CHALMERS

Patient flow analysis and digital support

- operational system for emergency departments

Master of Science Thesis

JENNY STRÖM

Department of Signals and Systems
Division of Signal Processing and Biomedical Engineering
CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden, 2013
Report No. EX028/2013

Patient flow analysis and digital support
- operational system for emergency departments

JENNY STRÖM
Department of Signals and Systems
Chalmers University of Technology

Abstract

The patient flows at emergency departments are constantly increasing, due to aging population, population growth and younger people seeking more medical care. The work processes at the emergency departments are not adapted to deal with these changes. The aim of the study is to perform a patient flow analysis at emergency departments and evaluate if the technical platform SAFE by Saab Group AB can be configured to be used as an emergency department information system (EDIS). There are several different IT-systems used at an emergency department. The acute journal and triage method used at many emergency departments in Sweden is Rapid Emergency Triage and Treatment System (RETTS), which typically is used in paper form. There is a need of a system that integrates the existing systems, digitalizes the acute journal and supports the work processes at emergency departments. Patient, personnel and information management can essentially be automatized to free resources, make the flows more efficient and increase the patient security. SAFE is a modern solution for business areas in need of a holistic view on security and safety. It is a technical platform designed to provide situational awareness and securing business flows. A patient flow analysis was performed and presented as a flow chart together with a detailed description of the flow. Using these data in combination with the author's experience as a nurse working at an emergency department, a SAFE edition named EDIS was configured. The work method used during the development was Scrum. The resulting system is a holistic operational system that manages the patient (arrival ambulances, registration, digitalized acute journal and general patient management), resources, assignments, work shifts and occupancy at the emergency department. A configuration in QlikView was used for statistical management. There is great interest in the subject and the system has received positive feedback from different stakeholders, both internally within the company and externally from different emergency departments. Further on, the system needs to be tested at sight, integrated against other systems and more functionality can be developed.

KEYWORDS: *emergency department, emergency department information system, patient flow, patient flow analysis, operational system, RETTS, SAFE, configuration, QlikView*

Table of contents

1. Introduction

In Sweden, there are 74 hospital emergency departments and approximately 2.5 million emergency visits made per year. The number of emergency departments varies between one and eleven in the different counties of Sweden and the catchment area varies from approximately 50 000 to 750 000 inhabitants per emergency department (Socialstyrelsen, 2011). The definition of emergency medicine according to The International Federation for Emergency Medicine (IFEM) is the following:

> *"Emergency medicine is a field of practice based on the knowledge and skills required for the prevention, diagnosis and management of acute and urgent aspects of illness and injury affecting patients of all age groups with a full spectrum of episodic undifferentiated physical and behavioral disorders; it further encompasses an understanding of the development of pre-hospital and in-hospital emergency medical systems and the skills necessary for this development."*
> (IFEM, 2012)

The inflow of patients to the emergency departments is constantly increasing due to aging population, population growth and younger people seeking more medical care. However, many emergency departments are closing. The amount of acute hospitals in Sweden has successively decreased from 87 to todays 74 since the year of 1990. The politicians are simultaneously demanding improvement of the lead times and the goal in most counties is that 90 % of the emergency department visits should not exceed four hours. There are also ongoing projects for improvement of patient flows (Socialstyrelsen, 2011).

There are several different and non-integrated systems used at emergency departments in Sweden; journal systems, laboratory systems, x-ray systems, monitoring systems, electrocardiographs (ECG), occupancy systems and many more. The systems in use vary between the counties and the emergency departments since no national or regional strategy for IT within the healthcare sector has existed. Some emergency departments have emergency patient administrative systems to keep track of the patient, while others still do this manually. Most of the emergency departments in Sweden use Rapid Emergency Triage and Treatment System (RETTS) as acute journal, mainly in paper form.

There is a need of a system that integrates the existing systems and supports the work processes at emergency departments. Patient, personnel and information management can essentially be automatized to free resources, make flows more efficient and increase the patient security. A system that logs all the events gives the opportunity for organizational follow-ups and thereby more efficient development work, since the bottlenecks of an organization can be detected.

1.1. Aim of the study

The aim of the study is to perform a patient flow analysis at emergency departments and to evaluate if the technical platform SAFE can be configured to be used as an emergency department information system.

2. Emergency department – an overview

Acute means that it cannot be predicted and is in need of fast disposal without delays. The National Board of Health and Welfare in Sweden (Socialstyrelsen) is in a report from 1995 defining acute disease/injury as abruptly occurring, hastily progressing disease or as suddenly caused injury. Acute care means interventions that cannot be delayed more than some hours, up to 24 hours (Socialstyrelsen, 2011).

The emergency departments usually provide the operational disciplines medicine, surgery and orthopedics. Acute care for children in Sweden is provided by 33 of the emergency departments and psychiatric by 10 emergency departments, often located in its own premises. The majority of the emergency departments are open around the clock, all days of the week. The demand of emergency care varies to a great extent regarding time of the day and day of the week (Socialstyrelsen, 2011).

The waiting times varies significantly between the emergency departments. The average duration of the emergency department visit the first six months of year 2010 was 3 hours and 5 minutes and the average time to physician the same period was 1 hour and 20 minutes at the emergency departments in Sweden. The major reasons for the long waiting times are reported by the counties to be the employment of physicians and the on call system, but it is also because of the increase of non-emergency patients visiting the emergency department and the lack of care beds. Most counties are actively working with improvement of the situation with long waiting times. Emergency primary care units and local hospitals have opened and the opening hours at the primary care units have been extended in order to deal with the increasing amount of emergency department visits. The healthcare counseling number “1177” has also been an intervention for this manner (Socialstyrelsen, 2011).

All counties in Sweden have emergency departments that measures waiting times, but in some counties there are not all emergency departments measuring the waiting times. The maximum time for an emergency department visit is set to between 3 – 5 hours in the different counties and the goal is that 80 – 100 % of the emergency visit time should be within this maximum time. The most usual goal is that 90 % of the emergency visits should not exceed a visit time of four hours. Focusing at the waiting hours can result in increased medical risks and that problem occurs in other parts of the healthcare sector. Thereby, The National Board of Health and Welfare in Sweden (Socialstyrelsen) proposes development of additional quality indicators for follow-up of the emergency care, with focus at patient security and patient perception (Socialstyrelsen, 2011).

The emergency departments in Sweden are continuously working with improvement of the patient security (Socialstyrelsen, 2011). Known problem areas are within information transmission, competence, prioritizing, concurrence, handling of drugs and availability (Socialstyrelsen, 2005). A national project for improved patient flows at emergency department is in progress 2012 – 2013 with 27 participating emergency departments named *“Akut förbättring”*. The goal with the project is to reduce the waste of the patients’ time,

increase the quality and patient safety and increase the satisfaction among the healthcare employees (SKL, 2012).

Triage and decision support systems are used to sort patients with various levels of need for acute care. The division of patients is based on different scales that indicate the medical risk of waiting for medical assessment and medical interventions (Widgren, 2012). In 2009, 54 emergency departments (73 %) used some kind of triage methods. The most used were Manchester Triage System (MTS), Medical Emergency Triage and Treatment System (METTS) and Adaptiv Triageprocess (ADAPT). MTS were used by 12 emergency departments (22 %), METTS by 18 emergency departments (33 %) and ADAPT by 15 emergency departments (28 %). Other triage methods were used at nine emergency departments and these were mostly smaller emergency departments with an amount of visits beneath 30 000 patients / year (SBU, 2010). One year later, in 2010, the usage of METTS had increased to be used as triage method at 48 emergency departments and a survey in January 2011 indicated that even more emergency departments were planning to change to METTS during 2011 (Socialstyrelsen, 2011).

The average of the emergency department visitors that get hospitalized is 30 %, but this amount is differs significantly among the emergency departments (Socialstyrelsen, 2011). There are approximately 25 % of the lowest prioritized patients triaged according to RETTS, i.e. priority color green, which is in need of some kind of inpatient care, often observation over time. The priority color will thereby not indicate the patients need of hospitalization. Usual causes of contact for green prioritized patients and symptoms observed in inpatient care are unspecific chest pain, dizziness, syncope and abdominal pain without other comorbidity (Widgren, 2012). There are ongoing projects for earlier identification of these patients in order to relieve the pressure at the emergency departments.

In each county there are official in preparedness (Tjänsteman i Beredskap, TiB), responsible for initiating and coordinating the initial crisis management work in order to illuminate, verify, alarm and inform about major accidents. The TiB can be contacted around the clock, all days of the year (Socialstyrelsen, 2012).

2.1. Information technology (IT) at the emergency department

There are several different systems used at an emergency department, for instance a journal system for documentation, a laboratory sample system for ordering of samples, monitoring systems, a system for ordering of x-ray examinations etc. The systems used for these manners differ among counties and emergency departments, i.e. there exist a lot of different systems for the same purpose. Therefore, a patient journal may not be reachable between the different counties and even within a county, which requires that patient data need to be sent manually between healthcare instances, by for instance faxing. The systems used are running individually, i.e. they are non-integrated. Therefore, the patient needs to be registered and handled in several systems.

2.2. Market analysis

There are some actors in Sweden that have developed systems for emergency care with a digitalized version of RETTS. These systems are for instance Aweria by Weltgeist AB (today in cooperation with Tieto), Take Care Akutliggaren by CompuGroup Medical (CGM) and COSMIC Emergency by Cambio Healthcare Systems AB. Aweria is used at the emergency department at the hospital Östersund. Information about emergency departments using Take Care Akutliggaren could not be found; it is for instance used in the county of Dalarna (Jacobsson, 2012). Whether COSMIC Emergency is used at emergency departments in Sweden or not could not be found, just that an implementation of COSMIC Emergency were planned in the county of Kronoberg in autumn 2008 (Cambio Healtcare Systems AB, 2012).

Take Care Akutliggaren monitors the patients at the emergency department. The patient's position, responsible care team, the responsible for the patient, and assignments and events are shown. The system is able to show the history of patients and patient bounded events for a historical time interval. Information can be chosen to be shown for the whole emergency department or for a specific specialty (CompuGroup Medical AB, 2012). COSMIC Emergency consists of features and views such as an overview of the registered patients, prioritizing/triage (decision support), care contact information, patient log (history of events for a patient), operational load (the load at the emergency department), corridor monitor (depersonalized quick overview of the patients and the rooms, which is placed in the corridor) and waiting time information (shown in waiting rooms, at the intranet or at the internet) (Cambio Healthcare Systems AB, 2011). Take Care and Cosmic are two of four journal systems that are dominating the market in Sweden; the other two are Melior by Siemens and SYSteam Cross by SYSteam Health & Care (Bark & Hardenberger, 2012).

2.3. RETTS

Rapid emergency triage and treatment system (RETTS) is a decision support, sorting incoming patients to an emergency department. Triage and prioritizing with RETTS is a combination of vital parameters and the result of a cause of contact algorithm called ESS (Emergency Symptoms and Signs), see Appendix 1. The vital parameters measured are saturation (oxygen saturation in the blood), breathing frequency, pulse, blood pressure, state of consciousness using RLS 85 (Reaction Level Scale) or GCS (Glasgow Coma Scale) and body temperature. All the vital parameters results in priorities according to the measured values, see Figure 1. Simultaneously as measuring the vital parameters, a brief anamnesis is gathered including the cause of contact, which is complemented with some yes and no questions. When the anamnesis is gathered and the cause of contact is clear, the corresponding ESS algorithm can be chosen (Widgren, 2012).

There are 99 ESS algorithms and every algorithm consists of one or several causes of contacts according to International Statistical Classification of Diseases and Related Health Problems 10th Revision Version for 2007, so called ICD-10 codes. The symptoms and signs that the patient exhibits, together with algorithm bounded interventions determine the priority of the chosen ESS using the decision support of the algorithm. The chosen ESS algorithm and the

priority of the patient will lead to specific interventions and blood samples. If the patient exhibits symptoms of several ESS algorithms, the algorithm giving the highest priority should be chosen. The total priority of the patient will be the highest priority of the vital parameters and the ESS algorithm together. This priority can be changed if vital parameters are re-measured. A priority can be increased or decreased, but the total priority cannot be lowered below the ESS priority. However, the physician can change total priority below the ESS priority (Widgren, 2012).

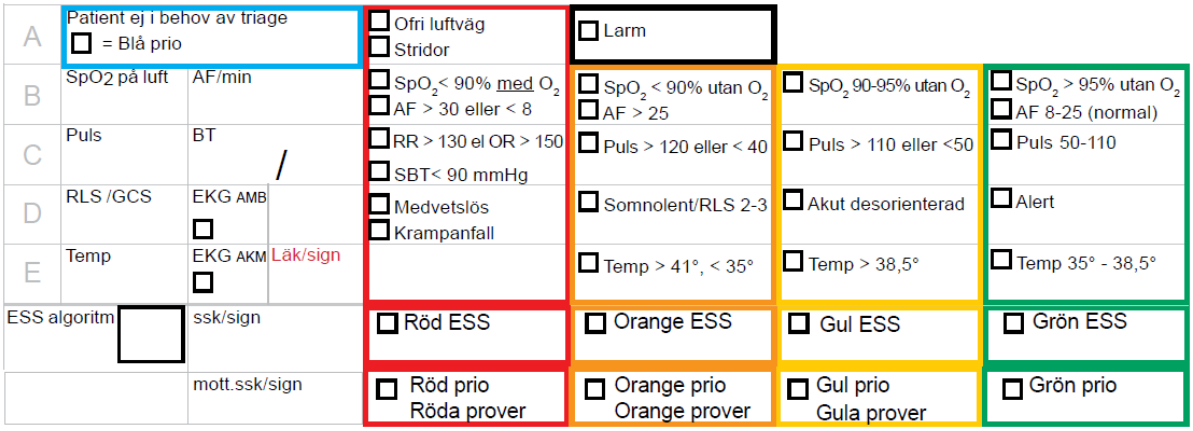


Figure 1. Triage vital parameters and ESS

The priority scale used is a five-colored scale, red – orange – yellow – green – blue, where red is classified as life-threatening and emergency care is urgently needed and blue is for patients that are not in need of triage. Orange prioritized patients are classified as potential life-threatening and need urgent emergency care. Red and orange prioritized patients need to be monitored and red patients also need a healthcare personnel bedside. Yellow and green prioritized patients are classified as not life-threatening but is in need of emergency care and care within reasonable time respectively. Reasonable time means that the patient can wait without any apparent medical risks. RETTS' priority color will thereby tell if the patient is in need of urgent emergency care or if the patient can wait without any apparent medical risks. It will not inform about recommended waiting time or if the patient is in need of hospitalization. Approximately 25 % of the green patients are in need of hospitalization, often with observation over time. Some patients can be referred to primary care due to specific referral ESS algorithms (Widgren, 2012).

RETTS was initiated in the year of 2003 as a research project with the intendance to study if a systematic and standardized work with a focus at objective and subjective variables could achieve a high sensitivity enough to find the patients that are in need of urgent medical care. The emergency department at Sahlgrenska University Hospital was the first hospital with this system. The name was changed to Medical Emergency Triage and Treatment system (METTS) in 2005 due to confusion with Retts disease. In conjunction with a change of version and update in 2011 the name was changed back to the original name RETTS (Widgren, 2012).

Implementation of RETTS as a decision support and triage method in combination with structural changes reduced the time to the first medical assessment, Time to Triage (TTT). Generally, an implementation does not reduce the Time to Physician (TTD), though it reduced the time to physician for the most acute and most severely ill patients. This gave increased medical safety and quality (Widgren, 2012).

The latest version, 2012, is divided into RETTS, RETTS-T and RETTS-P. RETTS-T is a trauma journal and RETTS-P is used for pediatric care and is under development. The pediatric version currently has 57 cause-of-contact algorithms and will have other boundaries for the vital parameters. The trauma journal is used for trauma patients, activated by a specific ESS algorithm called trauma alarm activation algorithm, see Appendix 1. It is mainly used for multi-trauma patients or if the patient may have experienced a multi-trauma, and/or a major isolated trauma of life-threatening characteristics. If the patient is prioritized orange or red in one of the injury algorithms, trauma alarm should be considered (Widgren, 2012).

3. Technical description of the system

3.1. SAFE

Situation Awareness for Enhanced Security (SAFE) is an issue management system by Saab AB focusing on security by giving a complete real-time operational overview. It is configurable to be able to be used in almost all businesses. Today, the system is used in critical businesses such as airports, arrests and prisons. SAFE creates flows, supports decision making and guides operators and administrators in general and critical situations. Users with various authorities can access and operate in the system simultaneously.

SAFE clients can be used in Microsoft Windows Vista and Microsoft Windows 7. The servers are used at Commercial Off-The-Shelf (COTS) hardware together with Microsoft Windows Server 2008 operational system. COTS correspond to commercial items sold in significant quantities in the commercial marketplace (FAR, 2012). Microsoft SQL Server is used as database server. Standard COTS monitors are used with the recommended size of 22 inch. The SAFE Graphical User Interface (GUI) uses the Microsoft standard Windows Presentation Foundation (WPF). The advantages with this standard are for instance flexible toolbars and menu components, fast reaction times, highly responsive interfaces and high refresh rates (Saab AB, 2011). In the system, the user can choose to use a dark or a light theme. The dark theme is mostly used by the developers and users at sight since it is said to be more resting for the eyes.

SAFE is a technical platform that can be configured to present the content and data, important for every specific role and user, see Figure 2. When a user logs on, a role and responsibility areas need to be chosen. A view configured for the specific login combination will be showed consisting of the modules needed for the user, a so called role-based layout. It may consist of several layouts shown on several displays and every layout may consist of several modules, i.e. small windows, showing different data. The modules can be configured so that the user can move them around in order to create an own layout.

Figure 2. SAFE features

A configuration is built on issue types being created with different properties, such as strings, buttons, enumerations etc. The property placements are configured in an issue details view and by an add button several issues for an issue type can be created. These can for instance be shown in an issue list where values of different properties of an issue can be shown in different columns in order to create an overview. A placement framework can be used for combining several issue types views in the same module, for instance an issue detail view together with an issue list. The issues can be prioritized, sorted and filtered by the user.

An issue type can be configured to have states in order to create flow. The relations between the states are configurable by setting which states that should be reachable from a specific state. *Todo*, *In progress* and *Done* can for instance be states and the state transitions can be *Todo* → *In progress* → *Done*, but it can also be in combination with *Todo* → *Done*, i.e. done can be reached from both *Todo* and *In progress*. This feature is called state transitions and will create the flow in the system and in operations.

A rule engine is used to create automatized actions when specific actions are performed in the system. A rule can be triggered for instance when an issue is created, a specific property is changed or when a state transition is performed. This will create an action that is configurable. An action can be that a property is set with a value or that something is sent to the lookup service. This will make operations more efficient, though it automates parts of it. Issues can be connected via response plans. The response plans will connect one or several issues of an issue type to the triggered issue according to what is being configured. Using the rule engine, the response plans can be evaluated by different triggering actions.

Important features that can be used in the configuration of issue types are action plans and query trees. Action plans creates workflow support by guiding a user in general or specific situations. An action plan consist of instruction rows that are configurable to be selectable or mandatory, i.e. one or several actions need to be done to be able to continue to the next step in the action plan. Query trees can be used as interview support, because it supports the user by a step-by-step tree of configured questions and due to the answer, the next level of configured questions is shown.

An indoor or outdoor map can be used for positioning of issues and resources in order to give a complete operational overview. Sensors can be integrated to the system and be shown in the map. If a sensor triggers an alarm it will be clearly shown in the system, both as an alarm notification and by an indication in the map. Cameras can be connected to a video grid and is shown as icons in the map and by clicking the icon, or at the camera view at the video grid, an expanded view of the video can be seen.

Every action in the system is logged and shown in a history view. The history events can be filtered in order to show the data important for the user. It is able to search in closed issues to see specific data, history and events for an issue type. External sites or applications can be shown in a browser view. Calls can be made in a communication module. Mobile clients can be used, such as for instance a SAFE mobile android application. It is configured directly in

the database by setting desired parameters to visible for the mobile clients in the issue type properties.

SAFE is prepared for integration using a Representational State Transfer (REST) API. REST is a software architecture style used for distributed hypermedia systems. It is a combination of several network-based architectural styles with additional constraints defining a uniform connector interfaces (Fielding, 2000).

> "*REST provides a set of architectural constraints that, when applied as a whole, emphasizes scalability of component interactions, generality of interfaces, independent deployment of components and intermediary components to reduce interaction latency, enforce security and encapsulate legacy systems.*"
> (Fielding, 2000, p 123)

SAFE is constantly under development. There are several Scrum teams at Saab Group AB constantly developing new features in the system. This results in several releases per year.

3.2. QlikView

Qlikview is a modern business intelligence software by Qliktech International AB in which the user easily can produce the statistics wanted if the data exists. It is a dynamic business intelligence system in which the data from the database is read into the RAM-memory from where the statistics can be efficiently calculated without heavily loading the performance of the computer (Jonsson, 2012; QlikTech International AB, 2012).

4. Method and materials

The focus in this study is divided into two main parts: patient flow and digital support at emergency departments. A patient flow analysis was performed to map the processes at emergency departments and to describe the domain. The patient flow analysis was also performed to illuminate which part of the processes at an emergency department that can be digitally supported. The vision with the digital support was that it should manage the patient, personnel, assignments, work shifts, occupancy and statistics, i.e. the system should be an operational system. The details of each of these modules were initially discussed with Jonas Borgström and Pehr Dahlbom (2012) to illuminate important functions and the visions of the different modules.

The general patient flow at the emergency department will be described mainly from my own experience as a nurse working at the emergency department at Östra Sjukhuset - Sahlgrenska University Hospital (SU) in Gothenburg. This was done in combination with a general view from own knowledge about other emergency departments and knowledge from Jonas Borgström and Pehr Dahlbom who have visited emergency departments as ambulance personnel and as sales personnel at Saab AB. The result of the patient flow analysis is presented as a flow chart, which was performed in Microsoft Visio. It is presented as an overview with details in separated sub-flowcharts. Description of the patient flow analysis is presented in the result section of this report.

The method used to evaluate if the technical platform SAFE could be used at emergency departments was to perform a configuration in SAFE, i.e. an edition aimed for emergency departments. This method was used in order to learn about and understand the functions in SAFE and thereby evaluate the possibilities. The configuration was performed with a vision of what the system should handle in combination with a goal of increased patient security and increased efficiency of the flow processes at the emergency department. The main goal during the development of the system was to allocate more time for the health care personnel for the patients. The limitation of this study regarding which and how much of the modules that would be configured was the time, i.e. configuration was performed until the time span expired starting with configuration of the patient management and journal, and then moving on to the general management of personnel and assignments and in parallel the statistical management.

The configuration in SAFE was performed module by module using the existing functions in SAFE. To achieve the most optimal functionality of a function, some functions were tested using different configurations. The configuration that was most similar to the desired functionality was chosen. For functionality that was not resolvable in SAFE, an external service was used. This is called a lookup service, since it initially was used to get data from databases, such as from a personal database. The basic of this lookup service already existed, it was initially used to learn and understand how the service worked. Further on, it was used to continue build on. The service was for instance programmed to validate values in fields and to count properties/data in a specific state or with a specific property in the database. The lookup service is programmed in C# .NET using Microsoft Visual Studio 2010.

SAFE is also using the programming language C# .NET. In order to learn the basics of this language, a part of the RETTS journal was initially programmed in Microsoft Visual Studio 2010. In the lookup service, some sequences are Microsoft SQL Server script, which is used to get data from the databases. The basics of this scripting were learned during the development process of the system.

The preparation and installation of SAFE was mostly done by the author of this study without external help and this was the most optimal way to learn and understand how SAFE working, since it is a complex system. As new versions were released of SAFE, the system was reinstalled and the configuration loaded into the new version. This was done without any major problems, which of course was an advantage. The system was updated three times.

The major part and configuration issue was the patient management module, including registration, journal and management of the registered patient. The acute module Paratus ED (earlier known as Akutmodulen) by Saab AB showing the incoming patients from the pre-hospital care is integrated into the system. Paratus ED is mostly called acute module in this study. The patient management module was the prior module in this study and while developing the module the knowledge about the configuration in SAFE was gathered and different type of configuration solutions was tested. The other management modules were easier to configure, since knowledge is already gathered and different problems was already dealt with.

The statistics management module was configured in QlikView. Andreas Jonsson (2012) from Optivasys AB gave a brief introduction about the system and how to configure. Andreas, who periodically was consulting at Saab AB regarding QlikView, wanted to contribute with his knowledge about QlikView to this study. QlikView is a preferable system comparing to other business intelligence systems, since it is a dynamic system.

4.1. Scrum

The work methodology that has been used in this study was Scrum. Scrum is a process framework used for complex product development. It is based on a scrum team working in iterative periods called Sprints. The duration of a Sprint can be up to one month. A team consists of a Product Owner (PO) and a Development Team. The Development Team consists of developers and a Scrum Master. The Scrum Master supports the team to follow the Scrum methodology and should be the link between the Development Team and the Product Owner. The Product Owner is responsible for keeping the quality of the product by sorting the most important tasks for the Development Team to work with for every Sprint. The functions and features that are wanted in the product are kept in a Product Backlog. The Product Owner is responsible for the content, ordering and availability of the Product Backlog. The Scrum process is a dynamic process, i.e. the content and ordering of the Product Backlog items is constantly changing. The highest ordered Product Backlog items should be described more in detail (Schwaber & Sutherland, 2011).

A Sprint Backlog consists of the features and functions that the Development Team will work with during a Sprint. A Sprint begins with a Sprint Planning Meeting, timeboxed (a one month Sprint will require a Sprint Planning Meeting of eight hours), which is divided into two parts. In the first part, the Development Team will select a number of items from the Product Backlog to work with during the upcoming Sprint, and during the other part, the Development Team will discuss and determine how a function/feature will be build and when it should be done. The chosen items together with a short description will be represent items of a Sprint Backlog. During the Sprint the Development Team will have a daily meeting, timeboxed to 15 minutes, called Daily Scrum. This to synchronize and plan for the upcoming day, where every team member tells what they did the day before, their plan for the actual day and if any obstacles exists (Schwaber & Sutherland, 2011).

In the end of a Sprint a Sprint Review is held, where the Scrum team together with stakeholders is going through the results of the Sprint. This meeting is timeboxed to four hours for a one month Sprint. The Product Backlog is discussed and it may be adjusted. This is where the stakeholders can influence the Product Backlog and thereby the development of the product. This gives the stakeholders the opportunity to give instantaneous feedback during the development of a product. After the Sprint Review, a Sprint Retrospective is held, where the Sprint is discussed and a plan for improvements for the next Sprint is established. This meeting is timeboxed to three hours for one month Sprints.

The items of the Product Backlog that are completed will be added to the so called Increment. The Increment is all the completed Product Backlog items altogether, i.e. the product. Subsequently, the Development Team will deliver an increment of product functionality every Sprint. The Product Backlog items will be completed when a Definition of Done (DoD) is achieved, i.e. a list of items that defines when a Product Backlog item is done. The Development Team establishes this list themselves in order to provide shared understanding (Schwaber & Sutherland, 2011).

Scrum is used in this study with a modification since it is not a team that is performing this study. The author was attending a professional Scrum Master Certification course by Cedur AB in order to learn about the methodology, where the certificate Professional Scrum Master I was received from Professional Scrum Foundations (scrum.org). The planning of this study was divided into four weeks periods, according to the periods used at the company. The overview plan was performed in the beginning of the study and more specific plans for the details were done continuously for the different parts of the study. The results of every four week period and the result day by day was presented to the company and the Development Team during the Sprint Review and Daily Scrum stand-ups as long as the opportunity was given. This was done in order to learn about scrum and how scrum is working in an organization.

5. Results

The results are divided into two parts, the patient flow analysis presented in 5.1. and the emergency department information system edition in SAFE presented in 5.2.

5.1. Patient flow at the emergency department

The patient flow through the emergency department consists of three landmarks; triage, physician and discharge, from which the main lead times are measured. These are time to triage (Tid till Triage, TTT), time to physician (Tid till Läkare, TTL) and total processing time (Total Genomloppstid, TGT) and are used to measure the productivity at the emergency department. In Figure 3, an example map of an emergency department can be seen.

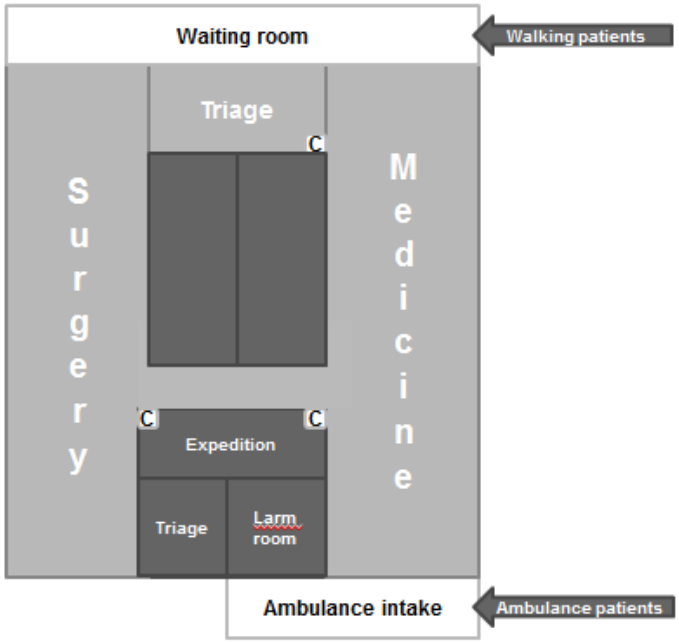


Figure 3. Example map of an emergency department

5.1.1. Coordinators, healthcare personnel and guards

This section gives a brief introduction of the different roles at an emergency department. The coordinator is the person that keeps track of the patients, personnel and physicians. Some emergency departments have one coordinator for the whole emergency department, while others have one per discipline. The coordinator is the person that has the overview of the overall situation at the discipline/emergency department, distributes assignments to the healthcare personnel (the personnel at the floor), prioritizes patients to the physician and is responsible for the logistics of the patients. The coordinator will more precisely take a short anamnesis and register patients, listen to the report after triage and mark the priority color in the acute information system and register transitions for the patient at the emergency department. These transitions can be triage (beginning/end time), physician (time), examination (beginning/end time), observation and caring (time) and when the patient is ready at the emergency department (time). The coordinator also checks for test results for the blood samples, check for answers from x-ray examinations and answer the phone and make

calls to different instances. These phone calls can be about forewarnings, to/from the guards, to/from the x-ray department or to/from wards etc.

The healthcare personnel at the floor consist of nurses and assistants, who will have the overall view of the patients and situation at the discipline/emergency department and reports about it to the coordinator. They are responsible for patient triage, performing assignments that the coordinator delegate, take short anamnesis of arrival patients, register patients and settle alarm teams for arriving alarm patients.

The guards are responsible to transport the patient to and from the emergency department and between wards. The guards will often be placed in connection to the ambulance hall so they will meet up with walking patients and direct them to correct discipline, meet up with ambulances and help them moving the patient from the ambulance gurney to a gurney and meet up alarm patients coming with ambulance and help moving the patient to a gurney, often in an alarm room. They are also responsible for the overall security and for guard rounds, but will also be available to handle violent patients until police has arrived.

5.1.2. Inflow of patients

The inflow of patients is mainly represented by walking patients and patients arriving with ambulance, but is also represented of patients arriving with patient transport, helicopter, police and toll.

