The Economic Impact of Telemedicine Capability in a Rural Hospital

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I. Introduction

As various forms of electronic interaction (such as e-mail and on-line shopping) become more commonplace in today’s society, the combination of this technology and health care has the potential to greatly impact the lives of rural residents. Also known as “telemedicine,” applications that use technology to move medical information over a distance have played an increasing role in rural health care since the late 1990s (Ricketts, 2000). From a quality-of-life perspective, telemedicine allows individuals in rural areas to be “observed” by specialists in various parts of the country (and even overseas). Thus, the spectrum of health care services available to rural residents is greatly increased. Similarly, the quality and speed of such services is typically increased, as premiere specialists that tend to be centered in urban areas can now assist rural residents without the need for travel. The presence of a telemedicine center has been shown to increase the perception of health care quality in rural communities (Nesbitt et al., 2005; Sargeant et al., 2004). However, the benefits of such a center to rural individuals and communities include much more than simply improved health services. The local economy is also enhanced via the addition of telemedicine capability.

From an economic standpoint, the inclusion of telemedicine capability in a rural hospital can have numerous benefits. Although extra jobs are not typically added when telemedicine equipment becomes part of the hospital, significant savings accrue to both the hospital and the patients that participate in telemedicine. These savings take the form of reduced hospital payments for the service offered via telemedicine (since the work is outsourced and full-time specialists are not needed) and decreased costs of travel /
amount of work time missed for residents who otherwise would have to drive to the closest area that offers a particular service. The local area also benefits by retaining any additional health work required from the initial visit, since people tend to have laboratory or pharmacy work done in the same area where their health service was performed (Eilrich, Doeksen, and St. Clair, 2007). This paper seeks to explain some of the most common forms of telemedicine used in rural areas today and determine their importance to the local economy. The paper is organized as follows: Section II describes the various forms and benefits of telemedicine, while Section III details a methodology for estimating the economic impact of telemedicine in a rural community. The methodology is then illustrated using actual data from Oklahoma. Section IV lists some additional issues that must be taken under consideration such as reimbursement and equipment costs, and the last section summarizes the results and provides a conclusion.

II. The Various Forms and Benefits of Telemedicine

Telemedicine can take various forms, but typically involves the interaction of a patient and local nurse or technician in one location (usually rural) and some type of physician in a separate geographic location (usually an urban center). The list of equipment involved can vary from simple web-based spreadsheets for patient data entry to complex videoconferencing equipment or specialty applications such as those used for telecardiology, where video of a patient’s heartbeat is captured.

There are two basic types of technology that make up telemedicine services. One, called “store and forward,” consists of capturing a digital image using either digital cameras or digitizing a hard copy of the image. Once the image is captured (stored), it is
then sent to another location (forwarded), where the physician can make a diagnosis. The most common use of this type of technology is teleradiology, where X-rays are captured in one location and sent to a radiologist in a separate location. This method of consultation can offer a patient diagnosis anywhere between 24 and 48 hours (Brown, 2005). The patient never has any direct contact with the physician reading the X-ray, and results are given after the patient has left the initial visit.

The second type of telemedicine technology is known as “real-time,” meaning that the patient and physician are interacting at the same time. Also called two-way interactive television (IATV), this method uses television screens set up in two different locations. The patient (typically located at the rural originating site) is able to interact with the physician (located at the more urban referral site) via a video conference. Both parties are able to see one another on the screen and can hear live audio transmissions. This offers real-time consultations and creates the impression of a face-to-face interaction between the physician and patient. The physician’s diagnosis can be given immediately during the consultation.

A third party is required when using the real-time form of telemedicine. This person can be the patient’s primary care physician, a nurse practitioner, or simply a telemedicine coordinator (Brown, 2005). The third party is responsible for operating the equipment at the originating site and recording any special instructions or prescriptions given by the specialist at the referral site. Many of the physicians utilizing telemedicine will use a combination of store and forward and real-time technology to optimize the care they give.
**Forms of Telemedicine**

Several different services are available within the realm of telemedicine. Specialty physician services that utilize telemedicine include, but are not limited to, radiology, psychiatry, dermatology, home health, pathology, internal medicine, rehabilitation, cardiology, pediatrics, obstetrics and gynecology, oncology, and neurology (Brown, 2005). Each of these specialty services is limited in its current availability to rural communities. Through telemedicine, these services can now be offered in remote locations.

