care unit (CCU), which in their part depend on similar factors.

The sometimes complex cascade of beds occupied by the patients and the diversity of patient flows (figure 1), some frequently used (solid lines), others occasionally (dashed lines), contribute to the complex management process.

Moreover there is an increasing need for numbers like mean, minimal and maximal length of ICU-stay for each different therapeutic procedure. Also datacollection has become important for widely accepted scoring tools, for example for the calculation of the Therapeutic Intervention Scoring System (T.I.S.S.).

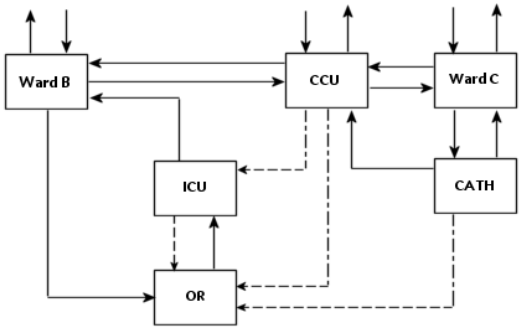

Figure 1. The diverse patient flows .

1.1. Patient planning

Up until recently, patient planning was done by means of written papers and their many, often not updated copies, a lot of walking through the wards, phone calls, counting beds and staff members, discussing the patients discharge and thereafter choosing the patients from the waiting list.

The described patient planning and tracking system provides univocal information for each different manager, planner or staff member. Through an optimized user interface, on each location, patients can be localized and bed availability is being predicted based on the expected length of stay per patient, the calculated mean stay for the type of procedure and the patient flow can be followed. A history view can be shown to support long-

term planning or just evaluating the past patient flow.

1.2. T.I.S.S. score

The Therapeutic Intervention Scoring System (T.I.S.S.) originally developed by Cullen et all in 1974 [3] and simplified by Miranda et all [4] as the TISS-28, is a world wide accepted method with double objectives of measuring the severity of the disease at patient level as well as assessing the corresponding nursing workload in the ICU.

T.I.S.S. has been recorded daily by the staff on paper forms due to the absence of a data management program. The patient planning and tracking system provides a build in T.I.S.S. calculation and data management tool.

2. Methods

To give real-time information on the four operating theaters, 14 ICU beds, 32 Ward beds and 12 CCU beds, a multi-level network software application was developed with true-to-life helicopter views of the wards with build in HIS interfacing, management tasks and reporting tools such as statistics and history overviews.

Main point was the plan layout of the ICU with the beds turning red when occupied and green when empty (figure 2).

To identify special patients who need extra (more) care, such as children or lung transplants, more quickly, the colour of an occupied bed instead of red changes to respectively yellow or blue. Closed beds are marked with a red border.

The system automatically counts the days of stay for each patient. The number of days turns red when exceeding a predefined number to emphasise a long stay.

The staff can manipulate data by clicking on a bed. An edit screen shows up (figure 3) in which patient data can be changed, removed or transfered to another ward. Beds can be closed and long stay ICU patients can be put on hold while using a ward bed for another patient in the meantime. At the same time a read-only copy of the main screen can be seen on all other locations. The read only screen can be minimized to the Windows taskbar and the icon will start blinking, warning the user realtime, that something has been altered.