Walking patients includes all the patients that arrive to the emergency department going through the entrance. These patients are either visiting the emergency department due to own perceived problems or with a referral from another healthcare instance such as the primary care. These patients are either taking a queue number or register in a reception and then waiting for triage in a waiting room. At the emergency departments where the patient takes a queue number, the number will be announced and a nurse/assistant nurse will meet up with the patient at the entrance to the triage room and ask for identification and the cause of contact. The patient will then be registered either by the personnel that have meet up with the patient, a secretary or a triage coordinator. Afterwards, the triage is performed. At some emergency departments and at some hours the walking patients are entering the emergency department the same way as the ambulances. In these cases the patients will be referred to the discipline the patient may belong to by the guards. If the patient arrives to the wrong discipline the patient will either be directly referred to the correct discipline or being registered and informed that personnel from the correct discipline is coming to triage the patient.

The patients arriving with ambulance are arriving either as an alarm, trauma alarm, forewarning or without report. The arrival and care of alarm and trauma alarm patients will be described in 5.1.6. The communication between ambulances and emergency departments differs between emergency departments. It can be performed via the acute module Paratus ED by Saab AB, via telephone or via other systems used for this manner. The acute module displays all arriving ambulances with information about the status of the patient, vital signs,

preliminary arrival time; it is also possible to send messages if there are any ambiguities. At other emergency departments where the acute module is not used the ambulance personnel calls an alarm telephone regarding alarm patients or to the coordinator at the responsible discipline regarding forewarnings to report the status of the patient, actual information, vital signs, given treatment and the preliminary arrival time. This line is often disturbed by different parameters such as the sirens and the isolated ambulance, which make it difficult to hear all details in the conversation.

In the cases where the ambulance arrives without contacting the emergency department, the patient is rolled in on a gurney to the responsible discipline or to the triage discipline, according to the local routines. The ambulance personnel have registered the actual facts about the patient in the ambulance journal systems and in the eventually existing acute module, but for further care at the emergency department a paper journal have to be completed or printed. Thereafter, the ambulance personnel verbally report the patient to the coordinator or to a healthcare personnel and the patient will thereafter be registered and placed in the queue for triage.

When the patient is arriving as a forewarning a report about the patient and about the arrival is performed via telephone or via the acute module. A decision is made about whether the patient should be rolled in to one of the triage/alarm rooms or into the corridor as a none-reported patient from the patient's condition. If the patient is rolled into a triage or alarm room healthcare personnel may meet up with the patient, based on the patient's condition. The report is performed verbally either to the personnel that meet up with the patient in the triage/alarm room or to the coordinator as for the none-reported patient.

The patient can also arrive with police or toll and these patients will be placed on a gurney by the guards and rolled in to the responsible discipline and the personnel from police/toll will report their agenda of the visit. It is the guards together with the police/toll personnel that decide about the responsible discipline due to the cause of contact. It can handle about blood samples from drinking and driving patients, toll issue such as different kind of smuggles or just a transport of patients which the police have been in contact with. If it is an issue initiated by the police or toll, i.e. the healthcare is used for investigation of a police/toll issue, the police/toll personnel will stay by the patient until the patient is discharge or registered as a patient at the emergency department for care.

At a triage discipline, the patient will either take a queue number or register in a reception after shortly described the cause of contact and thereafter sit down and wait for triage, this according to locale routines. The queue number will be announced or the patients name will be called when it is the patients' turn to be triaged. The patients with queue number will be asked to give a short description of the cause of contact and thereafter they will be registered. The patients that have arrived with ambulance to the triage discipline will be registered meanwhile or after the ambulance personnel have been reported about the patient and thereafter the patient will be triaged along with the walking patients as soon as there are personnel available for triaging. At the different disciplines, the patient will be triaged due to

the triage queue. This queue is formed by the coordinator, according to the patient's time of arrival and the patient's condition. The patient's condition will be assessed either by the ambulance personnel or by the personnel at the emergency department during the first contact.

5.1.3. The registration

The patient will be registered in different amount of systems according to local routines at different emergency departments. Generally, the patient will be registered in a patient administrative system which keeps track of the patient through the visit at the emergency department and in a journal system which is used for documentation and for eventual hospitalization. Printing of labels for different kind of samples is performed in a laboratory system.

The personal identity number is used to register the care contact in the systems and therefore the identification card is requested from the patient. If the patient is incapable of stating the personal identity number and has no identification card, a reserve number can be created. The care contact can afterwards be connected to the actual patient's journal when the patient is identified. When the personal identity number is fulfilled, personal data such as name and address are gathered from a personal database and will automatically be filled in. If the patient is from another country and thereby receive a reserve number, the personal data must be filled in manually. Afterwards, a list of different parameters for the care contact must be filled in. These parameters are cause of contact, responsible discipline according to cause of contact, type of identification, type of care request, type of care, type of arriving and there is a commentary field where information such as if an eventual free card is not registered. A free card is a card that patients receive if a high-cost ceiling for healthcare has been reached. It gives the patient free healthcare.

The patient will then be placed in a list of registered patients where important data will be visualized in different columns and one column is prepared for manual commentaries. These columns are locked and consist of for instance columns for secrecy, patient data, cause of contact, priority, last event, responsible discipline and time of registration. In the patient administrative system used at Östra sjukhuset, the patient flow through the emergency department is displayed in a timeline and the events are created by drag-and-drop of the patient into folders. Some of these events should be ended, which will be done by unregister the patient from the folder and the time difference will be displayed in the timeline. Identification band and personal data labels are printed from this system.

The patient journal used to document the events for every patient during the visit at the emergency department is either initiated at the emergency department when the patient is arriving or continued on at the acute journal from the pre-hospital care. This is mainly used in paper form, but in some cases it is used in the journal system. The journal from the ambulance is either continued in paper form or printed as a report from the ambulance journal systems. The paper journal will be provided with a personal data label and thereafter it will be placed

in the queue for triage. This will be done in different ways at different emergency departments according to local routines.

5.1.4. Triage

A triage is performed when the patient visits the emergency department in order to get a first assessment of the patients' health condition and to prioritize the patient for the physician. It will be done in a triage room, but if these are occupied, other rooms can be used. In case the patient is suspected to have any contagion such as for instance gastroenteritis, i.e. stomach flu, he/she will be positioned in a room where he/she will be isolated. The triage will be performed in this room, in order to decrease the risk for spreading the infection.

The patient will either be rolled into the triage room on the gurney they have been placed on or a gurney will be prepared for the patient in the triage room. When the patients arrive to the triage room they will be requested to take off necessary clothes so that needed examinations can be performed and in some cases to put on a hospital shirt. Afterwards, the triage session begins and the patient will be requested to lay down at the gurney.

Triaging with the RETTS acute journal consists mainly of three types of sessions. Vital parameter data are collected, patient data and information about the actual situation is gathered and necessary examinations are performed according to the cause of contact. The complete acute journal, trauma journal and an example of ESS algorithm can be seen in Appendix 1. All these sessions are performed in parallel. Generally, if two healthcare personnel are performing the triage, one takes controls and works near the patient and the other asks questions; this is most efficient. If one personnel perform the triage alone, it will generally take longer time due to that some work tasks cannot be performed at the same time by one person.

The questions are some standard questions, about the actual situation and verification of the identification. The standard questions are about secrecy, allergy, blood disease, vancomycin-resistant enterococci / multi resistant staphylococcus aureus (VRE/MRSA) which are multi-resistant bacteria, gastroenteritis, need of caring and name and number to the next of kin; all are filled out in the journal. If the patient has any allergy or blood disease, the corresponding allergen and disease will also be noted at the journal. The patient is suspected to have VRE/MRSA if they have been cared abroad, received dental care or have made any invasive intervention the last 10 – 12 years in another country than Sweden, according to local routines. The suspicion of gastroenteritis is based on the patient's actual symptoms and if anyone of the patient's relatives has had stomach flu or if the patient has met someone with stomach flu the last days before the visit. The need of caring is assessed by the clinical view of the patient's mobility and functionality and by asking how the patient manage at home. The patients are for instance asked if they use some kind of aids at home, such as rollator.

The personal identity number is requested to identify the patient before the identification band is applied. If it is difficult or impossible for the patient to state the personal identity number, the relatives can verify that it is the correct person. If the patient is coming from a caring

resident, the patient may already have got an ID-band by the personnel at a caring resident. The personnel from the caring resident must follow the patient to the hospital and stay with the patient during the visit at the emergency department and the identification can thereby be verified by the resident personnel if the patient is unable to state his/hers identification number. The id-card is returned when the id-band is applied and these two actions are then noted and signed at the journal.

The patient will be asked to describe the cause of contact. The healthcare personnel will ask questions while the patient describes his/her situation to clarify details and to gather the amount of information that is needed to make an assessment about the patient's health condition. This information is noted in a free text area in the journal. The history of diseases is requested and filled out in the journal, for instance by asking the patient about the actual medication.

Vital parameters monitored are saturation, breathing frequency, pulse, blood pressure, state of consciousness and body temperature. The collected values are noted in the patient journal. In the cases when RETTS is used, every vital parameter gives a priority color and the highest color will be the overall priority color for the vital parameters. Oxygen saturation is measured with a sensor placed at a finger or at the lobe of the ear. Breathing frequency is either counted manually or through a sensor placed in one of the nostrils or by the monitoring system via the electrocardiography electrodes. Pulse and blood pressure are measured by a monitoring system, but will in some cases be measured manually due to unreliable results or if the system cannot perform the measurement. The state of consciousness is assessed by the personnel using Reaction Level Scale (RLS 85) or Glasgow Coma Scale (GCS). Generally, these scales assess the state of consciousness stepwise. This is done by examining whether the patient responds when spoken to and if the patient is orientated in time, room, person and situation. To assess about the patient's orientation the patient is asked questions such as about the actual year/month/date, name and personal number, about where the patient is and about the actual situation. If the person does not responds to this type of attempt of contact, different kind of pain stimuli is performed to measure the grade of unconsciousness. The last parameter measured is the body temperature, which is measured in the mouth, ear, axilla, rectum or if the patient receives a temperature urinary catheter the body temperature can be measured through this.

The sessions described above are standard for all patients, except for those who are assessed not to be in need for triage. These patients will get the lowest priority, i.e. blue priority. For the patients that have gone through these sessions, there will also be examinations, blood samples and other interventions based on the cause of contact and priority color. In RETTS, the patient will be assessed through an algorithm which is chosen from the cause of contact. This algorithm tells the healthcare personnel about the specific triage interventions and its result in combination with the description of the patient's condition will give the patient a priority color for this ESS-algorithm. The specific triage interventions can be electrocardiography and capillary blood samples, blood count (Hb) or blood sugar (p-glucose). The algorithm number and color are noted in the journal in combination with a

signature by the nurse who made this assessment. If the patient is searching for multiple reasons, the algorithm that gives the highest priority color should be used.

The total priority is decided by the highest priority color from the vital parameters and the ESS algorithm. The total priority will decide which blood samples that should be taken and which process interventions that should be performed. Blood samples should generally be taken at yellow, orange and red prioritized patients and peripheral venous catheter should be applied at patients with orange or red priority. The healthcare personnel can also use the clinical view to assess if a patient needs any specific intervention.

The patient that arrives with ambulance already has an acute journal where the triage has been started, this will be handed over by the ambulance personnel, or printed out, and the personnel at the emergency department continue from there. The parts of the triage that have not been done are complemented and parameters may be re-measured if the deviation from the normal value is high or if the healthcare personnel assess that it needs to be re-measured. If a parameter has changed to the better, the total priority may be lowered. This can be done as long as the priority color of the new parameter value is higher priority or the same as the priority of the ESS priority color. Only the physician can reprioritize to a lower priority color than the ESS priority. If the re-measured parameter gives a higher priority color than the initial one, the priority will be increased.

After the triage is done, the patient will shortly be reported to the coordinator and the actual occupancy will be inspected to find a room or position where the patient can be placed while waiting for the physician. The patients that are prioritized orange or red should be monitored and will thereby be moved to a room with monitoring equipment. If these are fully occupied, the patient may be placed in the corridor with mobile monitoring equipment or stay in the triage room. The patients that are lower prioritized are either moved to a room, into the corridor or into a waiting room according to the actual occupancy. Sometimes even these lower prioritized patients need monitoring, which in these cases have been assessed clinically, and therefore these patients also may be placed where they can be connected to a monitoring system.

The patients that are positioned in the corridor or in a waiting room will be placed in a room as soon as it is empty and when the turn to the physician is approaching. Patients can also be moved during the waiting time, due to the current occupancy and situation at the emergency department.

5.1.5. Physician

After the triage has been performed, the patient will be waiting for meeting the doctor. This can take minutes up to several hours. The meaning of doctor in this study is a physician with any medical level of graduation with or without specialization who working with patients at emergency departments. The registered patients will be prioritized for the doctor by the coordinator, mainly according to the priority color. Patients within the same priority will be mutually prioritized due to the patient’s condition and arrival time. This queue will constantly

change due to that alarm patients and patients with higher priority may arrive during the waiting time.

The physician that is ready to take the next patient in the queue goes to the nurse expedition and takes the next patient according to the priority the coordinator has settled. The system to visualize the priority differs between different emergency departments, but in principle the next up to three patients are visualized for the physician. The visualization is done using some kind of tags placed for instance at the paper journal or at the room number, i.e. some kind of bin where the journal is placed. Sometimes the coordinator may not have prioritized the patient for various reasons, and in these cases the coordinator will tell the physician who is next or the physician have to ask the coordinator about this. When the physician has got the next patient and the journal belonging to this patient, the coordinator will mark that the physician has taken this patient in the patient administrative system and eventually tell a short conclusion about the patient's actual situation.

The physician will read about the patient's actual condition in the acute journal and through this get a picture about the actual situation. To get an overall understanding about the patient, the physician will go to the physician expedition and read about the patient in the journal system, look at the answers at the eventually taken blood samples and look at the patient's actual medication, if it is possible. If the patient is from another region in the country or have not visit the hospital before, there will not exist any documentation of the patient in the journal system. Other regions and the primary care journal data are not reachable from the hospital, often due to different journal systems. When the physician has got the overall understanding as far as it is possible, an examination and dialogue with the patient is performed. The physician will therefore visit the patient, who is positioned in one of the rooms at the emergency department.

The patient will be asked to describe the actual situation and the reason for the visit at the emergency department. A short anamnesis is requested, where the patient is asked for the disease history and actual medication. The physician will either memorize these data or note them on a notepad or a combination of these. A physical examination will be performed, including a general examination in combination with a more detailed examination according to the cause of contact. The physician will, with the collected information, decide about the further handing of the patient. The main paths are discharge, further examinations or hospitalization. Further examinations can be x-ray, blood samples, medication and consultation. The physician will inform the patient and the coordinator about the decision, see more details in section 5.1.5., 5.1.8. and 5.1.9.

5.1.6. Examination

As described in the previous section 5.1.4., the physician can decide that the patient should go through one or several examinations and interventions. The physician can either tell the coordinator that the patient can be discharged if the result of the examinations or interventions eventuates in a specific result or that the patient should be reassessed later on.

If the patient should go through an x-ray examination, the physician will inform the coordinator about the decision and write a remittance for the examination. The coordinator will register that the patient should go through an x-ray examination in the patient administrative system. The remittance will be sent to the x-ray department and they will respond to it if any preparations are needed, such as for instance if a peripheral venous catheter in a specific size is needed or that the patient should ingest dye, or if the patient can be transported to the x-ray department to go through the x-ray examination. The personnel at the x-ray department can during this call ask questions such as if the patient can lay still at the examination table or if personnel the emergency department follows to the x-ray department. This will be done if the patient's condition requires it, which they can have interpreted from the remittance. The coordinator will then order a transport to the x-ray department by phoning the acute guards, who will come to the emergency department and take the patient to the x-ray department. If the patient's health condition requires, a personnel from the emergency department will follow the patient to the x-ray department and mostly in these cases the patient will be monitored with mobile monitoring equipment.

When the patient arrives to the x-ray department the requested examination will be performed. Then the patient will be transported back to the emergency department, either by the acute guards or by the personnel from the emergency department, if anyone has followed the patient to the x-ray department. The patient will then be waiting for the answer at the x-ray examination. The coordinator will keep track of the arrival answer and when the answer has been received, the patient will be prioritized to the physician again. It will be registered in the acute system that the answer has been received and the system calculates to total time for the remittance to answer. The physician will then inform the patient about the answer and about the further care.

The physician can decide that more blood samples are needed to make a decision about the further care of the patient. The physician will inform the coordinator about this decision, who delegates the assignment to the healthcare personnel at the floor. The blood samples will be ordered from the laboratory and etiquettes will be printed for the test tubes. The blood samples will then be taken and the test tubes will be sent to the laboratory, either via a transport, such as pneumatic tube post, or someone will walk with them to the laboratory. The coordinator will then look for the answers and when the answers are received, the patient will be prioritized to the physician again. The physician will then inform the patient about the answer and about the further care.

The patient may need some kind of medication for the actual health problems and in this case the physician will prescribe the medication at the journal and inform the coordinator about the prescription. The coordinator will then delegate the assignment to the nurses and the next available nurse will administrate the medication. The effect of the medication will be evaluated after a while, either by one of the nurses/assistant nurses or by the physician. The patient will be reprioritized to the physician and the physician will decide about the further care from the effect of the medication.

The physician may need to make a consultation. This will be done either by calling the physician with the competence that is needed or by writing or dictate a remittance for consultation. The coordinator will be informed about the consultation and the remittance will be sent to the consultant clinic. The patient will thereby be sent to the consulted clinic and be discharged from the emergency department. When the patient has been assessed at the consultant clinic, the patient will either stay at this clinic for treatment or be referred back to the emergency department and an answer of the consultation will be sent to the emergency department. The patient will be registered at the emergency department again and prioritized into the physician queue and the physician will then meet the patient and inform about the answer and about further care.

The physician can also prescribe a lot of other interventions than the ones described above, such as bladder scan, urine catheter, blood culture, urine samples, nasogastric tubes, gastric lavage etc. The coordinator will be informed about the prescription or intervention by the physician, who will delegate this assignment to the personnel at the floor. The intervention will firstly be prepared, thereafter performed and afterwards it will take a little while to clean up and restore order. The effect of the intervention will be assessed either directly or after a while and the coordinator will be informed about the result. The patient will thereafter be prioritized into the physician queue. The physician will evaluate and discuss the effects with the patient and inform about the decision of further care.

The patient may be prescribed several of these interventions described above and thereby the evaluation of the effects may be performed stepwise or all of the interventions together. The physician will inform the patient and the coordinator about the intervention and evaluation plan. Mostly, the patient will be prioritized to the physician for a reassessment after all interventions have been performed and eventually evaluated.

5.1.7. Alarm and trauma patients

A patient can arrive to the emergency department as an alarm patient or as a trauma alarm patient, which will require preparations. Alarm patients are prioritized red and the trauma alarm patient is assessed as a trauma patient through a trauma alarm activation algorithm. The personnel at the emergency department will be informed that a patient of this kind is on the way to the emergency department either via an acute module or via telephone. In acute module by Saab the alarm will be seen in a popup window that has to be confirmed and when the phone rings a sound will be triggered at the emergency department that will make all healthcare personnel aware of that an alarm patient is about to arrive.

The information reported are ambulance number, patient data, such as personal identity number and name if available, anamnesis, description of the actual situation, vital parameters, pre-hospital treatment and estimated time of arrival. At the phone, the personnel at the emergency department can ask questions and direct the ambulance to a specific acute room. When the line is cut it is a process to contact the ambulance again if more questions need to be asked or if any information has to be communicated, so this is not often done. SOS Alarm need to be contacted and by telling the number of the ambulance, the personnel at SOS Alarm

can contact the ambulance personnel at the specific ambulance and divert the call to them. The advantage of the acute module is that the information that the ambulance personnel documents in their journal system will automatically be updated and seen at the emergency department, so no extra procedure is needed. The personnel can send commentaries if anything is unclear or if something needs to be communicated.

The competences required by the alarm patient's health status are gathered and start preparing for the alarm patient's arrival as soon as they are aware it. There will be nurses, assistant nurses, responsible physicians according to cause of contact and personnel from inside the house if needed, such as anesthesia personnel and jour physicians. A physician will be informed so that a decision can be made of which other competences that should be involved. The anesthesia personnel are being summoned through an anesthesia alarm and if other physicians are needed, the responsible physician will contact them. The preparation for the healthcare personnel can consist of reading about the patient in the journal system, preparing the possibly needed equipment and put on gloves and apron if needed. The most important is to mentally prepare for the problem the patient may have and eventual intervention that may be needed. The guards will also be informed about the arriving alarm patient, the preliminary arrival time and type of alarm patient, which gives them time to prepare for the arrival.

When the patient arrives to the emergency department, the ambulance gurney will be rolled into an alarm room and guards will follow. The ambulance personnel will give a fast report about the patient and during this time the alarm team should just listen, i.e. not start working with the patient. The coordinator will register the patient as soon as the identification data is known. Afterwards, the patient will be moved to a gurney, which the guards will help with. In some cases, the patient will be moved to a gurney in the ambulance hall before rolling into the acute room, which the personnel that receives the alarm decides about. The ambulance hall is the room the ambulances arrive to with their patients at the emergency department. The guards will thereby leave the alarm room, if it is not a risk that the patient will be violent to the personnel; in these cases they will stay. When the patient is placed on the gurney, the work and examination of the patient can be started. The nurses and assistant nurses will complete the triage process and the physician will examine the patient. The physician can prescribe interventions and medication in parallel with the triage process. These interventions and the ones included in the triage process are performed according to the possibilities, i.e. if the needed part of the patient is available and if the interventions that needed before are done. The interventions depend on the cause of contact of the patient.

In the case where the patient is a trauma alarm patient the process will be the same until the movement of the patient. If the patient is placed on a spine board, the patient will be moved to a trauma gurney and the spine board will be loosened at the same time as the patient being stabilized. A spine board is used to immobilize the spine of a patient that is suspected to have spine injuries. The patient will have a cervical collar that stabilizes the neck and if the patient does not have it and the indication exist, the neck needs to be stabilized and a cervical collar needs to be applied. Indication of a cervical collar can be that the patient has experienced a trauma and perceives pain in the neck. Before the patient will be belted at the trauma gurney,

a log roll will be performed and the physician examines the spine for eventual damage. A log roll is a turn of the patient to one of the sides by at least three persons, where the patient will be stabilized to minimize or prevent movement of the spine in order to prevent further damage. When the patient's spine has been examined, the patient will be rolled back and fastened at the trauma gurney. That makes it impossible for the patient to make any movements, in order to prevent further damage.

The RETTS-T trauma journal is used for trauma patients, which is based on the advanced trauma lifesaving concept Advanced Trauma Life Support (ATLS). A primary assessment should be performed using the survey ABCDE (airway, breathing, circulation, disability and exposure) as in Table 1. If it is done correctly, life-threatening injuries such as airway obstruction, chest injuries with breathing difficulties, severe external or internal hemorrhage and abdominal injuries can be identified (Wilkinson & Skinner, 2000).

Table 1. The concept of ABCDE (Wilkinson & Skinner, 2000)

	Aim	***Controls***	***Intervention***
Airways (A)	The airways are checked for obstruction.		Clear the airway, through back slaps and abdominal thrusts, bending the head backwards, oral or nasopharyngeal tube, orotracheal intubation or coniotomy.
Breathing (B)	The breathing is checked to find respiratory efforts.	Saturation (SpO_2) Breathing frequency (BF)	Oxygen, CPAP, breathing assistance (pocket mask, bag valve mask, non-invasive ventilation – ventilator via face mask, invasive ventilation – ventilator via endotracheal tube)
Circulation (C)	The circulation is checked to find circulatory efforts.	Pulse (P) Blood pressure (BP)	Establish intravenous access (peripheral intravenous catheter, intraosseous needle), hydration with drip, CPR, cardioversion, ECG
Disability (D)	Disability is checked to find cerebral efforts and eventual mechanism.	Consciousness (RLS/GCS)	
Exposure (E)	A whole body inspection is performed to find external efforts	Temperature	

When the triage is performed, the physician has examined the patient and the needed intervention is performed, the patient often goes to the x-ray department. An x-ray examination is performed of the body parts that may be hurt. If there is any damage shown at the x-ray, these will be intervened either at the emergency department or during a hospitalization. The patient can also be hospitalized for observation.

5.1.8. Observation and caring

There can be long waiting time until the patient meets a physician. Therefore, it is important to observe and assess the patient continuously in order to prevent deterioration of the patient's health status or detect if the patient is in need of care. The higher priority, the more important the observing is, but it is also important to observe patients in need of different type of caring. Caring can be eating assistance, assistance during different kind of movements, toilet visits and care for patients with reduced mobility. The contact with the patient can either be initiated by the personnel or by the patient.

The patient can call for help by pressing a belly button or by stopping personnel passing by. If the patient has pressed a bell button, available personnel will answer the call by going to the patient, turning off the bell and ask the patient what kind of help the patient is in need of. The same will be for the personnel that passing by, but this personnel may say that the patient have to wait a while if the personnel was about to do something. When the personnel know for what reason the patient was calling, the personnel can help the patient. If more personnel are needed to help the patient, the personnel that answered the call will go and get additional personnel. If nobody is available and if there is no risk for the health of the patient, the patient has to wait until someone is available.

There can also be the personnel that visit the patient for different reasons or just for observing the status of the patient. Eventual interventions or controls can be performed and a reprioritizing can be done if needed according to the reassessment. If the patient ask for help during this visit, the personnel will be able to help the patient or by getting additional personnel to help the patient.

5.1.9. Hospitalization

The physician can decide to hospitalize the patient, either for care or observation. The coordinator will be informed about the decision and the physician will dictate, prescribe medications and fill in the hospitalization part of the acute journal. When this is done, the coordinator will receive the acute journal to be able to inform the necessary parties about the hospitalization. The necessary parties could be the responsible of the occupancy, the ward the patient will be hospitalized at or to a ward responsible for the occupancy. The secretary will write the dictate. The patient will either be welcome to the ward after a verbal report or after the dictate has been written and read. When the patient is welcome, the coordinator calls the guards to order a transport for the patient to the ward and the guards will bring the acute journal together with the patient to the responsible ward. Sometimes the personnel from the receiving ward will come to the emergency department to get the patient and sometimes the personnel at the emergency department bring the patient to the ward. This is often done when the patient is in need of monitoring or observation during the transport.

5.1.10. Discharge

If the physician decides to discharge the patient, the patient will be informed about the decision and if any follow-up are needed. The patient can be discharged or discharged with an

electronic prescription of a medication, with a booked time for an examination, with a booked follow-up time at a clinic or by getting remittance to another healthcare instance. The patient can also, on the physicians' advice, return for a reassessment at the emergency department if the symptoms will last for an amount of time or with the advice to contact the healthcare if the symptoms reoccur or getting worse.

The physician also informs the coordinator about the discharge and whether some interventions should be performed before the patient leave the emergency department, such as medical administration. If an intervention should be performed before the discharge, the coordinator will delegate the intervention as an assignment to the healthcare personnel working at the floor. If the patient has any peripheral venous catheter, the removal will be delegated as an assignment. Afterwards, the patient is ready to leave the emergency department.

The patient may need help with transport home, which can be arranged if the patient fulfill the criteria to receive it according to local routines. If the criteria are fulfilled, a transport is ordered to the address where the patient wants to go. Otherwise, the patients may arrange transport themselves or get ride home by relatives. In the cases where the patient has home care and where it is a need for the home care personnel to meet up with the patient when the patient arrive at home, the home care will be contacted by the healthcare personnel at the emergency department. They will be informed about the discharge of the patient and the estimated time of arrival at home.

5.2. Using SAFE as an emergency department information system (EDIS)

The examination of whether SAFE is usable for emergency departments or not, ended up with a configuration with features that will support patient flows and work processes at the emergency department. The most important is that this system will automatize many steps in the work process that today are performed manually, which would be timesaving. It will increase the patient security, due to that the paper journal is transferred into a digital format. Every click and action will be logged, which is positive from a patient security point-of-view, but it is also important for producing statistics for follow-up and improvements of the emergency care. The system is planned to include issue management of the patient, issue management of assignments, resource management of the personnel, occupancy management and statistical management.

The management of the patient will include the flow through the emergency department, from registration to discharge. If the patient arrives with ambulance, this will be indicated in the acute module and when the patient arrives to the emergency department a registration is performed. The work with the patient will be documented in the acute journal RETTS in the system and the overall view of the registered patients can be seen in a registration list. The system will also be integrated with current systems at the emergency departments in order to minimize the amount of systems the personnel has to work within.

The system will handle the personnel working a shift, where it will be indicated if the personnel are available, busy or taking a break. Assignments will automatically be created for instance when the doctor prescribes a medication and attached to the nearest available personnel that has the permission to perform the assignment. The occupancy should be available for the current emergency department, but it should also be easy to see the occupancy at other emergency departments in the region.

5.2.1. System architecture

The system will consist of clients and mobile clients, see Figure 4. The clients can be used in the triage rooms, by the coordinators, the doctors, the guards, the secretaries, for planning of work shifts and for statistical follow-ups. The mobile clients are planned to be used by the mobile personnel at the emergency departments and by the guards for management of assignments. The acute module Paratus ED, which connects the emergency department to the ambulance care, will be integrated into the system. The already existing systems at the emergency department will in the long-term be integrated to the system via gateways and a REST-API. The systems that are planned to be integrated are the journal system, laboratory system, monitoring system, ECG, x-ray, transfusions medicine, occupancy system, national patient system (such as Nationella Patientöversikten, NPÖ) and initially the current acute patient-administrative system.

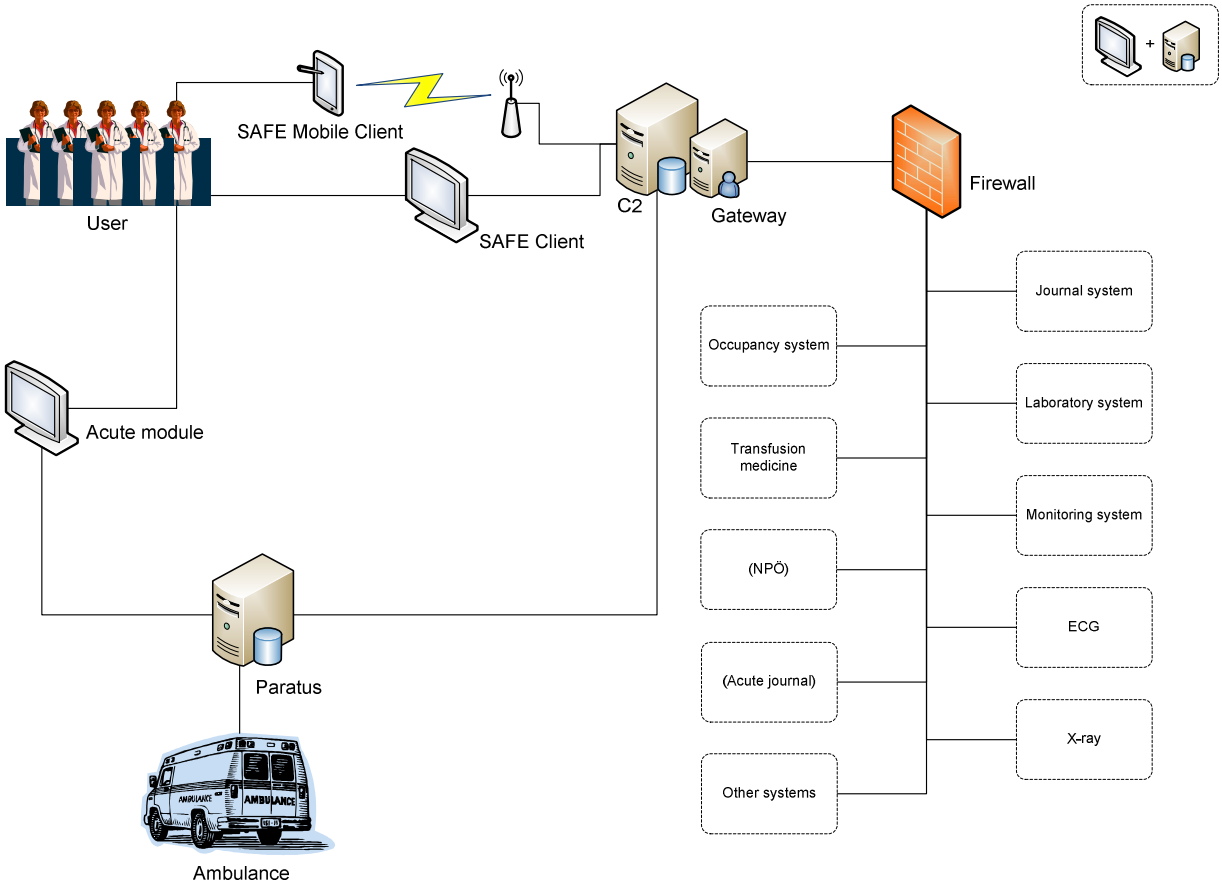


Figure 4. System architecture

5.2.2. Roles and responsibility areas

The login is performed via a login dialogue, see Figure 5. The users of the system will have individual logins, which will indicate which hospital the user working at.

