Web-Based Scheduling System for a Large Anesthesiology Department
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Summary
The scheduling needs of a large, diverse academic anesthesiology department are complex, and have a significant impact on surgical suite efficiency. Our department needed a system that would reduce scheduling effort, decrease errors (particularly uncovered or understaffed assignments), and improve schedule availability, the vacation request process and the ability to report on assignment history. We therefore developed a selectively automated staff scheduling system that combines traditional manual methods with spreadsheets, web technology, and a magnetized whiteboard. Although a highly customized system, our methods and results may be instructive for the selection, design, and management of clinical staff scheduling systems.

Introduction
Factors that complicate the scheduling task include educational considerations, variable caseloads, equity requirements, and personal preferences, plus the existence of different personnel categories, clinical specialization, and part-time staff. The schedule is dynamic, undergoing constant modification to accommodate unexpected staff absences, emergency cases, variation in case length, and unanticipated case complexity requiring personnel changes. Effective communications mechanisms are needed to distribute the schedule.

System and Process Design & Implementation
The informatics literature provides little guidance on optimal staff scheduling system design. Full process automation would be a major technological and cultural challenge. We therefore chose to selectively automate to achieve the specific goals stated above. The resulting system is comprised of two integrated components, one for assignments and one for vacation scheduling. The assignment component was developed in Visual Basic using Microsoft Excel as the front end. Multiple group-specific monthly schedules were formerly created manually and submitted on paper but are now entered into Excel. Files representing each month are stored in a web-based system that has a library style, password-protected, check-in and checkout interface. The monthly schedules, vacation requests, preferences, and other inputs used to be integrated by clerical staff and coordinators to create a series of “dailies” - the operating room and assignment allocations for all personnel. The new system automatically outputs multiple Excel sheets containing the dailies and in addition performs automatic rule-based error checking to replace the cross-schedule checking that occurred by hand prior to system deployment. The manual process was highly susceptible to errors. A major benefit of the new system is the automated implementation of rules to prevent input of scheduling conflicts to the dailies.

A magnetized portable whiteboard (the “magnet board”) was an integral feature of the old system, providing real-time representation of assignments and tasks, and a means to reallocate them. In the new system, the dailies are formatted to mirror the magnet board, which is still used. Staff then transcribe the Excel "daily" worksheet to the magnet board.

The original vacation schedule process involved paper request submissions, rule-based allocation, entry in a standalone spreadsheet, and then transcription to a monthly planner for department dissemination. Users can now make online vacation requests with instant feedback 24 hours a day, and can view the online vacation book in the same format that they used to view the paper version.

Conclusions
This pragmatic staff scheduling solution for a large anesthesiology department successfully implements scheduling rules, prevents catastrophic errors that cause non-staffed operating rooms, improves the vacation request process, and provides reporting capabilities which facilitate the equalization of workload. Our system is not totally automated but allows multiple scheduling personnel to work in an integrated fashion. We retained the flexibility of manual input to individual monthly schedules and the useful ability to respond to unpredictable last minute changes with the magnet board.

The system also allows universal off-site access, provides an audit trail, and permits access to the dailies without special client software other than a web browser and Microsoft Excel. Change management challenges, security concerns, integration issues and technical problems have been encountered. However the system overcomes these challenges to offer significant benefits in time and financial savings, increased clinician and administrator productivity, and improved scheduling accuracy and predictability.