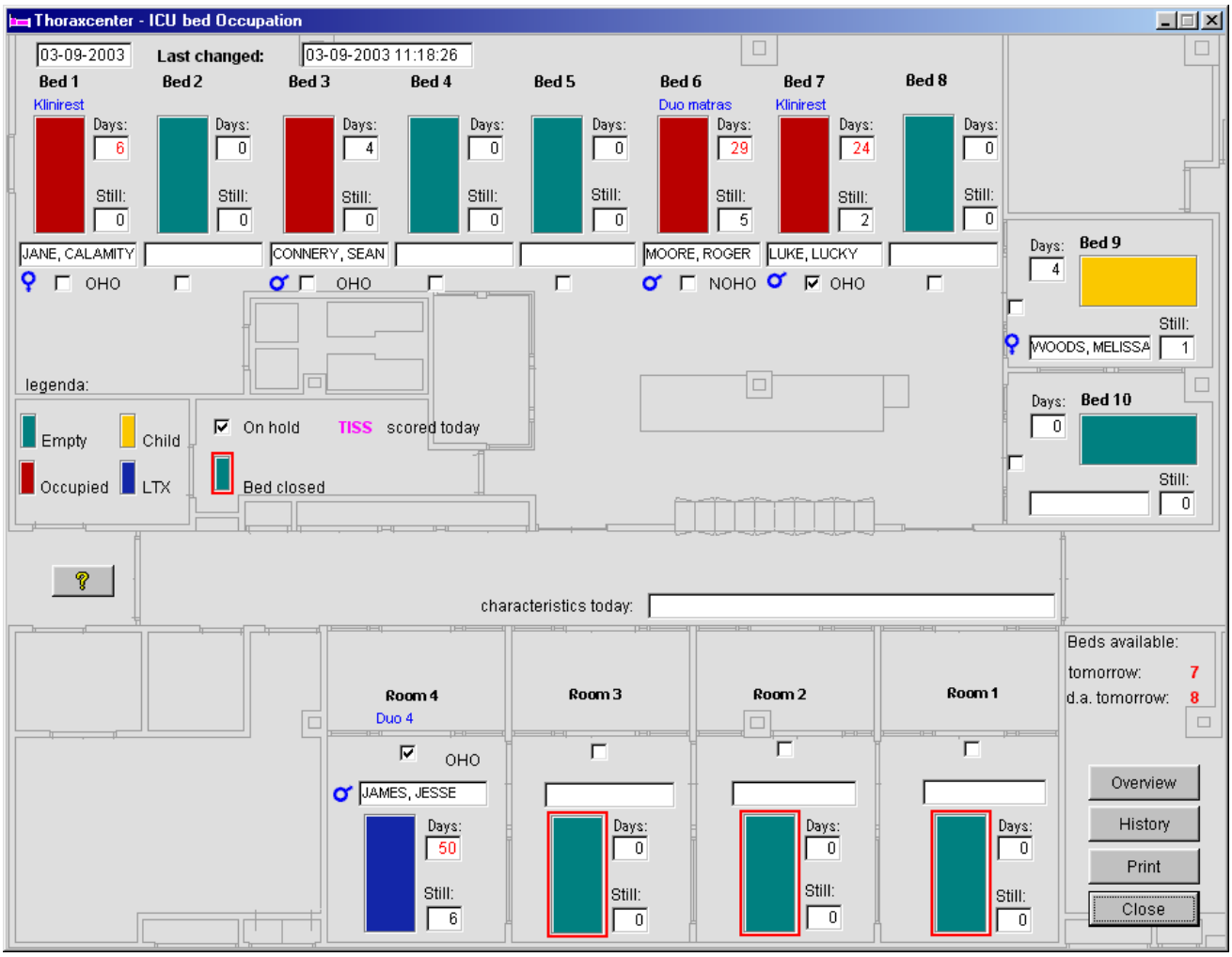

Figure 2. Main ICU screen

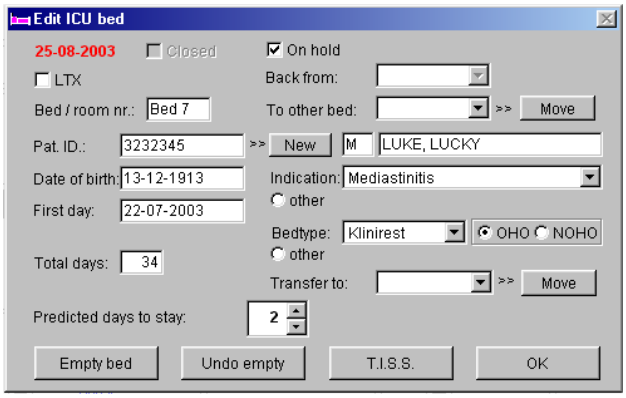

Figure 3. Edit screen

New patients are added by entering the hospital ID that is subsequently send to the Infocop [5] and HIS database to get all relevant patient data, or the data can be obtained from other wards.

Patients can be transfered to other wards by selecting the ward from a drop down box and clicking the move button. The appropriate ward then receives a signal on the screen (a blinking pink to green bed icon in top left corner of the screen or in the taskbar when minimized) and the patient with his/her data can be accepted and placed on a bed of the ward screen.

Indication or surgical procedure and type of bed can be chosen with a drop down box from a preselected list or as free text in case of a rare procedure and distinction can be made by choosing open heart (OHP) or non open heart procedure. A prediction of the length of stay is made, based on the past median days of ICU and ward stay for the selected type and the duration of the performed procedure. This can be overruled in the edit screen. For example an uncomplicated AVR takes 3 hours operating time, 1 day of the ICU and 7 days of the ward (table 1).

Procedure	#	Mean	Median
AVR	55	2,5	1,0
AVR + CABG	23	5,2	2,0
CABG	289	3,3	1,0
MVR/P +	30	2,4	1,0
Mediastinitis	12	1,5	1,0
Resp. insuff.	17	1,6	1,0
Switch	6	4,5	4,0
Congenital	69	2,9	1,0
LTX	8	17,3	1,5

Table 1. Length of ICU stay (01/01/2003 - 30/06/2003)

TISS is being scored daily for each patient by the ICU staff. The TISS screen (figure 4) is being activated on the edit screen and starts with last day's score items allready checked, for minimal clicking to ad a new score.