Figure 5. Login dialogue

After the login, the user has to choose a role and the areas the user are responsible for or should be working at during the current work shift. These choices will generate different layouts, see example of coordinator, doctor and triage layout in Appendix 3. In Figure 6 below, examples of users and responsibility areas are shown. When the role is chosen, the available responsibility areas are electable. Some responsibility areas must be covered; these will be indicated with a red marking around the symbol for the responsibility area. The non-available areas will be disabled. It is also possible to choose all available areas by clicking "Select all responsibility areas".

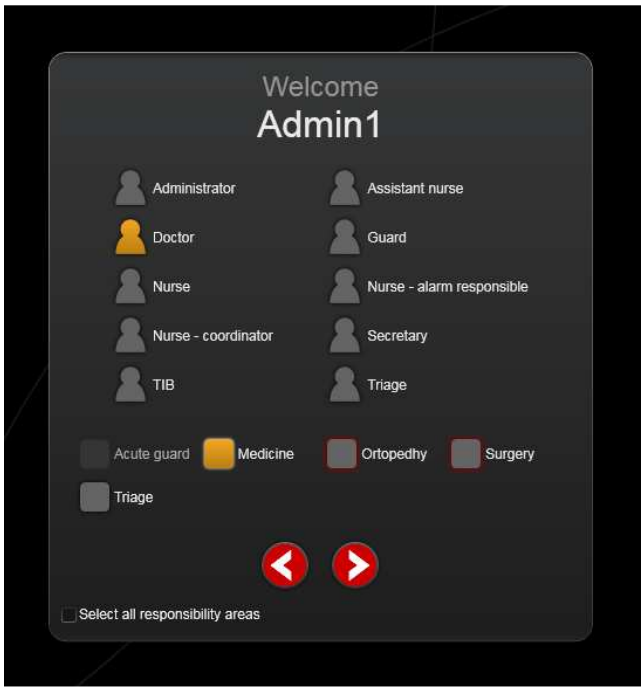


Figure 6. Roles and responsibility areas

The views for the coordinator, doctor, triage, guard and secretary may be client views, which show the modules that are relevant for the specific role. The nurse, assistant nurse and guard could be mobile clients and will thereby be used at an android client, but will also be available in the stationary client.

5.2.3. Paratus ED

Paratus ED is one of many modules in the Paratus product family invented by Saab AB. The purpose of the system is to give the staff at the emergency department an opportunity to act proactive instead of reactive in the emergency care of pre-hospital incoming patients. The Paratus product family manages ambulance care and is used in 18 of 21 counties in Sweden. Today, 11 of 21 counties use the Paratus pre-hospital journal, whereof seven uses the acute module (Dahlbom, 2012).

The acute module is a link to the pre-hospital care and gives an indication about the pre-hospital load, i.e. it has a "built-in mirror" of the pre-hospital care. In this web application, shown in a web browser in SAFE, the coordinator at the emergency department can see the arriving ambulances, including ETA (Estimated Time to Arrival), patient data, vital parameters, ESS algorithm and priority. The pre-hospital patient flow can be followed, due to that the data will be updated in real-time as the journal is produced. A report of the patient journal can be created and printed, and therefore used for the preparation of the arriving patient. If the patient is an alarm patient and the ambulance personnel has registered in the system that the destination is the specific emergency department, it will be indicated in the acute module with a view that has to be confirmed at this emergency department. It is also possible to communicate with the ambulance personnel through a message function. This function can be used to clarify details, to inform the ambulance personnel about for instance which room that are prepared for the patient or to send doctor advices (Dahlbom, 2012).

The acute module has a built-in manager for major incidents. If a major accident has occurred it will indicated in the system and it will be possible to communicate with all the personnel that is involved in this accident. The personnel at the emergency department will be aware of it through a view that has to be confirmed and thereby the work progress on site can be followed. The work process starts when the first ambulance has arrived on site. This one will be called the medical conductor. The medical conductor will perform a through-window report and afterwards they make a first priority assessment of all patients. It will be indicated in the acute module when 1/3, 2/3 and when all patients have been assessed. Thereby, the medical conductor will lead the work on site and direct the arrival ambulances. An official in preparedness (tjänsteman i beredskap, TiB) will be updated about the occupancy at the emergency departments in the region and inform how the medical conductor should direct the ambulances (Dahlbom, 2012).

5.2.4. Registration

The registration of the arriving patient is performed in the registration view by filling in the personal identity number and then creating the patient issue, see Figure 7. The personal

identity number can be filled in with and without the century and with and without the hyphen. Personal data (name, address) will then automatically be filled in via a lookup service that collects the data from a person database. Age and gender is calculated and filled in automatically through the same service. If the patient arrives with ambulance, the ambulance journal data will be obtained through the lookup service and these data will automatically be filled out in the acute journal. The cause of contact according to the ESS algorithm in RETTS will be chosen from a dropdown menu and the discipline will mostly be filled in automatically according to the choice of algorithm, besides for algorithms that can be used for several disciplines and thereby the user has to choose this value from a dropdown menu. Other values that have to be fulfilled are how the patient was identified, eventual free card, the patient's position at the emergency department and how the patient arrived. The fields for type of care request and type of care are filled in with typical values and have to be changed if the typical value is incorrect.

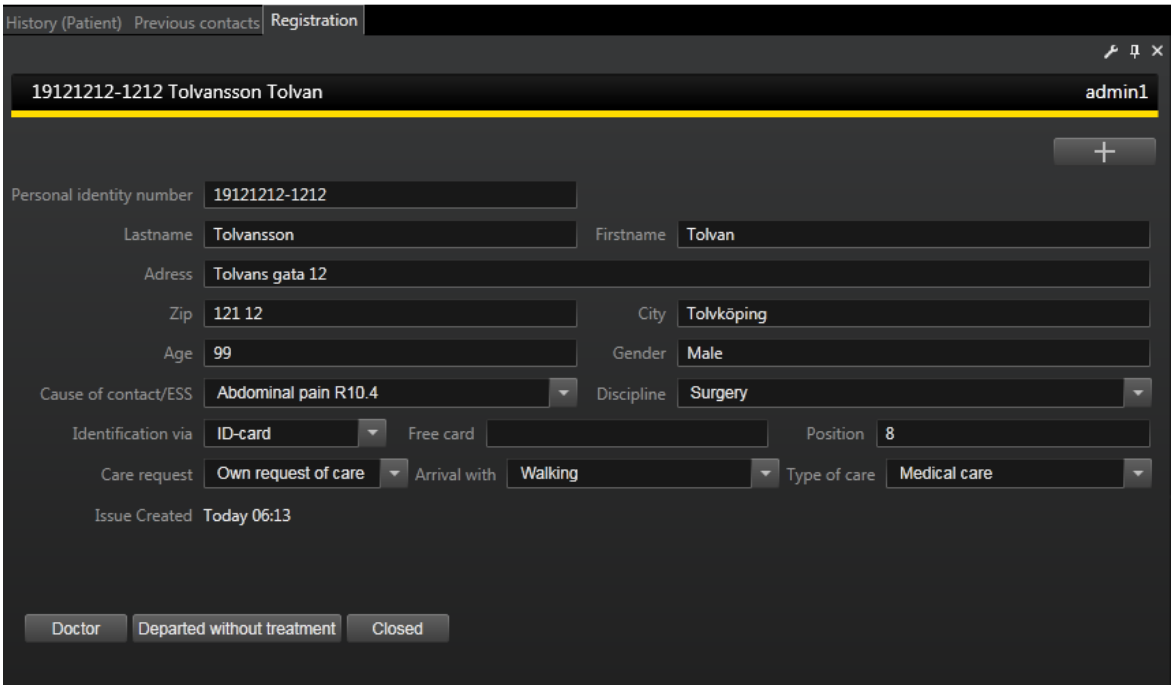


Figure 7. Registration view

In this view, it is also possible to change state in the state transition, which is more detailed described in 5.2.5. When the patient is registered the state can be changed to "*Ready for triage"*, which indicates that the patient is waiting for triage. Earlier contacts and acute journals can be seen in the Previous contacts view, see Figure 8 a), and all actions logged for an actual care contact can be seen in the History view for the patient, see Figure 8 b). The acute journals that will be shown as earlier contacts will be readable, but all properties will be disabled which makes the journal not editable.

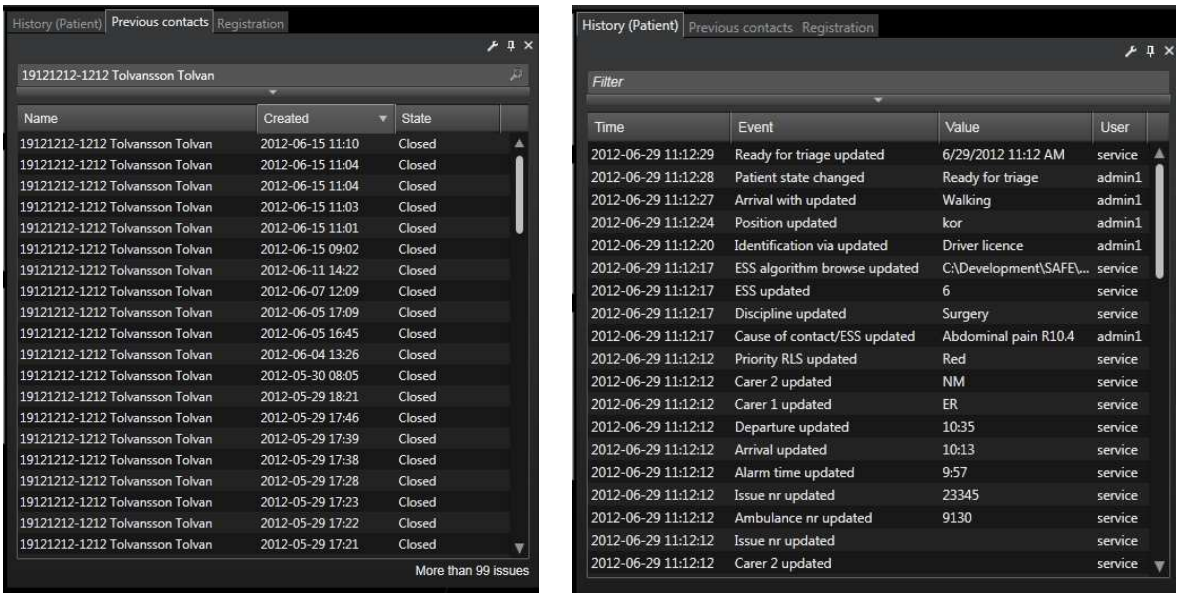


Figure 8. a) Previous contacts and b) History view

5.2.5. Patient flow through the emergency department

The patient flow through the emergency department can be followed through state transitions, where the state will be updated for each performed action for a patient. For each state in the flow the next available transitions are shown, i.e. only the available states from an actual state are possible to reach. See examples of the state transitions in Figure 9 and in the bottom of Figure 7.

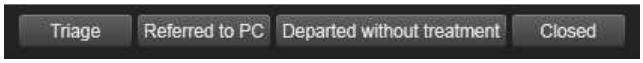


Figure 9. State transitions

The actions performed for a patient are shown in a list in a patient overview, which makes it possible to follow the patient's flow through the emergency department. In this view it is also possible to see different lead times, such as time to triage (TTT), time to doctor (TTL) and total process time (TGT), and how long period of time different actions have been taken, such as triage and x-ray examinations. In Figure 10 an example of this view is shown, where the first events for a patient visiting an emergency department are registered.

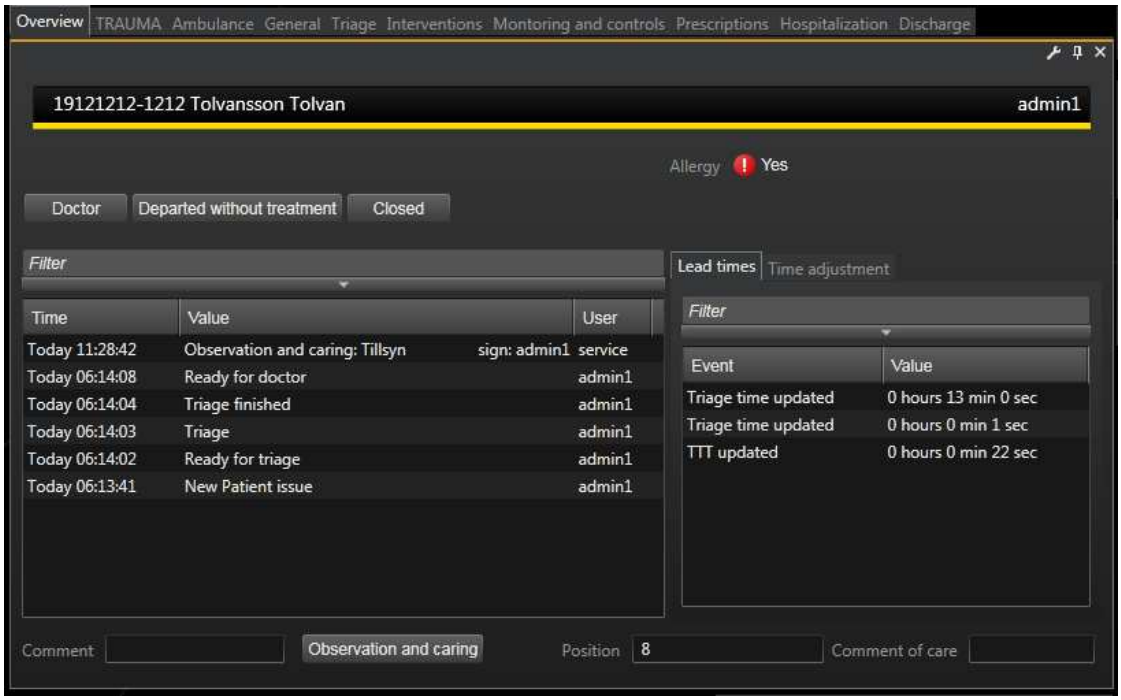


Figure 10. Patient overview

The patient overview tab in Figure 10 will be the tab shown when a patient is selected in the registration list. Sometimes the registration of an action will be performed after the action is performed, which requires a time adjustment. This can be performed in a specific view for time adjustments in the overview tab. The change of times will be registered in the history, which makes it possible to see how these times have been manipulated. This can be seen in Figure 10 where the triage time has been updated more than once. The view where the times can be adjusted is shown in Figure 11.

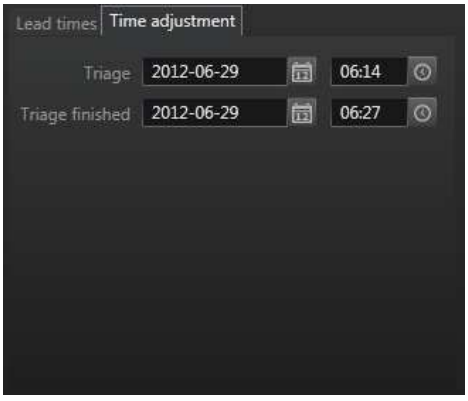


Figure 11. Time adjustment view

Observation and caring actions will also be listed in the patient flow list with a comment of the action that has been performed. A field for general comments that should be shown in the list of all registered patients (described in 5.2.6.) and a field for the position of the patient can be found in the patient overview. If the patient is allergic, is suspected to have VRE/MRSA or have any blood diseases, this will also be indicated in the patient overview with a warning sign.

5.2.6. Registration lists

All registered patients at the emergency department can be seen in a registration list, see Figure 12. Data shown for each patient are secrecy, name and personal identity number, arrival time, discipline, position, cause of contact, priority, actual state and comment of care.

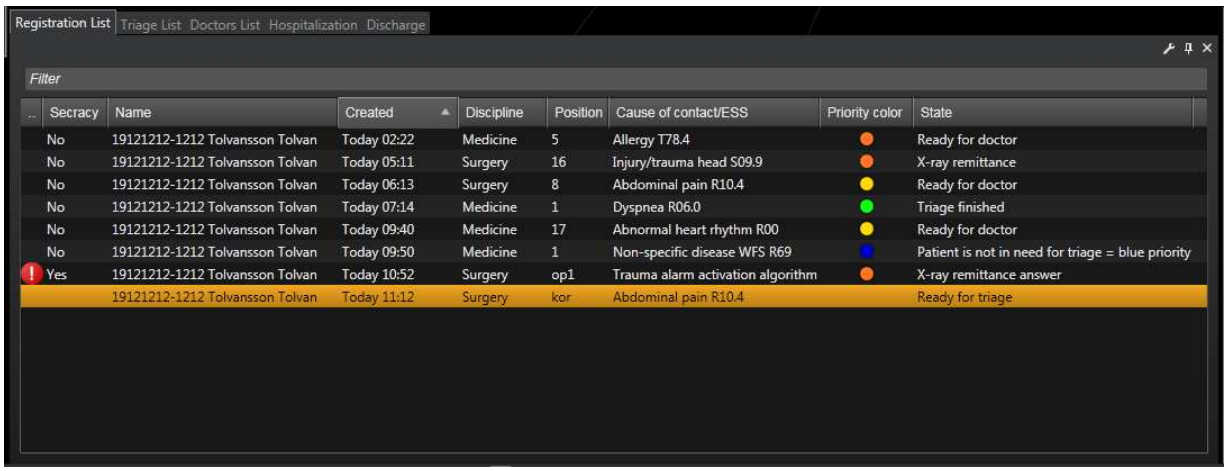


Figure 12. Registration list

The columns can be sorted, ordered in different manner and the list can be filtered in order to present the data the user wants to see. It is also possible to change the data shown in the list if other parameters are desired. There is also a triage list tab, showing the patients waiting for being triaged and the patients that currently are being triaged. There is a doctors list, showing the patients waiting to see the doctor or currently seeing the doctor. The patients that are finished at the emergency department are seen in the hospitalization list and the discharge list. In these different views, the relevant data for the specific list is shown; see Figure 13 and Figure 14.

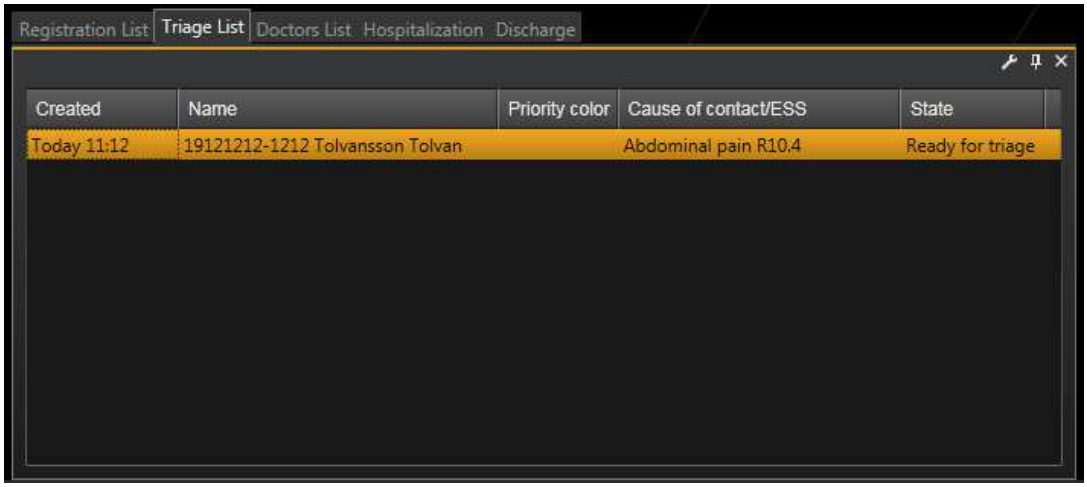


Figure 13. Triage list

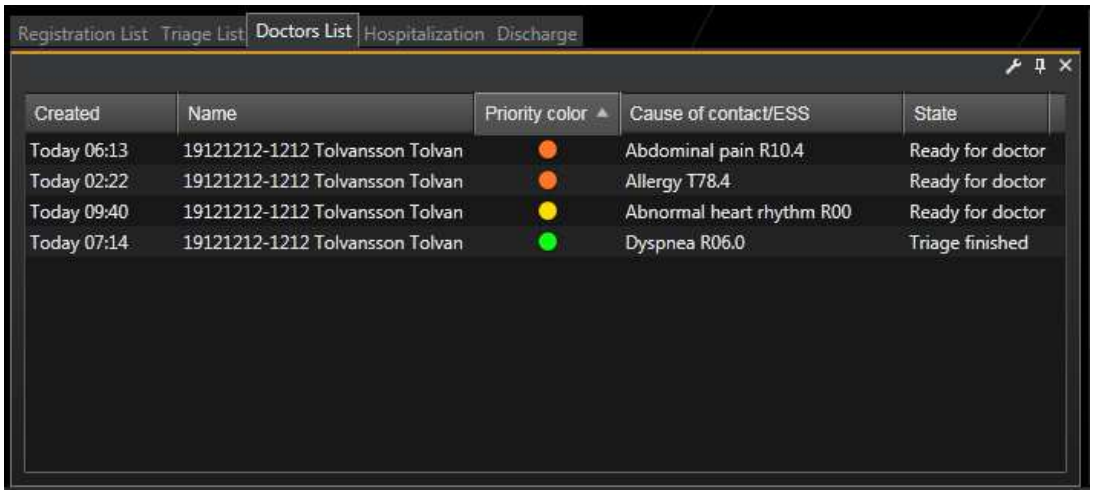


Figure 14. Doctors list

5.2.7. Occupancy

The occupancy of the emergency department can be seen in the occupancy view, see Figure 15. This view will be updated for every new registered patient and every updated state transition. It shows how many patients that are registered in every priority and how many of those that have not met the doctor, i.e. are unseen. In this view it should also be possible to see the occupancy at other emergency departments in a region, in order to see the load at these emergency departments.

Figure 15. Occupancy

5.2.8. Acute journal RETTS

The digitalized acute journal RETTS is shown in the tabs behind the patient overview and trauma journal tab. The parts of the RETTS journal is structurally divided into these tabs, called Ambulance, General, Triage, Interventions, Monitoring and controls, Prescriptions, Hospitalization and Discharge. When the patient arrives to the emergency department with ambulance, the RETTS journal data already fulfilled by the ambulance personnel will be collected from the Paratus database via a lookup service. These fields will automatically be fulfilled in acute journal in EDIS when the patient is registered.

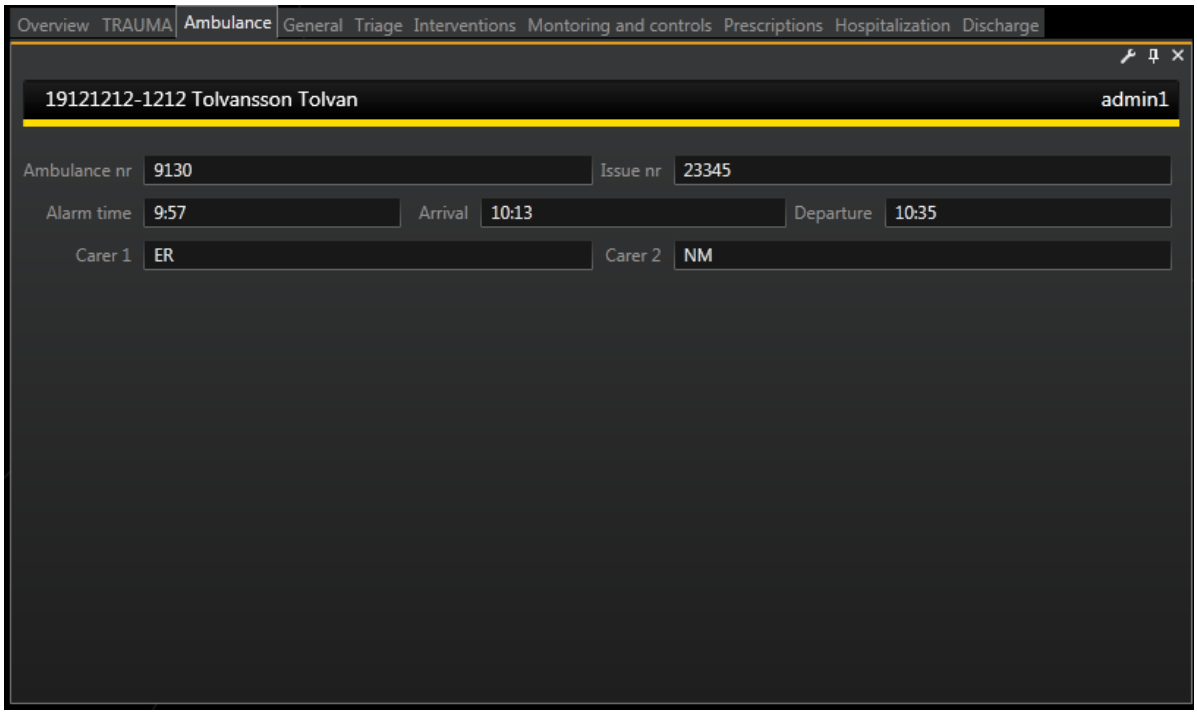


Figure 16. RETTS – Ambulance

If the patient arrives with ambulance, the fields in the Ambulance tab automatically will be fulfilled with data via the lookup service, see Figure 16. Thereby, any active action is not needed in this tab during the triage session. The tab General consists of the general questions in the RETTS journal, see Figure 17. The first questions are about secrecy, allergy, blood disease and suspicion of VRE/MRSA. If the patient answer yes to some of the last three, a free text field for a comment of what allergy, blood disease or in which country and year the patient has been treated is shown. The questions are also about suspicion of gastroenteritis, next of kin, ID-band placement and if the identification card is returned.

This General view also consists of questions about risk of falling, belongings and if the patient is in need of caring. If the last question is answered yes, the care personnel have to register what kind of caring the patient is in need of. This is done by marking which of these autonomies the patient lacks of; go + stand, toilet, drink or orientation. These are fields that otherwise are hidden. The questions in the general view are answered in dropdown menus and most of these general questions are yes- or no questions, which makes it easy to fulfill this view. The ambulance personnel may already have asked some of these questions and in this case the answers will be automatically fulfilled with data from the Paratus database via the lookup service during registration.

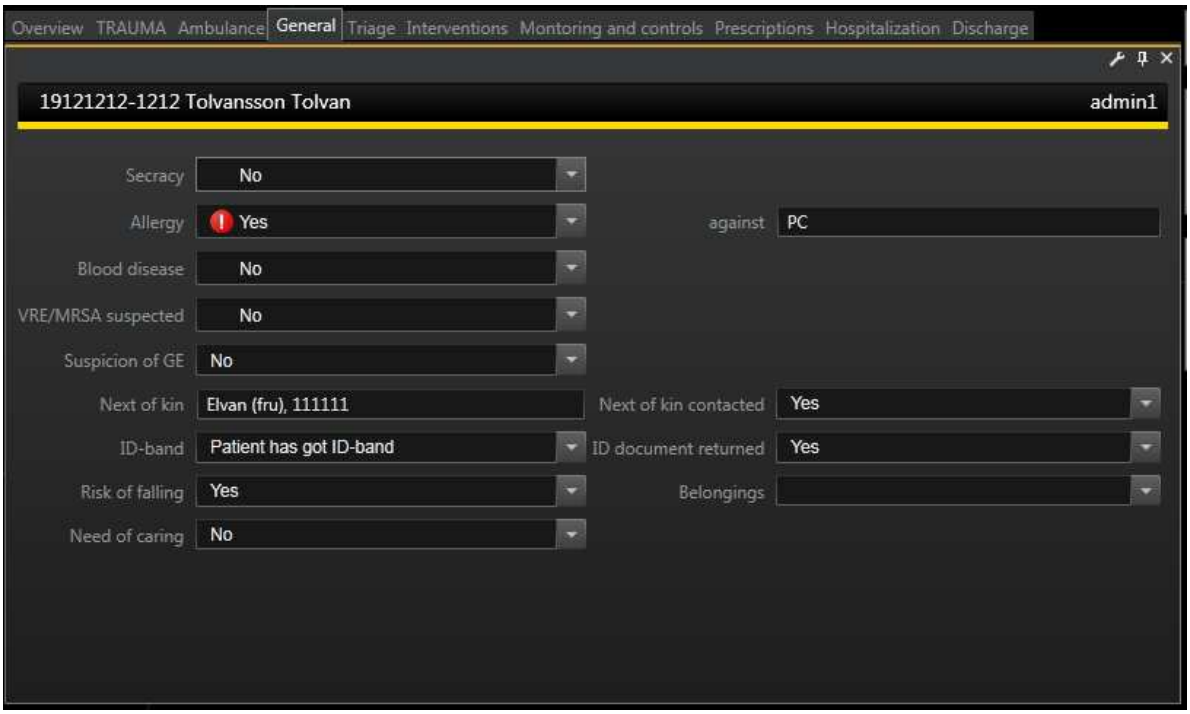


Figure 17. RETTS - General

The next step of the triage will be to fill in in the fields in the triage tab, see Figure 18. This view consists of the vital parameters, cause of contact, ESS algorithm and disease history. If the patient arrives with ambulance, most of these fields will automatically be filled in as in the general and ambulance tab described above. The first parameter is for A – Airways, i.e. whether the patient has airway obstruction or stridor or not. If any of these parameters are chosen, the priority for the airway will automatically be filled in with the value red. As the vital parameters are measured the values can be filled out in respective fields. The values will one by one be verified via the lookup service. The values will be controlled to be in correct format and interval and if it the value is correct the corresponding priority color according to the RETTS journal will be returned from the lookup service. The priority fields for each parameter will automatically be fulfilled with the returned priority. If the saturation is beneath a specific value or the pulse above a specific value, hidden questions about whether the patient has oxygen or irregular pulse, respectively, will be shown with yes or no as answer in a dropdown menu. The temperature can be filled in with comma or dot in the case of decimals. If any of the values are incorrectly fulfilled, a message will be shown about the incorrect value.

