



Figure 1.

## The Division of Management Consulting

Unique to the department of anesthesia at the University of Iowa is our division of management consulting. Few medical universities house such an exclusive entity, one that provides exceptional services within our institution, as well as offering consultation and teaching to other institutions.



Our division of management consulting is directed by **Franklin Dexter, M.D., Ph.D.**, Professor. Working with him is **Ruth Wachtel, M.B.A., Ph.D.**, Associate Professor. Assisting

both is Ms. **Jennie Espy** as project assistant.

What do these individuals do representing the division of management consulting? There are four major areas:

- Perform research in operating room and anesthesia group management
- Implement research by developing methods to improve perioperative workflow
- Teach managers, analysts, and engineers from the University of Iowa and other organizations about methods

that have been developed by them and by other investigators

- Perform analyses for hospitals and anesthesia groups to show them how to increase efficiency and/or improve patient flow

A unique aspect of the division is that its research generates practical results and mathematical methods that are directly applicable to improvements in surgical services. The division maintains the web site [www.FranklinDexter.net](http://www.FranklinDexter.net). The web site contains the most comprehensive bibliography available of operating room and anesthesia group management articles, slides of lectures, answers to frequent questions, descriptions of consults, and forms for uploading data.

Dr. Dexter performs most of the outside (non UI) consulting and public lecturing. The income from the consulting work is used to fund the research, which then

(ideally) leads to further applications and promotes future consulting. Dr. Dexter receives no funds personally other than his salary and allowable expense reimbursements from the State of Iowa. He receives no honoraria or personal funds for performing consultations. He and his family have no financial holdings in any company related to his work, other than indirectly through mutual funds for retirement. He has tenure and does not participate in any incentive programs.

### Research

During the past 15 years, the division of management consulting and its collaborators have developed science in anesthesia group and operating room management. All of the research is published and is in the public domain. The division has published 160 papers in the area of operating room and anesthesia group management, plus 95 book chapters, editorials, and letters. Dr. Dexter has

also assisted in more than 90 projects by performing statistical analyses.

The development of operating room management science at the University of Iowa started when Dr. Dexter came to the University in 1990 for his anesthesia residency. In addition to receiving his medical degree from Case Western Reserve University, Dr. Dexter also earned his doctorate in biomedical engineering. To specialize in biomathematics, he took mathematical modeling courses from different departments. Many of the applications were in business systems. When he was finishing his residency, the then head of the Iowa anesthesia department, Dr. **John Tinker**, asked him to apply his background in statistical and mathematical modeling to address the economic consequences of patient stays in the postanesthesia care unit. This was the beginning of internal consulting.

Dr. Dexter remained at the University of Iowa after his residency. By 2003, he was spending an increasing amount of time doing projects for hospitals and companies other than the University of Iowa. By 2003, Dr. Wachtel had recently completed her masters in business administration degree in medical group management from the University of St. Thomas in Minneapolis, MN. She began working on our department's internal projects, providing Dr. Dexter with more flexibility in performing the external projects. The research in the division:

- addresses future challenges in the department of anesthesia and throughout perioperative care at the University of Iowa
- considers topics that will be of concern to anesthesia groups and hospitals in the future and for which consulting software

can be developed

- evaluates methods for best teaching the principles of operating room management through the course given by the division, the material posted on the division's web site, and other educational programs

Research in the division spans a wide variety of areas. The examples below are based on the figures:

- Consider the picture from the cover of *Anesthesia and Analgesia* in which people try to force an elephant into a large cage whose opening is too small (figure 1<sup>1</sup> *opposite page*). This picture illustrates the problem of matching staffing to actual workload in the operating room. Papers have investigated the assignment of block time to surgical services, how to schedule cases to avoid as much overtime as possible, how to estimate case durations, when to perform add-on cases, methods for predicting when a case will end given that it has already exceeded its scheduled time, etc. These papers have resulted in mathematical algorithms for staffing the operating room to maximize efficiency. A hospital or anesthesia group, or the division when doing consulting, employs these algorithms with operating room data or anesthesia billing time data to match staffing to workload. The elephant would then fit nicely into an appropriately sized cage.
- Another cover picture from the same journal deals with the start time of a case, incorporating uncertainty in the time remaining of an ongoing case (figure 2<sup>2</sup>). With over two decades of research in case duration prediction, methods of calculations are sophisticated. For example, when it is calculated that there is a 90% chance that the preceding case has 1 hour and 10 minutes remaining,

