Faculty Scheduling:

It Should be Easy

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In this issue, you will find a thought-provoking, somewhat formal, mathematical article about scheduling of radiologists' time (1). It is very well done, and brings up many of the issues that those of us involved in Clinical Operations and rules-based, expert-system, automated approaches to scheduling have struggled with over the years, as well as one that I never thought of. I often have stated that the business aspect of radiology has many similarities with the airline business: expensive equipment, well-paid highly trained employees, scanner slots or seats, and patients or travelers to fill those seats. When the airplane or scanner is unfilled or not in the air, it is not being fully productive. The airlines have appreciated and invested in the importance of automated and optimized crew scheduling for decades, because it is their third largest expense (we also have capitalized equipment but not fuel.) We in radiology have not, and with a few exceptions, still generally rely on manually generated spreadsheets, based on rules negotiated and agreed upon or dictated from above. One interesting debate, for example, is the "clumping" of academic time versus maximizing group flexibility in choosing vacation/meeting time. You cannot have both.

As described in the accompanying article, there is a rich background of mathematical methods for optimizing the solution of various similar problems in operations research. The recent era began at the end of World War II, with Danzig's description of the simplex method linear programming solution to the classic traveling salesman problem (known as TSP): Given a set of locations and the distances between each and all of them, find a route that minimizes the distance traveled (2). It extends through the birth of artificial intelligence to the current time.

Why is scheduling important, and what does computer-based automated or computer-assisted scheduling offer as an advantage? First is the issue of transparency and fairness. This has a positive effect on new and current faculty for recruitment and retention, one of the most important factors in the success of an academic department. Second is accountability. For each full-time faculty, every one of the 250 nonholiday working days per year needs to be accounted for by assigning to clinical service, administrative service, educational/academic, meeting, or vacation (appropriately factored for increasingly popular part-time positions; eg, 80% commitment/20% unpaid time off). A scheduling system can easily keep track of tallies for all to see. As pointed out in the cited article (1), this includes granular distribution of specific clinical assignments. Next, the department needs to make sure that every clinical task is fully staffed. And there comes the complexity, particularly in an academic department. Although private practice groups tend to be relatively rigid and efficient in their radiologist staffing, the same in general is not true of academic practice, until recently. Academics tend to make more exceptions and allow ad hoc bending of the rules to satisfy the other two missions of research and education, such as group attendance at the annual subspecialty conference or Radiological Society of North America. This results in challenges for computerized rules-based solutions. Bill Gates cites those challenges as the reason for the only project he walked away from: a class-scheduling program for his high school. "Tapped as the logical choice to develop such a program, he chose to stay on the sidelines. This wasn't a simple problem by any means … the variables, Gates realized, were endless: … 'I want dance, I want bio lab, I don't want three courses in a row … this thing is far more complicated than you think.'" (3). He also described how he tilted the program to have himself scheduled with desirable classmates; an example of how a computer-based solution can still be biased without careful oversight.

There have been many attempts over the years to address these problems, some of which have been described by myself and others (4,5). A few years ago, we attempted to attack this formidable project once again, with help from a commercial software consulting company; build a Web- and rules-based system that would have single server source of "truth," instead of various version copies floating around by e-mail and paper; and push daily assignments out to a personal calendar on a computer or a smartphone (6). The effort and financial resources sunk into that project were significant, even as a personal third go-round on attacking the scheduling problem. We learned a lot but abandoned that effort in favor of a newly available commercial solution that offered a group discount to AUR/AAARAD (Association of University Radiologists/Association of Administrators in Academic Radiology) departments (7). At least two other commercial products have become available for radiology and similar hospital-based service practices (8,9) (Disclaimer: I have no current financial interest in any

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scheduling software company). The product that we adopted has been impressive in its capability but challenging to implement with regard to change management and perceived disruption of/or interference in the department section status quo. Section leadership management of scheduling is a huge control issue. We were ultimately successful, through unwavering departmental leadership commitment. Audits of our system have even been used for financial planning of the transition of our academic practice from a professional fee model to a funds flow model.

A general overview of the rules-based scheduling process is as follows. Call shifts are often but not always determined separately and before daytime clinical assignments. For a given period of time:

1) Radiologists submit and have approved their vacation and meeting requests.
2) A call schedule is built around those constraints that equalizes call burden and maximizes average time between call assignments.
3) Call assignments sometimes dictate mandated days off clinical service.
4) The designated clinical assignments are staffed by some rules-based algorithm, such as the one described in the paper in this journal, to maximize equality and/or some other metric.
5) Non-clinical service time is allocated between administrative service and academic time.
6) Scheduling algorithm checks for conflicts; manual override fraught with hazard. Most of these systems allow manual over-rides, but they are not always checked for rules violations of various sorts.

As documented in (4), there are huge number of ways to schedule, for example, 10 radiologists into seven tasks each day, and the possibilities become virtually endless as days are extended into weeks or months. The task of the scheduling algorithm is to search for the optimum, or close to optimum solution, based on the chosen metrics.

The interesting point in the article that had never occurred to me is the implication that interventional radiology (or by extension other section) revenue can be affected by the scheduling of specific radiologists at specific locations. In general, in radiology, we do what flows through from the institution, but the suggestion here is more of a surgical practice model: specific physicians are more successful at marketing their personal abilities. Something to think about.

Also, the article does not carefully distinguish between institutional technical revenue and departmental professional revenue.

That being said, the new era we are in demands efficiency. We need to work hard when on clinical service to be able to have and afford academic time, without going to the extreme of Lucy in the Chocolate Factory (10).

Careful management of radiologists' clinical time resources is essential to a financially healthy department, and the esprit de corps of the faculty. Intelligent scheduling as described in the accompanying article contributes to that end, and similar techniques should be adopted by all of us in academic radiology. It is an excellent example of the successful intersection of radiology management and information technology.

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