Two of the most common uses of telemedicine in rural areas are teleradiology and telepsychiatry. Section III of this paper uses these two services to illustrate a methodology for estimating the economic impact of telemedicine in a rural community. Additional detail on these two forms of telemedicine is provided below.

Teleradiology uses the store and forward method for consultations. It consists of a radiology technician taking the X-ray image of the patient and scanning the image through a "digitizer." The digitizer is essentially a piece of equipment similar to a scanner that converts the X-ray into a digital image. The digitizer produces a digital version of the X-ray that can be transmitted electronically via a high-speed data line to a radiologist at another location. Some hospitals use T1 lines, which are secure fiber or copper connections that can carry approximately 1.5 Megabits of data per second (Mbps) – nearly 60 times faster than ordinary dial-up modems.¹ The radiologist at the other location then reads the image and sends the results back to the primary care physician and patient in a timely manner. Preliminary reports are usually sent back within one to three

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¹ In Oklahoma, most hospitals obtain high-speed connections through OneNet, a state-provided network that connects numerous public entities such as technical schools, libraries, colleges, and health care centers.
hours, with official, signed reports available in under one day. X-rays, computed
tomography scans (CT or CAT scans), and magnetic resonance imaging (MRI) are all
services that can be available through teleradiology. See Figure 1 for an example of the
equipment used in teleradiology.

**Figure 1. Teleradiology Equipment Example**

[Image: Digitizer (left) and resulting electronic image (right) – Jefferson County Hospital, Waurika, Oklahoma]

Telepsychiatry uses two-way interactive television (IATV) to link the patient with
the psychiatrist. In Oklahoma, the most common type of IATV is known as a Mobile
Integrated Medical Instrument, or “MiMi,” A secure high-speed connection is once again
required to perform this type of telemedicine. Once a digital conference is set up, the
physician and the patient conduct a "normal" counseling session (as if they were face-to-
face) via this equipment. Typically, an aide will sit in the room with the patient to
operate the equipment and help with any medication or treatment options that the
psychiatrist recommends. See Figure 2 for an example of the equipment used for this
type of videoconference.
Benefits of Telemedicine

Telemedicine has many benefits, not only for the patients, but for physicians and employers as well. Some of these benefits include reduced travel time or time away from work, an increased number of services offered by a hospital or medical facility, potential cost savings, quick turnaround time for tests and consultations, more educated and informed primary care physicians, and an increase in the quality of services offered by a hospital or medical facility.

For many patients, a trip to a specialist can be very time consuming. If the local medical facility does not offer the specialty physician needed, the patient may be required to drive an hour or more for only one visit. This can cause a difficult situation for rural patients to receive the proper care when it is needed (Puskin, 1995). This not only affects the patient, but the patient’s employer as well. Time that the patient spends traveling for medical assistance is time lost on the job. Studies find that patients who live in a community where telemedicine services are offered may have a decreased need or desire to travel outside of the local community for health care services (Nesbitt et al., 2005).
Also, with telemedicine’s store and forward technology, research indicates that one out of every four in-person visits can be avoided (Whited, 2006). With real-time consults, one out of every two clinic visits can be avoided (Whited, 2006). Not only do telemedicine services reduce travel time, they reduce the number of physician-patient visits as well.

Another positive benefit of telemedicine is the wide variety of services that can be made available to a rural facility. Many rural hospitals do not have the funding or patient volumes to justify hiring full- or part-time specialists. Without telemedicine services, many rural hospitals are limited to having certain specialists visit their facility only a few days of the week or month. This can greatly limit the availability of such services to the patients. With telemedicine services, the patients have access to a variety of specialty services on a more frequent basis, possibly every day of the week, instead of only certain limited times. When hospitals begin to offer these enhanced telemedicine services, a community’s access to health services greatly increases (Jennett et al., 2003).