Additional information like ECG and CAG are directly available when present by rightclicking the desired bed and thereby entering the Muse system [6] or the Digital Echocardiographic Images [7] or CAG's.

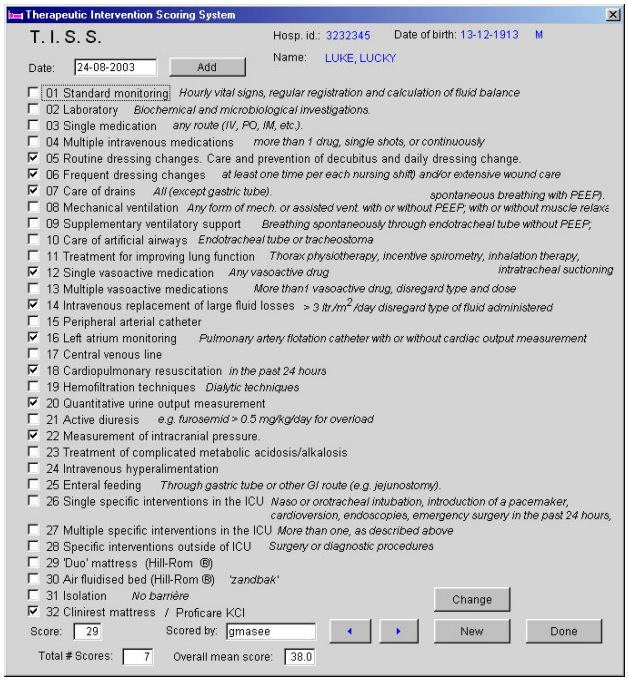

Figure 4. TISS screen

A paper copy of the plan with the occupied beds can be printed with "last changed" date and time to assure the user has the most recent printout.

Authorization is checked by DDE requests on the department server. By means of password control several levels of usage are available.

Analogous to the ICU screen, the ward screens have similar functionality and plan views (Figure 5)

The described application was written in Microsoft Visual Fox Pro version 7.0 ®.

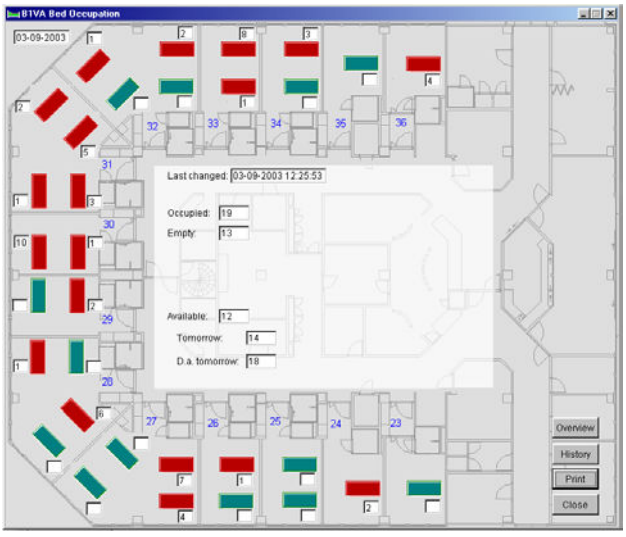

Figure 5. A ward plan view.

3. Results

The described patient planning and tracking system provides real time bed management information and collects essential data in favor of the nursing staff, the bed managers and the operation schedulers for half a year now. ICU and ward plan views are being consulted daily. Patient data is being edited hourly whenever expectations change about length of stay or when patients are being transfered to another ward or being discharged. The ICU nursing staff is adding TISS score for every patient daily. The financial manager gets a daily list of the amount of occupied beds and personnel involved.

The ICU plan view is consulted several times throughout the day by the ward nursing staff, the operation schedulers and the surgeons.

Overviews of numbers of patients, average bed occupation and mean TISS scores are being reported monthly.

Although it is difficult to measure the overall benefits in time or costs but it is evident that much discussion and walkthrough time has been saved since the system is operational. The quality of the data and the communication processes involved in bed management improved significantly resulting in a better patient care.

4. Discussion / future developments

Maximum participation of all users involved has lead to maximum support and enthusiasm in using the system. Therefore the Patient Planning and Tracking system is developed with frequent consultation of the users. Right now the program is being expanded with more data collection items as there are more scoring items like the MPM_0, (Mortality Prediction Model), SAPS-II (Simplified Acute Physiology Score) and APACHE II (Acute Physiology And Chronic Health Evaluation) which all can be of great importance in patient care.

Furthermore data will be shown in graphically presented time diagrams in future versions.

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