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Making the Business Case for Telemedicine: An Interactive Spreadsheet

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ABSTRACT

The objective of this study was to demonstrate the business case for telemedicine in nonrural areas. We developed an interactive spreadsheet to conduct multiple financial analyses under different capital investment, revenue, and expense scenarios. We applied the spreadsheet to the specific case of poststroke rehabilitation in urban settings.

The setting involved outpatient clinics associated with a freestanding rehabilitation hospital in Oklahoma. Our baseline scenario used historical financial data from face-to-face encounters as the baseline for payer and volume mix. We assumed a cost of capital of 10% to finance the project. The outcome measures were financial breakeven points and internal rate of return. A total of 340 telemedicine visits will generate a positive net cash flow each year. The project is expected to recoup the initial investment by the fourth year, produce a positive present value dollar return of more than $2,000, and earn rate of return of 20%, which exceeds the hospital's cost of capital. The business case is demonstrated for this scenario.

Urban telemedicine programs can be financially self-sustaining without accounting for reductions in travel time by providers or patients. Urban telemedicine programs can be a sound business investment and not depend on grants or subsidies for start-up funding. There are several key decision points that affect breakeven points and return on investment. The best business strategy is to approach the decision as whether or not to build a new clinic.

INTRODUCTION

TELEMEDICINE is being used to provide health services in a growing number of medical disciplines. The three general applications are: telemetry (such as monitoring patients in an intensive care unit or blood sugar readings for people with diabetes), store-and-forward digital image interpretation (such as radiographs or retinal pictures), and interactive patient–clinician encounters (e.g., psychotherapy, patient education, or specialty consultations).

Telemedicine programs require a significant capital investment in equipment and on-going technical support. Many, if not most, telemedicine programs are financially dependent upon public sector financing in the form of grants and telecommunications subsidies for connec-

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tion charges. These grants and subsidies are nearly always restricted to rural counties. Consequently, the programs with the largest volume of service tend to be associated with university-based medical systems in states or provinces with large rural areas and physician shortages.

An organization's decision to direct capital to a telemedicine program is a simple one: Will they make a profit? If not, will they decrease the margin of losses (if any) of a face-to-face encounter system?

Several investigators have explored the costs and benefits of implementing telemedicine programs in prison systems and rural areas.[1] Financial analyses of prison telemedicine programs often report cost savings over face-to-face encounters. Alessi et al.[2] found telepsychiatry caused a significant cost savings when applying mental health interventions to prisoners via telemedicine. Zincone et al.[3] performed a payback analysis of its telemedicine prison system and reported prison utilization did not create sufficient demand until the fourth year of operation. McCue et al.[4] found a net cost savings of $14 per visit for all prison telemedicine services over a 12-month period. The savings arose from eliminating the need for a security guard to accompany the prisoner to a clinic outside the penitentiary.

Most financial analyses of rural telemedicine programs also show profitable returns on investment.[5,6] Logan and Schwartz[7] projected financial analysis for Indian health services via telemedicine. Two urban telemedicine programs showed societal cost savings: Young and Ireson[8] calculated the cost effectiveness of school-based telecare for an urban school in Kentucky, and Dansky et al.[9] developed a cost analysis of an urban home healthcare nursing program for patients with diabetes. However, we believe these studies overvalue the financial returns because they include savings to the patient's family in time and travel, or savings to society through avoided hospitalizations. These indirect dollars do not support an institution's telemedicine operation and are rarely reimbursed by health insurers. In other words, these savings do not accrue back to the organization that is investing the capital. We identified only two studies simulating reimbursement rates and a profitable position for a telemedicine program in nonrural areas—one within a large integrated healthcare delivery system[10] and one to outpatient services between two metropolitan hospitals.[11]

Thus, a review of the literature suggests that telemedicine is only profitable where the cost of traveling to a clinic is very high. It is not clear that a telemedicine program is financially viable once the patient's travel costs or avoided hospitalizations are removed from the analyses. We believe this creates the perception that telemedicine programs are money losers, thus inhibiting serious consideration by community-based hospitals of investment in telemedicine.