Telemedicine services also offer potential cost savings for hospitals. Without the commute of the specialists to the hospital once or twice a week, the transportation costs for the specialty physician are alleviated. Some studies show that rural areas have a lower average cost for telemedicine consultations in comparison with conventional consultations (Loane, 2001). As more patients utilize the telemedicine services, the cost per visit decreases because the hospital is achieving economies of scale.

Telemedicine services also create a faster turnaround time, not only for exam results, but patient visits as well. For radiologist readings, the time to obtain an official, signed report reduces from several days to less than 24 hours. Further, preliminary reports typically only require a few hours, significantly increasing response time for rural
residents. For patients who need to visit a cardiologist, it could take up to a month to get an appointment for a specialist located in another city. Rural hospitals that offer telecardiology can now schedule patient exams within a week in the convenience of their own community.

Primary care physicians are also able to stay better informed about their patients and have enhanced educational opportunities available to them with telemedicine services. Primary care physicians can sit in the room with their patient during the specialist consultation, and will be aware of what treatment options are given, what medications are prescribed, and are better informed for their next patient consultation. Physicians can also attend videoconference classes using telemedicine equipment such as the IATV, further increasing their knowledge, skill, and value to the community.

The most notable benefit of telemedicine services is the increase in the quality of care that rural facilities can offer. Facilities that offer educational opportunities for their staff through telemedicine report an enhancement in clinical care (Ricci et al., 2003). One study showed that the general perception of health care quality in a community is much higher when telemedicine services are made available (Nesbitt et al., 2005). Rural facilities are also able to utilize better quality physicians with telemedicine. Due to smaller budgets and a lack of amenities compared to urban areas, rural hospitals typically have difficulty hiring elite, full-time specialists. When telemedicine is implemented, facilities have access to the top-notch specialists located in more urban areas.

Overall, telemedicine has many benefits for patients, physicians, and communities. Without such services, rural health facilities are forced to offer scaled-down health care to the residents of their community. In this sense, telemedicine offers a
great opportunity for enhancement to a community's health care network. Additionally, as noted in the introduction to this paper, the presence of telemedicine can impact the local economy while simultaneously improving the availability of health care services. The following section provides a methodology for estimating this economic impact.

III. Methodology and Data for Estimating the Economic Impact of Telemedicine in a Rural Community

The primary source of data for this study is taken from Oklahoma State University’s Telemedicine Network, which currently has 22 locations throughout Oklahoma (Figure 3). Figure 3 also shows that more hospitals are interested in becoming part of this network in the future.

Figure 3. Oklahoma State University Telemedicine Network, June 2007
Table 1 lists information about the rural hospitals in Oklahoma that are active in telemedicine, including the number of hospital beds and the types of procedures available. The population of the local community where these hospitals are located is also shown. As noted above, the dominant uses of telemedicine equipment as part of Oklahoma State University’s network include radiology and psychiatry. This is similar to the dominant uses in other telemedicine networks (Twist, 2001; Whitten and Sypher, 2006).