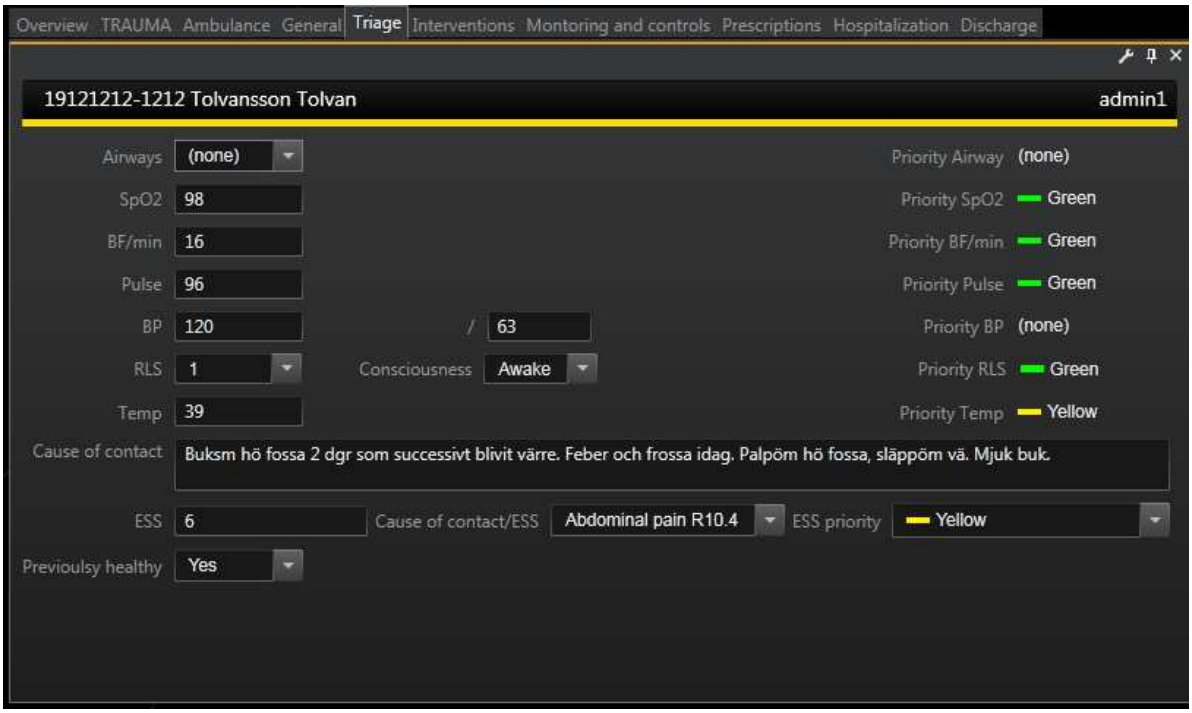


Figure 18. RETTS - Triage

The cause of contact field in the triage tab is a multiline free text field where the personnel can describe the patient's situation and cause of contact. The ESS algorithm is filled in during the registration part and the algorithm number will automatically be fulfilled from the chosen algorithm. The healthcare personnel only need to fill in the priority, according to the chosen ESS algorithm. To facilitate for the personnel in the choice of priority the chosen ESS algorithm can be seen by clicking at the ESS algorithm tab at the right side of the main window, see Figure 19. The ESS algorithms document in this tab is a pdf document shown in a web browser view, presenting the specific page for the chosen algorithm. It is possible to scroll to other algorithms, which can be useful when the patient perceives several different symptoms in order to evaluate which algorithm that best suits the patient's situation. In this case, the algorithm giving the highest priority should be chosen.

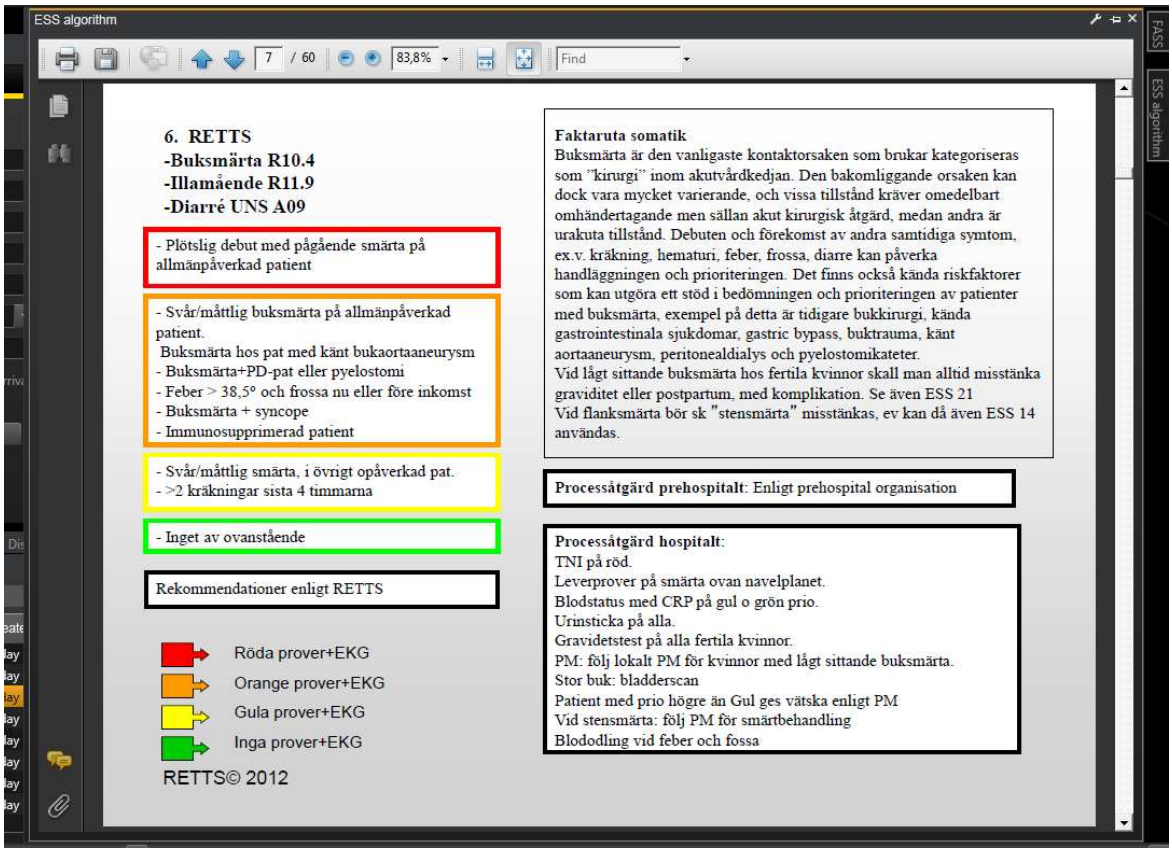


Figure 19. ESS algorithm side tab

Subsequently, the field indicating whether the patient is previously healthy or not should be filled in. The field has the default value yes, i.e. that the patient was previously healthy. If the patient is not, the value can be changed to no in the dropdown menu. This will lead to that a number of categories of diseases will be shown, as in the RETTS journal, with the default value No, see Figure 20. The patient's history of diseases needs to be fulfilled by changing the value No to Yes in the dropdown menu for the actual categories of the diseases. There is also a free text field if there are specific diseases that need to be documented in the acute journal.

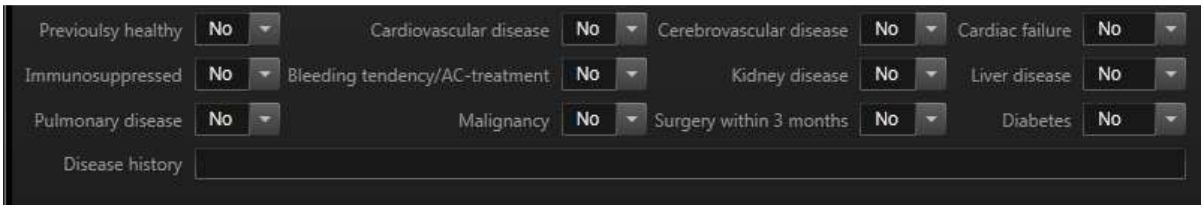


Figure 20. Previously healthy in the triage

The next tab is the tab of interventions, where the interventions of the triage and the interventions performed during the patient's visit at the emergency department can be filled in. If the ambulance personnel have done any interventions, these data will be filled out in this tab via the lookup service. The categories of interventions are blood samples, capillary samples, urinary specific, peripheral venous catheter (PVK) and other, which each consists of the interventions that belong to the specific category from the RETTS journal. The list of interventions consists of interventions with a checkbox and comment field or just a comment

field, such as in the RETTS journal. The check boxes can be used for doctor prescriptions and the comment field is for the healthcare personnel to sign that the assignment is performed or the result of the prescribed action. The performed actions will be listed to the right, see Figure 21, where it easy to see the actions that have been performed, at which time and by who.

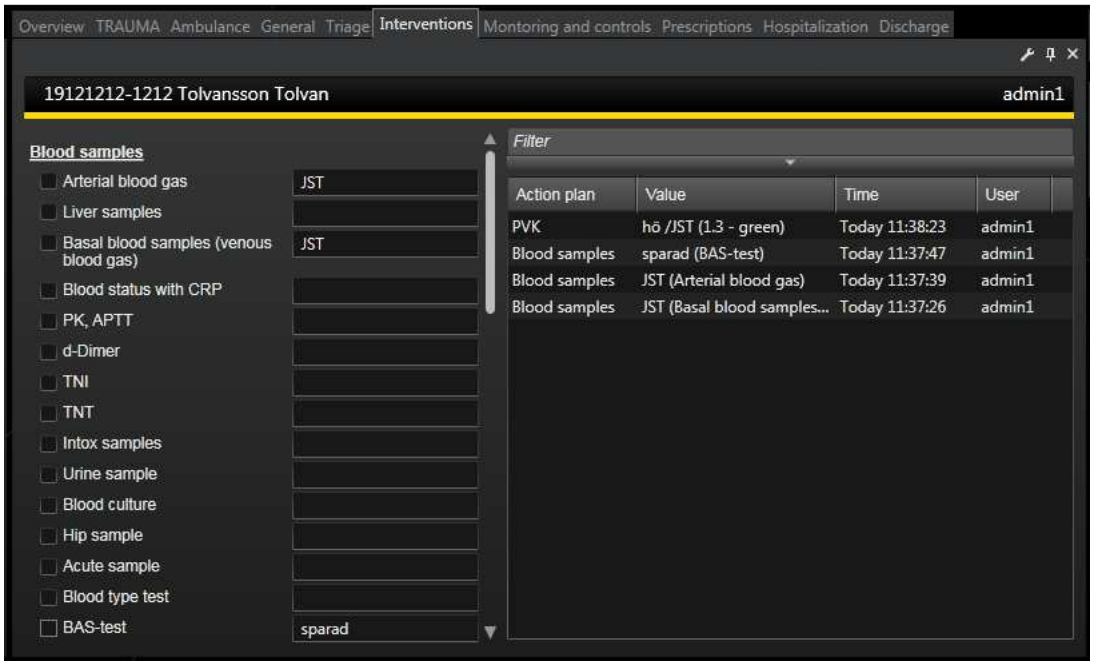


Figure 21. RETTS - Interventions

During the patient's visit at the emergency department the patient can be monitored or re-triaged. The goal is that the monitoring view should be integrated and shown in the patient's journal. The current version of the system has re-triage fields where the re-triage values can be registered and the eventual change of priority can be filled in. If the patient receives oxygen at the emergency it can be registered in this view, see Figure 22.

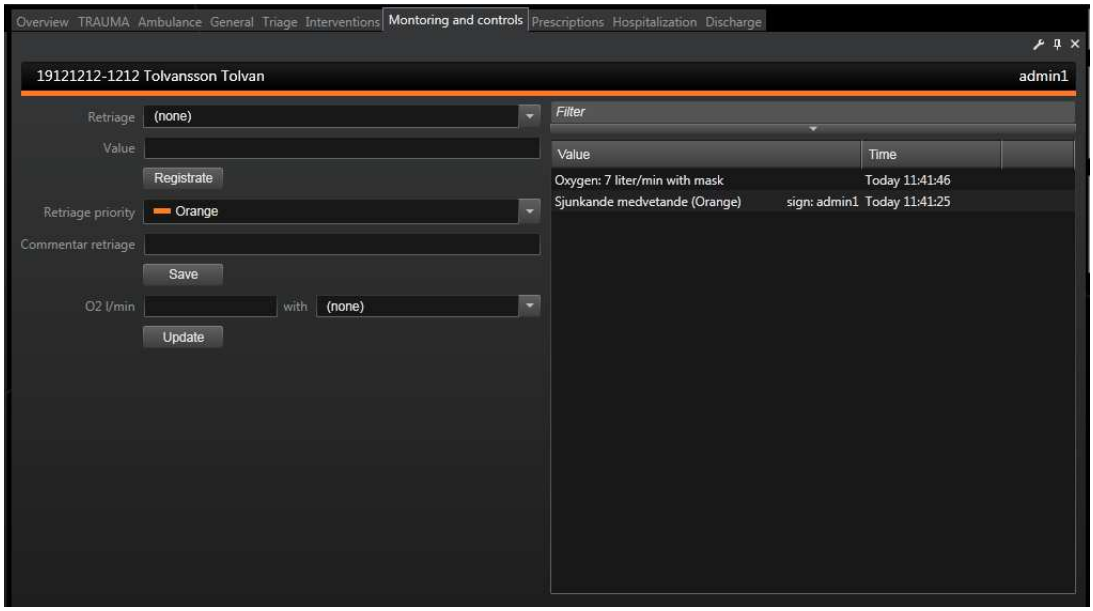


Figure 22. RETTS - Monitoring and controls

Prescriptions are performed in the prescription tab, see Figure 23. Drugs, x-ray examinations and other interventions can be prescribed and thereafter signed as administrated. An assignment of the prescribed intervention/drug will automatically be created and the assignment will be attached to the next available or the least loaded healthcare personnel at the floor. When the assignment has been performed and closed, the prescription will automatically be signed as administrated in the patient journal, or with a comment of why it was not administrated.

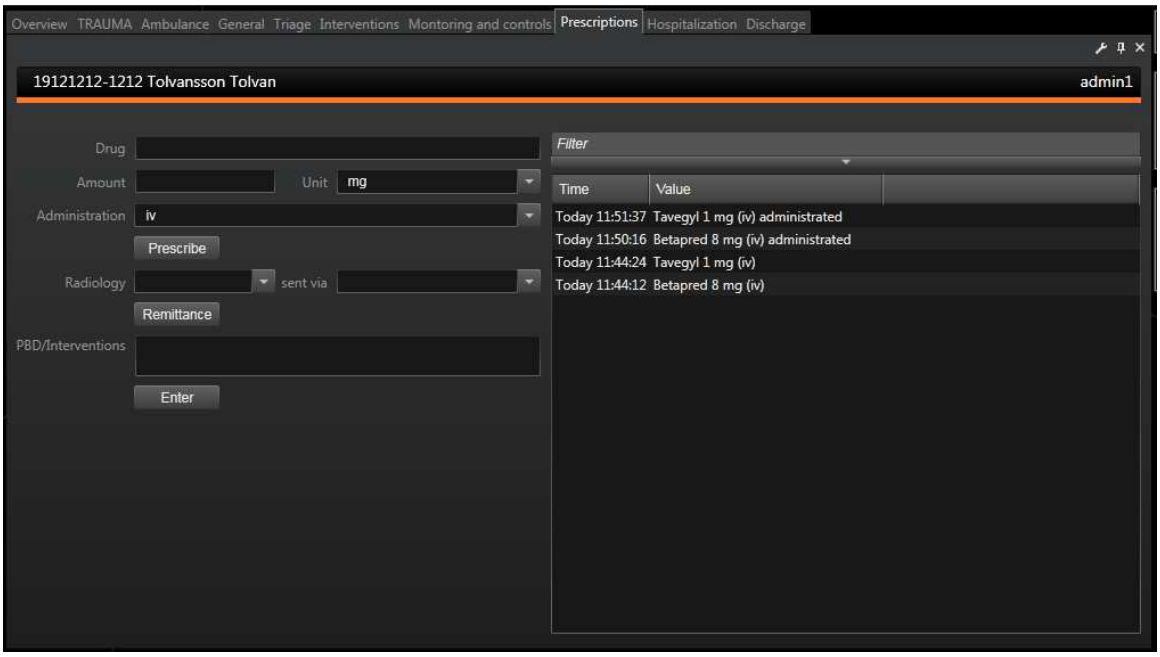


Figure 23. RETTS - Prescription

If the doctor decides about that the patient should be hospitalized, the doctor has to fill in the necessary fields in the hospitalization tab, see Figure 24. This section is the hospitalization part of the RETTS journal, which is quite massive. Though, it looks approximately the same as the hospitalization part in the paper version of RETTS, which makes it easy for the doctor to find parts that needs to be filled in. To facilitate, some fields have default values and some fields are hidden in order to be shown when specific values are chosen in the connected fields.

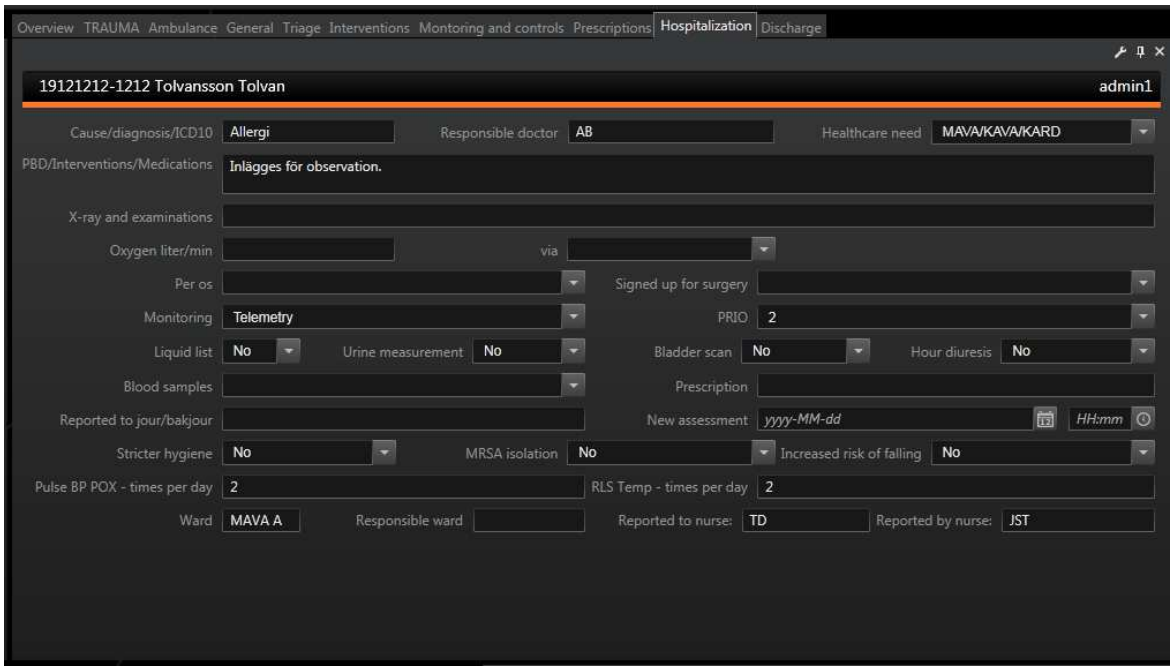


Figure 24. RETTS - Hospitalization

In the discharge tab, the relevant fields will be shown according to the choice to where the patient is discharged, see Figure 25. The doctor can decide that the patient should be discharged to home and in these cases the patient may need a home transport or if the patient has home care, they may be contacted before the patient goes home; all this can be documented in this tab. If the patient is referred to the primary care, the patient's health condition and the reason of the referral can be documented in this view. If the patient should be hospitalized, the ward to which the patient will be discharged and the responsible doctor for the hospitalization should be documented in the discharge view as the patient is being discharged from the emergency department.

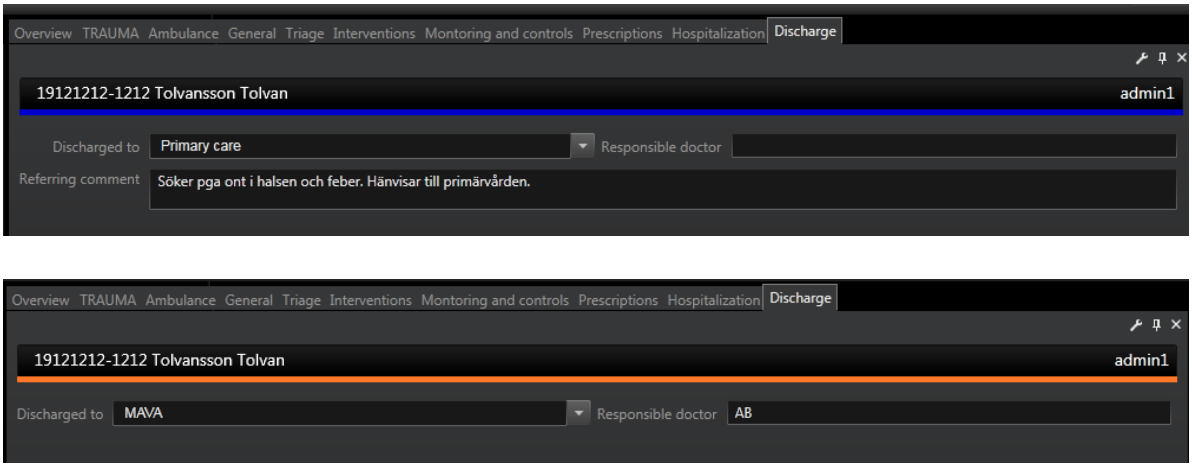


Figure 25. RETTS – Discharge views

5.2.9. Trauma journal RETTS-T

The patient may fulfill the criteria for the trauma alarm activation algorithm and in these cases the RETTS trauma journal should be used. This journal will be activated in SAFE when the

state transition TRAUMA is chosen when the patient has been registered. The journal consists of several different tabs, as for the RETTS journal in the system. The tabs are placed beneath the tab TRAUMA behind the overview tab in the acute journal. The parts are named alarm triage, alarm details, primary assessment, general, observation and prescriptions, interventions, injury report and hospitalization.

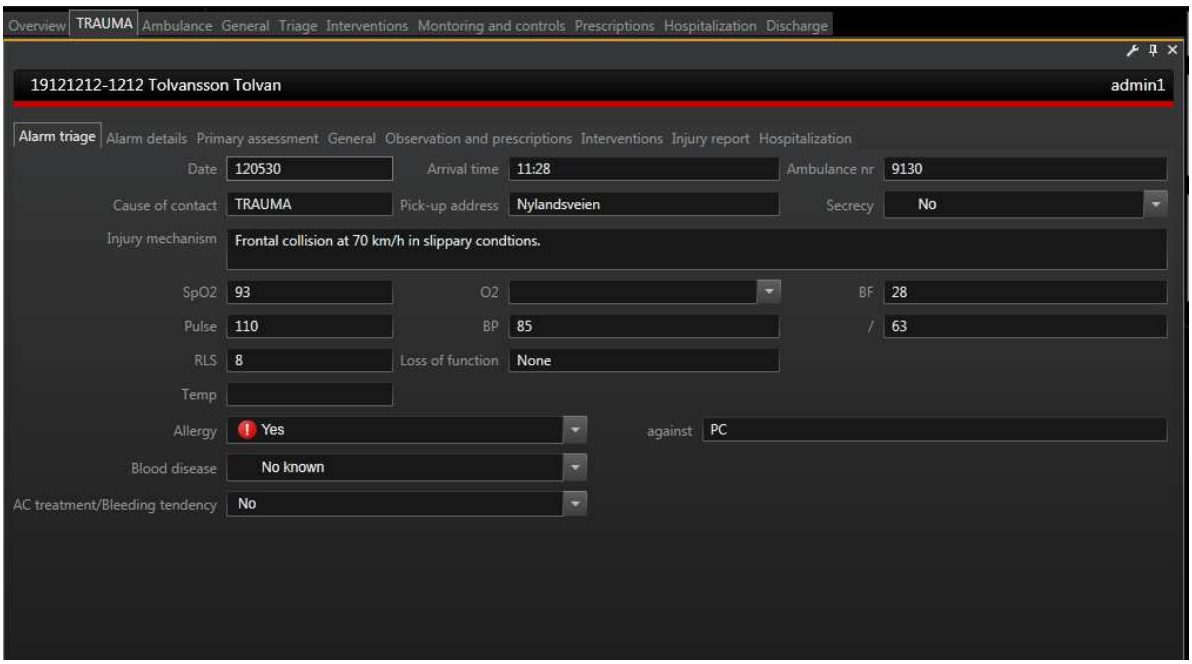


Figure 26. RETTS-T – Alarm triage

The alarm triage tab (see Figure 27) shows information about the injury, vital parameters and some important general information. The alarm details tab (see Figure 27) shows the parameters that activated the trauma alarm and how the airways, breathing, circulation and disability are affected. The conclusion of these parameters gives the level of the triggered trauma alarm. When the patient arrives with ambulance, which is the case for most of the trauma patients, most of the information will automatically be filled out in these tabs during registration. The healthcare personnel at the emergency department just need to complete the missing parts.

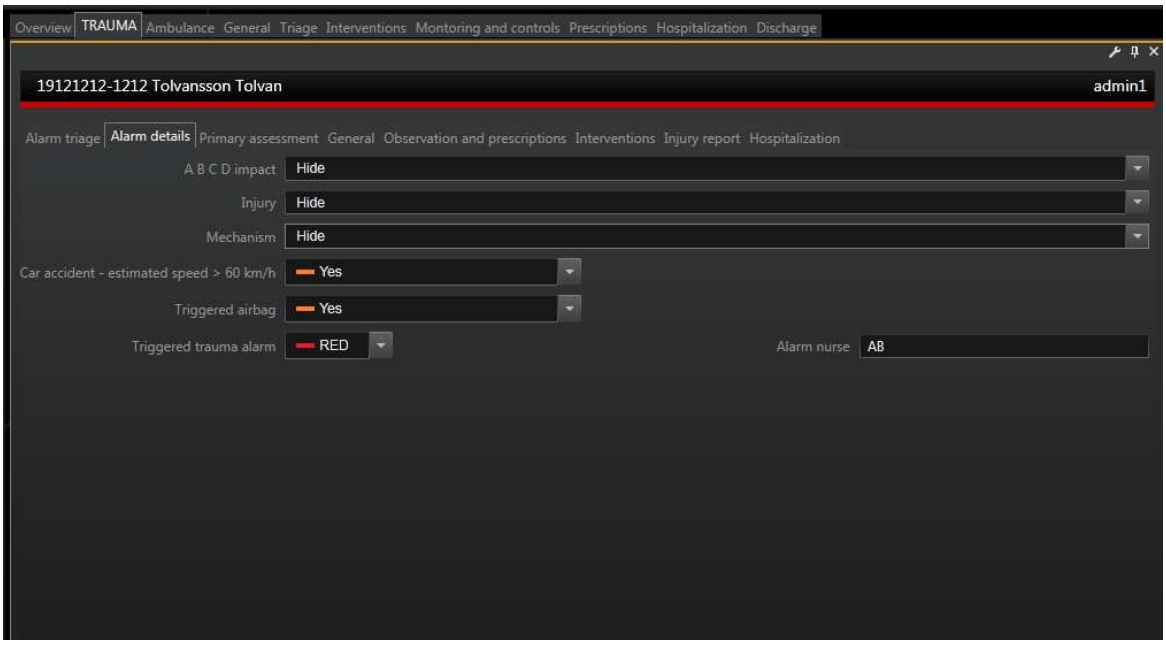


Figure 27. RETTS-T – Alarm details

At the emergency department a primary assessment will be performed using the ABCDE concept, which are gone through in this specific order A → B → C → D → E, see Figure 28. For airways and exposure, the actual status can be chosen in a dropdown menu, while for breathing, circulation and disability, the actual status can be chosen to be normal or abnormal in a dropdown menu. If abnormal is chosen a number of different parameters are shown with default value no, which can be changed to yes if the specific value is affected. Afterwards, if abnormal is changed back to the group name, i.e. to (Breathing) / (Circulation) / (Disability), the parameters with the value no will be hidden and the fields changed to value yes will be shown. Vital parameters will be controlled for each alphabetic group and these values can also affect the parameters described above. From this assessment the level of the trauma alarm can be decided, either as red or orange, or the trauma alarm can be decided to be called off giving a yellow priority.

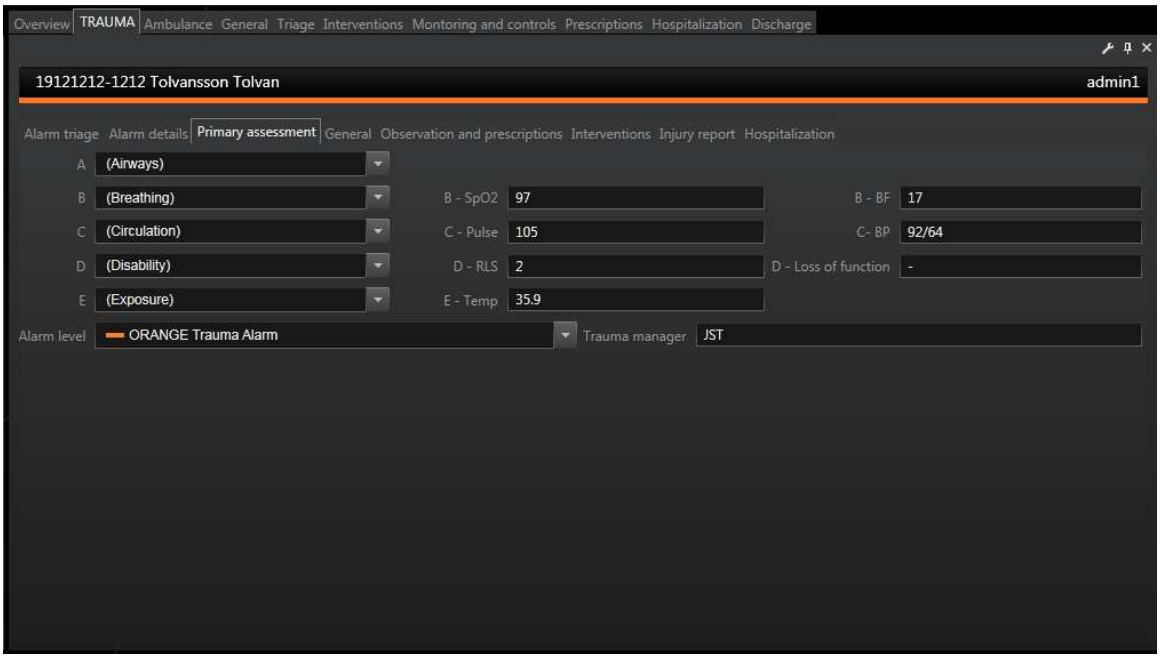


Figure 28. RETTS-T – Primary assessment

The general view consists of a field for name and number to the patient's next of kin, a dropdown menu for the handle of the patient's belongings and a field for identification band. The next tab is about observation and prescriptions. These two tabs include approximately the same as described in 5.2.8. The intervention tab will be structured with the same concept as in the RETTS acute journal, though the categories are x-ray examinations in the trauma room, x-ray CT, complements and examinations trauma room, see Figure 29.