We were interested in exploring the investment decision by a freestanding rehabilitation hospital in an urban area. People with disabilities are similar to people in rural areas in that they face physical barriers accessing care. For rural patients, the barrier is distance. For people with disabilities, and especially for people in pain, the barrier is their functional impairment in navigating the built environment (e.g., stairs, or getting in and out of a taxi). An anecdotal report indicates a high percentage of missed appointments for outpatient rehabilitation therapy, which makes it difficult for rehabilitation clinics to cover their fixed costs.[12] Telerehabilitation could help urban residents with disabilities to receive the therapy they need while simultaneously reducing the number of missed visits. We wanted to know if a financially self-sustaining telerehabilitation program could be established in a nonrural location, independent of grant funding or telecommunications subsidies.

MATERIALS AND METHODS

The overall approach was to build an interactive financial spreadsheet that would allow a hospital financial analyst to model different scenarios. The workbook contains 13 sheets, including 5 sheets to input direct projected revenues (Medicare, Medicaid, commercial insurers, workers' compensation, self-pay and

contracts), 1 sheet for indirect revenues, and 3 expense sheets (telecommunication expense, medical expenses, and capital outlay). There are 4 output sheets for: consolidated revenues, consolidated expenses, breakeven points, and payback period and internal rate of return over a 5-year projection period. The Appendix provides further explanation of these key financial terms.

To model different scenarios, we used actual cost and revenue information from a free-standing rehabilitation hospital that has an active telerehabilitation program in the state of Oklahoma. Using videophones or Internet videoconferencing, this hospital provides speech therapy to schools and physical therapy throughout the state of Oklahoma.

Key personnel at three rehabilitation hospitals were interviewed to obtain a realistic picture of how telerehabilitation could be used to provide outpatient therapy and to obtain actual data that were used in estimating start-up and operating costs as well as projected revenues.

Direct revenue variables

Because reimbursement amounts for telemedicine vary by payer, we segmented revenues into five different sources: Medicare (national health insurance for the elderly and adults with disabilities); Medicaid (combined national and state health insurance for the poor); workers' compensation; self-pay and contracts; and commercial (private sector health insurance paid by employers). The financial model allows the user to enter different payer mixes, project service volume by procedure code, different revenues for each procedure code and payer, and bad-debt losses for uncollected copayments or coinsurance. For example, Medicare will not pay for any telemedicine if the beneficiary resides in a county designated as "urban," even if the beneficiary lives in a rural portion of the so-called urban county. For most services, the projected Medicare volume and revenue would equal "zero." In contrast, the state Medicaid program may pay for telemedicine services provided to the same individual, if the rural part of the county is documented as a local physician shortage area.[13,14]

Indirect revenue variables

The spreadsheet allows users to incorporate indirect revenues from thee potential sources: (1) operating profits for a fixed-price hospital stay when the patient is able to be discharged earlier because monitoring or management services will be provided through telemedicine; (2) additional revenues gained because patients keep their appointment (albeit by videoconferencing) instead of missing an appointment; and (3) savings from not spending money for the clinician to travel to remote sites for face-to-face encounters. However, our analysis only focuses on the direct revenues generated from the project and on a case by case basis, there may be an inclusion or exclusion of these indirect revenues.

Telecommunications expenses

The spreadsheet allows analysts to distribute fixed and variable costs by different equipment types. Staffing, maintenance, and transmission costs are included. We included the labor costs of a telecommunications technician to maintain the equipment and troubleshoot connection problems (each site hired at least one individual). The site used existing personnel to schedule the rooms, greet patients, maintain medical records, and bill insurance companies for payment. The site also used existing therapists or clinicians during the start-up period, with some of their time booked for a telemedicine encounter instead of a face-to-face encounter. The model allows users to incorporate the costs of adding new staff.

Medical expenses

Staff costs are calculated for each Current Procedural Terminology (CPT) procedure code. There is also a fixed cost per visit to cover supplies.

Capital outlay

Users input the costs for the telemedicine systems including displays and peripherals, communication software costs, telemedicine room renovation costs, and training. Users can enter their own salvage values and years of de-

preciation. In this first-generation spreadsheet tool, we only compute straight-line depreciation. Finally, our spreadsheet model allows the user to input different assumptions about the percentage of time that the equipment is used for telerehabilitation (an allowable cost) versus videoconferencing.