Table 1. Oklahoma State University Rural Telemedicine Sites

<table>
<thead>
<tr>
<th>Location</th>
<th>Data Used</th>
<th>Number of Beds</th>
<th>Community Population</th>
<th>Telemedicine Services Offered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bristow</td>
<td>x</td>
<td>30</td>
<td>4,325</td>
<td>x</td>
</tr>
<tr>
<td>Cleveland</td>
<td></td>
<td>14</td>
<td>3,282</td>
<td>x</td>
</tr>
<tr>
<td>Cushing</td>
<td></td>
<td>99</td>
<td>8,371</td>
<td>x</td>
</tr>
<tr>
<td>Durant</td>
<td></td>
<td>120</td>
<td>13,549</td>
<td></td>
</tr>
<tr>
<td>Enid</td>
<td></td>
<td>169</td>
<td>47,045</td>
<td>x</td>
</tr>
<tr>
<td>Eufaula</td>
<td></td>
<td>33</td>
<td>2,639</td>
<td>x</td>
</tr>
<tr>
<td>Henryetta</td>
<td></td>
<td>41</td>
<td>6,096</td>
<td></td>
</tr>
<tr>
<td>Hugo</td>
<td>x</td>
<td>34</td>
<td>5,536</td>
<td></td>
</tr>
<tr>
<td>Idabel</td>
<td>x</td>
<td>111</td>
<td>6,952</td>
<td></td>
</tr>
<tr>
<td>Okmulgee</td>
<td></td>
<td>66</td>
<td>13,022</td>
<td>x</td>
</tr>
<tr>
<td>Owasso</td>
<td></td>
<td>73</td>
<td>18,502</td>
<td></td>
</tr>
<tr>
<td>Pawnee</td>
<td></td>
<td>25</td>
<td>2,230</td>
<td>x</td>
</tr>
<tr>
<td>Poteau</td>
<td>x</td>
<td>84</td>
<td>7,939</td>
<td></td>
</tr>
<tr>
<td>Stigler</td>
<td></td>
<td>43</td>
<td>2,731</td>
<td>x</td>
</tr>
<tr>
<td>Waurika</td>
<td>x</td>
<td>25</td>
<td>1,988</td>
<td>x</td>
</tr>
<tr>
<td>Wilburton</td>
<td></td>
<td>33</td>
<td>2,972</td>
<td></td>
</tr>
</tbody>
</table>


While each site in Table 1 keeps data on the number and types of telemedicine procedures performed, the extent of their data and willingness to share with researchers varies greatly. Data from five rural hospitals (Table 2) were used to develop the methodology detailed below. On-site visits to three of the hospitals (Bristow, Waurika,
and Poteau) provided additional insights into how telemedicine is implemented in a rural community and how its presence might affect the local economy.

Table 2. Telemedicine Data from 5 Rural Hospitals - Annual Encounters

<table>
<thead>
<tr>
<th>Location</th>
<th>Number of Beds</th>
<th>Community Population</th>
<th>Radiology</th>
<th>Psychiatry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bristow</td>
<td>30</td>
<td>4,325</td>
<td>6,600</td>
<td></td>
</tr>
<tr>
<td>Hugo</td>
<td>34</td>
<td>5,536</td>
<td>9,600</td>
<td></td>
</tr>
<tr>
<td>Idabel</td>
<td>111</td>
<td>6,952</td>
<td>1,500</td>
<td></td>
</tr>
<tr>
<td>Poteau</td>
<td>84</td>
<td>7,939</td>
<td>27,600</td>
<td></td>
</tr>
<tr>
<td>Waurika</td>
<td>25</td>
<td>1,988</td>
<td>1,740</td>
<td>96</td>
</tr>
</tbody>
</table>

Source: Community population from U.S. Census Bureau, 2000 Census; monthly encounters from discussions with hospital personnel.

The typical methodology for estimating the economic impact of an industry in a rural community would be to calculate employment and income multipliers based on the number and type of jobs in that industry. However, the case of telemedicine is relatively unique in that additional employees are very rarely added to rural hospitals to perform telemedicine procedures. Rather, the additional work created by implementing telemedicine is usually assimilated into the daily work of other hospital employees. For example, site visits revealed that part of a nursing assistant’s daily workload includes scanning in X-rays with the digitizer. These employees had no telemedicine-oriented work before the equipment was brought in, but were given relatively short and simple tasks in lieu of hiring additional workers specifically to work the telemedicine equipment. Similarly, the local director of nursing typically sits in during patient telepsychiatry sessions and then writes up a prescription for the patient based on the remote physician’s recommendation. Because there are no distinct “telemedicine-only” jobs created in the local hospital, no basis exists to calculate income or employment multipliers for this
industry. Instead, this study uses four distinct categories to estimate the economic impact of a telemedicine center in a rural community. Three of these categories focus on the “opportunity costs” of telemedicine – that is, costs that telemedicine helps to avoid – while the last category deals with additional health–oriented work that telemedicine may bring in to a community. The four categories are:

1) Hospital cost savings from outsourcing telemedicine procedures
2) Transportation savings to patients (estimated by distance to nearest specialty location and mileage costs)
3) Missed work income savings to patients (estimated by average household income and potential time missed)
4) Laboratory tests / pharmacy work performed locally (estimated by type of service performed and historical data)

The following section further explores each category and develops methodologies for estimating their economic impact. Several examples demonstrate what data is required to apply the methods to various rural areas.