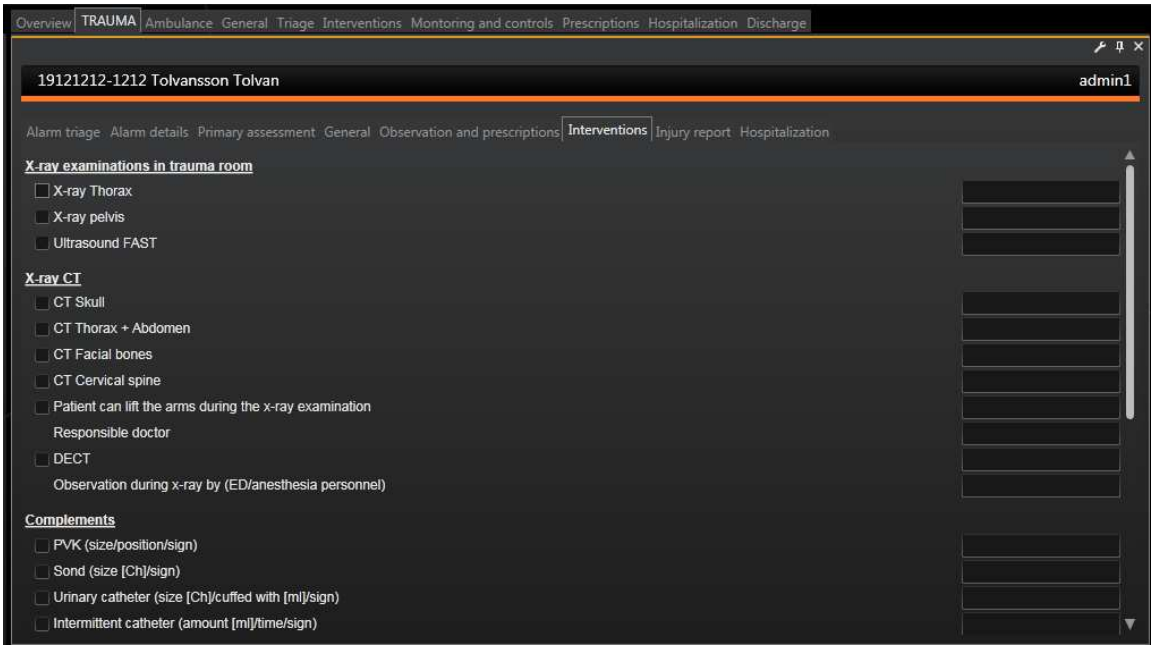


Figure 29. RETTS-T – Interventions

There is an injury report tab (see Figure 30), with a field where the injuries that have been found at the emergency department and after the x-ray examinations can be described. The level of further care and whether a secondary assessment has been performed can also be registered in this tab.

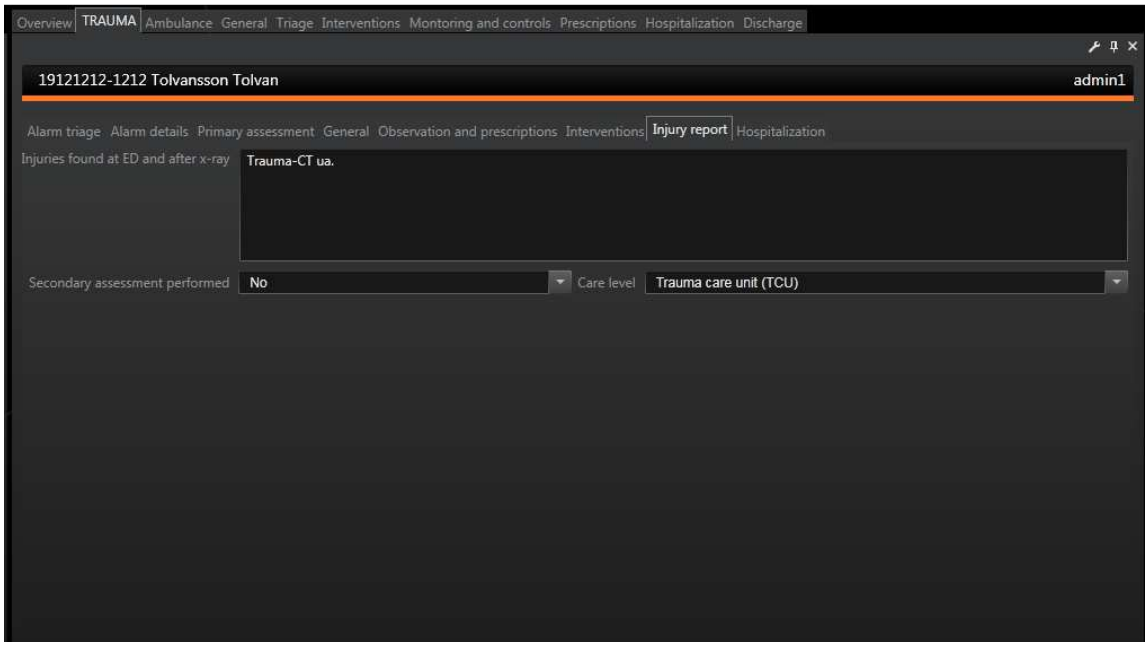


Figure 30. RETTS-T – Injury report

If the patient is hospitalized, there is a hospitalization tab where all the essential information for the hospitalization can be fulfilled (see Figure 31). The content of this tab corresponds to the hospitalization part of the RETTS-T journal.

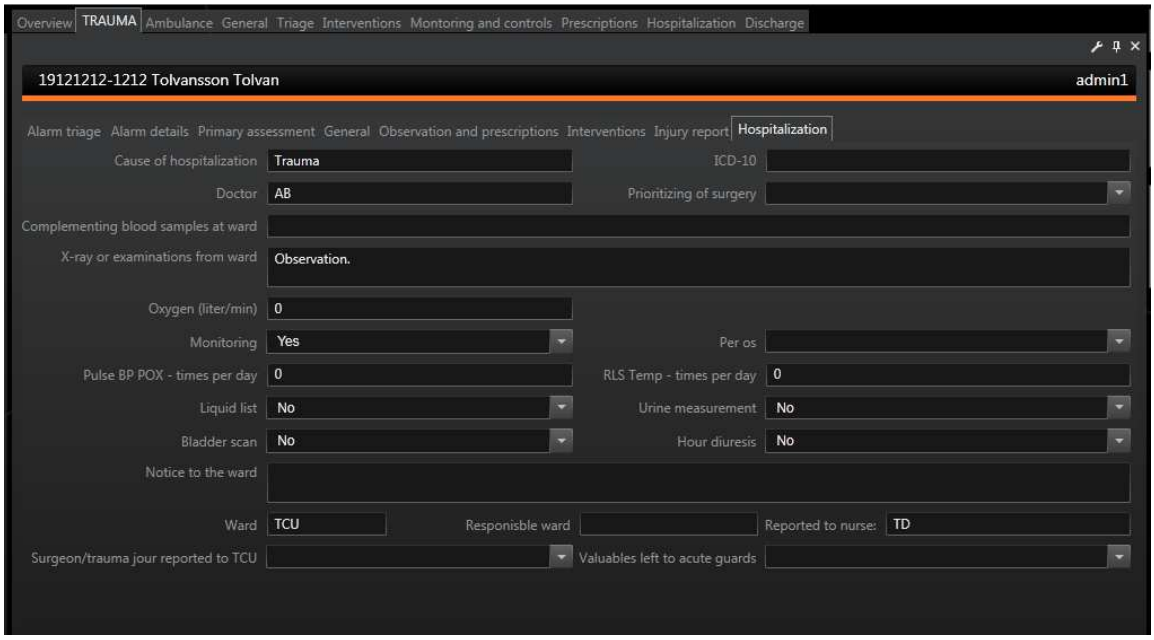


Figure 31. RETTS-T - Hospitalization

5.2.10. Assignments

The assignments that the coordinator today distributes between the healthcare personnel will in this system automatically be distributed; however the opportunity to create and distribute the assignments manually will be available. The system can thereby be called a semiautomatic system. The assignments will automatically be created when for instance the doctor performs a prescription in the journal. The assignment will be connected to the specific patient. The assignments can also be manually created by choosing the type of assignment from a list and in the next field make a description of the assignment. Afterwards, the priority of the assignment, the time when the assignment should be performed (if it should be performed at a specific time) and the prescriber name can be stated. Subsequently, the assignment can be created, see Figure 32.

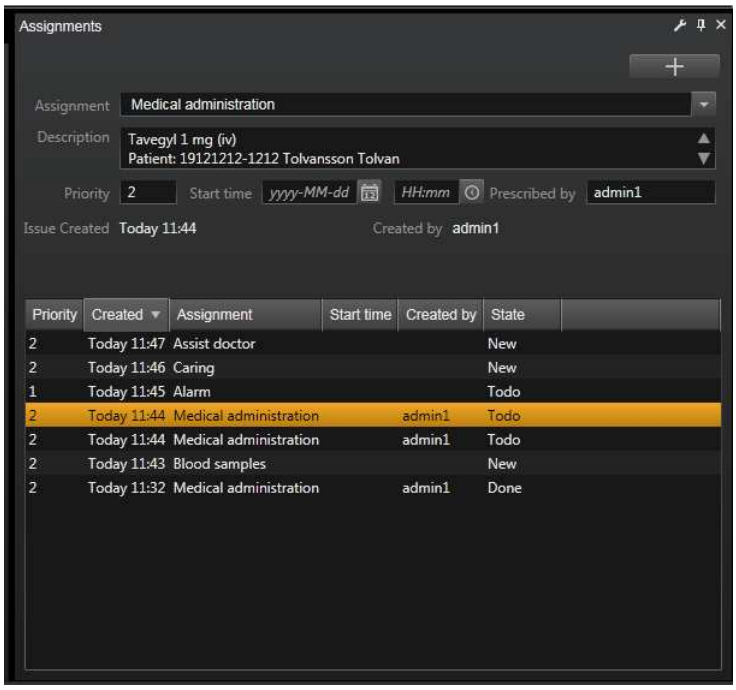


Figure 32. Assignments

The assignments will be listed in a list of all assignments and be connected to the nearest available healthcare personnel that can perform the assignment. The states of the assignment issues are todo, in progress and done.

5.2.11. Workshift

The system also handles the personnel working at a shift, see Figure 33. Recurrent shifts can be added automatically by a registration of how often and between which times the shift should reoccur. The shifts will then automatically be created the chosen interval before the start time of the shift. Shifts can also be created one by one and for specific shifts, by setting the recurrence choice to no recurrence. A shift is created by choosing the profession from a dropdown menu and the start and stop time of the shift. The shift will then be created and added to the issue overview where the actual shift is visible according to the start time.

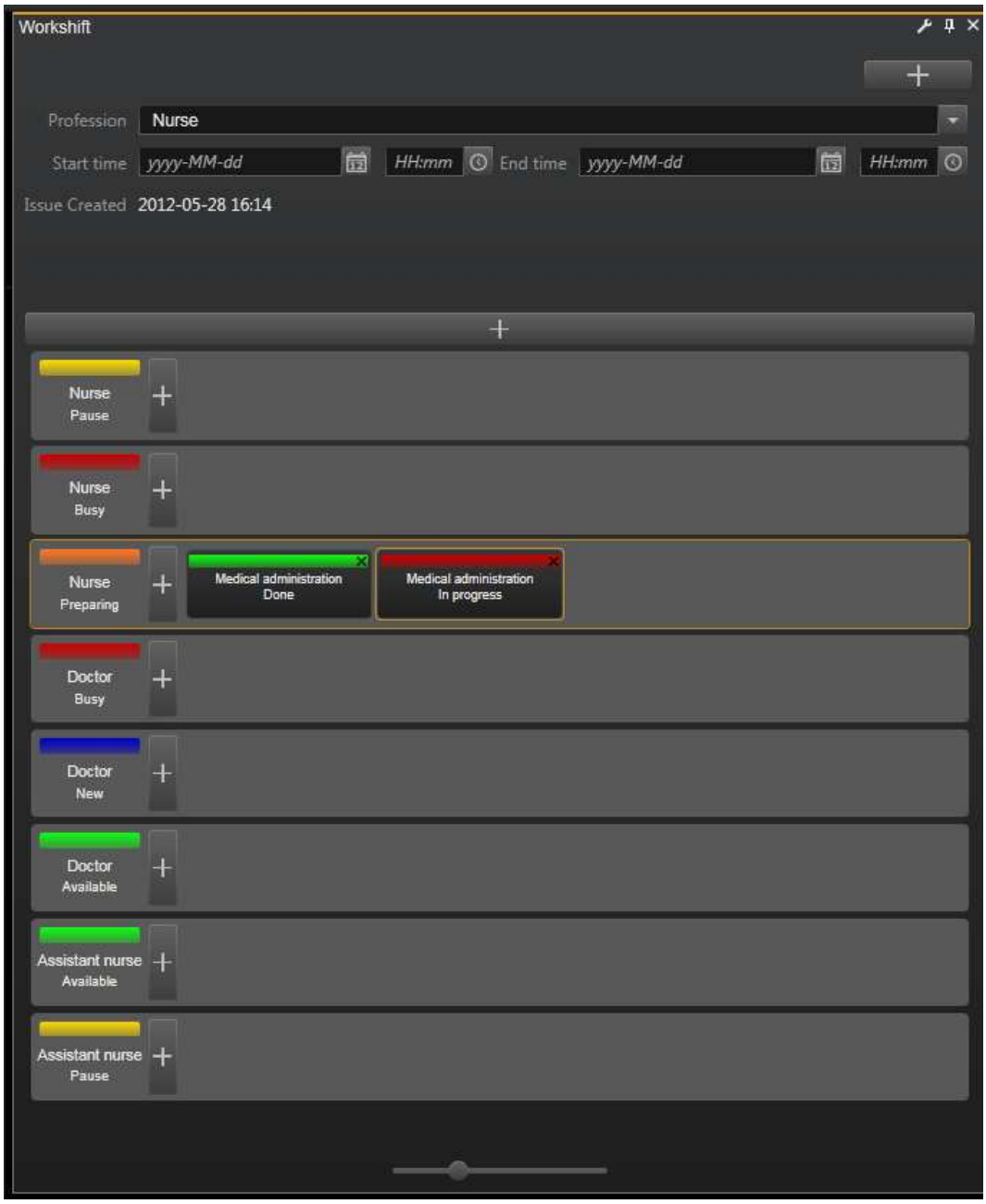


Figure 33. Workshift

The assignments described in 5.2.10. can be added to specific personnel either by drag and drop from the assignment list to the personnel or it will automatically be connected to someone in the personnel or semi-automatically where the creator of the assignment can choose between some of the proposed personnel. The proposal is based on the available personnel, the ones with the correct competence and by how much they individually are loaded at the moment of distribution. It will be possible to add the specific competences for each personnel, which makes it possible to plan the position of each personnel for the different shifts and to distribute assignments to personnel specific competence.

5.2.12. Calling

It is also possible to make calls in the system and the advantage of that is that every call is logged with different parameters. This view can be seen in Figure 34. It makes it possible to exactly see the history of incoming and outgoing calls. Thereby, the coordinator does not need to remember such things.

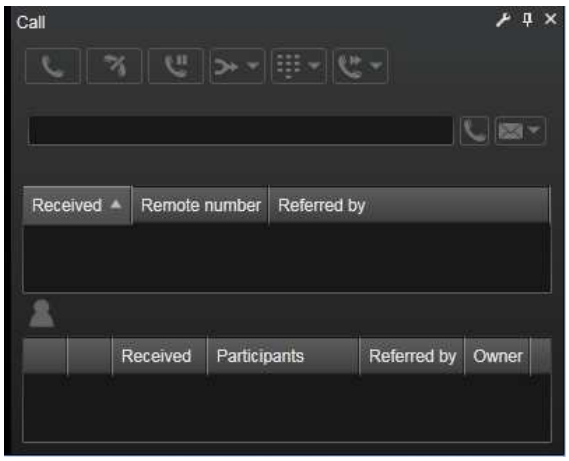


Figure 34. Call view

5.2.13. Android application

The SAFE android application is used for two reasons. One view is displaying the actual status at the emergency department for the official in preparedness (tjänsteman i beredskap, TiB) and the other is used by the physicians and personnel at the floor which receives their assignments in this application, see Figure 35 and Figure 36. The different view is bounded to the login data. The actual status means the actual occupancy at the emergency departments and other disruptions such as if a computer tomography (CT) is down.

Figure 35. SAFE application – Occupancy for the TiB

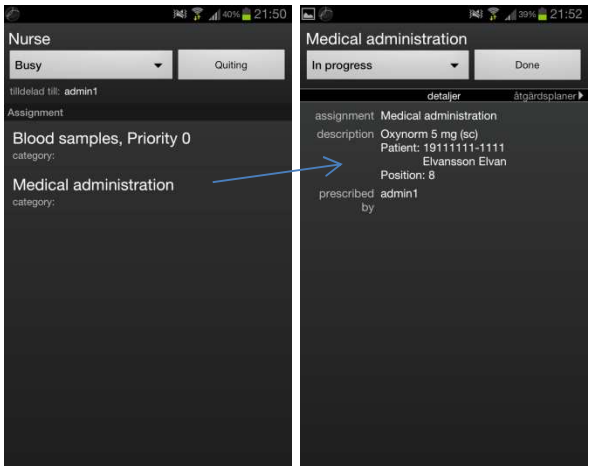


Figure 36. SAFE application – healthcare personnel

5.2.14. Statistics with QlikView

Every action in the system is logged and these logged data can be used to produce a large quantity of statistics. This gives the emergency departments an opportunity to evaluate and plan their organization and to generate data to different quality registers and research databases. Every emergency department can decide about in which statistic tool the data should be presented. The system that has been chosen for this manner in this study is Qlikview, in which the user can produce the specific statistics wanted in a web browser and present parts of it in SAFE as business intelligence reports with actual real-time data.

The statistics presented in this first version of the statistical management module are lead times, number of applicants and occupancy. The statistics can dynamically be viewed from year, month, week and date, see Figure 37, together with more specific parameters for the different data. The statistics are efficiently calculated when these parameters are changed.

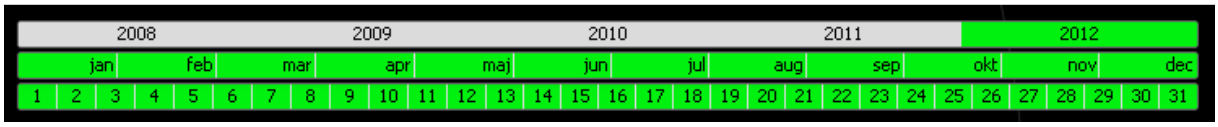


Figure 37. Statistical time period selector

Lead times data including time to triage (TTT), time to doctor (TTL) and total processing time (TGT) can be analyzed through the parameters of which discipline the patient belongs to, the priority and the cause of contact. In Figure 38, the data for patients with abdominal pain as the cause of contact can be seen. In the first row (the bars) it can easily be seen if the lead time goals have been reached. The goal has been reached when a part of the bar becomes green; this indicates that over 90 % of the patients have been triaged within 10 minutes, met the doctor within one hour or left the emergency department within four hours. If the bar only has the red color the goal of 90 % has not been reached. The second row shows these data in another way, where the blue part of the bar corresponds to the patients where the lead times have been reached, the red part where the lead time goals have not been reached and the dot indicates if the 90 % goal has been reached by the color. Green dots means that the goal has been reached and red dots indicates that the goal has not been reached. The last row shows all

the data in time format and the white-marked data is the data from which the graphs above are based on according to the choice of the parameters.

Figure 38. Lead times statistics

The number of applicants at the emergency department can be viewed from which discipline the patient belongs to, arrival type, priority and cause of contact, see Figure 39. In Figure 38 and Figure 39, there are graphs with a yellow round arrow, beneath this it is a menu where the data in the graph can be chosen to be seen from different dimensions. These dimensions are date, year, month, week, day, yearmonth (months the selected years), yearweek (weeks the selected years) and weekday (days the selected weeks). Month, week and day shows all the data combined for the dates selected in the date selector. This means that data can be viewed for instance for a month of a year or for a month for all selected years.

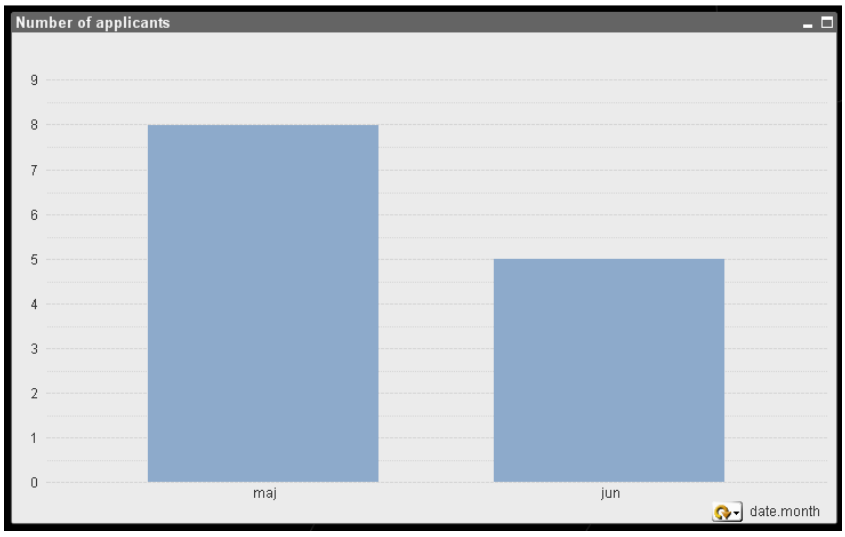


Figure 39. Number of applicant's statistics

The occupancy can be viewed as current occupancy and over time. The current occupancy shows the total number of registered patients and by the priority, which can be manipulated through the parameters discipline, priority and cause of contact. In Figure 40, the current occupancy view can be seen. The compressed graphs at the top, shows data of how many of the patients in the different priorities that have not meet the doctor.

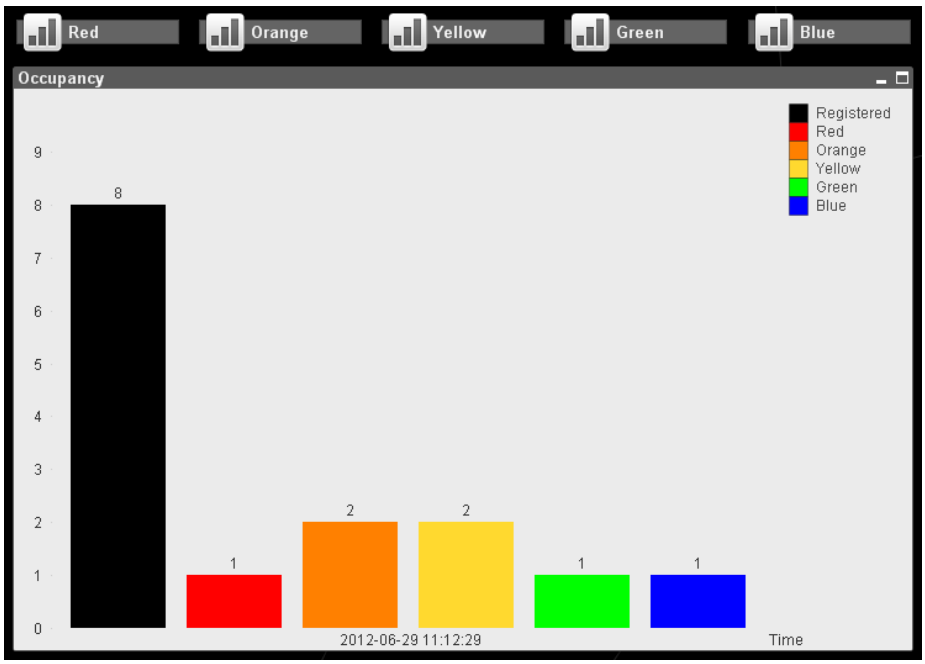


Figure 40. Current occupancy

The occupancy over time represents the number of registered patients, which can be viewed through the priority and unseen patients in the different priorities, i.e. the patients that have not met the doctor. An example of the occupancy of orange unseen patients over time can be seen in Figure 41. The data in this graph may not be that realistic but it shows the concept of occupancy statistics view.

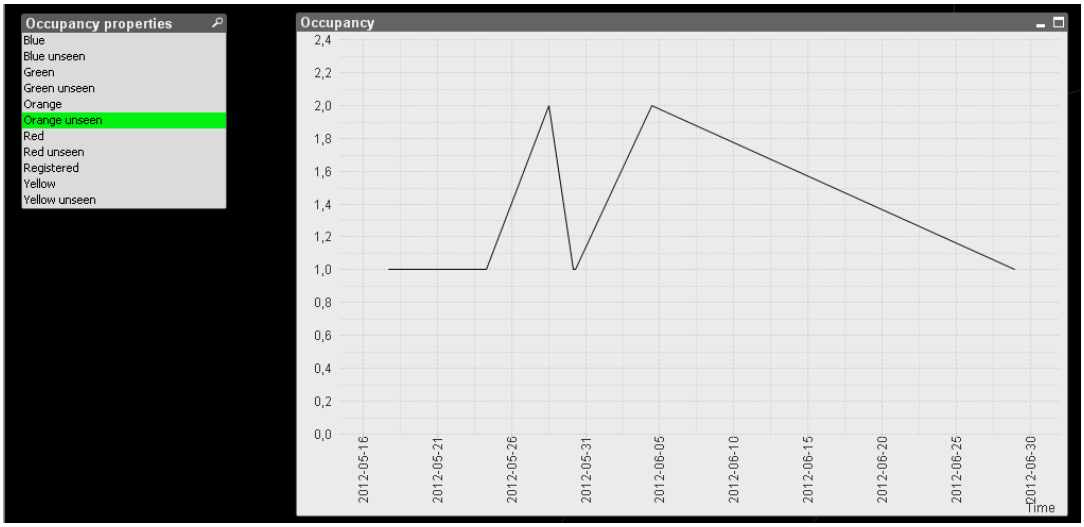


Figure 41. Occupancy over time for orange unseen patients

6. Discussion

6.1. Method discussion

The method used in this study is the most optimal in relation to time. My own experience as a nurse working at an emergency department has been an advantage regarding the patient flow analysis. This may also be a drawback since the flow processes differs between the emergency departments in Sweden and in this study, the main focus regarding the flow processes has been of one hospital. To study all different kinds of flow processes at emergency departments, more time is needed. Microsoft Visio was used for producing the flow process chart; this system was easy to learn and use.

In the beginning the expectations of the study was not that clear, which led to that some time was spent for structuring, organizing and preparing the study. The patient flow analysis was not that difficult to perform because of my experience; more preparations were needed for the configuration in SAFE. These preparations were about to gather knowledge about the programming language, the installation of SAFE and to perform preparations of the operational system. During the configuration phase, there were a lot of problems with the computer and bugs that stole a lot of time of the study. Most of these problems were solved efficiently without external help.

The features that were configured in SAFE often required reflections and testing of the feature with different configurations to achieve the most optimal from the existing functionality in SAFE. As the time moved on and the knowledge about SAFE and configuration in SAFE increased, the more efficient the configuration sessions became. The lookup service was used for creating functions that were not able to be solved in SAFE, which was a method used in other projects that were using SAFE at the company. A learning period was required to understand how the lookup service was functioning and a brief introduction was obtained from one of the creators of the service. The basics of Microsoft SQL Server and how to make database scripts were learned during the installation of SAFE, the configuration of SAFE and the programming of the lookup service.

Scrum as a framework is modern and efficient when it is used in an organization prepared for the work method. The method was not optimal for this study, since it is not applicable for one-person projects. The features wanted in the system that initially were discussed with the stakeholders were documented, using lists and mind maps. Retrospectively, this feature lists and mind maps could have been used to establish a Product Backlog with items that were selected for each sprint. However, a physical Product Backlog was not established, since this study was time limited and not that extensive. The descriptions and list of the features aimed for the system was continuously changed as the system was developed; some features were not included in the study. Daily Scrums were held intermittently together with a development team at the company. Sprint Reviews were held together with the development teams at the company, where the stakeholders could give their feedback and influence the further

development. A real Sprint Retrospective was not performed, which may have been a minor drawback, since the work may have been more fluent if the earlier problems were illuminated.

6.2. Result discussion

The result of this study is a patient flow analysis and an operational system for emergency departments, which is a result that surpassed the expectations of the study. The resulting system manages the patient, personnel, work shifts, assignments and statistics. The system is based on a holistic perspective, supporting processes locally at the emergency department and the general processes within the healthcare sector. The system has advantages and a width that the competitive systems probably do not have.

The result of the patient flow analysis is presented as a flow chart divided into main parts as in the patient flow at an emergency department, i.e. arrival, registration, triage, doctor, discharge/hospitalization/further examinations and observation and caring. These are the main events for a patient at the emergency department. Together with the process of alarm patients, they are presented in an overview and are more detailed described in sub-flow charts.

The acute journal is digitalized which has a great impact on the patient security. The paper journal can easily be forgotten and end up lying at a position where it should not be. The digital journal will be more accessible, for good and bad, but the most important is that it will be possible to see who has read a patient's journal. The digitalized journal provides traceability.

The National Board of Health and Welfare in Sweden (Socialstyrelsen) have proposed a national model for tracking of waiting times at emergency departments, which have been formulated from a patient, security, operational, management, efficiency and process perspective. The proposal includes lead time data such as the time of arrival, time for first medical assessment and when the patient leaves the emergency department. These data are meant to be registered automatically in an IT system that will not cause any additional work. Data about whether patients leave the emergency department before they meet a doctor or before they are medically ready should be gathered, since it is an important indicator of the perception of the waiting time. Medically ready mean that the medical treatment of a patient is completed and the patient is thereby ready for discharge. Other data that should be registered are arrival type, discharge type, age and gender. Age and gender could automatically be registered by using the personal identification number. From a patient security perspective, there is also a need to register other indicators of quality than waiting time. The goal is that the hospital emergency departments in Sweden should contribute to the patient register when measuring these parameters (Socialstyrelsen, 2011).

Today, data is measured with different quality or not at all at the emergency departments in Sweden. Some emergency departments have systems that automatically register some of the parameters mentioned above, some have systems that register patient data but the data need to be quality assured, others have systems for patient registration but performs the measurements of waiting times manually and some emergency departments does not have any electronic

system and may do some of the measurements and in these cases manually (Socialstyrelsen, 2011). There is a need of a system that registers data automatically and SAFE EDIS will suit perfectly for this manner. All events in the system are logged and these data can be used to produce in principle any desired statistics. If there is a parameter desired to be measured, an issue property can be added into the system and thereby the parameter will be possible to measure. This is one of the reasons for the flexibility of SAFE; changes can easily be done by configuration. Since the acute journal RETTS is digitalized, data bounded to RETTS can also be measured.

The different lists of patients in different stages in the emergency department flow makes it easier for the coordinator to get an overview of the actual situation and the patients registered at the emergency department. This will result in increased patient security.

QlikView is proposed and used in the study for compilation of statistics, since it is a dynamical system that is easy to use and it efficiently produces the statistics wanted. The configuration which was performed in Qlikview processes data to produce statistics within lead times, amount of applicants and occupancy (current and over time). The goal is to present a business intelligence report in SAFE using QlikView, containing the current load and a predictive load at an emergency department. Some kind of simple indicators with for instance green for normal load, orange for more heavily loaded and red for too much load could be used for this manner. The load and predicted load should be shown in relation to staffing/competence, individual performance, the patient's need of caring, historical statistics of the load, patient flows and priorities of the patients. This business intelligence report may also consist of the pre-hospital load, the occupancy at the hospital and if there is any major problem in the healthcare chain that need to be taken into account. QlikView should also be used to produce statistics such as different time intervals, the amount within different parameters and the level of competence (formal and real).

Today, there are 73 national quality registers in Sweden, consisting of personal data about problem/diagnosis, treatment and result. These quality registers are used for quality development within healthcare (SKL, 2012). Most of the registers only include separate diagnosis or treatments methods. Svenska Akutvårdsregistret (SVAR) is a register with a goal of becoming a national register including data from the whole acute care for all patients. It should be built on automatic data gathering from patient journals and administrative systems, since it gives a high coverage and accurate data. Therefore, advanced technical solutions are needed. The quality metrics in SVAR are background variables (arrival type, cause of contact and vital parameters), process indicators (time to first assessment by nurse and doctor, total time of visit, triage level and diagnosis when the patient is discharged) and result indicators (final diagnosis for the current care contact, pain, mortality, cause of death and total time of hospitalization) (Letterstål, Lindmarker, Ekelund, Säfwenberg, Castrén & Kurland, 2010). SAFE EDIS is a system that could be connected to this register, since it is a stable reliable system producing data of acute care important for a register such as SVAR.

