

# Computers in the O.R.

## An assessment of trends, potential and expectations

By Donna Prokopczak

Probably one of the most exciting technologies to enter the operating room in this century is the computer, with its vast potential for an infinite array of applications. How important is it for operating room nurses to become involved in this technology and participate by identifying their computer needs and applications and share in the planning, selecting, developing and implementing phases? This presentation will focus on addressing this question and the myriad other considerations that must be dealt with if the operating room nurse is to be successful in his or her new role.

### Computer literacy

In order to assume this role, however, operating room nurses need to prepare themselves by becoming computer literate and knowledgeable regarding the expectations and potential of the computer.

There are many factors that must be taken into consideration when computer automation is pursued. In addition to cost-benefit analysis, the purpose, expectations and alternatives must be carefully assessed. The concern for cost containment in any hospital's highest cost centre - the operating room - has motivated these O.R. departments to pursue ways of evaluating their own efficiency. Concern for rising hospital costs combined with pressure from hospital administrators to improve patient care while reducing costs, forces departments such as the O.R. to review utilization statistics.

A few examples of reports needed for resource utilization statistics and which require automation include O.R. utilization, supply and equipment usage, and staffing patterns. These become important management tools for problem solving, decision making, identifying trends, and designing surgical schedules.

In April, 1988, your author completed a *Master's Project Study*. The purpose of this study was to assess the potential for an O.R. computer-automated system for a major teaching hospital from a users perspective. The following questions were addressed in the study:

1. What are the trends in operating room computer automation?
2. What was currently happening in computer automation?
3. What was expected in the application of computer automation?
4. What options are available in computer automation?
5. What are the selection considerations for computer automation?

In order to answer these questions, the utilized data sources included:

- reviewing relevant literature for trends, computer applications, and system cost justification;
- interviewing both medical and operating room



### About the Author

Donna Prokopczak, R.N., B.Sc.N., M.Ed., Clinical Nurse Specialist, Surgical Suite, University of Alberta Hospitals, Edmonton. She is a graduate of the Royal Alexandra Hospital School of Nursing with a Post

Basic B.Sc.N. from the University of Alberta. This study was conducted as a major project for the completion of a Masters of Educational Administration Degree, University of Alberta.

staff (30) to establish their perception as to what functions the computer system should be capable of performing and identifying their concerns;

- conducting a cross-Canada survey of 37 selected major hospitals to determine what was happening by way of operating room computer systems, applications, interest and system satisfaction;
- evaluating the suitability of the microcomputer and mainframe computer for intended applications.

The following is a synopsis of the findings predicted on this study assessment.

### Literature review of OR computer automation trends

The literature pertaining to applications of O.R. computer technology as reported, became prevalent during the 1980s. Initial accounts in the literature describe the use of mainframe computers (large computers as distinguished from mini or microcomputers) for O.R. data analysis through batch reporting systems. These fixed format reports provided O.R. management with utilization statistics upon which to base administrative decisions, identify trends and long range plans, and to co-ordinate staffing and supplies.

Access to on-line (computer connected) systems led to a variety of innovative ways of using the computer for O.R. logging and statistical reporting. The ability of an operating room to study its utilization and efficiency provided opportunity for the development of more effective scheduling systems.

Some hospitals, mainly university affiliated, have developed totally integrated "on-line" mainframe programs that allow the documentation and retrieval of all patient information from the point of admission through to discharge.

Also, there appears to be a growing interest in the use of the microcomputer for a variety of O.R. applications. The flourishing of commercial operating room software packages appearing in the marketplace creates a selection dilemma for operating rooms considering the purchase of computer technology.

These packages are designed essentially for stand-alone systems or intra-departmental network systems. These software packages provide the department with control over their own data. With a hospital's mainframe computer system, any patient information would not be accessible unless multiple interface programs were to be written. Mainframe computers and microcomputers are generally

not designed to be compatible or share logic and data without extensive programming.

Another alternative system that appears to be emerging is the minicomputer. These are capable of storing vast amounts of data and have a greater network capacity than a microcomputer. However, the development of suitable software programs appears to be lagging.

The full potential of O.R. computer applications is only now being realized. Hospitals involved in computer technology were moving from development of O.R. data bases, then redesigning their scheduling systems prior to implementing automated systems. Many other applications were identified such as communication by electronic mail, staff scheduling, manual and preference cards, inventory control and educational programs. Computer systems can penetrate the entire department by incorporating terminals in every operating theatre or by using portable input/output devices.

Some of the advice emerging from the literature recommends mainframe systems while others support stand-alone micro-systems. The importance of staff involvement, careful selection and planned implementation appeared evident in most recommendations, regardless of the system.

