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Identifying the Value of Computers in Dialysis

Part II: Clinical Applications

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In Part I of this article, the author explained the value of computerization and showed how it can help dialysis facilities manage the fiscal side of providing care. In Part II, Dr. Sargent looks at how computerization can make clinical information more valuable for the renal staff.

Evaluating the Value and Benefit of Clinical Information for the Dialysis Provider

Defining and analyzing the automation of clinical information is much more difficult than for automating business systems. It is a more difficult task to clearly define the goals for computerizing clinical data.[1] The cost of computer complexity will be similar to business systems. However, the cost of the clinical problem and how it is affected by computerization is difficult to determine and may be composed of several factors.

Likely Benefits of Computerization of Clinical Information

As was stated in Part I of this article, it is important to understand the goals of computerization before investing in hardware, software, and personnel. Those goals should include being able to automate complicated, repetitive tasks and easing staff burden, and developing knowledge and understanding of an operation so that it can be conducted in a more effective manner.

These goals can apply when looking at business or clinical systems, although the tasks in a business system are more complicated than in a clinical system. However:

- It is likely that charge capture can be improved by computerizing a small subset of clinical data.
- It may be possible to ease staff burden with a system because of the high visibility of data retrieval tasks associated with regulatory agencies, the information needs for patient admission and travel, and the convenience associated with being able to access outcome and status data remotely (e.g., an off-hour hospital admission of a patient requiring physician involvement).

- The potential would also seem to exist to use information better in order to anticipate problems — either by implementing continuous quality improvement (CQI) programs or by assuring that critical information is passed on to subsequent caregivers.

Experience with existing computerization gives some insight regarding the extent that these benefits can actually be realized in the clinical arena. Addressing complicated tasks and easing staff burden would be expected to reduce labor costs. By and large this has not been the experience of the dialysis field. As dialysis practitioners know, the field has done a heroic job of controlling staff costs over the past decade. To suggest that staff can be further reduced by the introduction of computers would strike some as unlikely.[2]

Charge capture is an area where there can be real benefit, depending on the level of missed charges that currently exist. The value of this capability will depend on the systems and processes the provider currently has in place to assure that charges are not missed. Once again, as margins became ever tighter during the past decade, surviving dialysis providers have developed methods to address this problem.

The benefit to be derived from better use of information through CQI programs and anticipation of problems falls into the category of improvement of the quality of patient care. The quantifiable result of this use of information for the provider — the purchaser of the system — is in fewer hospitalizations and lower mortality. For example, the average patient in the U.S. misses approximately 5% of expected treatments per year due to hospitalization (7—8 treatments).3,4 If through better use of information this number can be reduced to half, there would be four extra treatments performed by the dialysis facility (see below for analysis of the value of these added treatments). In addition, with a “computerized” dialysis facility it is possible that there will be an increase in referrals because physicians may find it easier to follow patients with automated records

From the financial point of view of the provider who must purchase the system, the major benefit of automation that achieves the goal of better patient care is conducting more treatments. The value of any such additional treatments will be the margin associated with a dialysis treatment — the excess of increased revenue over the cost of the treatment.

The Financial Impact of Better Information on Increasing Treatments

The cost benefit for increased numbers of treatments is a calculable value, which depends on the revenue per treatment and the corresponding margin for the particular facility. It is true that the margin for incremental treatments (i.e., a small number of treatments that will not increase staff cost or other “semi-fixed” costs) may be high. However, for greater increases the semi-fixed costs must also rise and the margins decrease.

The financial benefit of increasing treatments by better use of information can be easily quantified. For a facility with R revenue per treatment ($/Tx), with a margin of *m* (expressed as a decimal fraction), and clinical system cost of C ($/Tx), total annual system costs will be ΣTx*C (where ΣTx is the total number of treatments per year). The increase in available revenue (the difference in increased revenue and increased expenses associated with increased treatments) will be ΔTx*R*m (where ΔTx is the increase in number of treatments annually). To break even with computer costs, the computer cost must equal the increased available revenue:

- 1a. $\Sigma Tx * C = \Delta Tx * R * m$ and
- 1b. $\Delta Tx/\Sigma Tx = C/(R*m)$

In Equation 1b, ΔTx/ΣTx is the fractional increase in treatments needed for the facility to pay for its computer capability that addresses the quality of care issue.

