# Design Concept of an Information System for the Intuitive Assessment of Laboratory Findings

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## Abstract

*The clinical landscape of IT systems is characterized by a diverse set of specialized applications. Apart from embedded hardware-specific solutions that are tailored for one specific use-case, hospital information systems (HIS) include a much broader feature-set and aim to support various aspects of daily clinical routine. However, based on their wide scope, those systems often lack a dedicated optimization of information representation, e.g. by proper implementation of visualization. This results in an excessive use of plain key-value pairs that need to be processed and evaluated by the respective user. The implementation of visualization is able to address those issues by allowing quick and easy access to data and the contained information. We have developed a design-oriented concept for an evaluation system for laboratory findings using different charting methods as well as an intuitive navigation throughout the interface.*

## Introduction

Considering the emerging presence of mobile or desktop apps in the Microsoft, Google and Apple ecosystems, a majority of software solutions nowadays are primarily focused on supporting a single task (e.g. e-mail, calendar, banking) rather than a complete set of problems. This limitation by choice enables a deep focus on the optimization of user guidance and experience. In one of our recent studies, we have investigated the requirements for a specialized assistance system in the head and neck tumor board. An important incidental finding among all clinical participants was the demand for well-designed user interfaces (UI)[1]. With this submission, we would like to emphasize the implementation of design-oriented clinical IT systems that also adapt to the specialized medical or clinical environment. For the design challenge, we have chosen to submit our proposal based on a specialized evaluation system for laboratory findings. We have used the MIMIC III dataset[2] as an input to get all the information about possible parameters and categories from the included D_LABITEMS table. After assessing the amount and structure of the given data, we have developed our vision for a system that aims to consider three key aspects: user adaptation, simplicity, and intelligent data preprocessing.

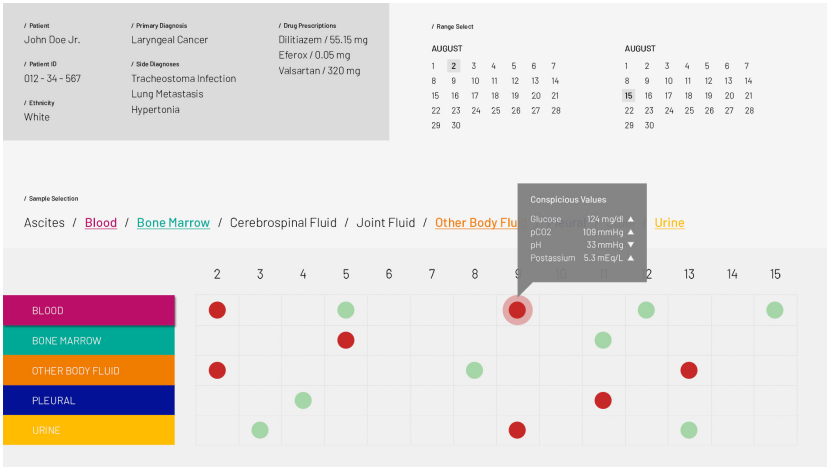


**Figure 1:** The overview layout of the system enables intuitive management of laboratory orders.

## Design Study: Overview

The overview layout (Fig. 1) represents the systems' entry point[3] and is segmented into three main components. The patient inspector (upper left corner) contains the patients' administrative data (name, id). It also features relevant

details about medical conditions that might affect the interpretation of the laboratory results (diseases, medication) and are thus crucial for the traceability of possible anomalies. The second component is the range selector (upper right) that enables filtering the laboratory orders through a certain date range. The selection also affects all other modules in the over- and detail view. The second half of the UI contains the actual procedure visualization. The user is free to enable or disable every possible category of laboratory orders (sample selection) while the visualization dynamically adapts to the respective choices. Each category is color-coded to match the item in the selection. All of the enabled categories are alphabetically ordered and positioned on the y-axis of the visualization while the x-axis features the timeline that was previously defined by the range selector. Every laboratory order is represented by either a green (no anomalies detected) or red (at least one anomaly detected) circle which enables a quick and efficient way to review the overall health status of a patient. A click on a red event opens a tooltip window that contains further information about the anomalies as well as their associated value while a double click reveals the associated laboratory order in detail as a separate view (with respect to Shneidermans' information-seeking mantra[3]).

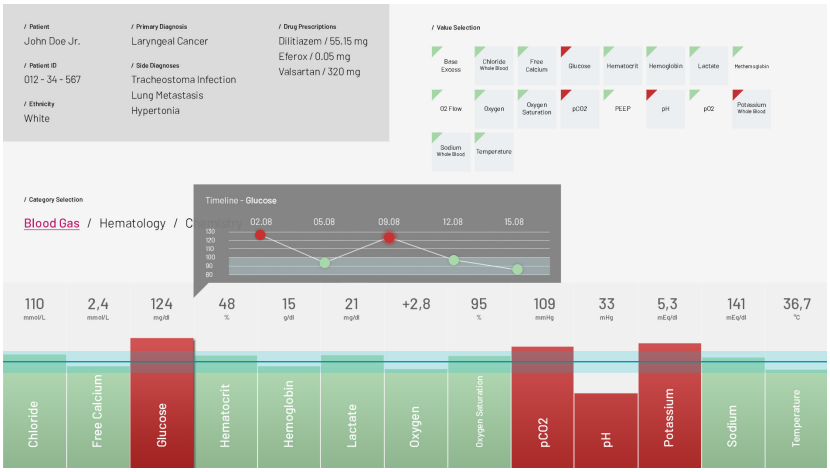


**Figure 2:** The detail view allows for easy assessment of a certain laboratory order and/or the course of a specific parameter over time.

### Design Study: Detail View

To further examine the results of each laboratory order, the detail view (Fig. 2) of the system features three connected methods for the assessment of individual results. The filtering process starts with the determination of the sample category (if applicable). The filter is located in the same position as in the overview layout. The parameter selection (upper right) then displays all examined sample characteristics in a grid-based layout. A small color-coded triangle in the upper left of each parameter cell evaluates the result based on former preprocessing by the system. The parameter selection by click is adapted by the bar-chart visualization on the bottom half. Each bar in the chart is normalized in its representation to enable a global normal range that is shown as a light blue area including the mean normal as well as the corresponding range of tolerance. An additional click on one of the parameters reveals a tooltip that features a line-chart showing the progression of the respective parameter values within the previously selected date range (overview). In this way, the user is able to evaluate the course of each characteristic, e.g. to verify treatment response or the suitability of individualized medication.

### References


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