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Impact of computerized information systems on workload in operating room and intensive care unit

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The number of operating rooms and intensive care departments equipped with a clinical information system (CIS) is rapidly expanding. Amongst the putative advantages of such an installation, reduction in workload for the clinician is one of the most appealing. The scarce studies looking at workload variations associated with the implementation of a CIS, only focus on direct workload discarding indirect changes in workload. Descriptions of the various methods to quantify workload are provided.

The hypothesis that a third generation CIS can reduce documentation time for ICU nurses and increase time they spend on patient care, is supported by recent literature. Though it seems obvious to extrapolate these advantages of a CIS to the anesthesiology department or physicians in the intensive care, studies examining this assumption are scarce.

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Introduction

Computerized information systems (CIS) for the anesthesia department and the intensive care unit have been around for several years. The initial homemade programs from the early eighties/nineties primarily collected data as captured by the bedside devices. The currently available systems have evolved into advanced record-keeping programs. Most of the systems are capable of not only collecting the available data and documenting the clinical course; in some instances the systems are making suggestions regarding patient management. This stage corresponds to the third generation of computer based patient records according to the classification scheme of Gartner cooperation.[1] The Gartner cooperation envisions that the computer based patient records will evolve in the coming

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decennia from the current "helper" functionality through the "colleague" stage to reach "mentor" capabilities.

Amongst the general perceived advantages of computerizing the bedside is the reduction in the workload for the clinician, one of the most appealing. This reduction in workload will be embraced by the hospitals that are faced with an ongoing shortage of personnel in the critical care environment.[2–5] This chapter will focus on changes in workload induced by implementing a CIS in the operating room (OR) or the intensive care unit (ICU).

Workload

In order to measure workload, we have to define workload. In the scarce literature regarding CIS in the OR and ICU the most frequently used definition for workload is the amount of time spend performing certain predefined tasks.[6] The vast majority of studies in the OR and the ICU interpret this as time needed for documentation and time spend in patient care. There are several restrictions to this limited view on workload: first of all it only considers time spend performing certain tasks and ignores other aspects of the work e.g. the physical and psychological strain. Only measuring methodologies like the Borg Ratings of Perceived Exertion (see methodologies section) take these aspects in account.[7] Secondly, the studies disregard the additional work needed to implement and maintain a CIS in an environment which operates 24/7.[8] Thirdly, by focusing the research on the people directly operating the CIS, all the possible indirect advantageous effects of the CIS on other persons and departments are discarded. Some of the possible area's where indirect advantages can be achieved are discussed in point indirect reductions in workload on a management level and indirect reductions in workload on a more personal level.

Direct reductions in workload

Both the OR and the ICU are data-rich environments with many bedside devices, medication orders, tasks and observations. It seems obvious that workload reduction could be achieved by capturing data from bedside devices (monitor, ventilator, medication pumps, dialysis machine, assist devices and so on). The connection with the hospital information system should provide not only demographics of the patient but also laboratory results. The majority of studies on workload in the OR and ICU focus predominantly on the possible reduction in charting time created by this automatic data capture.[9–23] Additional advantages can be expected of aspects as automated progress notes, summary reports, integrated protocols, quick access buttons for rapid entry of interventions and given medication. Access to other hospital databases such as e.g. the radiology picture archive, should be done without providing username or password (single sign on functionality) and should only return the results for the currently active patient in the CIS (patient aware).

Additionally, there is the point of ergonomics: both the OR and the ICU are complex environments with rapid changes. Physicians and nurses need not only to assimilate multiple information sources, but also nearly instantaneously integrate, analyze and prioritize the data to provide the appropriate response. Integrated trend analyses and problem oriented screens of a CIS can reduce the time to detection, help to understand the nature of the anomaly and assist in providing a solution.[24–27]

Indirect reductions in workload on a management level

Intensive care units and anesthesia departments consume a large portion of the total hospital budget.[28–30] Managing such departments can be a considerable challenge. A CIS can facilitate insight by providing aggregated information on the daily activities in OR and ICU: e.g. how many patients were ventilated in the ICU, how many procedures were performed in the OR. For the OR key information concerning e.g. the duration of the procedure and turnover times is available. Resource utilization, by anesthesiologist or surgeon, can be measured, benchmarked and eventually guided by a CIS.[31–33] In the ICU the CIS can provide similar metadata. For instance, most ICU's are required to collect information on the severity of illness and intensity of nursing activity of their patients using scoring systems like the TISS, APACHE or SOFA score.[12,34–37] The raw data for these scoring systems can be extracted

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