1) Hospital cost savings from outsourcing telemedicine procedures.

Some rural hospitals are interested in telemedicine because they would no longer have to pay salaries for individual specialists, such as radiologists or cardiologists, to be physically located at their hospital. These professions typically command large salaries that rural hospitals struggle to pay – or when they can pay, it is only for part-time service

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2 Not all rural hospitals, however, pay salaries for these specialists. Instead, the specialist is provided clinic space with some staffing and the opportunity to bill patients.
(1-3 days per week). In fact, two of the rural hospitals we visited indicated that they had initially lost their radiologist because they were unable to pay for their services.

From an individual physician’s perspective, a physician (radiologist, cardiologist, or psychiatrist) is able to be much more productive by being in a single location and constantly working with patients instead of spending a large portion of their day traveling. Instead, physicians specializing in this work in a more urban area can market themselves to a number of rural hospitals and complete many more actual examinations. According to the Physician Compensation and Production Survey, the average annual salary for a non-invasive radiologist working in a rural area is $202,000; a psychiatrist, $130,000, and a non-invasive cardiologist, $210,000 (Medical Group Management Association, 2000). Although these salaries are somewhat lower than those in urban areas, they are dramatically higher than the fees typically paid by hospitals for these same services when provided by telemedicine. The data for three rural hospitals in Oklahoma participating in telemedicine indicate that they are paying, on average, $10 per radiology read and $120 per psychiatry visit. Most of these payments are made monthly and are not always pro-rated based on the number of reads performed.³

Estimating the potential annual cost savings from using telemedicine for a rural hospital involves understanding how much the hospital is currently paying for those services and approximating the number of outsourced visits. It is then a simple mathematical exercise to determine the possible savings from outsourcing.

³ The Benefits Improvement and Protection Act of 2000 included a $20 origination facility fee (Whitten and Buis, 2006). Typically this fee is paid by the patient. Some hospitals are not paying any money to a third party for telemedicine procedures (typically the psychiatrist or radiologist who reads the image remotely). In these cases the volume of work is enough so that the third party’s salary is made up entirely by bills to individual patients.
For example, consider 2 rural hospitals, each of which employs a radiologist and psychiatrist (either full or part-time). Table 3 displays the cost savings that would result if these procedures were converted to telemedicine and the number of procedures performed remained the same. Depending on the amount of time worked by the previous physicians and the number of annual reads, the hospitals save between $64,800 and $150,800 each year by converting to telemedicine.

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Job</th>
<th>Before Telemedicine</th>
<th>After Telemedicine</th>
<th>Annual Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Radiologist</td>
<td>$202,000 0.4</td>
<td>$80,800</td>
<td>2,760 $10</td>
</tr>
<tr>
<td>A</td>
<td>Psychiatrist</td>
<td>$130,000 0.2</td>
<td>$26,000</td>
<td>120 $120</td>
</tr>
<tr>
<td>B</td>
<td>Radiologist</td>
<td>$202,000 1.0</td>
<td>$202,000</td>
<td>6,000 $10</td>
</tr>
<tr>
<td>B</td>
<td>Psychiatrist</td>
<td>$130,000 0.4</td>
<td>$52,000</td>
<td>360 $120</td>
</tr>
</tbody>
</table>

However, the savings demonstrated above do not include costs that may be spent on purchasing and maintaining telemedicine equipment. These and other relevant issues such as provider reimbursement and patient acceptance are discussed in Section IV of this report.