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**Dr. Dexter's 'Operations Research for Surgical Services' course was outstanding and has provided our institution with a framework for prioritizing operational decision making in the operating room. His approach has helped us to simplify the analysis of a very complex in- and out-of-the-OR environment.**

**Judy Kersten, M.D.**

UI anesthesia resident graduate, 1992  
Professor and senior vice chair of  
anesthesiology  
Medical College of Wisconsin, Milwaukee

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Figure 2.



## FOCUS ON A DIVISION

*continued*

the actual probability is between 89% and 91%. Statistical methods are so important because many combinations of procedures have been performed previously by the same surgeon only a few times, if at all.

- The third cover picture deals with a metaanalysis comparing times to extubation and the variability in times to extubation for sevoflurane and desflurane (figure 3<sup>3</sup>). Learning how to quantify variability in nonoperative times is important because surgeons rate “patient quick to awaken” as being almost as important as “ability to calmly manage a crisis.” Our research has also compared times to extubation and the variability in times to extubation for several other drug pairs, including combinations involving isoflurane and propofol.

35 companies. In addition, more than 140 internal projects have been performed. The division work has been and will continue to be about implementation. We take basic (applied) science developed by management scientists and industrial engineers and apply it to surgical services.

For some management studies, a paper can be read and then applied by hospital personnel. However, most papers require extensive computer programming for implementation. Some hospitals and anesthesia groups do not have trained personnel to perform the management calculations. Therefore, the division performs the analyses for outside hospitals, anesthesia groups, and companies. As part of a consult, Dr. Dexter teaches the organization about those analyses that

- selecting numbers of operating rooms
- matching of staffing to workload
- assessing market growth potential
- allocation of block time
- appropriate anesthesia institutional support

A group downloads the professional services agreement form, corresponds via email with Dr. Dexter, and then uploads data to our secure private cloud. Typically, results are discussed by web conferencing, or Dr. Dexter can visit.

The division also has a large hourly consulting practice, when mathematics is not the focus. Dr. Dexter uses his knowledge of the scientific literature and his extensive experience to aid an anesthesia group or hospital in making a decision. The consult is accomplished using web conferencing, email, or telephone. A typical example is implementation of a scheduling system for operating rooms or remote locations. The implementation will be done by the anesthesia group and/or its hospital with the help of outside consultants. Before the group makes a decision, it wants to know the principal issues to be considered. Usually this type of work takes a few hours. Essentially, the division’s goal is to teach organizations how to use the science.

Drs. Dexter and Wachtel perform similar types of analyses internally for our department of anesthesia. In fact, much of the research is based on University of Iowa data. Dr. **Javier Campos**, executive medical director of the operative rooms, may have a question about the main surgical suite or the preanesthesia evaluation clinic. Dr. **John Laur**, medical director of the ambulatory surgery center, may have a question relative to his area of responsibility, or one of the anesthesia division directors may want to know more about an issue that requires data. They turn to the division of management consulting to provide the science on which they can base their decisions. Drs. Dexter and Wachtel analyze historical data and predict what issues will be important over the next year or more. Internal projects during the past two years have included:

- estimation of appropriate numbers and cost effectiveness of anesthesia technicians

Figure 3.



Other examples of our research include the epidemiology of anesthesia in remote locations, patient satisfaction with monitored anesthesia care, patient waiting times for surgery, economics and psychology of first case of the day starts, and staffing of the postanesthesia care unit.

### Consulting

The division of management consulting has performed more than 160 external consults, for more than 100 hospitals and

were helpful. An advantage of having the division do the initial work is that software used to perform all of the analyses has already been developed. The anesthesia group needs to provide only raw data from its anesthesia or operating room information system.