SAFE EDIS was continuously discussed and evaluated with internal and external stakeholders. Internal stakeholders included the majority of the Security and Safety Management (SSM) division of Saab AB, i.e. the sales division, SAFE development teams in Gothenburg and Linköping and the ongoing customer projects in SAFE. They were more or less involved in the development of SAFE EDIS. Monthly demonstrations were held for the division and weekly for the mostly involved stakeholders, when the opportunity was given. The system was also presented, demonstrated and described for representatives from different emergency departments. There was an advantage to discuss and receive inputs continuously during the development of the system. The external stakeholders were generally satisfied and impressed of the functionalities of the system, though some was not completely satisfied with the user interface (UI) design.

There is a lot of information needed to be registered in the acute journal and the paper version of RETTS consists of a lot of check boxes. SAFE does not have check boxes as an issue property today, which has resulted in workarounds that may have impacted the design and UI. It can be perceived as cluttered. The system as it is today is probably easy to use when the flows within it are known, the important functionality exist and works. However, the design has to be considered before the system could be run at sight.

The first assessment whether a feature may work at sight or not were done continuously during the development. Reflections of how a feature will affect the care of the patient and the flow processes of the emergency department were continuously made. The average goal with the system was to create more bedside time for the patient, which may increase the patient satisfaction, since the personnel will be more available and the patient may feel less forgotten. Patient surveys have shown that the patients generally are satisfied with the treatment by the healthcare personnel and have confidence in the personnel, but they wanted more and continuous information about their position in the doctor queue (SKL, 2011). SAFE EDIS should in the future inform the patients about their position in the doctor queue.

The dimension of the EDIS edition was much larger than the other existing SAFE editions regarding the amount of issue properties. The issue type called Patient in SAFE EDIS has around 300 properties, while other SAFE editions have issue types with around 50 properties. This means that the SAFE was tested with a new dimension. It was run and tested locally during the development, without any major problems occurring related to the dimension. The system was also tested with several clients and a server, which worked well if one disregards that it was tested at laptops with not enough capacity. The computers were heavily loaded due to lack of RAM-memory of the server computer on which also a client was running, but generally it worked excellent when working simultaneously in the clients; the clients were updated instantaneously.

A long term main goal is that SAFE EDIS should be integrated against other systems used at emergency departments. SAFE EDIS should be the system used and the other systems should be running in the background. For instance, when triaging the vital parameters should automatically be registered, and when the patients are monitored, it should be shown in the

system. If a parameter deviates from reference range the user needs to verify that an alarm has been noticed.

6.3. Further research

There is a need of a more general patient flow analysis and comparison of patient flow analysis from several emergency departments. Generally, there is a great need of a system that automates several of the processes at an emergency department together with a digitalized journal to improve the patient security. In SAFE, new system features need to be developed in order to make it possible to improve the UI and simplify the flows in SAFE EDIS. Further, more functionalities can be configured in SAFE EDIS to achieve a width within the system where the customer can choose the functionalities that suits their organization best. Further research can also be about how processes and flows at an emergency department can be supported with an emergency department information system such as SAFE EDIS in order to create efficiency and increased quality.

7. Conclusions

This study ended up with an emergency department patient flow analysis presented in a flow chart together with a comprehensive description. It includes the main parts of the patient flow at emergency departments, i.e. arrival, registration, triage, doctor, discharge/hospitalization/ further examinations and observation and caring.

The general conclusion of this study is that SAFE can be used as an emergency department information system. SAFE EDIS is an operational system with a holistic perspective, supporting the flows at emergency departments and creating value for the users. Part of the patient flows and work processes will be automated, giving the emergency department the opportunity to rearrange resources and redistribute/reduce costs. It will increase the patient security in several ways, since the acute journal is digitalized. SAFE EDIS will give the opportunity to deliver important data to quality registers and will thereby be a part of the quality development of acute care. SAFE EDIS gives the opportunity for a national emergency department information system, with its width of functionalities and the configurability for adaptation to different emergency departments.

8. Acknowledgment

I would like to express my great appreciation to my examiner Sabine Reinfeldt at Chalmers University of Technology and to my tutors Jonas Borgström, Pehr Dahlbom and Adriana Aires at Saab AB. You all have supported me through this master thesis in different ways. I also would like to thank all the colleagues at Saab AB for helping me to deal with the major problems I encountered during the study.

References

Bark, C. & Hardenberger, M. (2012). *Landstingen behåller kritiserade journalsystem.* [www document] URL: http://www.sjukhuslakaren.se/2012/05/01/landstingen-behaller-kritiserade-journalsystem/ [Accessed 2012-11-05]

Borgström, J. & Dahlbom, P., Saab AB (2012-02-14 – 2012-05-21). Personal communication. Topic: Discussion regarding system functionality.

Cambio Healtcare Systems AB. (2009). *Cosmic Emergency – Akutmottagningens bästa vän.* [www document] URL: http://www.cambio.se/document/sv-se/COSMIC%20Emergency_sv%202011.pdf [Accessed 2012-02-22]

Cambio Healtcare Systems AB. (2012). *Cambio COSMIC – Våra kunder.* [www document] URL: http://www.cambio.se/document/sv-se/V%C3%A5ra%20kunder%20SV.pdf [Accessed 2012-11-05]

CompuGroup Medical AB. (2012). *Akutliggaren och Akutuppgifter.* [www document] URL: http://www.samverkantc.se/TC-Manualer/Funktionsbeskrivningar/index.html?akut_akutliggaren.htm [Accessed 2012-02-22]

Dahlbom, P., Saab AB. (2012-06-14). Personal communication. Topic: Paratus ED.

Federal Acquisition Regulation (FAR). (2012). *Subpart 2.1. – Definitions.* [www document] URL: https://www.acquisition.gov/far/html/Subpart%202_1.html#wp1145508 [Accessed 2012-10-27]

Fielding, T. (2000). *Architectural Styles and the Design of Network-based Software Architectures. Chapter 5 Representional State Transfer (REST).* [www document] URL: http://www.ics.uci.edu/~fielding/pubs/dissertation/fielding_dissertation.pdf [Accessed 2012-11-03]

Fryckstedt, J., Hulting, J., Höjer, J. & Ludwigs, U. (2010). *Matell – Reichards Akutmedicin.* Lund: Studentlitteratur

International Federation of Emergency Medicine, IFEM. (2012). *About IFEM.* [www document] URL: http://www.ifem.cc/About_IFEM.aspx [Accessed 2012-10-30]

Jonsson, A., Optivasys AB. (2012-05-22). Personal communication. Topic: The basic of Qlikview.

Jacobsson, U. (2012). Nytt journalsystem för säkrare vård. *INBLICK, nr 2,* 6 – 7.

Letterstål, A., Lindmarker, P., Ekelund, U., Säfwenberg, U., Castrén, M. & Kurland, L. (2012). *SVAR – unikt svenskt akutvårdsregister*. [www document] URL: http://www.lakartidningen.se/store/articlepdf/1/15276/LKT1043s2659_2661.pdf [Accessed 2012-09-24]

QlikTech International AB. (2012). *QlikView Overview*. [www document] URL: http://www.qlikview.com/us/explore/products/overview [Accessed 2012-09-24]

Saab AB. (2011). *SAFE – Situation Awareness for Enhanced Security. Feature description.* Unpublished company documentation, Saab AB.

Schwaber, K. & Sutherland, J. (2011). *The Scrum Guide. The Definitive Guide to Scrum: The Rules of the Game.* Scrum.org

Socialstyrelsen. (2005). *Patientsäkerhet vid akutmottagningar. Rapport från verksamhetstillsyn vid sex akutmottagningar i Södra sjukvårdsregionen.* [www document] URL: http://www.socialstyrelsen.se/Lists/Artikelkatalog/Attachments/9916/2005-109-1_20051091.pdf [Accessed 2012-10-28]

Socialstyrelsen. (2011). *Väntetider vid sjukhusbundna akutmottagningar. Slutrapport mars 2011*. [www document] URL: http://www.socialstyrelsen.se/Lists/Artikelkatalog/Attachments/18284/2011-3-36.pdf [Accessed 2012-10-27]

Socialstyrelsen. (2012). *Socialstyrelsens tjänsteman i beredskap (TiB).* [www document] URL: http://www.socialstyrelsen.se/omsocialstyrelsen/kris/tjanstemaniberedskap%28tib%29 [Accessed 2012-11-01]

Statens beredning för medicinsk utvärdering, SBU. (2010). *Triage och flödesprocesser på akutmottagningen. En systematisk litteraturöversikt.* SBU-rapport nr 197. [www document] URL: http://www.sbu.se/upload/Publikationer/Content0/1/Triage_fulltext.pdf [Accessed 2012-09-24]

Sveriges Kommuner och Landsting, SKL. (2011). *Resultat för akutmottagningar 2010.* [www document] URL: http://www.skl.se/vi_arbetar_med/halsaochvard/kvalitetsutveckling-och-uppfoljning/nationellpatientenkat/nyhetsarkiv/resultat-for-akutmottagningar-2010 [Accessed 2012-11-02]

Sveriges Kommuner och Landsting, SKL. (2012). *Akut förbättring.* [www document] URL: http://www.skl.se/vi_arbetar_med/halsaochvard/tillganglighet-i-varden/akut-forbattring [Accessed 2012-10-27]

Sveriges Kommuner och Landsting, SKL. (2012). *Vad är Nationella Kvalitetsregister?.* [www document] URL: http://www.kvalitetsregister.se/om_kvalitetsregister [Accessed 2012-11-02]

Widgren, B. (2012). *RETTS. Akutsjukvård direct.* Lund: Studentlitteratur

Wilkinson, D A. & Skinner, M W. (2000). *Primary Trauma Care.* Oxford: Primary Care Foundation

Appendix 1

RETTS 2012

- **Paper journal RETTS, RETTS-T**
- **Example of an ESS algorithm, number 6**
- **Trauma activation algorithm, ESS 39**

Akutjournal

klistra patientetikett

Amb.nr	Larmtid	Framme	Avfärd	Vårdare	Vårdare	Ärendnr
Kontaktorsak		Datum		Ankomst kl.	Sekretess Ja ☐ Nej ☐	

Aktuellt

Disciplin: Plac:

☐ Läkartriage

☐ Tid. väs. frisk ☐ Kardiovaskulär sjd. ☐ Cerebrovask sjd. ☐ Hjärtsvikt ☐ Immunosuppr. ☐ Blödningbenäg./AK-beh ☐
☐ Njursjukdom ☐ Leversjukdom ☐ Lungsjukdom ☐ Malignitet ☐ op inom 3 mån ☐ Diabetes ☐ Ins ☐ Tabl ☐

Triage

Överkänslighet ☐ Ingen känd ☐ Ja

Blodsmitta ☐ Ingen känd ☐ Ja

VRE/MRSA misstanke enl.PM ☐ Ingen känd ☐ Ja

Ökad fallrisk enl.PM ☐ Ja ☐ Nej

Omv.behov? ☐ Ja ☐ Nej

Autonomi: brister i

A	Patient ej i behov av triage ☐ = Blå prio		☐ Ofri luftväg ☐ Stridor	☐ Larm	Misstanke om GE ☐ Ja ☐ Nej	☐ Gå + stå ☐ Toa ☐ Dricka ☐ Orienterad
B	SpO2 på luft	AF/min	☐ SpO_2< 90% med O_2 ☐ AF > 30 eller < 8	☐ SpO_2 < 90% utan O_2 ☐ AF > 25	☐ SpO_2 90-95% utan O_2	☐ SpO_2 > 95% utan O_2 ☐ AF 8-25 (normal)
C	Puls	BT /	☐ RR > 130 el OR > 150 ☐ SBT< 90 mmHg	☐ Puls > 120 eller < 40	☐ Puls > 110 eller <50	☐ Puls 50-110
D	RLS /GCS	EKG AMB ☐	☐ Medvetslös ☐ Krampanfall	☐ Somnolent/RLS 2-3	☐ Akut desorienterad	☐ Alert
E	Temp	EKG AKM ☐ Läk/sign		☐ Temp > 41°, < 35°	☐ Temp > 38,5°	☐ Temp 35° - 38,5°
ESS algoritm ☐		ssk/sign	☐ Röd ESS	☐ Orange ESS	☐ Gul ESS	☐ Grön ESS
		mott.ssk/sign	☐ Röd prio Röda prover	☐ Orange prio Orange prover	☐ Gul prio Gula prover	☐ Grön prio

Process

Omprio/reevaluering sign/klockslag

Kommentar till omprio/reevaluering:

Övr. åtgärder

Kap. prover

☐ ☐ ☐ CRP kl. sign. ☐ Hb kl. sign.

☐ ☐ ☐ Lpk kl. sign. ☐ P-gl kl. sign.

Pvk	sign	ut:	Fasta kl:	KAD nr/ml	Bladderscan	ml Kl
Pvk	sign	ut:	Tolk behov ☐ Ja	Språk:	Tolk kl:	

Kontroller och läkemedelsordinationer

PREHOSPITALA läkemedel, mängd, adm.sätt	kl	sign

Kl: Händ

220 200 180 160 140 120 100 80 60 40

LÄKEMEDEL AKUTMOTT. Sat./AF/RLS/VAS

O_2l/min ☐ grimma ☐ mask	Läk.sign								

Lab och rtg

Provtagning. Signera!

- ☐ Arteriell blodgas.....
- ☐ Leverprover.....
- ☐ Basprover (ven blodgas).....
- ☐ Blodst. m CRP.....
- ☐ PK, APTT.....
- ☐ d-Dimer.....
- ☐ TNI.....
- ☐ TNI.....
- ☐ Intoxprover.....
- ☐ Urinsticka.....
- ☐ Blod odl.....
- ☐ Höft prov.....
- ☐ Akut prov.....
- ☐ Pat.provs.vis.läk.....
- ☐ Kontr.provs.sign. av läk. .....

☐ Blodgruppering Sign____ ☐ Skickad Sign____ U-gl ____ U-pH ____ U-leu ____

☐ Bastest ____ enh Sign____ ☐ Skickad Sign____ U-ket ____ U-prot ____ U-hcg ____

U-ery ____ U-nit ____

☐ Odling skickad
☐ Urin sparad
☐ Makroskopisk hematuri

PBD/Åtgärd på akuten

Läk.sign.

☐ Lungor ☐ CT hjärna ☐ CT thorax (LE) ☐ CT buk ☐ UL ben ☐ UL buk ☐ ____

☐ BÖS ☐ Urografi ☐ CT halsrygg ☐ CT ansikte ☐ CT aorta ☐ Bäcken/höft ☐ ____

remix/fax/sign

Närstående

Närstående	Tel.	Närstående kontaktad? ☐ Ja ☐ Nej

Tillvarataget ☐ Värdesaker/kläder tillvaratagna ☐ Värdesaker lämnat till anhörig	sign	ID-band ☐ ID-band sedan tidigare ☐ Patient fått ID-band	sign

Kommentar	☐ ID-handling åter	sign

Omvårdnadsåtg/händelser

Rond/tillsyn	sign

Kontakt med hemsjukvård/hemtjänst inför hemgång

Hemsjukvård ☐ Ja ☐ Nej ____ Hemtjänstboende ☐ Ja ☐ Nej ____ Anhörig ☐ Ja ☐ Nej ____

Nycklar finns ☐ Ja ☐ Nej Journalanteckning medskickad/faxad ☐ Ja ☐ Nej Remiss ☐ Ja ☐ Nej

Transportsätt ____ beställt kl. ____ Hämtas av anhörig ____

LÄKARORDINATIONER TILL AVDELNINGEN

Orsak/diagnos/ICD10 ☐ Ansv Läk

Vårdbehov: ☐ IVA ☐ MAVA/KAVA/KARD ☐ Stroke ☐ Vårdavd. ☐ Geriatrik

PBD/ÅTG/VB MEDICINER

☐ Rapporterad till husjour/bakjour ☐ Ny bedömning kl. ____

☐ Hb ☐ Elstatus ☐ Lever ☐ PK/APTT ☐ TNI-serie ☐ CRP ☐ Blododling ☐ Bastest ☐ Urinodling

Övriga prover

Syrgas: % via specialmask:

eller liter/minut ☐ Mask ☐ Grimma

Röntgen och undersökningar från avd:

Per os
☐ Fasta ☐ Fritt flytande ☐ Normalkost

Op-anmäld
☐ Ja ☐ Nej

Hygien och fallrisk
☐ Skärpt hygien/GE ☐ MRSA isolering ☐ Ökad fallrisk

Ordinerade basala kontroller

☐ Puls, Blodtryck, Saturation (POX) ____ ggr per dygn

☐ Vakenhet (RLS), Temp ____ ggr per dygn

Monitorering
☐ Ischemiövervakning ☐ Telemetri
☐ Vätskelista ☐ Bladderscan
☐ Urinmätning ☐ Timdiures

PRIO ☐ 1 ☐ 2 ☐ 3

Enligt vårdprogram

☐ Akut coronarsyndr ☐ Stroke/TIA ☐ DIABETES ☐ KOL ☐ Commotio ☐ Ompalp BUK ☐ Annat:

Avdelning ____ Bakavd. ____ Rapporterad till ssk: Rapporterad av ssk:

TRAUMAJOURNAL

Traumajournal enligt RETTS-T

Datum	Ankomsttid
Besöksorsak TRAUMA	Ambulansnr
Hämtadress:	
Sekretess ☐ Ja ☐ Nej	Förbehåll

ID: Rum:

Larm - triage

Skademekanism

SpO_2	AF	Puls	BT /	RLS	Bortfall	Temp

Överkänslighet
☐ Ingen känd ☐ Ja

Blodsmitta
☐ Nej ☐ Ja ☐ Vet ej

AK behandling/ Blödningsbenägenhet
☐ Nej ☐ Ja ☐ Vet ej

A, B, C, D påverkan

- ☐ SpO_2 < 90% med O2 eller ofri luftväg
- ☐ Puls > 130
- ☐ RLS > 3, GCS < 12
- ☐ AF > 30 eller < 8
- ☐ Systoliskt BT < 90
- ☐ Neurologiskt bortfall

Skada

- ☐ Penetrerande skada på huvud, hals eller bål
- ☐ Minst 2 frakturer på långa rörben
- ☐ Instabilt bäcken
- ☐ Amputation ovan hand eller fot
- ☐ Trauma med rökskada eller brännskada över 18%
- ☐ Trauma med drunkningstillbud eller nedkylning
- ☐ Instabil bröstkorg
- ☐ Ryggskada med neurologisk påverkan

Mekanism

- ☐ Bilolycka, beräknad hastighet > 60 km/t
- ☐ Utlöst krockkudde
- ☐ Utkastad ur fordonet
- ☐ Fordonet voltat, personen fastklämd
- ☐ Dödsfall i samma fordon
- ☐ MC/moped/cykelolycka > 30 km/h
- ☐ Fotgängare eller cyklist påkörd av motorfordon
- ☐ Fall från höjd över 3 meter
- ☐ Annat uppenbart högenergivåld

Utlöst Traumalarm
☐ RÖTT Traumalarm
☐ ORANGE Trauma
☐ Annat:

Sign Larmsjuksköterska

Primärbedömning

SpO_2	AF	Puls	BT /	RLS	Bortfall	Temp

Larmnivåbeslut
☐ RÖTT Traumalarm ☐ ORANGE Trauma ☐ Avblåsa traumalarm (GUL prioritet)

Sign traumaledare

Röntgenundersökningar på traumarummet
☐ Rtg Thorax ☐ Rtg Bäcken ☐ Ultraljud FAST

Pat kan lyfta armarna i samband med RTG JA ☐ NEJ ☐
Ansvarig Läkare:

Röntgen CT
☐ CT Skalle ☐ CT Thorax+Buk ☐ CT Ansiktsskelett ☐ CT Halsrygg

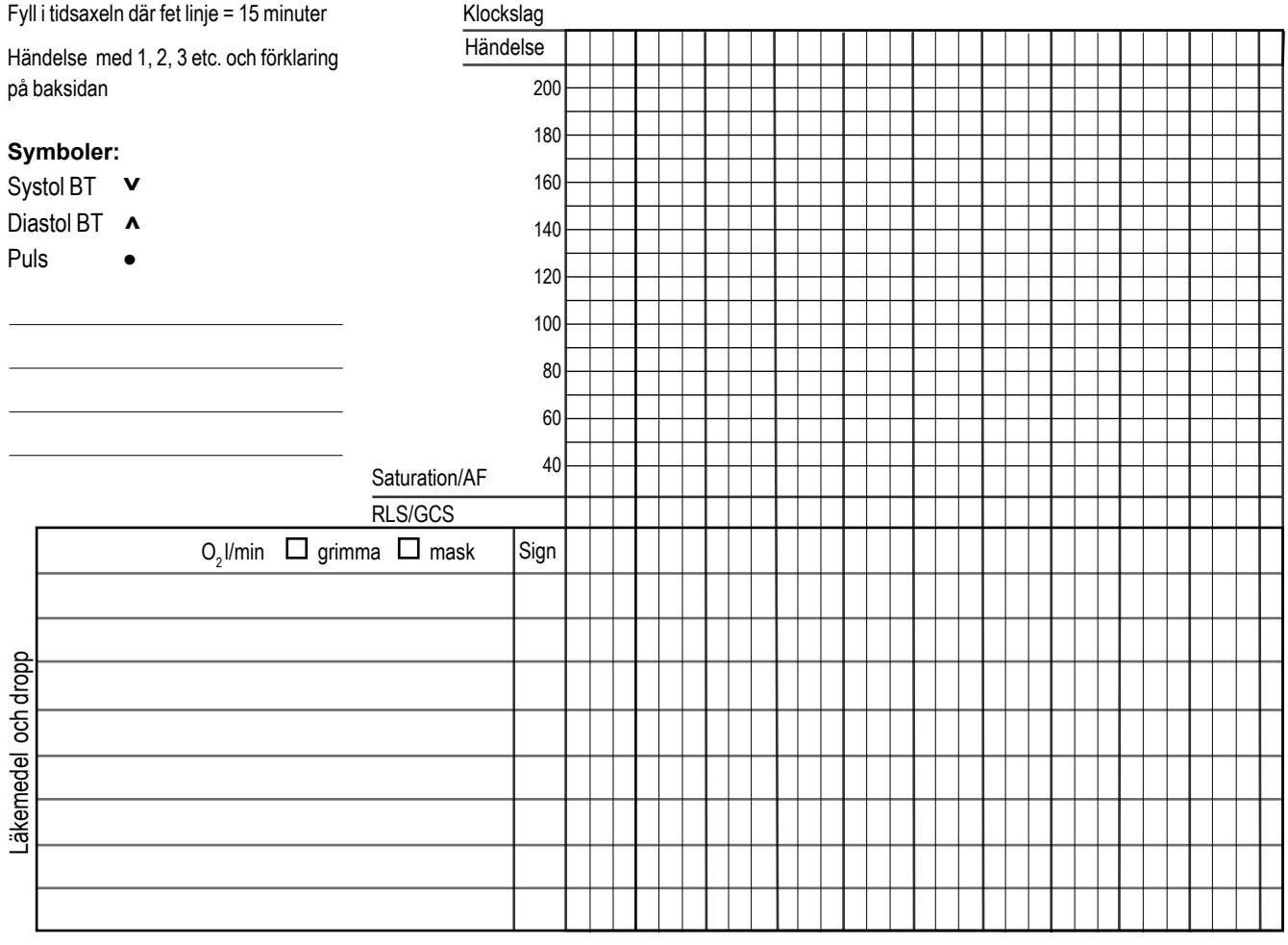
Övriga röntgenundersökningar
DECT

Kontroller, vätskor, blod och läkemedel

Fyll i tidsaxeln där fet linje = 15 minuter

Händelse med 1, 2, 3 etc. och förklaring på baksidan

Symboler:
Systol BT ˅
Diastol BT ˄
Puls •



Läkemedel och dropp

O_2 l/min ☐ grimma ☐ mask	Sign

RETTS, version 2012

Journalen granskad och signerad av: .....

TRAUMAJOURNAL

Traumajournal enligt RETTS-T

Komplement

PVK	PVK	Sond	KAD
Artärnål	CVK	Thoraxdrän höger utbyte: ☐ Luft ☐ Blod ml_____	Thoraxdrän vänster utbyte: ☐ Luft ☐ Blod ml_____

Provtagning på traumarummet
☐ Röda Traumaprover tagna ☐ Oranga Traumaprover tagna

Övriga provtagning på traumarummet

Undersökningar på traumarummet
☐ EKG taget ☐ Peritoneal lavage ☐ Thoracotomi / annan op:

Övriga undersökningar på traumarummet

Händelse

Nummer	Händelse

Övervakning på Röntgen utförs av:
AKOM ☐ Narkos ☐

Kontakt med ansvarig SSK på AKOM
Sektionsledare: 0736 601 624

Pat färdig på AKOM klockan:

Primär bedömning

A	B	C	D	E
Fri luftväg ☐	UA ☐	UA ☐	UA ☐	UA ☐
Intubation ☐	AF > 25 ☐ POX < 90 ☐	Puls > 120 ☐ Syst BT < 90 ☐	RLS > 3 ☐	Temp < 35 ☐
Kirurgisk luftväg ☐	Nedsatta andningsljud hö ☐ vä ☐	Instabilt bäcken ☐	Pupiller ☐	
Larynxmask ☐	Instabil bröstkorg ☐	Femurfraktur hö ☐ vä ☐	Bortfall:	

Närstående

Närstående	Tel	Närstående kontaktad? ☐ Ja ☐ Medföljer

Tillvaratataget ☐ Värdesaker/kläder tillvaratagna ☐ Värdesaker lämnat till anhörig	Sign	ID-band ☐ ID-band sedan tidigare ☐ Pat har fått ID-band	Sign

Skaderapport

Skador upptäckta på AKOM samt efter röntgen

Skall tas ur traumatransfer

Sekundär bedömning ☐ Sekundär bedömning utförd	Vårdnivå ☐ Operation ☐ CIVA ☐ TVE ☐ Avdelning ☐ Åter AKOM	Tid färdig efter röntgen

MEDDELANDE TILL AVDELNINGEN

Inläggningssorsak	ICD-10	Inläggande läkare	Operationsprioritering ☐ 1 ☐ 2 ☐ 3 ☐ 4

Kompleterande provtagning från avdelningen

Röntgen eller undersökningar från avdelningen

Per os
☐ Fasta ☐ Fritt flytande ☐ Normalkost

Syrgas
liter/minut ☐ Mask ☐ Grimma

Basala kontroller
☐ Uppkopplad på monitor
☐ Puls, Blodtryck, Saturation (POX) _____ ggr per dygn
☐ Vakenhet (RLS), Temp _____ ggr per dygn

Monitorering
☐ Vätskelista ☐ Urinmätning
☐ Bladderscan ☐ Timdiures

Allmänt meddelande till avdelningen

Avd

Avdelning	Bakavd.	Rapporterad till ssk Kirurg / Traumajour rapporterat till TVE	Värdesaker ☐ Värdesaker inlämnat till akutvaktmästare	Sign

6. RETTS
-Buksmärta R10.4
-Illamående R11.9
-Diarré UNS A09

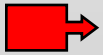
- Plötslig debut med pågående smärta på allmänpåverkad patient

- Svår/måttlig buksmärta på allmänpåverkad patient.
  Buksmärta hos pat med känt bukaortaaneurysm
- Buksmärta+PD-pat eller pyelostomi
- Feber > 38,5º och frossa nu eller före inkomst
- Buksmärta + syncope
- Immunosupprimerad patient

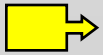
- Svår/måttlig smärta, i övrigt opåverkad pat.
- >2 kräkningar sista 4 timmarna

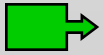
- Inget av ovanstående

Rekommendationer enligt RETTS


Röda prover+EKG


Orange prover+EKG


Gula prover+EKG


Inga prover+EKG

RETTS© 2012

Faktaruta somatik
Buksmärta är den vanligaste kontaktorsaken som brukar kategoriseras som ”kirurgi” inom akutvårdkedjan. Den bakomliggande orsaken kan dock vara mycket varierande, och vissa tillstånd kräver omedelbart omhändertagande men sällan akut kirurgisk åtgärd, medan andra är urakuta tillstånd. Debuten och förekomst av andra samtidiga symtom, ex.v. kräkning, hematuri, feber, frossa, diarre kan påverka handläggningen och prioriteringen. Det finns också kända riskfaktorer som kan utgöra ett stöd i bedömningen och prioriteringen av patienter med buksmärta, exempel på detta är tidigare bukkirurgi, kända gastrointestinala sjukdomar, gastric bypass, buktrauma, känt aortaaneurysm, peritonealdialys och pyelostomikateter.
Vid lågt sittande buksmärta hos fertila kvinnor skall man alltid misstänka graviditet eller postpartum, med komplikation. Se även ESS 21
Vid flanksmärta bör sk ”stensmärta” misstänkas, ev kan då även ESS 14 användas.

Processåtgärd prehospitalt: Enligt prehospital organisation

Processåtgärd hospitalt:
TNI på röd.
Leverprover på smärta ovan navelplanet.
Blodstatus med CRP på gul o grön prio.
Urinsticka på alla.
Gravidetstest på alla fertila kvinnor.
PM: följ lokalt PM för kvinnor med lågt sittande buksmärta.
Stor buk: bladderscan
Patient med prio högre än Gul ges vätska enligt PM
Vid stensmärta: följ PM för smärtbehandling
Blododling vid feber och fossa

39. RETTS-T
Traumalarmsaktiveringsalgoritm

Faktaruta trauma
Algoritmen används genom att larmssk erhåller rapport om vitalparametrar, skador* och skademekanismer från ambulans.
Larmssk på AKM aktiverar larmnivå.
*Skador definieras som kända/uppenbara eller misstänkta i röd ruta.
Vid ankomst genomförs reevaluering på akutmott/sjukhus.
Ett eller flera kriterier i röd ruta ger RÖD traumalarmsnivå.
De som saknar uppenbara eller misstänkta kriterier för röd blir orange även om man inte finner lämpligt kriterium i orange ruta. Dessa blir orange traumalarmsnivå.