A graphical representation of Equation lb is shown in Figure 1, with several different levels of revenue per treatment (R) and margin (m). As detailed in Table 1, the annual cost of a mid-range computer system for a 150-patient facility (21,600 treatments annually) is $65,505.1 If this cost is spread over the 21,600 treatments, it amounts to $3.03 per treatment for computerization.

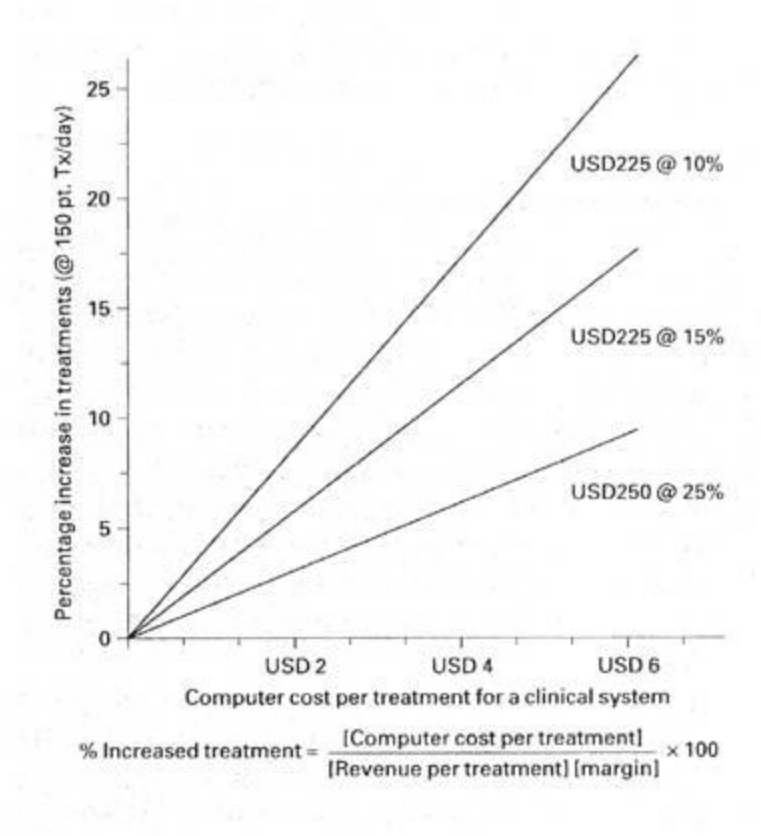


Figure 1

Table 1: Annual Costs for a Mid-Range Computer System[1]	
HW/SW Purchase	$27,105
HW/SW Maintenance	$8,400
User Support	$10,000
Systems Manager	$20,000
Total Annual Cost	**$65,505**

If the facility is achieving $225 per treatment in revenue and 15% margins, it will need to increase the number of treatments by 9% to cover this cost, or 1,944 additional treatments per year (six extra treatments per day). Singling out the value of halving hospitalizations discussed above and an increase in treatments of 2.5% to prevent operating at a loss, the cost of computerization would have to be less than $0.84 per treatment.

It is unclear if this increase in treatment numbers derived above is likely to result from better use of clinical information. What is clear, even if such increases are possible, is that it is important to implement only those aspects of patient information most likely to help achieve this increase in quality of care so that the financial benefit can more easily meet the increased system cost. That is, the increase in treatments to break even will be half as much for a system that costs $1.50 per treatment as for a system that costs $3.00 per treatment. In addition, because it is possible that the needed increases in treatments will not occur, controlling the cost of automation will result in a lower level of expense that has to be incorporated in the “cost of doing business,” or provider overhead.

In addition to increased numbers of treatments, there are other measurable cost savings in the renal setting that can be attributable to computerization. A better understanding of treatment might permit more effective use of a medication and, depending on the margins for such a medication, this could either increase or decrease a facility’s margin. That is, if a provider administers a medication at a loss, optimization of its use would improve the treatment margin. By and large, medications that fall into this category — those provided at a loss to the dialysis enterprise — have always drawn the provider’s attention, such as the early use of Epogen®, reimbursed initially at a fixed amount per treatment. When larger doses needed to be administered, the provider administered the drug subcutaneously, in order to minimize the amounts used and control the unreimbursed expenditures.