Some of the analyses that the division performs include:

- case scheduling
- financial analyses
- staffing of the postanesthesia care unit

- how and why to focus on turnovers based on psychological factors
- role of surgical outreach clinics in maintaining perioperative caseload
- impact of changes in scheduled procedure(s) on predictive errors in case durations
- optimal resident staff scheduling on specialty rotations
- influence of training programs on recruitment of CRNAs
- scheduling of preanesthesia evaluation clinics

Scientific approaches to these issues permit the department chair, vice chairs, assistants to the chair, etc., to make long-term evidence-based managerial decisions.

The external consulting is an important source of data and collaboration for scientific investigations that benefit the department of anesthesia at the University of Iowa. For example, current ongoing research aims to understand how an anesthesia group can best coordinate case scheduling at multiple facilities simultaneously. We collaborate with a group that has hundreds of operating rooms at dozens of facilities within a city. We also collaborate with basic and applied industrial engineers employing novel statistical and computational methods to understand the impact of anesthesiologists', nursing directors', and surgeons' psychological biases that affect appropriate decision-making. After this research is complete, the division will work on adaptation of the management science for practical use within the department. Principles will also be incorporated into its educational programs.

## Education

The division of management consulting presents a course entitled "Operations Research in Surgical Services" several

times per year. The course provides the cognitive knowledge and problem-solving skills required by the American College of Graduate Medical Education for anesthesia systems-based practice. Each of this year's CA-3 residents is participating in the class. By providing the class twice per year in Iowa City, residents, faculty, and new programmers working in our department can learn the science without having to travel. More detail regarding this course can be found on page 18 in this issue.

Franklin Dexter, M.D., Ph.D.

*Professor*

*Director, division of management consulting*

## References:

1. McIntosh C, Dexter F, Epstein RH. The impact of service-specific staffing, case scheduling, turnovers, and first-case starts on anesthesia group and operating room productivity: A tutorial using data from an Australian hospital. *Anesth Analg* 2006; 106:1499-1516.
2. Dexter F, Epstein RH, Lee JD, Ledolter J. Automatic updating of times remaining in surgical cases using Bayesian analysis of historical case duration data and "instant messaging" updates from anesthesia providers. *Anesth Analg* 2009; 108:929-940.
3. Dexter F, Bayman EO, Epstein RH. Statistical modeling of average and variability of time to extubation for meta-analysis comparing desflurane to sevoflurane. *Anesth Analg* 2010; 110:570-580.

## OPERATIONS RESEARCH IN SURGICAL SERVICES

**Franklin Dexter, M.D., Ph.D., director,**  
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The department's division of management consulting offers this three and one-half day course twice annually in Iowa City and often, the course is arranged at hospitals and health systems that have a sufficient number of students. Typically, the organizations ask for statistical analyses through consults and subsequently choose to educate managers, anesthesiologists, and analysts about the principles to which the consults are based.



Currently, “analytics” (i.e., how to use data that are being accumulated) is one of the most popular business topics, and that is our expertise. The course teaches participants how to apply such principles to solve problems in the operating room and perioperative environment: (1) monitoring operational and financial performance of surgical suites and anesthesia groups (“descriptive analytics”); (2) forecasting case durations, time remaining in cases, use of staffed operating room time (“predictive analytics”); (3) making common decisions, such as staffing levels, block time planning, case scheduling and assignment, and financial management (“prescriptive analytics”); (4) making strategic decisions, such as choice of the subspecialties of new surgeons to be recruited; (5) identifying in-house expertise to aid in problem-solving and determining whether outside consultants are needed; and lastly, (6) evaluating current decision-support systems.

During the past several years, there has been an increased emphasis on teaching residents systems-based practice. The course provides the cognitive knowledge and problem-solving skills required by the American College of Graduate Medical Education for anesthesia systems-based practice. Each of this year's CA-3 residents is taking the class. About half of the course consists of lectures. The remainder of the time is spent in groups solving statistical word problems. Course participants enter answers into a specially developed Excel workbook that provides interactive feedback in response to incorrect answers. In Iowa, Dr. Dexter gives the class with Dr. Ruth Wachtel; otherwise, Dr. Wachtel assists by using a class chat room. This use of the chat room and Excel also familiarizes clinicians with technology and helps them develop the judgment and computer skills necessary for better decision-making on the day of surgery.

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Attendee quote: **“Good course. This was an honor to be able to attend!”**

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