Outcome measures

We projected total annual cash revenues and costs over a 5-year period, which is a standard time frame in applying capital budgeting techniques. We used our model to compute standard financial performance measures for business investment decision-making—internal rate of return (IRR) and payback. These can be found in any financial analysis textbook, such as Zelman et al.[15] If the IRR is greater than opportunity cost of capital, then the business case for telemedicine is made.

Scenario

Our scenario explores the investment decision for providing poststroke rehabilitation services to urban patients. We modeled costs and revenues for five speech-language pathology (SLP) services that the hospital provides to its rural poststroke patients over videophones or videoconferencing equipment (speech–language evaluation, swallowing evaluation, swallowing oral fix, individual therapy session, and aphasia assessment) and two physical therapy (PT) codes (individual activities and physical therapy evaluation). We input actual telemedicine operating costs for salary and benefits for the telemedicine technician and relevant therapists, transmission costs, and marketing costs. We identified those fixed costs that may not change with volume such as technician costs.[14]

We then modeled annual estimates for cash revenue, cash costs, and net cash flow. In the baseline analysis, we projected the specific payer mix for each procedure using the historical proportion of Medicare, Medicaid, and commercial stroke patients seen in face-to-face outpatient clinics at the hospital. This scenario assumes that Congress would lift the prohibition of Medicare reimbursement for telemedicine services provided by therapists.

Breakeven volume for each service is measured by dividing total fixed costs by its contribution margin. Contribution margin is defined as the difference between cash revenue or payment per visit minus the variable operating cost per visit for each service.[16] To measure breakeven volume by SLP and PT services, we first measured a weighted payment or revenue per visit for each payer across all CPT codes and then across all payers. To compute this value, we conducted a two-stage process. The first stage required estimating a weighted average of the cash revenue or payment per visit across CPT codes by each payer. The payments per visit were weighted by patient volume across the CPT codes by each payer. The second stage weighted this previous value by the patient volume across payers. Finally, total fixed costs for the SLP and PT service were allocated by patient volume. The Appendix provides a detailed explanation of these key financial terms of breakeven, payback, internal rate and net present value.

RESULTS

Table 1 lists the projected visits and payment per visit by insurance payer for the baseline period. Table 2 summarizes the projected net pa-

Table 1. Assumptions for Projected Visits and Payment per Visit by Insurance Payer for the Baseline Period

Modeled Medicare PT visits	148[a]
Modeled Medicare—weighted payment per PT visit	$13.60[a]
Modeled Medicare SLP visits	0
Modeled Medicare—weighted payment per SLP visit	0
Modeled Medicaid PT visits	72
Modeled Medicaid—weighted payment per PT visit	$12.02
Modeled Medicaid SLP visits	3
Modeled Medicaid—weighted payment per SLP visit	$29.25
Modeled Commercial PT visits	70
Modeled Commercial—weighted payment per PT visit	$49.58
Modeled Commercial SLP visits	47
Modeled Commercial—weighted payment per SLP visit	$68.59

[a]Note that Medicare does not currently reimburse for speech-language pathology (SLP) or physical therapy (PT) provided via telemedicine.

Table 2. Proforma Revenue, Expense, Net Cash Flow Summary, Internal Rate of Return, Payback and Net Present Value in a Hypothetical Poststroke Rehabilitation Program

Year	*0*	*1*	*2*	*3*	*4*	*5*
			Revenue			
Patient revenue						
Medicare[a]		$2,013.48	$ 2,073.88	$ 2,136.10	$ 2,200.18	$ 2,266.19
Medicaid		$ 952.95	$ 972.01	$ 99.45	$ 1,011.28	$ 1,031.50
Commercial		$6,694.16	$ 7,363.58	$ 8,099.93	$ 8,909.93	$ 9,800.92
Total patient revenue		$9,660.59	$10,409.47	$11,227.48	$12,121.39	$13,098.61
			Operating Expenses			
Labor and supply		$3,808.00	$3,884.16	$3,961.84	$4,041.08	$ 4,121.90
Transmission		$2,160.00	$2,203.20	$2,247.26	$2,292.21	$ 2,338.05
Medical		$2,621.38	$2,700.02	$2,781.02	$2,864.45	$ 2,950.39
Total operating expenses		$8,589.38	$8,787.38	$8,990.13	$9,197.74	$ 9,410.34
Capital expenditure	−$6,186					
Net cash flow	−$6,186	$1,071	$1,622	$2,237	$2,924	$ 3,688
Cummulated cash flow		$1,071	$2,693	$4,931	$7,854	$11,543
Net present value	$2,096.37					
Internal rate of return	20.12%				Year 4	