- Bilolycka, beräknad hastighet >60/h
- Utlöst krockkudde
- Fordonet voltat, personen fastklämd
- Utkastad ur fordonet
- Dödsfall i samma fordon
- MC/moped/cykelolycka >30km/h
- Fotgängare eller cyklist påkörd av motorfordon
- Fall från höjd > 3 meter
- Annat uppenbart högenegivåld

- SpO2<90% med 02 eller ofri luftväg
- AF >30 eller < 8/minut
- Puls >130/min
- Systoliskt BT < 90mmHg
- RLS >3 eller GCS <12
- Neurologiskt bortfall
- Ryggskada med neurologiskt bortfall
- Penetrande våld på huvud, hals eller bål
- Instabil bröstkorg
- Minst 2 frakturer på långa rörben
- Instabilt bäcken
- Amputation ovan hand eller fot
- Trauma med rökskada eller brännskada >18%
- Trauma med drunkning eller nedkylning

Inget rött kriterium och ett eller flera i orange:
Orange traumalarm (Nivå 2) (se faktaruta ovan)

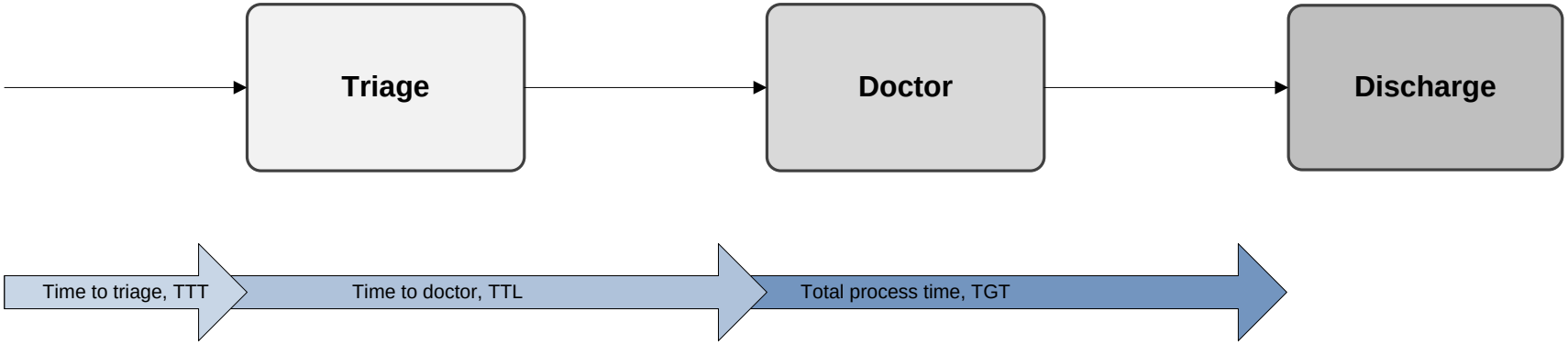
Ett eller flera uppfyllda kriterier:
RÖTT traumalarm (Nivå1)

Processåtgärd hospitalt: Den slutliga traumanivån sker på sjukhus.
Prehospitalt anges endast larmnivån på traumateamsaktiveringen

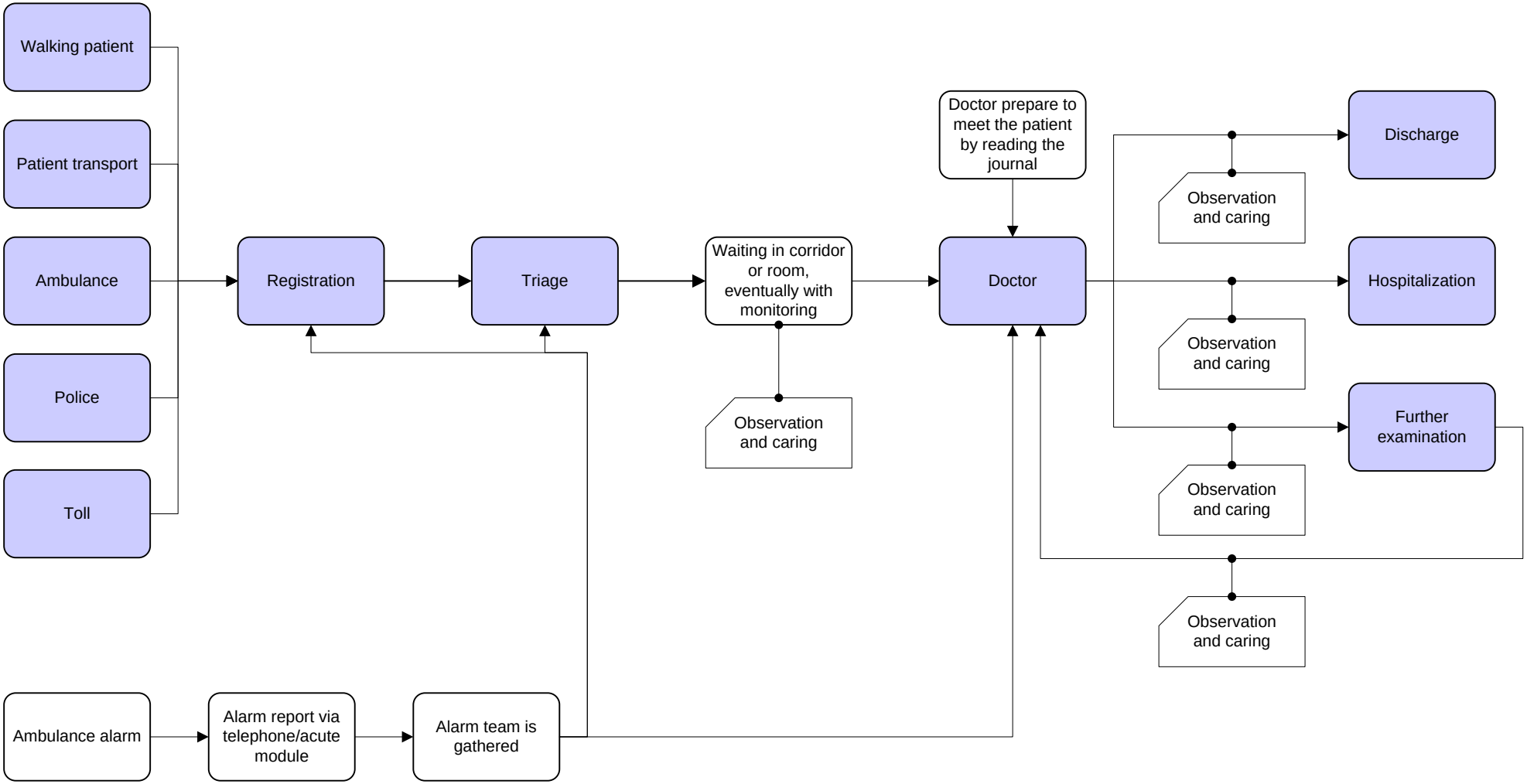
Appendix 2

Patient flow analysis

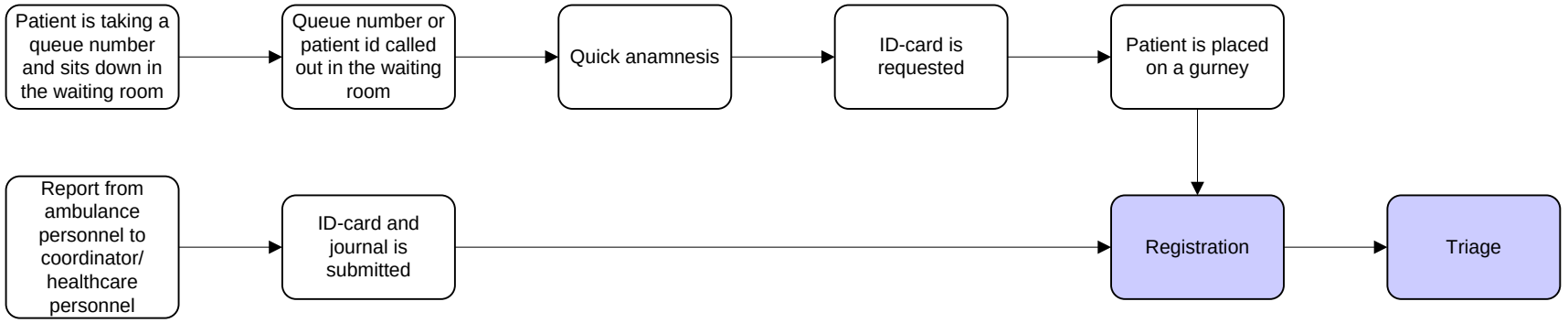
Patient flow analysis - overview



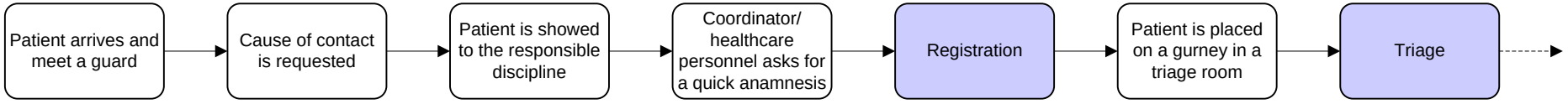
Process overview - details



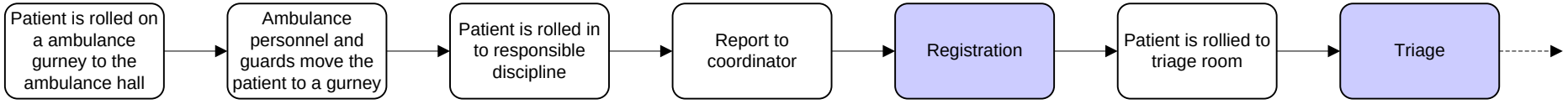
Arrival patients – triage



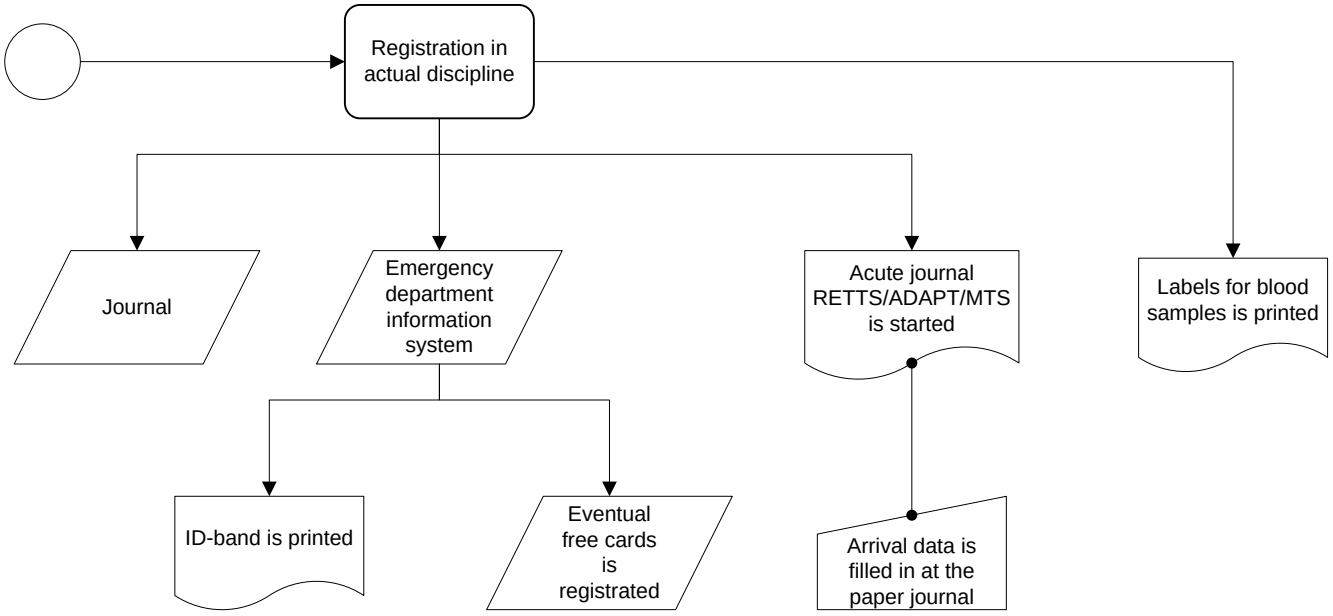
Arrival patients, walking – discipline



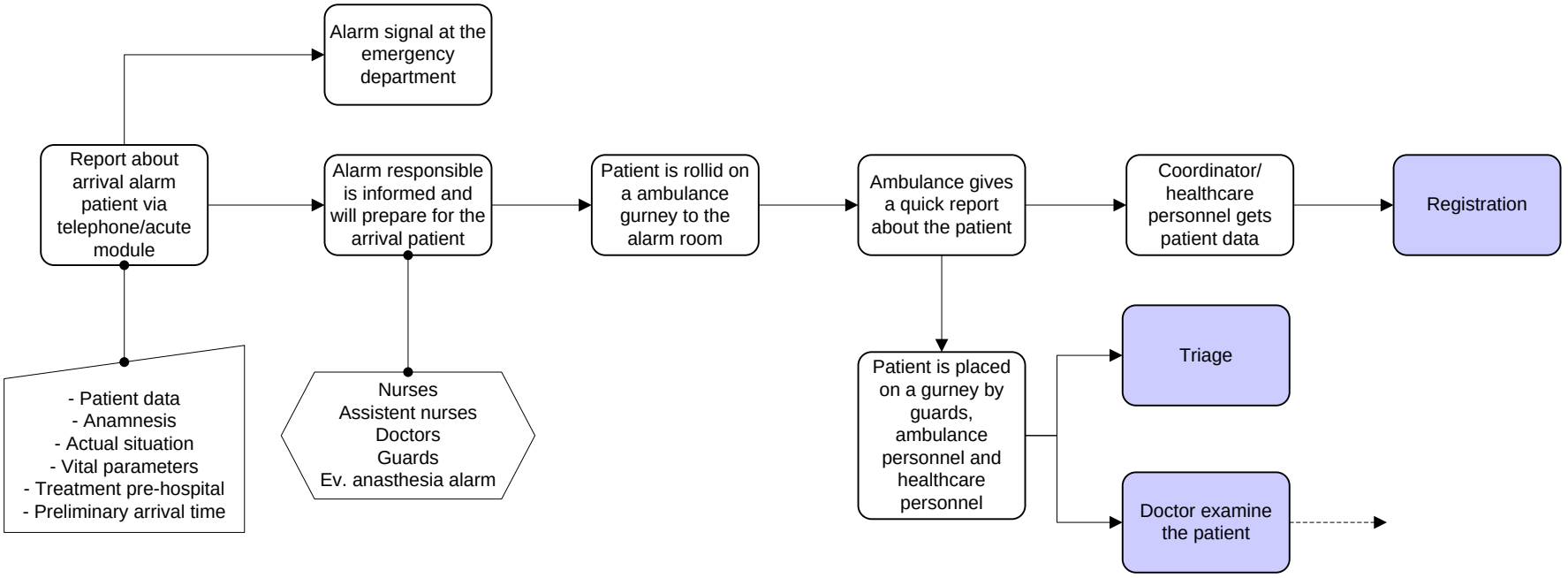
Arrival patients, ambulance not reported– discipline



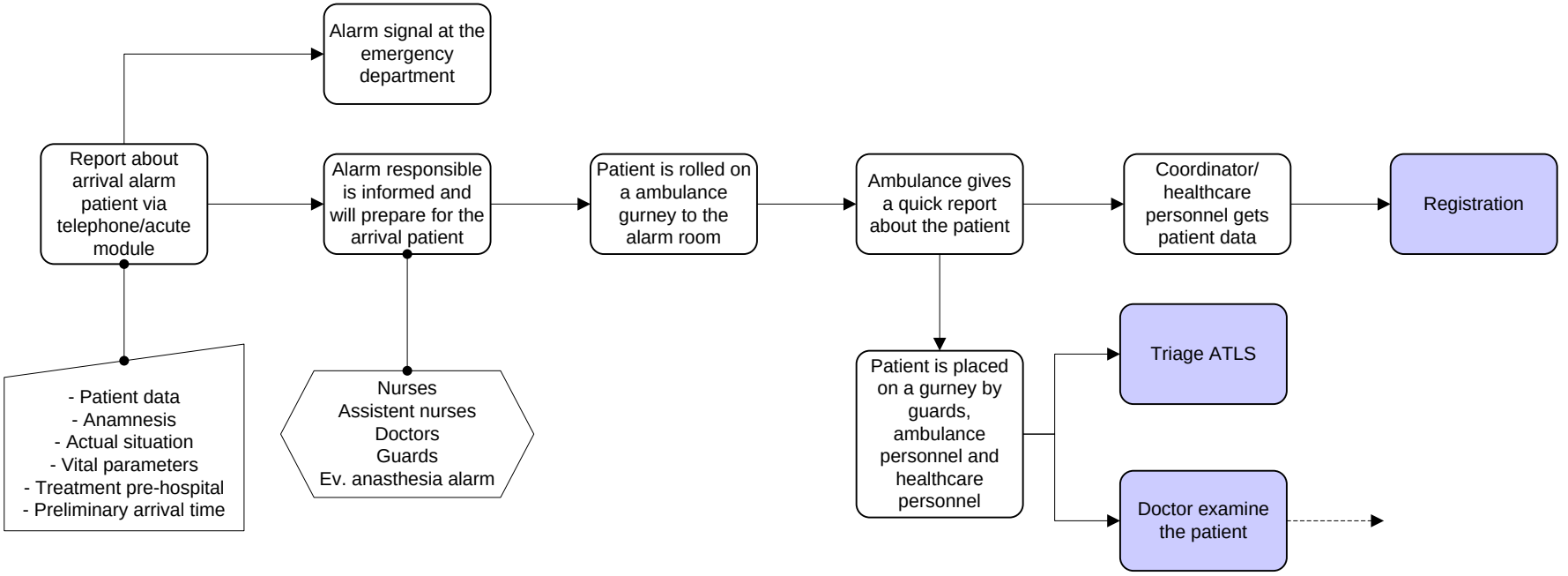
Registration



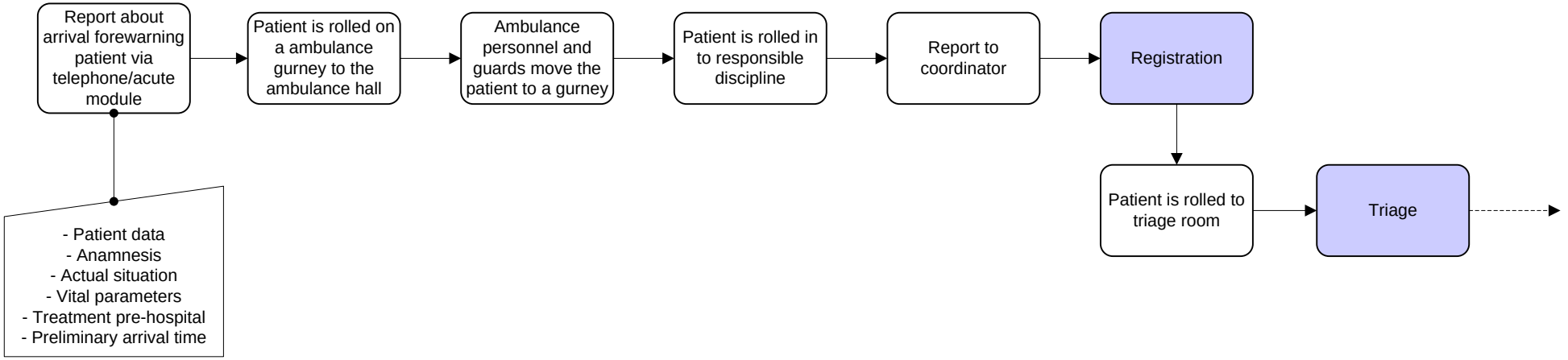
Alarm patient



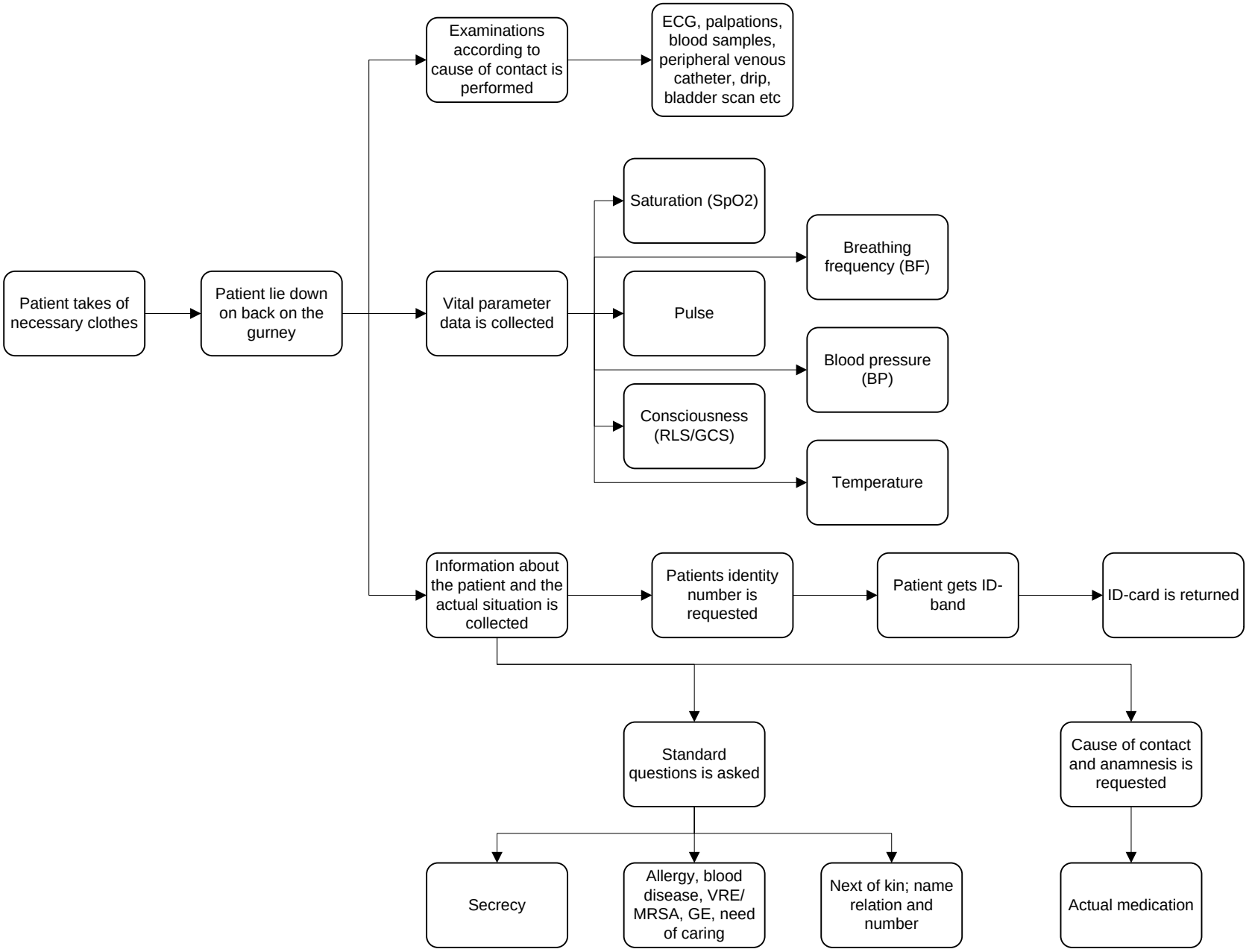
Trauma alarm patient



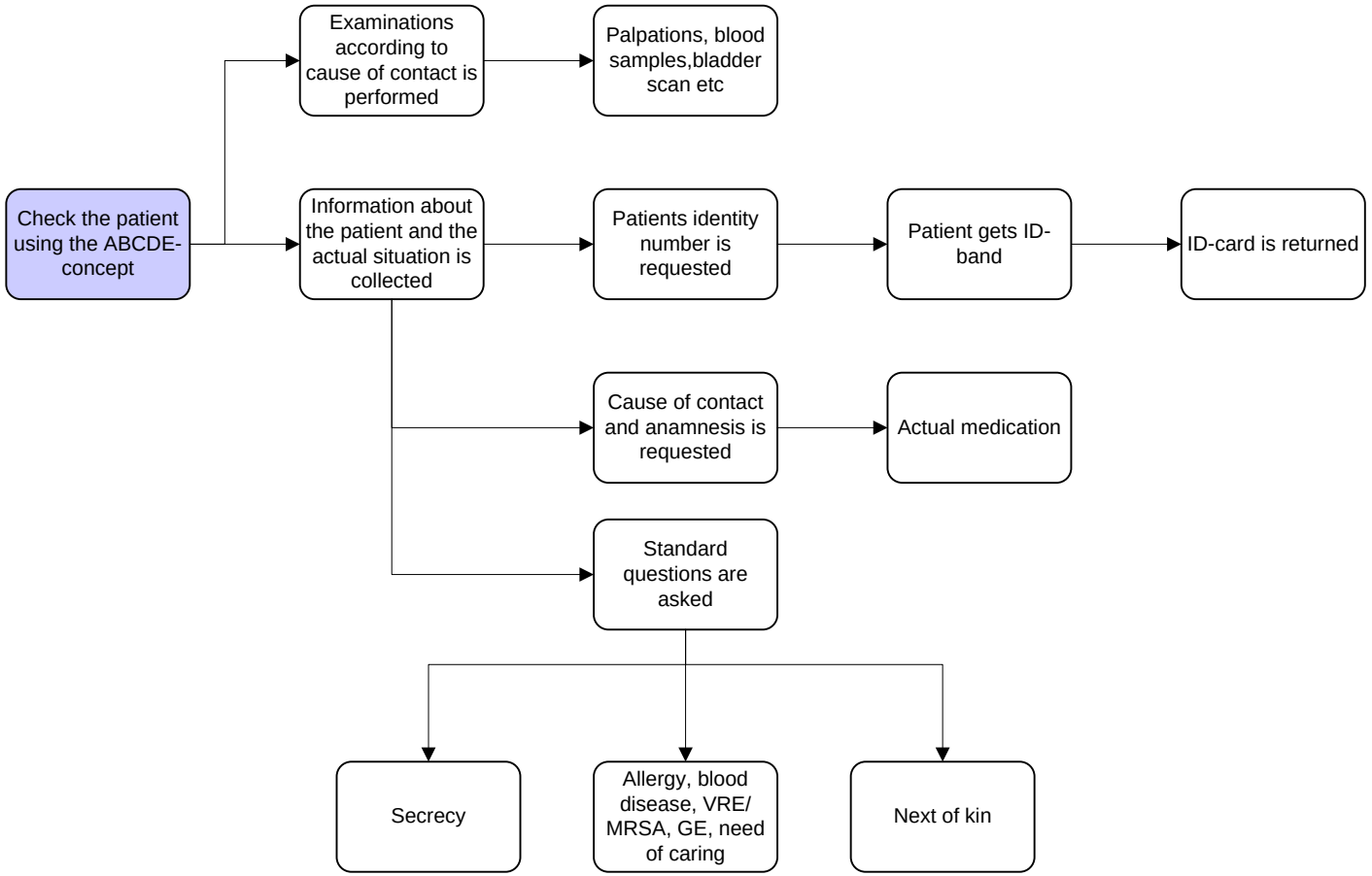
Forewarning



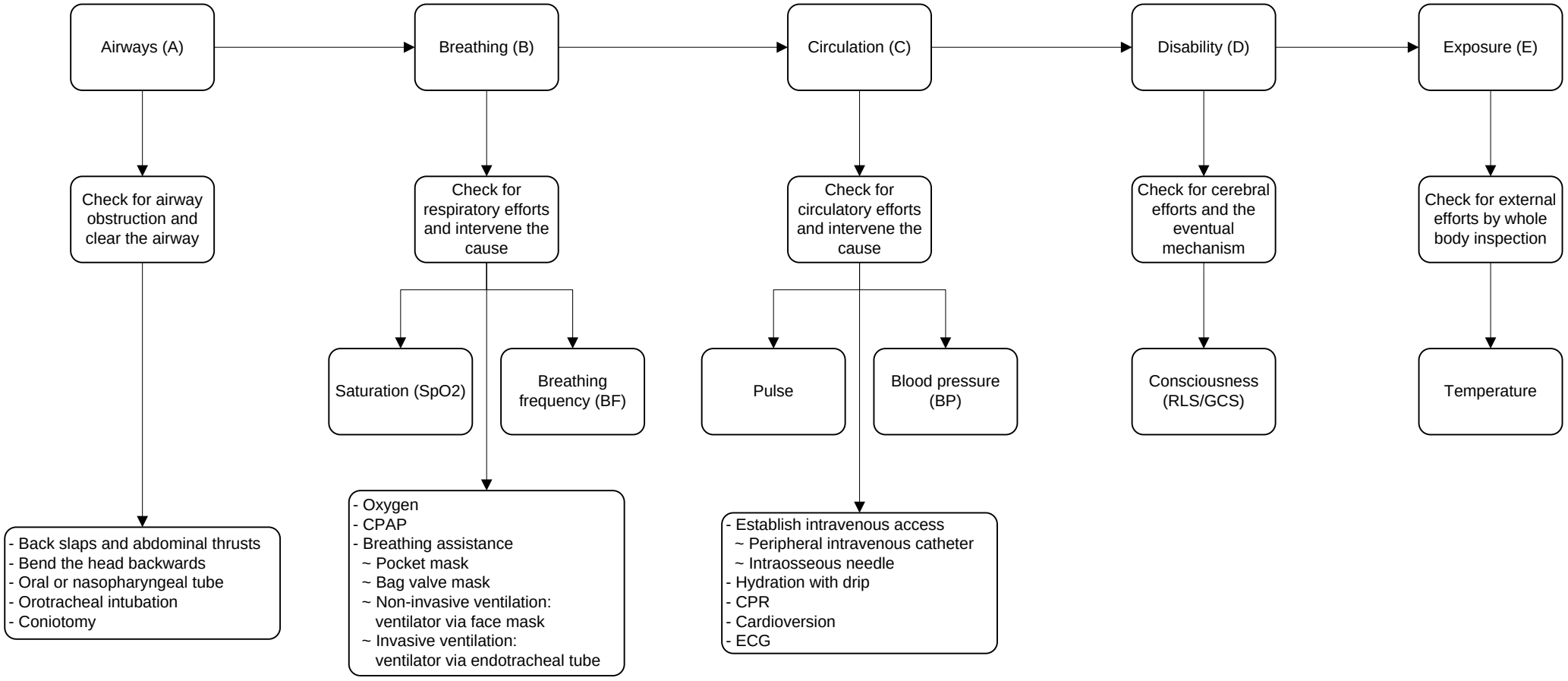
Triage


Patient takes of necessary clothes
Patient lie down on back on the gurney
Examinations according to cause of contact is performed
ECG, palpations, blood samples, peripheral venous catheter, drip, bladder scan etc
Vital parameter data is collected
Saturation (SpO2)
Breathing frequency (BF)
Pulse
Blood pressure (BP)
Consciousness (RLS/GCS)
Temperature
Information about the patient and the actual situation is collected
Patients identity number is requested
Patient gets ID-band
ID-card is returned
Standard questions is asked
Cause of contact and anamnesis is requested
Secrecy
Allergy, blood disease, VRE/ MRSA, GE, need of caring
Next of kin; name relation and number
Actual medication

Triage Advanced Trauma Life Support (ATLS)

