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The Experimental OR - An Opportunity for Manufacturers, Surgeons and Users

Operating rooms – ORs - show deficits in a wide range of areas. As a workplace, they do not meet today's ergonomic standards. In economic terms, they offer potential to exploit substantial additional resources. Moreover, interaction between the different medical-technical centres, facilities management and work processes could be improved.

The experimental OR at the University Hospital Tübingen is a unique, interdisciplinary project designed to deliver an integrated, holistic system for future operating theatres which will optimise future theatre planning. It will allow hospitals to realise long-term cost savings in their most expensive functional unit while achieving sustained improvements in theatre working conditions.

OR personnel give their workplace a poor report card. In a survey carried out at the German Surgery Congress in 2004, almost 70% of the surgeons interviewed indicated that they could not intuitively operate equipment properly.

Although air conditioning systems are supposed to guarantee sterile air in ORs, they create draughts and do not provide a pleasant in door climate for everyone in theatre. Cables and tubes create trip hazards that cause falls, while identifying appropriate locations for sockets can present problems.

The different operating philosophies of manufacturers can result in accidental misuse of equipment. For example, many devices feature unintelligible symbols or have specular displays. In addition, the positioning of equipment may prevent simultaneous observation of the patient and the device. Not only is this disruptive from an ergonomic perspective, it is also relevant from a safety point of view.

An evaluation of cases referred to the Federal Institute for Drugs and Medical Devices in Germany under medical device safety plan regulations found that between 2000 and 2006, the institute received 1,330 reports related to the use of medical devices in operating theatres. Of these cases, 42% were caused by problems in human-tomachine communications and in 90% of these incidents patient health was put at risk (Montag, 2007).

Fitness for Purpose

It is estimated that adverse events attributable to medical and technical equipment cause between 44,000 and 98,000 deaths in US hospitals each year (Kohn, 1999). Von der Mosel (1971) and Bleyer (1992) noted that two thirds of equipment errors were attributable to interaction between devices and users, as opposed to technical defects. It is estimated that the treatment of complications arising from problems with the use of equipment in intensive care wards costs German hospitals 396 million euros per annum (Back - haus, 2004).

Air Conditioning Technology

Similar problems occur in medical technology, architecture and building services engineering. Air conditioning technology is a good example of the incompatibility of components. Substantial technical and financial resources are expended on providing an air supply that should allow pure air to flow downwards from the ceiling into the operating area, thus avoiding contamination. Despite this, smoke rises during coagulation, a sure sign that the air flow is moving in the wrong direction. This fault is facilitated by the OR team and OR lighting.

Conductive Flooring

The installation of conductive flooring is now standard in operating theatres. This measure was adopted to protect against the risk of explosion. However, ad vances in anaesthesia have eliminated the need to use anaesthetic gases that can produce combustible mixtures. For this reason, it is no longer necessary to spend large sums on the installation and maintenance of conductive flooring in operating rooms (Scherrer 2008).

Efficiency Improvements

To improve efficiency in a theatre block, the focus must be on reducing changeover times rather than the surgical intervention itself. Previous initiatives aimed at optimising changeover times have reduced turnaround by between 15% and 45% (Sokolovic 2002, Sandberg 2005, Hanss 2005, Cendan 2006). Increases in staff resources were a factor in realising these reductions. Spatial chan ges were confined to establishing

induction and exit zones.

While every staff member knows what actions need to be performed before an operation can be successfully completed, the constituent steps do not proceed in an ordered fashion and are, therefore, inefficient. A video-based analysis of the individual steps involved in a short changeover procedure lasting just 33 minutes demonstrates the potential for structured optimisation. Activities that require the attention of staff, for example, record-keeping by clinicians and nursing staff, are repeatedly interrupted, while subprocesses, including the preparation of instruments, X-rays and so forth, can be performed outside the theatre (Kutz 2006),

Changeover Procedures

An unbiased and, where appropriate, video-based analysis of the various measures, combined with training in optimised processes, could significantly improve the effectiveness of the surgical team. Sufficient architectural, building services engineering, medicaltechnical and staff resources are not always available to manage the process efficiently and ergonomically. In this context, investment in structures, technology and staff would be cost-effective and save staff time. The time saved by avoiding unnecessary waiting for subsequent operations can be used to provide patient care, thus improving quality and safety and enhancing patient perceptions of their treatment (establishing good customer relations). Parallel processes are required to achieve this goal, which means, for example, administering an anaesthetic to the next patient scheduled for an operation outside theatre while another patient is undergoing surgery. Patients should also emerge from anaesthesia and instruments should be removed from the instrument table outside theatre. Ideally, these steps will reduce change over times to as little as ten minutes, while complying fully with hygiene standards. Storage activities and the application of antiseptic can be performed in induction. The patient reaches theatre after the room has been cleaned and “just in time” for his operation.

If one minute of theatre time costs 7 euros, a 25-minute reduction in changeover time would save approximately 132,000 euros per annum. Of course, more staff are required to cater to the needs of patients. However, any increase in staffing costs will be compensated for by optimised processes and associated value added. The case of a surgical area in which data on processes are recorded in exacting detail highlights the potential for success. Each week, 25 patients are operated on in two theatres and changeover times, at 30 to 35 minutes, are already very good. Nevertheless, the OR must be used for 15 hours each day before its allotted workload is complete. The data on floor plan and personnel was entered in simulation software, analysed and superimposed on the experimental OR. The simulation shows that the same number of patients could be processed in one 12-hour shift.

An additional advantage is that the full programme for the week is completed by Thursday evening at 6 p.m., leaving a day free to re du ce overtime, care for outpatients and patients on the wards or in crea se the number of operations performed.

Against the background of these initial research findings for the experimental OR, the sensible course of action for hospital operators would appear to be to analyse and simulate their own processes to determine whether their theatres could be operated more profitably, safely and humanely with additional staff and an optimised layout.

The Experimental OR in Tübingen

To examine and further develop the issues cited above, Expe ri mental OR and Ergonomics cons truc ted two theatres in a 1,000 sq. m. hall, each of which was fitted out with the most advanced equi pment and technologies.

Com panies from the medicaltechnical industry, architects, planners, re search structures of the state government of Baden- Wurttemberg and medical staff will work together on this live international platform to develop, realise and validate the operating room system of the future.

Work shops on specialist subjects will run alongside this process and assist the development of the project. Participating groups will also use these installations for training and education purposes. This new OR system will deliver long-term im provements in the ergonomics, safety and profitability of operating rooms over their life cycles.

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