The Composite Value and Cost of Automation

Taken together, the value derived from automation as a function of the cost is shown in Figure 2. At first glance, this figure would seem to indicate that there is considerable benefit to be derived from computerization because the curve is above the break-even line throughout most of the figure. It is important to realize, however, that the various segments of the curve shown in this figure are from the automation of specific functions. As was evaluated in Part I of this series, the payoff for moving to an effective

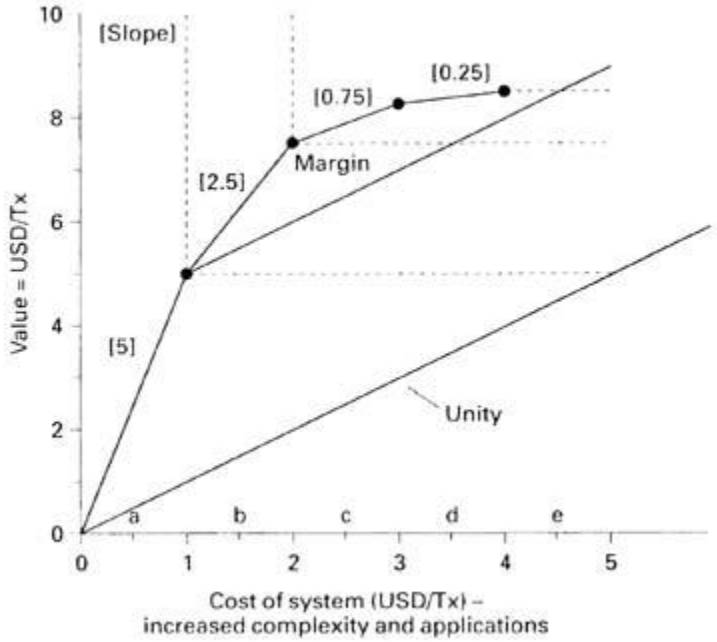


Figure 2 billing and receivables system had a value of $5.00 for $1.00 expended (resulting in a line of slope 5.0 in this portion of the figure). We have assumed from our “abandoned charge” analysis that the charge capture portion of a clinical system will add approximately $2.50 for an additional $1.00 in computerization (the cost of added automation needed to supply this capability). We have further assumed that increased computerization cannot be totally paid for by adding treatments and that there will be a value of $0.75 for an additional $1.00 of computer cost (it remains to be determined if even this level of treatment increase can be realized). A feature of Figure 2 is that with aggressive computerization the value no longer increases and in fact could decrease as the computer system requires more and more staff effort. Overall, while showing that considerable computerization can be installed and have value, Figure 2 shows that it is the billing and receivables and charge capture capabilities that make the major contribution to a profit in the overall process of automation.

Incremental Value and Cost of Automation

The coordinates shown in the middle of Figure 2 indicate what the analysis would show for those who have already implemented the billing/AR component of this figure and who are evaluating automation of their clinical records (the system that will provide charge capture and other clinical information). This analysis should generate some caution on the part of the provider planning to automate clinical records because one is relying heavily on the charge capture aspects of the system to make it affordable.

The Hierarchy of Clinical Data

One flawed assumption of the "paperless" approach is that all data are of equal importance and need to be collected. A provider may also feel that because data are in electronic form, they should be included in the database (e.g., run parameters from the dialysis machine). In reality, data can be separated into several categories:

- Data that are needed to determine current status and progress of the treatment. These include blood and dialysate flow, temperatures, intradialytic blood pressures, initial safety tests on the dialyzer, and machine parameters. These measures are used to monitor intradialytic events, and are seldom needed after the treatment is complete.
- Data that indicate presenting and long-term status of the patient. These include patient assessment pre/post treatment, pre/post blood pressure, lowest blood pressure during a treatment, pre/post weight, dry (or target) weight, and weight change. These measures are used to track patient status and treatment problems. They can be useful for longitudinal tracking of the patient.
- Data that track treatment delivery and treatment charges. These include dialyzer used, average blood flow, Kt/V, and medications administered. These are billable events and are parameters that affect outcome. They are used to better understand reasons for different outcomes and to generate charges.
- Outcome data. These include laboratory values and key markers of medical progress. These are used to evaluate whether treatment and/or treatment changes are effective. They help track overall medical status and provide triggers for modifying treatment.
- Other data. These include access-related events and problems and general medical problems. These are used to assess and react to the

patient's general medical condition. They help determine areas where medical effort should be concentrated.

