A NEW APPROACH TO OPERATIONAL EFFICIENCY FOR CHRONIC RENAL DIALYSIS PROGRAM

Ronald M. Korabik

ABSTRACT

Irreversible kidney failure requires either a kidney transplant or renal dialysis treatment. The Federal Government has enacted legislation which provides for the reimbursement of renal dialysis costs. But, the prescribed reimbursement rarely covers the full cost of renal dialysis treatment.

Under these circumstances, a chronic renal dialysis treatment center must be able to control and minimize operating costs. As labor costs are typically the single most substantial cost and equipment costs are relatively low, it is important to minimize labor through proper staff and patient scheduling and increased equipment utilization.

Computer simulation is an effective tool which can help establish the most efficient relationship between labor, equipment, scheduling and treatment demand.

BACKGROUND

In recent years, the Federal Government has enacted legislation that extends Medicare benefits to nearly every American for the reimbursement of renal dialysis services. (1) As with other services provided to Medicare beneficiaries, the reimbursement for renal dialysis services is based upon actual costs (full costs as determined by Federally prescribed cost finding techniques). But renal dialysis has certain distinctions from other reimbursable services that severely constrain its reimbursement.

For example, a person who meets the Medicare reimbursement eligibility requirements is not eligible for entitlement until the first day of the third month after the month in which his dialysis treatment was initiated. (2) Also, if a person has received a kidney transplant, his coverage ends twelve months after he received the transplant or after his course of dialysis was terminated. If after this twelve-month period the person again requires treatment, he must again meet the eligibility waiting period. This means that during the periods of ineligibility, the cost for renal dialysis must be borne in many cases by the patient, often resulting in uncollectible amounts for the institution rendering the service.

Another important aspect of the Medicare program is the establishment of a reimbursement limitation (screening cap) per dialysis treatment. Consequently, the total possible reimbursement of the renal dialysis program is limited to the level of this screening cap.

With revenues constrained as such, it is extremely important that a chronic maintenance program control operating costs and operate at the most efficient level possible. Many factors contribute to the operating costs of a chronic renal dialysis unit. But typically, labor costs are the single most substantial cost, accounting for between 30% and 40% of total operating expenses. Equipment depreciation or rental, however, rarely exceeds 2% of total operating expenses. It makes sense, therefore, to tightly control labor costs while attempting to increase equipment utilization.

There are few existing operational standards in the field of Nephrology (Renal Dialysis) to use as guidelines to control costs. No standard methodology exists for evaluating the operating capacities, utilization and efficiency of the labor and equipment of a renal dialysis unit. Of course, for effective cost control, it is imperative to evaluate and monitor these operational parameters. In this regard, it is important to define a standard relationship between staff, equipment, scheduling (patient and staff) and the treatment demand for a chronic renal dialysis unit.

It is apparent that a renal dialysis unit must be staffed to meet its treatment demand, contingent upon the equipment it has available. If the available equipment is insufficient, less than efficient staffing patterns must be adopted. This situation is exemplified in treatment centers that are forced to run two treatments per day per dialysis machine. The staffing patterns usually adopted to run a double machine shift involve two overlapping employee shifts. These overlapping shifts appear to be required only because two consecutive dialysis treatments cannot be accomplished in one eight-hour employee shift. The point that should be emphasized is that the second shift employees present during the overlapping of the shifts are only productive after the first shift is over. Thus, during the time that two employee shifts overlap, twice the actual needed staff is present. In addition, in cases where adequate manpower is not available, existing staff are forced to work significant amounts of overtime. In either of these cases, the increased labor costs due to under-utilized staff or overtime can easily justify additional dialysis machines.

The number of dialysis machines required for a chronic renal dialysis unit must be carefully determined to be compatible with the treatment requirements of that unit. Not only is the staffing affected by the availability of dialysis machines to meet the treatment loads, but also the method of patient scheduling must accommodate the machine availability. The scheduling of patients is a critical component of achieving an efficient renal dialysis system. Treatment centers must have the capability to determine and monitor the scheduling of their patients. Because of the high cost of labor and the relatively low cost of equipment, the method of scheduling should not be determined by the availability of dialysis machines, rather, the number of dialysis machines available should be determined by requirements of the best method of patient and associated staff scheduling.

One of the approaches commonly used to schedule patients is to begin all treatments at approximately the same time, and as a direct result, end at the same time. This type of patient scheduling often results in an extremely heavy work load per employee at the beginning and ending of the treatments, but relatively light duties during the interim period. In some cases, the most intensive work requirements occur during the time period usually allotted for lunch. This is especially true when a double machine shift is used. This type of patient scheduling does not evenly distribute the more intensive tasks such as the set-up/access and the termination of treatments throughout the day.