2) Transportation savings to patients

One of the largest benefits cited by hospital personnel when discussing telemedicine was the ability to obtain quick turnaround time for their patients, who never had to leave the area. Thus, residents who take advantage of telemedicine procedures available at their local hospital do not pay out of pocket to travel to the nearest specialist location. At the community level, this can accrue to a significant amount of money. Factors impacting the amount of savings that occur include the driving distance to the
nearest location that would offer the same level of service, an average cost per driven mile, and the percentage of telemedicine encounters that would necessitate an immediate response. This last factor accounts for the idea that not all teleradiology encounters require immediate feedback – for example, before telemedicine became common, radiologists used to make only weekly visits to rural hospitals. Local patients getting an X-ray over the weekend might have to wait until the end of the week to get that X-ray read. Since the local patients did not have to travel to receive services, no telemedicine savings could be claimed. However, in more serious cases, the patient would either be taken to a facility where the X-ray could be performed and interpreted right away, or the film itself would be couriered for interpretation. These cases, then, are the ones where telemedicine travel savings occur.

Table 4 presents travel cost savings estimates for four teleradiology sites and two telepsychiatry sites in Oklahoma. The nearest location that can perform the same work on-location is noted, along with the total travel miles to and from that site (estimated by map distance). A mileage cost per trip is then estimated, based on the official Internal Revenue Service mileage rate for 2007 of $0.485 per mile. This cost per trip is then applied to the total number of encounters that would require travel, which is based not only on the number of encounters but also on the percentage of those encounters requiring immediate assistance. Discussion with radiology experts at three rural hospitals indicated that approximately five percent of all radiology encounters are serious enough to warrant immediate attention. Telepsychiatry sites, without an available option to “wait for the doctor,” have 100 percent of encounters that qualify for telemedicine cost savings. This information is summarized below.
Table 4. Transportation Savings Due to Telemedicine

<table>
<thead>
<tr>
<th>Site</th>
<th>Nearest Site</th>
<th>One Way Miles</th>
<th>Total Travel Miles</th>
<th>Mileage cost per trip</th>
<th>Total Number of Reads per Year</th>
<th>% Needing Service</th>
<th>Total Annual Cost Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Radiology</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bristow</td>
<td>Sapulpa</td>
<td>30</td>
<td>60</td>
<td>$29.10</td>
<td>6,600</td>
<td>5%</td>
<td>$9,603</td>
</tr>
<tr>
<td>Hugo</td>
<td>Durant, OK</td>
<td>53</td>
<td>106</td>
<td>$51.41</td>
<td>9,600</td>
<td>5%</td>
<td>$24,677</td>
</tr>
<tr>
<td>Poteau</td>
<td>Ft. Smith, AR</td>
<td>31</td>
<td>62</td>
<td>$30.07</td>
<td>27,600</td>
<td>5%</td>
<td>$41,497</td>
</tr>
<tr>
<td>Waurika</td>
<td>Red River, TX</td>
<td>54</td>
<td>108</td>
<td>$52.38</td>
<td>1,740</td>
<td>5%</td>
<td>$4,557</td>
</tr>
<tr>
<td><strong>Psychiatry</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Idabel</td>
<td>McAlester</td>
<td>116</td>
<td>232</td>
<td>$112.52</td>
<td>1,500</td>
<td>100%</td>
<td>$168,780</td>
</tr>
<tr>
<td>Waurika</td>
<td>Lawton</td>
<td>60</td>
<td>120</td>
<td>$58.20</td>
<td>96</td>
<td>100%</td>
<td>$5,587</td>
</tr>
</tbody>
</table>

Note: $0.485 per mile travel cost assumed (current IRS rate)
Source: Google Maps; Percentage estimates from radiology personnel at 5 rural hospitals

Thus, a community with a small hospital like Waurika that typically has only 1,740 annual teleradiology encounters and 96 annual telepsychiatry encounters stands to save around $10,000 each year just in travel costs. A community with a larger hospital like Poteau running 27,600 teleradiology reads each year would save over $40,000 in annual travel costs based on this methodology. Communities with hospitals that offer psychiatric services stand to save the most in this category due to the relative lack of psychiatric professionals in rural areas, and thus longer driving distances to the nearest substitute. Because of this, Idabel psychiatric patients can potentially save over $160,000 each year in travel costs.