- Administrative information. These include the HCFA 2728 form and other justification for treatment, power of attorney (advanced directives), acknowledgment of being informed of treatment options, and other legal documents. They are needed for legal and regulatory requirements.

All of the above data can be computerized and stored, thereby eliminating much of the paper and record keeping associated with the current medical record. The first item — data needed to monitor the status of treatment — represents a considerable volume of data. Each treatment will have a large number of treatment parameters that are used to monitor the status of the machine and conduct of the treatment. With increasingly sophisticated equipment, more and more of these data can be electronically transmitted to databases. These data, however, are of minor value once a dialysis treatment is completed, although they could account for a large percentage of data in an electronic medical record.

The remaining items (with the exception of administrative information) describe data that can be used to track patient progress, to assure that problems are analyzed for causes, and to assure that problems are passed on as needed to other clinical personnel. These will characteristically represent a much smaller data set than the machine and intradialytic parameters. As a result there may be only a modest effort associated with gathering the information and entering the information into the database. They are also parameters that treatment personnel realize are of long-term value and can help them in delivering quality care and anticipating clinical problems. As such, caregivers may better understand the value of collecting accurate information and computerizing it so that they can take advantage of this information in the future.

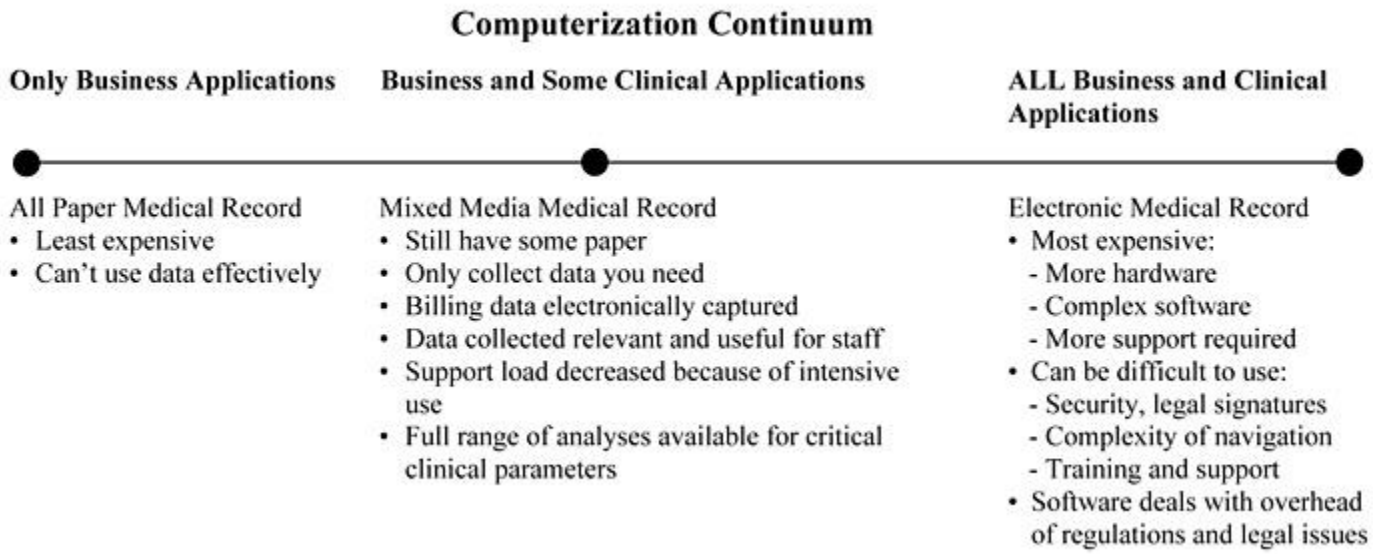
The last item, administrative information, is of limited value to the caregiver when addressing quality of care issues. It is important to know that an advanced directive exists and what resuscitation is desired, but the actual documentation doesn't need to be in a database.