SIMULATION

In order to develop proper operational standards and guidelines for renal dialysis, a technique must be employed that will be unbiased and will not compromise patient care. In this respect, computer simulation is an effective tool for analyzing the renal dialysis process and developing a standard relationship between staff, equipment, scheduling and treatment demand.

For example, consider a computer model that simulates a logic that allows the employees to determine the best method of patient scheduling and number of dialysis machines that would be required to effectively complete a maximum number of treatments in an allotted working shift. Let us define, in this example, the general procedures that are required by a renal dialysis staff to complete a treatment as follows:

1. Set up the dialysis machine.
2. Access a patient to the dialysis machine.
3. Monitor the treatment of a patient.
   a) Correct any blood pressure drops.
   b) Correct any coil leaks.
   c) Correct any need for a bath change.
4. Terminate the treatment of a patient.
5. Clean up the dialysis machine.

The nature of computer simulation allows the procedures to be unique based upon these factors:

- The time renal dialysis staff takes to perform the procedure.
- The type of dialysis machine used.
- Special conditions existing before, during, or after the procedure.

To be realistic, the computer model must allow the staff to perform any procedure on any dialysis machine if the conditions existing at that machine allow the procedure to take place. Illustration I conceptualizes the decision logic that can be used to simulate the staff's performance in a renal dialysis unit.

Let us now put this model to work. Consider a chronic renal dialysis unit equipped with batch type dialysis machines with canister filtering devices. Suppose that the following procedural times were observed in this unit:

PROCEDURE	TIME
1. Set up dialysis machine	30 ± 3 minutes
2. Access patient to dialysis machine	24 ± 3 minutes
3. Treatment	
Employee must monitor a patient at least once every ½ hour during a treatment	2 minutes
Employee must react if any corrective action is required:	
Blood pressure drop (1 out of 4 treatments)	10 minutes*
Coil leak (1 out of 8 treatments)	6 minutes
Required bath change (1 out of 20 treatments)	20 minutes
4. Terminate treatment	25 ± 3 minutes
5. a) Prepare machine for rinse	5 minutes
b) Machine rinse	45 minutes
c) Post-rinse machine cleanup	17 ± 2 minutes

*Two employees required

Given this information, plus the number of employees available, the computer model can determine the number of treatments that the available employees could complete in a defined shift (8 hours in this example). The results of this simulation reflect optimal levels of staff utilization. The model also determines the method of patient scheduling and the number of dialysis machines required to achieve these optimal staffing levels. By simulating various staffing levels, we can obtain a optimal set of relationships between staff, machines, and treatment demand. The resulting relationships of staff, machines and treatment demand for this example are shown in Illustration II. Illustration III presents the corresponding staff and patient scheduling that resulted. Of course, a computer simulation model of this type can be adapted to any chronic renal dialysis treatment center by utilizing actual treatment and employee shift times.

BENEFITS

The results of this computer simulation exercise are valuable from many aspects. First, they custom tailor staffing, machine and scheduling standards for a chronic renal dialysis unit. In addition, by operating in accordance with prescribed standards, the following benefits can be provided:

Minimized operating costs, especially labor expense.

Increased staff utilization; decreased idle time.

Elimination of overtime required to complete poorly scheduled treatments.

Balanced daily treatment work load that provides more free time during the lunch hour.

Ability to systematically plan, monitor and budget most operational aspects of the renal dialysis program.

Ability to determine the optimal chronic renal dialysis unit operating size.

Ability to determine equipment needs, both number and type of dialysis machines.

Naturally, a computer simulation model is not the solution to all of the problems facing a chronic renal dialysis unit. Rather, it is a tool that, if used correctly, can solve many of the problems. The success of the computer simulation exercise is dependent upon the careful analysis and implementation of the results and most importantly the continual monitoring of the operations after implementation. Consequently, computer simulation should be viewed as the first step toward developing a well controlled and efficient chronic renal dialysis program.

ILLUSTRATION I
CONCEPTUAL ILLUSTRATION OF THE MODEL FOR RENAL DIALYSIS

When not busy, each employee checks the STATE of each machine during eight-hour shift.

