Abstract

In order to pursue greater efficiency of overall anesthesia resources and provide a database for operating room (O.R.) utilization, we have developed and implemented a computerized operating room information system (C.O.R.I.S.).

Introduction

Due to the rise in elective surgical case loads, Anesthesiology Departments come under increasing pressure to schedule elective surgery on Saturday and Sunday (non operative days for elective surgery). Because of these factors, it becomes imperative to quantize how presently scheduled time and resources are used.

Several studies 1-3 have indicated that O.R. utilization has ranged between 50-60%, with O.R. costs averaging $600 per hour, improvements in this area could lead to dramatic savings of time and money.

Methods

Data Collection

During the requirement analysis phase of designing C.O.R.I.S., it was recognized that the data collection procedure had to be simple but as complete as possible. Long involved forms have a high percentage of inaccuracies and omissions, and are difficult to key into the database.

We decided to modify the operating room billing record card that was presently being filled out on all patients by the attending anesthesiologists or nurse anesthetist.

Of the 30 maximal critical data points, the fields relating to utilization are defined as follows:

A) Anesthesia start: Anesthetist first involvement with the patients in the O.R. or the holding area for IV placement, etc.

B) Induction completed: Anesthetist informs the surgical teams that they may proceed with the surgical preparation of the patient.

C) Surgery start: Time of incision.

D) Surgery stop: Dressings are secured.

E) Anesthesia stop: Anesthetist completed transfer for the patients to the Recovery Room, or Surgical Intensive Care Unit.

Other fields are recorded to provide additional information. In particular are the operation performed, surgeons name, anesthesiologist, operation diagnosis, surgical service, ASA physical status, surgical modifiers (up to 10), type of Anesthesia, date, patients name, age, sex, inpatient or outpatient, emergency or elective operating room number and hospital.

Our studies have indicated that the total time needed to fill out the card ranged from 3-5 minutes.

System Design

The system is functionally decomposed into three subsystems.

1) Data entry program
2) Database inquiry and Report generators
3) Graphical summary report generators

The system is implemented on the University of Texas Health Science Centers' DEC 20 computer. The data entry program is written in Fortran, the Database Report programs are written in NIS:DPL and the graphical Reports are produced using ISSCOS' Telegraph software in conjunction with Textronics' 4014 graphic terminal.

Figure 1 illustrates a overview of the data collection process and Database reporting process.

System Definitions

In order for information to be of any value precise definition of terms and time slices are
necessary.

As defined by Brown, we chose to measure utilization as a combination of all cases both elective and emergency.

The available time (AT) for an O.R. use is defined as the total number of minutes between 0730 and 1500 hours per day.

The total Anesthesia time is the difference between Anesthesia Stop Time and Anesthesia Start Time.

The room usage time (RUT) is the total Anesthesia time + 20 minutes clean up time. We realize that by using the total Anesthesia time as a factor of room usage, the usage times will be slightly inflated, the reason being that the Anesthesia starting time could begin outside the O.R. The small percentage of time this represents we feel did not warrant adding another field to the data cards.

The 20 minute clean up time was determined by averaging all clean up times for all operating rooms for a one month period.

The percent utilization (PU) is: \( PU = 100 \times \frac{RUT}{AT} \).

Anesthesia prep time is the time of completed induction minus anesthesia start time; surgical prep time is surgery start time minus completed induction time; and operative time is surgery stop time minus surgery start time.

The collected cards are called for completeness and accuracy and keyed into the University's Dec system-20. Data entry time per patient record is less than 1 min. Storage and input cost is approximately $100 per month.

Results

Based on the first six months data, we have met our initial goal of designing a data collection form that is simple to use, and is in fact used. In the worst month only 5% (of 700 cases) of all O.R. cards are unusable.

Figure 2 and 3 respectively, illustrate the calculated O.R. utilization for each operating room per weekday, and the total utilization by month. Overall utilization for the reporting period between July and December 82, averaged 47.8%.

Other information obtained from C.O.R.I.S. included a monthly summary of procedures by surgical specialties including running totals, the total number of procedures for the first 6 months was 5607; a report on the number of inpatients versus outpatients, the former being 5396 and 211 in the latter. Also generated, a profile of patients by age and ASA status; the duration of operative procedures by specialty service and procedure and including mean induction time, mean prep time, mean operative time, range of operative time and mean anesthesia time, and a summary of procedures by gross categories: intraabdominal, intrathoracic, intracranial, pump cases, renal transplant, vaginal deliveries, etc.

Conclusion

C.O.R.I.S. has enabled us to identify inefficient utilization of operating room services at a
relatively low cost. Because of the realization that O.R. inefficiency exists, a request for scheduling elective surgery on weekends was cancelled with the resultant net saving to the Department of Anesthesiology of $70,000 annum.

Furthermore, a new cooperative effort has been initiated between the Department of Surgery and the Department of Anesthesiology to link the Database reported on in this paper, to a proposed operating room scheduling system in order to provide improved scheduling guidelines.

With this new proposed system it is expected that operating room utilization and overall patient management will be improved.

References

1. Hanson, Kermit H., M.D. "Four Years of Computer Operating Room Scheduling". SCAMC 1982 IEEE 0195-4210/82/0000/0252.