[a]Note that Medicare does not currently reimburse for speech-language pathology (SLP) or physical therapy (PT) provided via telemedicine.

tient revenue/cash payment, operating expenses, net cash flow, payback, and internal rate of return over a 5-year period. Given these volumes and rates by payer for SLP and PT telerehabilitation services, the program is projected to earn a positive net cash flow of $1,071 in the first year and positive cash flows for the remaining years. Assuming a capital investment of $6,186, the cumulative cash flows from this new service generate a payback period of 4 years. The new service is projected to generate an internal of return of 20%, which indicates that the hospital system should invest in this new service as long as its cost of capital for this project is less than 20%. Finally the net present value indicates that the telerehabilitation program will generate a dollar return of $2,096 when the healthcare system's cost of capital is 10%.

Table 3 presents the breakeven analysis. We present the breakeven volume projections separately for SLP and PT therapies. We weighted the net revenue per visit for each service by the actual payer mix at the hospital. In the case of SLP, net revenue per visit was $66 compared to $22 per visit for PT. The variable expense, which was composed only of salary and benefit rate per visit for each service, is computed by a projected standard hour of work within an hour time frame times the salary and benefit hourly rate. In the case of PT and SLP services, the standard hour of work per visit was 0.22 and 0.18, respectively. Contribution margin was defined as the difference between the net revenue per visit and variable expense per visit. The telemedicine operating expense of $5,968 was assumed to be a fixed expense and was allocated to each service by the volume of service they generated, which was 15% for SLP and 85% for PT. Finally, the breakeven in visits was computed for each service. For SLP, the study estimated a breakeven of 14 visits given a fixed expense of $878 and contribution margin of $61. For PT, the study estimated a breakeven of 369 visits given a fixed expense of $5,090 and contribution margin of $14. For all the telerehabilitation services, the breakeven in visits was estimated to be 129. Based on the simulation of the key components of this model, the 129 visits indicate the number of visits that are needed to cover the fixed costs at a given contribution margin of $14 per visit.

Sensitivity analysis

A sensitivity analysis (Table 4) was conducted to assess how changes in patient vol-

Table 3. Proforma Breakeven Analysis for a Hypothetical Poststroke Rehabilitation Program

	Payer	*SLP*	*PT*	*Total*
Net revenues:				
	Net Medicare revenue per visit[a]	$0[a]	$14[a]	
	Net Medicaid revenue per visit	$29	$12	
	Net Commercial revenue per visit	$69	$50	
	Net revenue per visit weighted by payer visits	$66	$22	$60
Variable expenses:				
	Salary and benefit expense per visit	$5.53	$8.09	$13.62
Contribution margin				
	Net revenue per visit weighted by payer visits	$66	$22	$60
	Minus varible expense per visit	$6	$8	$14
	Contribution margin	$61	$14	$46
Fixed expenses				
	Allocation of fixed costs based on % of visits:	15%	85%	100%
	Telemedicine operating expenses:	$878	$5,090	$5,968
Breakeven				
	Total fixed expenses:	$878	$5,090	$5,968
	Contribution margin	$61	$14	$46
	Breakeven in visits	14	369	129

[a]Note that Medicare does not currently reimbuirse for speech-language pathology (SLP) or physical therapy (PT) provided via telemedicine.

ume could change the financial outcome of the study. For example, if revenues from commercial insurers grow only 5% instead of the 10% assumed in the baseline simulation, the net present value (NPV) is −$546, while IRR decreases to 6.8%—well below the hospital's cost of capital. From a financial assessment under this scenario, the telerehabilitation program should not be considered—it does not make "business sense" because the investment return on the project is below the return to finance the project. Conversely, if commercial revenues increased to 15%, the NPV is $4,991 and the IRR rises to 20%—well above the hospital's cost of capital.