### Computer activity in Canadian operating rooms

To identify the trends and involvement of Canadian hospital operating rooms with regard to computer automation, a mail-out survey to operating room directors of nursing or operating room supervisors in 35 major (in excess of 500 beds) Canadian hospitals was conducted.

A short questionnaire reply card focussed on information pertaining to the types of system in use; what the system was being used for; general user experiences; and satisfaction with the system.

In addition to the mail-out survey, four major operating rooms were contacted directly by telephone. The following are the results of this survey.

Of these 37 hospitals responding to the survey, 17 indicated they were using, or in stages of implementing, some form of O.R. computer application. Eleven of these hospitals were using a mainframe system (five on-line, five batch system and one with a micro-mainframe link). Other systems included two microcomputers, two word processors and two network clusters (probably mini).

Seven operating rooms were using purchased software, while nine were using self-developed software. Fourteen operating rooms were using their system for statistical logging and reporting, nine

Table 1

### Surveyed Canadian Operating Rooms Using Computers

(Total of 17 hospitals reporting O.R. computer use of 37 surveyed)

Computer system in use What systems used	Types of computer applications How the systems used					
	Software run on these systems (Number reporting use)		Information access only	Statistical log/reports	Surgical schedule	Plans for future application
	Per/Com*	Self* develop				
Hospitals Mainframe						
On-line (5)	2	3	5	4	3	1
Batch (5)	1	4	-	5	-	3
Micro-link (1)	1	-	1	1	1	1
Microcomputer (2)	2	-	-	1	2	1
Word processor (2)	-	2	-	1	1	1
Network/Cluster (2)	1	1	2	2	2	1
<b>TOTALS (17)</b>	<b>7</b>	<b>10</b>	<b>8</b>	<b>14</b>	<b>9</b>	<b>8</b>

Pur/Com\* = Purchase/Commercial

Self Develop\* = Self-development or Homestyle

were doing surgical scheduling and another nine used their system only for assessing information. Eight of the 17 hospitals reported plans for future development of their systems. (See Table 1)

Of the 20 hospitals that indicated no computer usage in the O.R., only four reported the availability of a mainframe. There were six operating rooms interested in computer applications and an additional eight actively pursuing this technology. (See Table 2) Of three hospitals that used batch reporting systems, two indicated low ratings in user satisfaction with the system in meeting their needs and expectations.

Frustrations tended to arise from the inability to obtain desired statistical information, desirable formats, slow computer response time, inability to program and implement required changes, length of time required to obtain information, and concern for accuracy and generated information.

Ratings for ease of computer use were high, indicating satisfaction with entering and extracting routines. One system that appeared to rate very highly involved extensive user input into the development of the software resulting in a highly

regarded program. Interest in microcomputer systems appears to be emerging with four of the hospitals indicating either stages of planning or implementation of these systems using commercially designed programming.

#### Computer expectations

The involvement of the user in identifying, developing, and implementing a computer system appears to be of paramount importance. In order to identify what is needed with regard to a surgical scheduling and reporting system, it is important to include the suggestions of those persons currently involved in this function. This study provides an opportunity for personnel directly affiliated with, or affected by the O.R. scheduling system, to express their ideas, expectations, and concerns pertaining to potential O.R. computer automation.

Interviews were conducted with various levels of O.R. staff including nursing administration, medical and clerical staff. In addition to arranged interviews, a letter and interview form were mailed to the chairman of each surgical service so that the

Table 2

### Surveyed Canadian Operating Rooms Not Using Computers

(Total of 20 hospitals reporting no computer activity out of 37 surveyed)

Computer System	O.R. Development stage				TOTALS	
	Resources available	No Activity	Interested	Planning/ Assessing		Selecting/ Developing
No computer		6	4	3	1	14
Hospital mainframe			2		2	4
Micro- computer				1	1	2
<b>TOTALS</b>		<b>6</b>	<b>6</b>	<b>4</b>	<b>4</b>	<b>20</b>

concerns of each surgical department could be identified. The response to these letters revealed considerable interest in computer automation. Following is a summary of the needs as identified by the 30 participants of this phase of data collection.

Responses to questions regarding factors affecting surgical scheduling were categorized into the following six categories:

1. patient related
2. procedural related
3. physician/surgeon related
4. anaesthesia related
5. facility related, and
6. equipment/resource related

There were several variables within each of these categories (See Table 3). Expectations of the system as expressed by participants included:

- flexibility in scheduling
- data log and reporting functions
- source of patient information
- a mechanism for communication.

Data base information tracking should include:

- patient information
- anaesthesia/post anaesthesia
- recovery room information
- facility/schedule utilization, and
- equipment supply information.