Complexity Associated with the Electronic Medical Record

If a computer system strives to be the total patient chart or electronic medical record, there will be considerable "overhead" associated with the system. It is necessary to have extensive security, electronic signatures, and methods whereby only certain staff members can access specific parts of the database. All of these restrictions have to be administered. Because of the legal nature of such a record, counter-signing of pre-dialysis machine checks, for example, needs to be mandated and these data retained as records. Thus, computerizing all patient medical records rather than just tracking key clinical indicators can be labor intensive, frustrating the goal of "easing staff burden."

Finding the Right System

Computers fit where you want them to fit. There is a wide range of capabilities that are available, and it is up to the dialysis provider to decide what capabilities are appropriate for its specific needs. It is critical that the benefits and costs are clearly understood. As has been discussed, greater complexity may provide not only more capabilities but also greater cost — both in purchase price and in maintenance, support, and internal infrastructure. In addition, a complex system can also place an increased data entry burden on treatment staff. Fig. 3 shows the options.



< Figure 3

- **The Complete Electronic Medical Record** (right side of the continuum) is the most expensive choice (see the cost of ownership — Figure 2). With the right system, clinical direction, and an enthusiastic staff, such systems can be a major factor in increased quality of care and can be locally justified even with the high cost.
- **The Paper Record with Computerization of only Business Functions** (left side of the continuum) reflects the less expensive choice for clinical records, but it is inefficient and more difficult to use as it requires all analyses to be conducted by hand. The provider also has to rely on the clinical and reimbursement staff to assure that all billable events are captured. Evaluation of quality issues is difficult, although individual analyses are possible using common office spreadsheet software and other automated tools.

- **The Hybrid System** retains paper records and computerizes critical aspects of clinical care. The disadvantage of this approach is that the facility still needs to maintain some paper medical records. The primary advantage is that with a paper record, the collection of relatively unimportant data (e.g., flow rates, temperature, machine checks, etc.) do not need to be stored in the system with the attendant legal requirements. In addition, all of the complexity and extra effort required to support a legal record are not needed. Only needed data are collected, which avoids extra staff work. Such a system can be used to capture billing data — the single most valuable aspect of computerized clinical systems (see Figure 2), and a full range of analyses of the critical parameters that are entered into the system can be available

Conclusion.

Computers are tools that, when used properly, can provide considerable benefit to the user. In the dialysis setting, computers can effectively increase the business success of a provider and help staff understand the critical aspects of quality patient care. Computers are expensive and the more complex they are, the more they cost. The costs associated with computerization are not just the purchase price of the system but include staff involvement and extra effort by key personnel. The cost of computerization of a clinic can range from $1.00 per treatment to well over $6.00 per treatment. In choosing the level of computerization desired, one should evaluate the expected costs as well as how those costs will be borne (decrease in other costs, an increase in revenue, or an increase in facility overhead). Although computers have made uneven inroads in the dialysis field — being used mainly in the business tasks of the provider—they will become more and more a part of the clinical care of the ESRD patient as specific problems are defined. With such definition, the computer can truly fulfill its role in supplying information to increase knowledge of a patient's medical problems, which in turn will ultimately result in higher quality care.

References

1. Sargent JA: Identifying the value of computers in dialysis: Part I. Nephrol News Issues 15:7:19-23, 2001
2. Sargent JA, Clark RA, Paget M, Kingston WW: Cost-effectiveness of computer solutions in dialysis. Dial Transpl 20:4, 1991
3. U.S. Renal Data System: USRDS Annual Data Report: Atlas of End-stage Renal Disease in the United States. National Institutes

of Health, National Institutes of Diabetes and Digestive and Kidney Diseases, Bethesda, MD 2000

4. Sargent JA: Benchmark data on financial and clinical operations from the QMS Focus and Focus 2000 Database, January 1, 1999—March 31, 2000. Internal QMS document, December 2000

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