DISCUSSION

Most so-called financial analyses of telemedicine programs are actually cost-benefit analyses to build the public policy case for investing in telemedicine infrastructure. Most of these studies[3,4,6–9] calculate indirect benefits to the investor, such as improved population health by providing timely services to people in re-

Table 4. IRR and Payback Volumes for Different Scenarios Under an Urban Telemedicine Program Using an Existing LAN and IP Conferencing

Scenario	*Breakeven visit volume*	*Payback year*	*IRR at year 5*
Baseline	17	1	−19%
Increase annual visit volume to 20%	17	1	−8%
Change start volume to 100 visits per year	40	1	−29%
Indirect revenue: clinician adds 100 patients, by seeing patients when would otherwise be driving to remote site 30 miles away	8	1	−1%
Indirect revenue: clinician adds 200 patients, by seeing patients when would otherwise be driving to remote site 60 miles away	6	1	−1%
Reduce no-shows by 50 visits	5	1	18%
All of the above	12	1	75%

IRR, internal rate of return; LAN, local area network.

mote geographic areas, or improved productivity for people who must travel for care.

Our financial analysis suggests that more attention should be given to building the business case for private sector investment in telemedicine in both rural and urban areas. Many studies on the diffusion of new technologies show that adoption is faster when investors can expect a quick return on their financial investment. A strategic plan that views telemedicine as a business opportunity is more likely to result in new growth in patient volume with a smaller capital investment and quicker start-up than a strategic plan that views telemedicine as a rental application from a telecommunications business.

Our analysis illustrates the importance of segmenting the revenue market and making educated assumptions about the revenues from each, by specific type of service. This is dictated by the overlapping reimbursement practices within a health system's delivery area, as well as the different contribution margins of various departments. In our second example, the lower contribution margin of PT services created a greater need for higher volume to cover the fixed costs of operation. Conversely, higher contribution margins for SLP services required lower volume to cover these fixed costs. Lower payments per visit for Medicare and Medicaid patients may require a greater marketing of these services to either higher paying commercial payers or a greater volume of government payments in order to cover the fixed costs of operating a telerehabilitation program.

Our study suggests that telemedicine can be profitable and financially self-sustaining, independently of grants and subsidies. Granted a major assumption of this study is that Congress would allow for the Medicare reimbursement for telemedicine services in urban markets. Our sensitivity analysis underscores the importance of developing a marketing program that targets the highest paying insurers and stimulates new business growth. Indirect revenues from reductions in missed appointments could also be considered. For example, Cashman et al. found that 73% of adult patients in an urban community health center missed one or more appointments; 30% missed three or more.[12]

Finally, our study suggests that providing telerehabilitation to people with permanent or temporary physical disabilities can be a sound financial business decision for urban hospitals.

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Free copies of the interactive spreadsheet may be downloaded from the ATA website.

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APPENDIX OF KEY FINANCIAL TERMS

1. Breakeven analysis (BEA): Represents a financial approach to evaluate the relationship among revenues, costs and volume. The breakeven approach typically solves for the volume of patients or visits by dividing fixed costs of the service by its contribution margin. Contribution margin equals revenue per visit minus variable cost per visit of the service
2. Payback: A capital budgeting technique used to evaluate the financial feasibility of a capital investment by determining the length of time it takes to recover the initial investment
3. Internal rate of return (IRR): A capital budgeting technique used to evaluate the financial feasibility of a capital investment by measuring the percentage return on the investment. This return of return equates the present value of the net cash flows expected to be generated from the project to the capital outlay required to invest in the capital project
4. Net present value (NPV): A capital budgeting technique used to evaluate the financial feasibility of a capital investment by measuring the dollar return on the investment. It is measured by discounting back to the present the net cash flows expected to be generated from the project and subtracting them from the initial capital outlay required to invest in the capital project

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