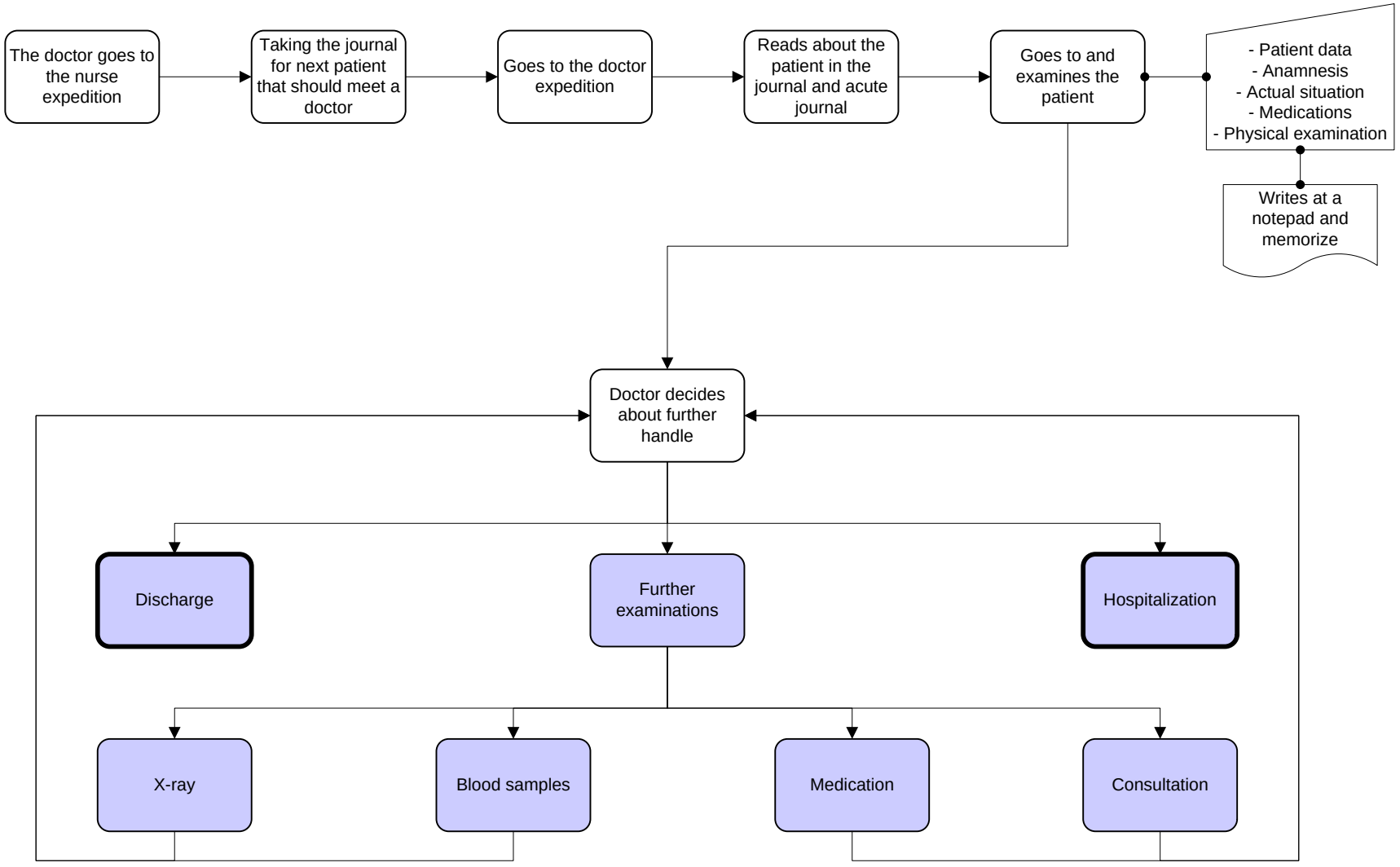


ABCDE

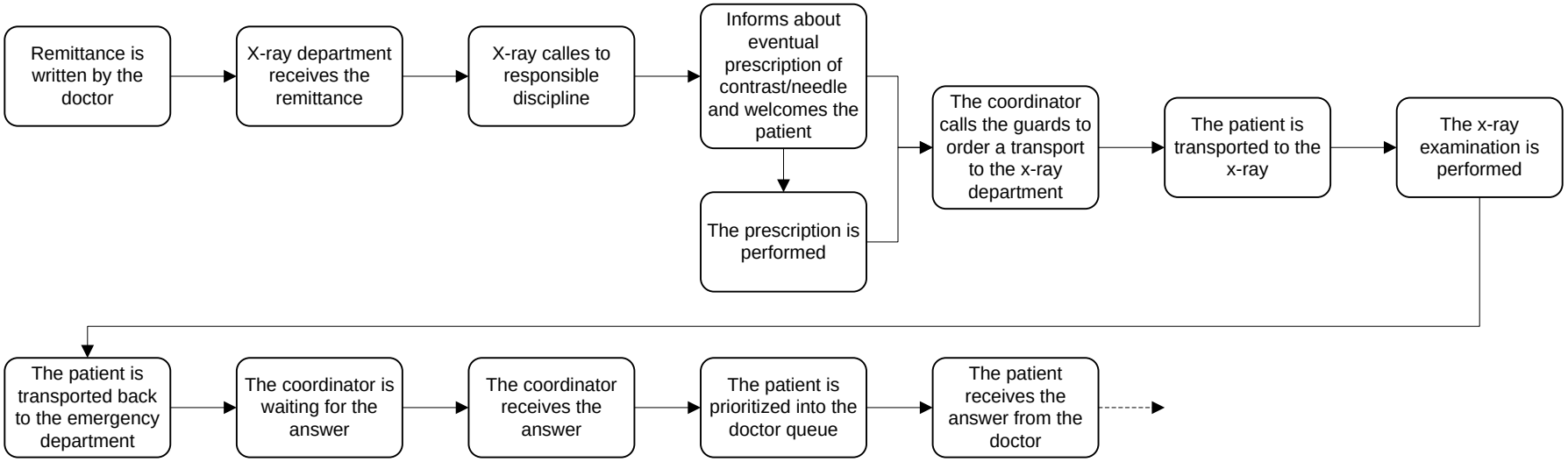


Reference:
Fryckstedt, J., Hulting, J., Höjer, J. & Ludwigs, U. (2011). Matell-Reichards Akutmedicin. Lund: Studentlitteratur

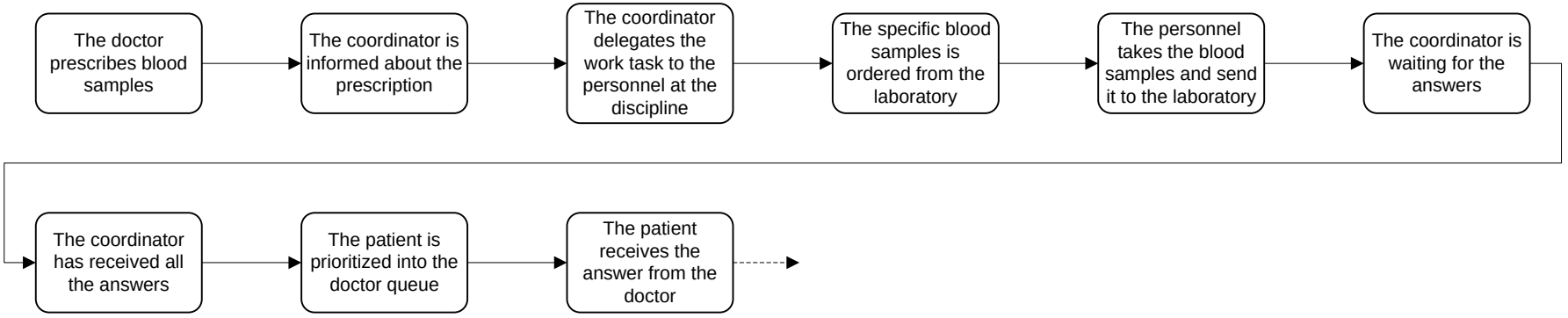
Doctor


The doctor goes to the nurse expedition
Taking the journal for next patient that should meet a doctor
Goes to the doctor expedition
Reads about the patient in the journal and acute journal
Goes to and examines the patient
- Patient data
- Anamnesis
- Actual situation
- Medications
- Physical examination
Writes at a notepad and memorize
Doctor decides about further handle
Discharge
Further examinations
Hospitalization
X-ray
Blood samples
Medication
Consultation

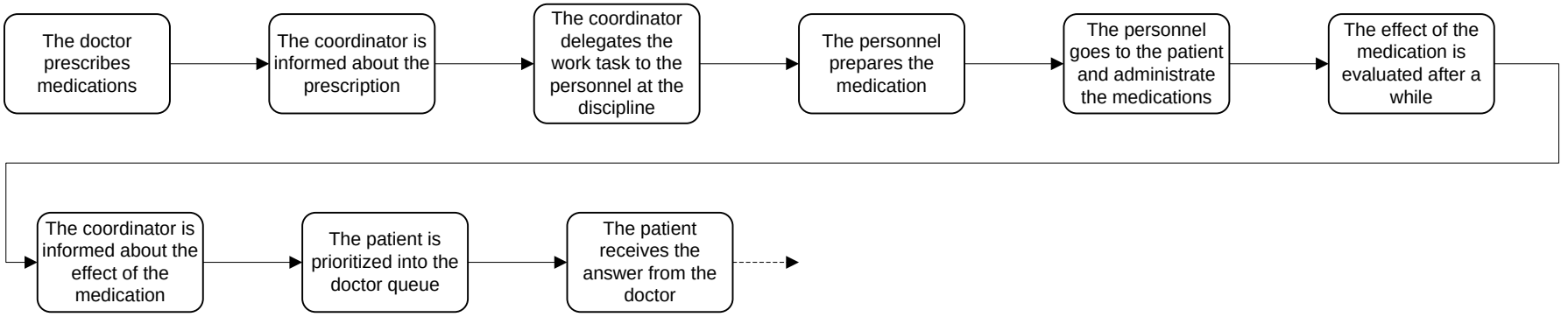
Examination – x-ray



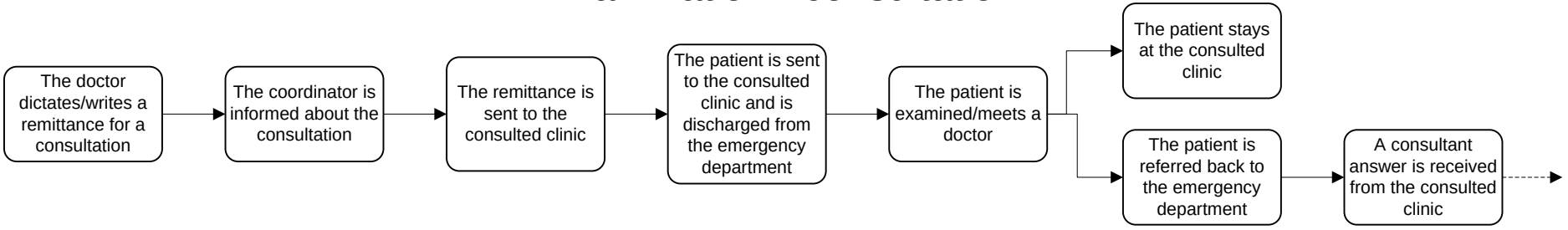
Examination - blood samples



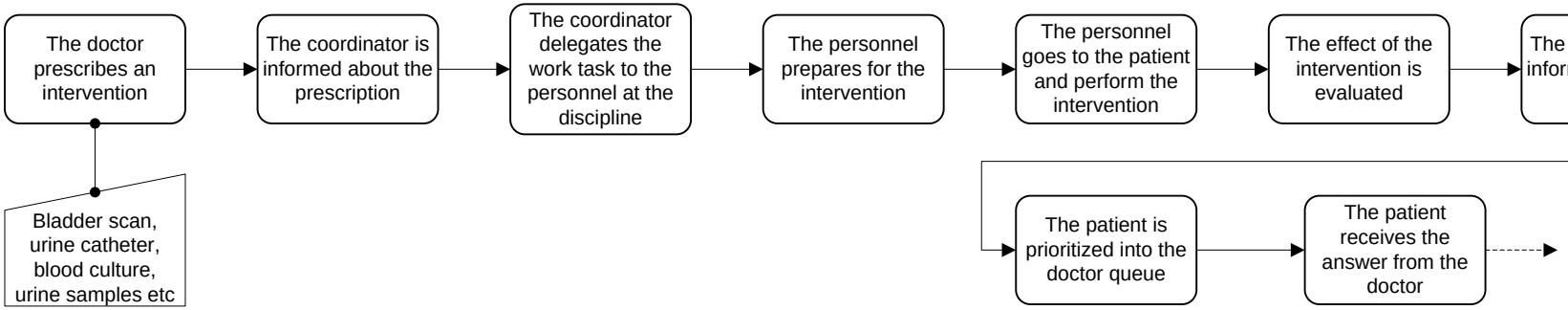
Examination - medications



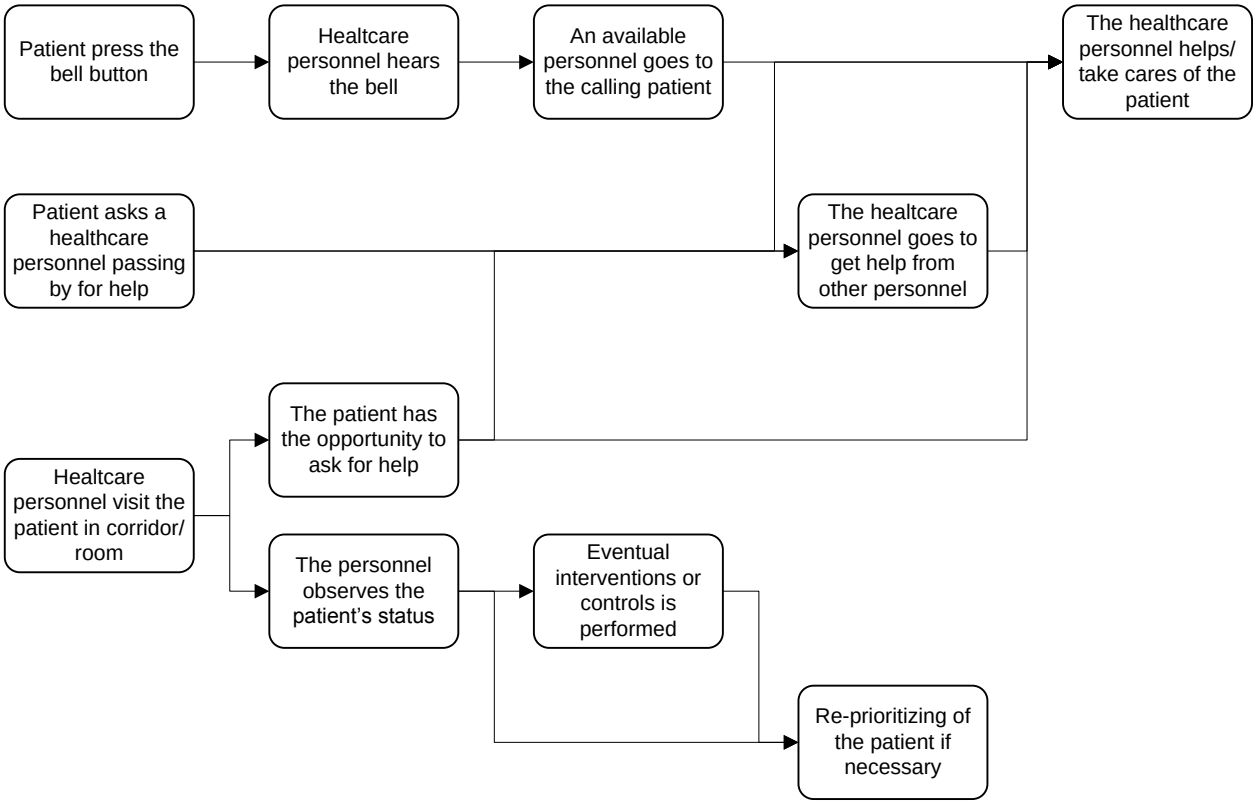
Examination - consultation



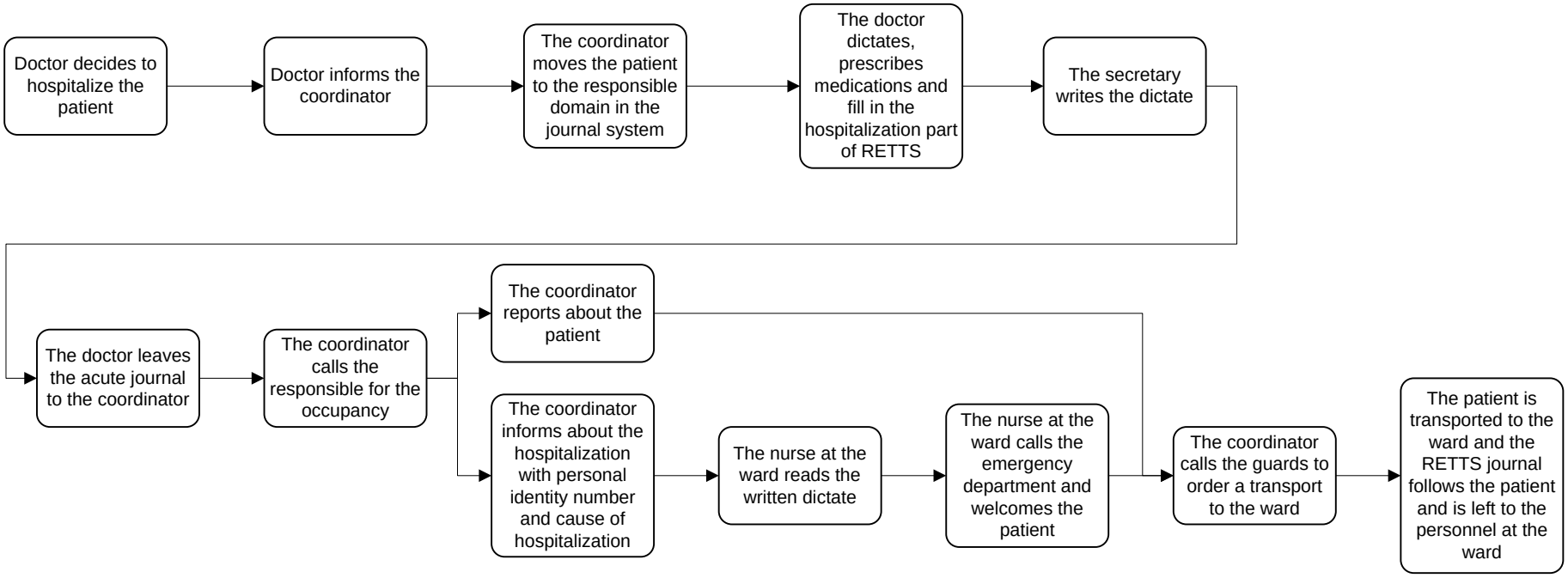
Examination - other



Observation and caring



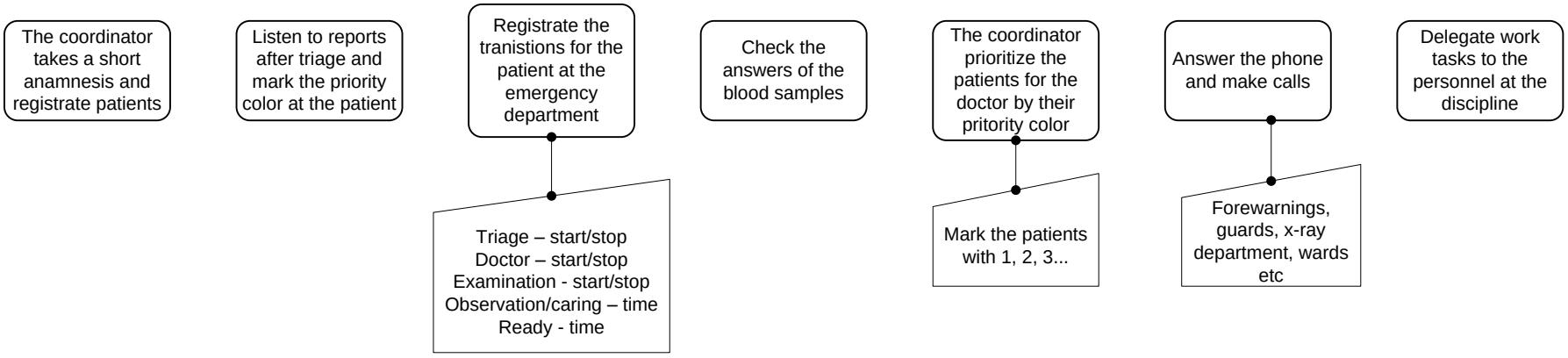
Hospitalization



Discharge

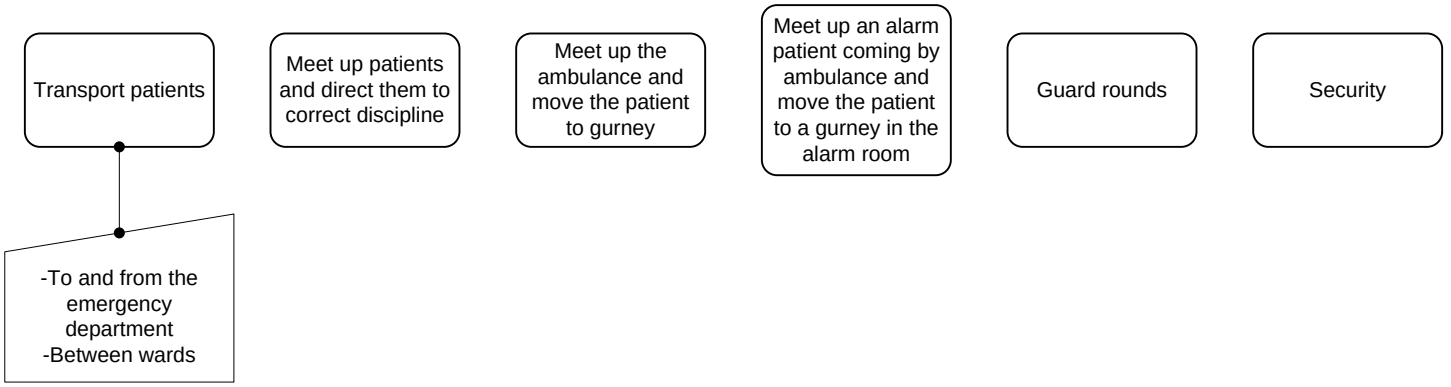

The doctor decides to discharge the patient
The doctor informs the coordinator about the decision
Eventual prescription is delegated to a personnel
Eventual needle is taken away
The patient is going home
The doctor dictates about the patient
The journal is put in a box for discharged patient for the secretary to write the dictate and eventually be scanned

Coordinator



Healtcare personnel – nurse and assistant nurse

Guards


Transport patients
-To and from the emergency department
-Between wards
Meet up patients and direct them to correct discipline
Meet up the ambulance and move the patient to gurney
Meet up an alarm patient coming by ambulance and move the patient to a gurney in the alarm room
Guard rounds
Security

Appendix 3

SAFE EDIS Layouts

- **Coordinator layout - main window**
- **Doctors layout**
- **Triage layout**

SAFE

About | View | Configure | Layout

History (Patient) | Previous contacts | Registration

Personal identity number

19111111-1111 Elvansson Elvan — admin1

Lastname: Elvansson | Firstname: Elvan
Adress: Elvans gata 11
Zip: 111 11 | City: Elvaborg
Phone: 0701111111
Age: 100 | Gender: Male
Cause of contact/ESS: Abdominal pain R10.4 | Discipline: Surgery
Identification via: Driver licence | Free card | Position: 12
Care request: Own request of care | Arrival with | Type of care: Medical care
Issue Created: 2012-09-11 04:21

Triage finished | X-ray remittance | Doctor reassessment | Departed without treatment | Ready for discharge | Ready for hospitalization | Closed

Overview | TRAUMA | Ambulance | General | Triage | Interventions | Monitoring and controls | Assessment | Hospitalization | Discharge

19111111-1111 Elvansson Elvan — admin1

Triage finished | X-ray remittance | Doctor reassessment | Departed without treatment | Ready for discharge | Ready for hospitalization | Closed

Allergy: Yes

Patient flow | Lead times | Time adjustment

Time	Value
2012-09-11 09:00:04	Doctor
2012-09-11 05:40:35	Ready for doctor
2012-09-11 04:27:08	Triage finished
2012-09-11 04:26:33	Triage
2012-09-11 04:22:07	Ready for triage
2012-09-11 04:21:03	

Summary | Details

Summary
SaO2: 96 %
BF: 21/min
Pulse: 114
BP: 135 / 81
RLS: 1
Temp: 39.5

Cause of contact: Buksm hö fossa.

Priority: Yellow

Interventions:

FASS | ESS algorithm | Guidelines

Registration List | Triage List | Doctors List | Hospitalization | Discharge

Filter

...	Name	Created	Discipline	Position	Cause of contact/ESS	Priority color	Priority to doctor	Comment of care	Warnings	State
	19121212-1212 Tolvansson Tolvan	2012-09-11 03:20	Medicine	1	Fever R50.9					Doctor reassessment
	19111111-1111 Elvansson Elvan	2012-09-11 04:01	Medicine	5	Abnormal heart rhythm R00				(!) Allergy	Ready for hospitalization
	19101010-1010 Tiansson Tian	2012-09-11 04:05	Surgery	9	Urine retention R33			rtg/		Ready for discharge
	19111111-1111 Elvansson Elvan	2012-09-11 04:21	Surgery	12	Abdominal pain R10.4				(!) Allergy	Doctor
	19121212-1212 Tolvansson Tolvan	2012-09-11 06:25	Surgery	b2	Diarrhea WFS A09				(!) Supicion of GE	Ready for doctor
	19101010-1010 Tiansson Tian	2012-09-11 06:55	Medicine	lv	No acute problems					Ready for doctor
	19121212-1212 Tolvansson Tolvan	2012-09-11 06:58	Medicine	16	Allergy T78.4				(!) VRE/MRSA suspicion	Triage finished
	19101010-1010 Tiansson Tian	2012-09-11 09:01	Surgery	op1	Trauma alarm activation algorithm					X-ray remittance
	19111111-1111 Elvansson Elvan	2012-09-11 09:10	Medicine	kor	Dyspnea R06.0					Ready for triage

Occupancy

Registered	9		
Red	1	Red unseen	0
Orange	2	Orange unseen	1
Yellow	2	Yellow unseen	0
Green	2	Green unseen	1
Blue	1	Blue unseen	1

Call

Active calls

All Incoming 0 in queue

Doctors List | Registration List

Created	Name	Priority color	Cause of contact/ESS	State	Priority to doctor
2012-09-11 06:58	19121212-1212 Tolvansson Tolvan		Allergy T78.4	Triage finished	
2012-09-11 03:20	19121212-1212 Tolvansson Tolvan		Fever R50.9	Doctor reasses...	
2012-09-11 04:21	19111111-1111 Elvansson Elvan		Abdominal pain R10.4	Doctor	
2012-09-11 06:25	19121212-1212 Tolvansson Tolvan		Diarrhea WFS A09	Ready for doctor	
2012-09-11 06:55	19101010-1010 Tiansson Tian		No acute problems	Ready for doctor	

Call

Active calls

All Incoming 0 in queue

FASS | ESS algorithm | Guidelines

History (Patient) | Previous contacts

19111111-1111

Name	Created	State
19111111-1111 Elvansson Elvan	2012-11-13 10:32	Closed
19111111-1111 Elvansson Elvan	2012-09-11 09:10	Ready for triage
19111111-1111 Elvansson Elvan	2012-09-11 04:21	Doctor
19111111-1111 Elvansson Elvan	2012-09-11 04:01	Ready for hospitalization

4 issue(s)

Overview | TRAUMA | Ambulance | General | Triage | Interventions | Montoring and controls | Assessment | Hospitalization | Discharge

19111111-1111 Elvansson Elvan — admin1

Airways

SpO2 96 — Priority SpO2 Green

BF/min 21 — Priority BF/min Green

Pulse 114 — Priority Pulse Yellow

BP 135 / 81

RLS 1 — Consciousness Awake — Priority RLS Green

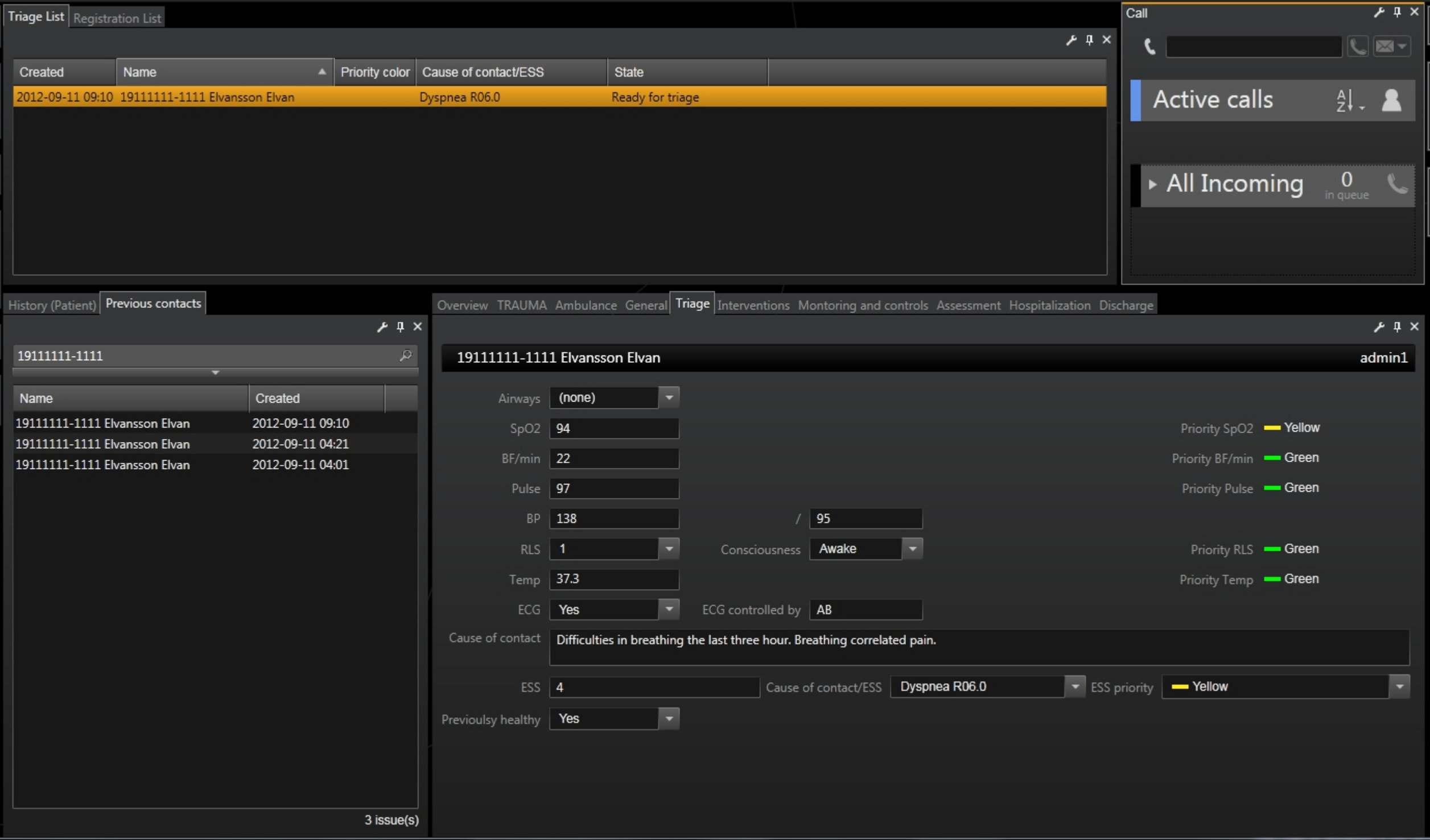
Temp 39.5 — Priority Temp Yellow

ECG No

Cause of contact: Buksm hö fossa.

ESS 6 — Cause of contact/ESS: Abdominal pain R10.4 — ESS priority: Yellow

Previoulsy healthy: Yes


Triage List
Registration List
Created
Name
Priority color
Cause of contact/ESS
State
2012-09-11 09:10
19111111-1111 Elvansson Elvan
Dyspnea R06.0
Ready for triage
Call
Active calls
All Incoming
0
in queue
History (Patient)
Previous contacts
19111111-1111
Name
Created
19111111-1111 Elvansson Elvan
2012-09-11 09:10
19111111-1111 Elvansson Elvan
2012-09-11 04:21
19111111-1111 Elvansson Elvan
2012-09-11 04:01
3 issue(s)
Overview
TRAUMA
Ambulance
General
Triage
Interventions
Montoring and controls
Assessment
Hospitalization
Discharge
19111111-1111 Elvansson Elvan
admin1
Airways
(none)
SpO2
94
BF/min
22
Pulse
97
BP
138
/
95
RLS
1
Consciousness
Awake
Temp
37.3
ECG
Yes
ECG controlled by
AB
Priority SpO2
Yellow
Priority BF/min
Green
Priority Pulse
Green
Priority RLS
Green
Priority Temp
Green
Cause of contact
Difficulties in breathing the last three hour. Breathing correlated pain.
ESS
4
Cause of contact/ESS
Dyspnea R06.0
ESS priority
Yellow
Previoulsy healthy
Yes