	PRIORITY 5	PRIORITY 4	PRIORITY 2	PRIORITY 3	PRIORITY 6	PRIORITY 1	Default to check another machine
All machines are initially in STATE 1	Should an employee set up this machine for treatment?	Should an employee access a patient to this machine for treatment?	Should an employee monitor and inspect a treatment at this machine?	Should an employee terminate a patient's treatment at this machine?	Should an employee clean-up this machine?	Is an employee needed for a 2-man procedure at this machine?	Nothing can be done at this machine.
STATE of the machine	STATE 1	STATE 2	STATE 3	STATE 4	STATE 5	STATE 6	STATE 0
Conditions of the STATE	Conditions	Conditions	Conditions	Conditions	Conditions	Conditions	Conditions
	• A machine can only be set up for treatment if it has already been cleaned. • It is assumed that all machines are clean at the beginning of a shift. • A machine is set up if there is remaining time in the shift to complete an entire cycle (set-up — clean-up). • After machine is set-up, place it in STATE 2.	• If a machine has been set-up for treatment, a patient can be accessed to the machine and treatment initiated. • Place machine in STATE 3.	• A patient must be monitored at least once every ½ hour during his treatment. • The employee must check the patient's blood pressure and pulse and inspect the machine. • The employee looks for and corrects: —Blood pressure drop (two employees required for corrective action; place machine in STATE 6). —Coil leak. —Bath change. • After 4 hours (eight inspections) place machine in STATE 4.	• If a patient has been treated at least 4 hours, the employee will terminate the treatment. • Place machine in STATE 5.	• After a patient's treatment has been terminated, a machine must be cleaned. • All machines used during a shift must be cleaned. • Place machine in STATE 1 after it is cleaned.	• If another employee discovers a blood pressure drop during an inspection of a patient, it requires two employees to correct the situation.	• Other employees are performing the required procedures at this machine or • No procedure is required at this time instant for this machine.

• An employee will perform the procedure required at each machine defined by the STATE of that machine.
• A machine can only exist in one unique STATE at any given time.

ILLUSTRATION II

RENAL DIALYSIS

SIMULATION EXAMPLE OF STAFFING, EQUIPMENT AND TREATMENT RELATIONSHIPS

PER EIGHT-HOUR SHIFT

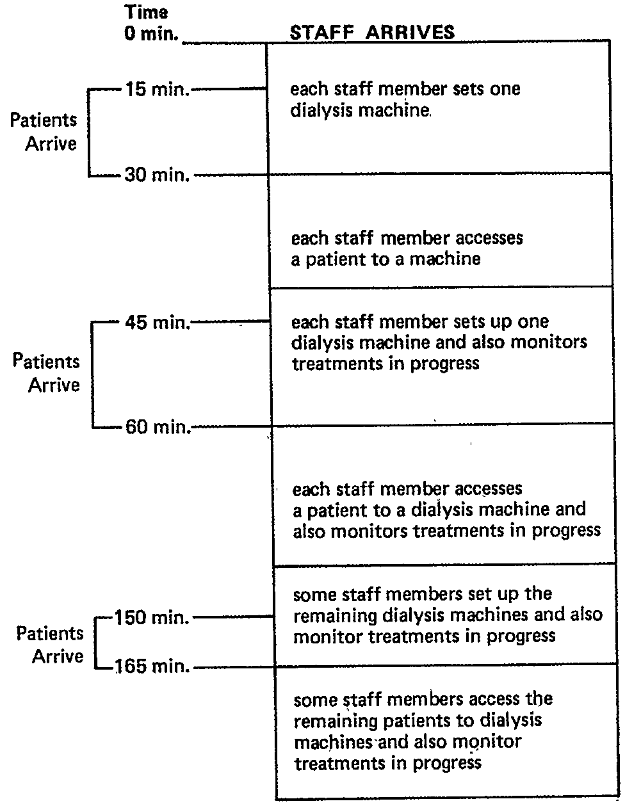
Number of Treatments Scheduled	Number of Staff Personnel Required	Number of Dialysis[(A)] Machines Required
0	–	–
1	2	1
2	2	2
3	2	3
4	2	4
5*	2	5
6	3	6
7*	3	7
8	4	8
9	4	9
10*	4	10
11	5	11
12	5	12
13*	5	13
14	6	14
15*	6	15
16	7	16
17*	7	17
18	8	18
19*	8	19

* Indicates the most efficient level of operation.
(A) Dialysis machines are all batch type with canister filtering devices.

ILLUSTRATION III

RENAL DIALYSIS SIMULATION

EXAMPLE OF PATIENT AND STAFF DAILY SCHEDULING



BIBLIOGRAPHY

(1) P.L. 92-603 (The Social Security Amendments Act of 1972), Section 2991, amended June 3, 1976.

(2) In general, persons under age 65 who require hemodialysis for "End-Stage renal disease" are eligible for Medicare benefits. End-Stage renal disease is defined as "that stage of kidney impairment which is irreversible, cannot be controlled by conservative management alone, and requires dialysis or kidney transplantation to maintain life."