Interdepartmental information access should allow communications between the surgical suite and 23 other identified hospital departments. Surgical slate features should include routine information plus sections for update, complication codes, special requests, diagnosis, and patient specific information.

Several concerns regarding computer implementation included a need for privacy and confidentiality of patient care information on the printed surgical schedule (slate), staff education regarding computers, computer information security, potential benefits, costs, and computer system functions.

#### Computer system alternatives

When considering implementation of an automated system, it is important to assess what is available by reviewing aspects of systems already in place, relating to the experience of others., evaluating what is emerging in this rapidly advancing technology and consulting with experts in this field.

Currently, there appears to be two possible computer selection choices available with the potential to meet the requirements of a major O.R. system. The advantages and disadvantages of each of these two alternatives - the mainframe computer or microcomputer - are discussed on the basis of the nine factors that follow:

1. **Systems features** - The mainframe computer is available throughout the hospital. It is

Table 3

Factors Affecting Surgical Scheduling as Identified by Project Interviews

**Patient Related**

1. Admitting information
  - routine demographic information
  - waiting lists
2. Patient care data
  - availability, readiness; consent; complications (debilitating disease); patient status (acuity); diagnosis; required documents, reports; special requirements
3. Booking category
  - elective, emergent, urgent

**Physician surgeon related**

1. Availability of surgeon
  - areas of potential conflict (official hours, meetings, conferences, teaching commitments, other departments); illness
2. Availability of surgical assistance

**Facility Related**

1. Scheduling policies
  - block/open scheduling; theatre allocations, theatre reallocations, bed closures, case cancellations
2. Altered booking routines
  - Christmas/summer hours, grand rounds, major conferences, medical staff luncheons
3. Theatre/procedure
4. Time allocation/procedure

**Procedural related**

1. Type of surgical procedure/service
2. Expected length of procedure
  - time allotment based on surgeon/ case accrued averages, and anaesthesia/ case averages
3. Case to case time (changeovers)

**Anaesthesia Related**

1. Availability of service
  - anaesthesia specialist; schedule conflicts (meets, other commitments)
2. Anaesthesia techniques or agents
  - epidurals, regional blocks, general anaesthetics
3. Induction/extubation time
4. Special equipment

**Equipment/Resources Related**

1. Availability of scarce/limited resources
  - equipment, supplies, drugs, prosthesis, instruments
2. Staff availability
  - expertise, specialty, illness vacation, other commitments
3. Co-ordination of resources
  - case carts, blood products, x-rays, instruments, prosthesis, positioning equipment
4. Inter-departmental dependency
  - radiology, blood bank, pathology

used in many departments identified as essential data source links for the operating room. This system would facilitate a centralized booking mechanism and have the capacity to process data at high speeds. However, the availability of information systems resources is limited and scarce due to high demand throughout the hospital and the requirement for specially skilled staff. On the other hand, the choice of a microcomputer provides control over one's own data and is generally easier to use. They also can be

linked to a mainframe to act as a dual purpose terminal. Microcomputers tend to be slower in speed, and this is reduced even more by networking. Although the two systems could be linked to share logic with interface programming, this could be a very expensive venture, depending on the extent of interfacing.

**2. Memory capacity**

Mainframes appear to have almost unlimited memory capacity; however, data storage becomes expen-

**ATTENTION  O. R. Supervisors**

*QUICKCART* is an affordable case cart manager for the Operating Room and CSR that implements state-of-the-art data management technology and saves hundreds of man-hours every year!

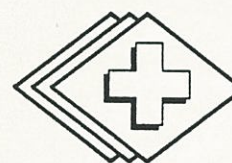
**FEATURES**

- Surgery booking
- O.R. Scheduling
- Reports
- Prints daily slate
- Prints pick lists
- Electronic mail
- Surgeon's preferences
- Security system
- Many other features

**EASY TO USE**

*With the pull-down and pop-up menus, you always know where you are. Help is available by pressing one key. Most users can learn the system in one hour, even without the user manual!*

**EMERGENCY ON-LINE  
USER SUPPORT !!!**



**MEDISOFT Systems**

4004 - 36 Street N.W. Calgary, Alberta T2L 2A1  
Contact : Rick Persad Phone : (403) 289-5520

*Time saved means dollars saved and improved patient care!*

sive. Microcomputer systems are becoming more powerful with data storage options on hard disk drives, floppy disks or streaming tapes. The annual operating room accrued data base would require a large memory capacity plus computer capability to manipulate and run comparative statistics on this information. Could a microcomputer actually store, retrieve and manipulate the volume of data generated by a 14-theatre, 15,000 caseload operating room?

**3. Software design**

Custom design "in-house" programming for the mainframe would require extensive services of a programmer/analyst plus a user group development team. The design could be developed on the patient care foundation base already in progress. The microcomputer option, with at least 18 IBM-compatible

and commercially prepared operating room software packages to choose from, appears to be an attractive alternative. Many of these soft-ware packages claim to provide programming for almost every application an O.R. could dream of; however, because of the number of these applications, an in-depth assessment to ensure the suitability of these applications in the O.R. would seem essential.

**4. Implementation**

Request for operating room systems development would have to be prioritized in the hospital's long range plan. The development would require extensive programming and implementation would be gradually phased in over a span of time. With a microcomputer commercial package, the program applications could all be introduced simultaneously; how-

ever, several months would be required to organize and load supporting data.

## 5. Security

Mainframe systems' security, controlled through sign-on authorization, may be lacking in microcomputer systems, although software security for certain versions of microcomputers is available. Without some form of security mechanism, anyone could access and manipulate the data. Also, data loss on the mainframe is protected by sophisticated data backup mechanisms where data on a micro system is more vulnerable to power surges or computer malfunction or human negligence to make backup copies.

## 6. Resource/cost factors

Mainframe costs would include hardware in the form of terminals, printers, peripherals and computing capacity with software costs arising from programming, maintenance and modifications. The hospital's information systems department would be responsible for the development and maintenance of "in-house" programs. The cost of a microcomputer system includes similar hardware but would probably be more expensive due to the need for memory, data storage and networking devices.

Software costs arise from the initial purchase price plus an additional annual maintenance fee of approximately 10-12% of the purchase price. System support could not be expected from the hospital's information systems, but rather the software vendor who may be thousands of miles away and accessible only by telephone.

Problems arising from both hardware and software would have to be resolved through the user department and contracted agreements rather than with the assistance of the 24-hour information systems resources. Failure to resolve problems via the telephone could result in prolonged system downtime and costly services.

## 7. Micro-mainframe link

The implementation of both systems could allow for partial program development on the mainframe such as surgical scheduling requiring integration with the hospital patient care system and the logging and statistics function development on the microcomputer. A link between the two systems for downloading, uploading or two-way information exchange would require computer programming specific for each transaction.

## 8. Training requirements

Well developed training programs are essential to the success of computer implementation. Information systems and nursing education and research can provide mainframe training programs, but these require many man-hours of time. Microcomputer training programs would have to be provided by the software vendor or microcomputer education courses. These programs, generally, are more user friendly with considerable on-line help, but still require extensive man-hours to learn. The cost of these microcomputer programs would be incurred by the user.

## 9. System expandability

The expansion of the mainframe system is the responsibility of information systems and new programs can be developed as resources allow. The technology of microcomputer systems is rapidly advancing, producing faster speeds, greater data capacity, better system security and superior networking capabilities. Microcomputer technology is beginning to appear almost as attractive as mainframe computer technology.

## Conclusion

Probably the most important issue emerging from this project was that of cost justification for implementing computer technology. The costs associated with computer automation can be enormous, depending upon the degree of implementation and the computer system selected. Costs include hardware, software (purchased or developed) with continued maintenance and update of both hardware and software. This does not include the tremendous amount of manpower commitment for selecting, planning, developing, educating, implementing, monitoring and maintaining the system, all of which operating room nurses need to be involved in. In addition, there are costs associated with data storage, computer supplies and perpetual training needs.

How can these extensive costs be justified at a time when escalating health care costs are a major government concern, with every hospital striving for cost containment and reduced spending?

On the contrary, what is the cost of **not** proceeding with computer automation? Is this not the very tool that can ultimately facilitate cost containment through access to a wide variety of decision supportive information that can never be produced manually? In addition, a highly efficient computerized surgical scheduling system should result in effective utilization of a very expensive hospital resource - the operating room. ■



## Play the Role for Real.

You and your business decisions should look good in the spotlight. You know how to manage an O.R. and our systems are designed to support and enhance your know-how. With accurate management data that substantiates intuitive knowledge, you become increasingly able to effect and manage change.

### The "Stars"

O.R. STAR and ADMIS Ensemble are flexible systems that can start out as small or as large as you want. And then grow as your business expands. Our software is truly multi-user and fully

integrated. Data entered once can be accessed throughout the system. Plus, our software can accommodate multiple surgical sites. That means a cost-effective growth path built in up front. Saving you valuable capital for other important needs.

### Showtime... Anytime

We'd like to invite you to a private showing of O.R. STAR or ADMIS Ensemble. To arrange an appointment, please call Roy Weber, Product Manager, Baxter, 2390 Argenta Road, Mississauga, Ont. L5N 3P1 Phone (416) 821-9660

Hospital Systems Division

# Baxter