3) Missed work income savings to center patients

When a rural patient has to travel to obtain health services, they not only have to pay for the cost of that travel (as shown above), but they are also absent from work during their travels and forfeit any work income during that time. The methodology for
estimating this missed work income is very similar to that for travel cost savings, but instead of driving distance and a per-mile cost, total driving time and an average hourly wage are used. To simplify the calculations, only actual round-trip travel time is included in this estimate since the time to perform a procedure should not vary significantly between hospitals. However, it should be noted that some additional travel time may occur due to paperwork requirements for a first-time hospital visitor, and thus the missed work savings are underestimated.

Table 5 again displays the four teleradiology sites and two telepsychiatry sites along with their nearest location and distance from that site in miles. To estimate the total work savings, an average hourly wage was obtained for the county in which the telemedicine site resides using 2005 Bureau of Economic Analysis (BEA) data. This hourly wage was then multiplied by the total number of hours spent traveling to derive a cost savings per trip, which was estimated by several readily available online mapping services, such as Google Maps. Similar to Table 4, the number of trips per year and the percentage requiring immediate service are also included to provide a fair comparison for sites that have not yet implemented telemedicine.
Table 5. Missed Work Income Savings Due to Telemedicine

<table>
<thead>
<tr>
<th>Site Radiology</th>
<th>Average Hourly Wage</th>
<th>Nearest Radiology Site</th>
<th>One Way Miles</th>
<th>Travel Time Saved (minutes)</th>
<th>Cost Saved per trip</th>
<th>Number of Trips per year</th>
<th>% Needing Service</th>
<th>Total Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bristow</td>
<td>$13.85</td>
<td>Sapulpa</td>
<td>30</td>
<td>62</td>
<td>$14.31</td>
<td>6,600</td>
<td>5%</td>
<td>$4,723</td>
</tr>
<tr>
<td>Hugo</td>
<td>$10.56</td>
<td>Durant, OK</td>
<td>53</td>
<td>122</td>
<td>$21.47</td>
<td>9,600</td>
<td>5%</td>
<td>$10,307</td>
</tr>
<tr>
<td>Poteau</td>
<td>$11.30</td>
<td>Ft. Smith, AR</td>
<td>31</td>
<td>94</td>
<td>$17.70</td>
<td>27,600</td>
<td>5%</td>
<td>$24,431</td>
</tr>
<tr>
<td>Waurika</td>
<td>$10.13</td>
<td>Red River, TX</td>
<td>54</td>
<td>142</td>
<td>$23.97</td>
<td>1,740</td>
<td>5%</td>
<td>$2,086</td>
</tr>
</tbody>
</table>

| Psychiatry     |                     |                        |               |                            |                     |                          |                   |               |
| Idabel         | $13.41              | McAlester              | 116           | 230                        | $51.41              | 1,500                    | 100%              | $77,108       |
| Waurika        | $10.13              | Lawton                 | 60            | 144                        | $24.31              | 96                       | 100%              | $2,334        |

Source: 2005 Bureau of Economic Analysis wages by county, Google Maps

In general, smaller hospitals can generate work income savings of approximately $5,000 per year by implementing some type of telemedicine facility, while larger hospitals can produce between $20,000 and $80,000 in work income savings depending on the type of procedures they offer.

4) Laboratory testing / pharmacy work performed locally

While the costs discussed above are certainly valid for demonstrating the benefits of telemedicine, they all represent savings that do not explicitly find their way into the pockets of local businesses or community members. On the other hand, an increase in laboratory testing or pharmacy work performed locally is a financial impact that is felt directly by the local economy. Eilrich, Doeksen, and St. Clair (2007) indicate that the site of a patient’s initial screening is a primary determinant of where they will have their laboratory or pharmacy work performed. Because telemedicine patients do not leave
their local area to receive their original diagnosis, any resulting follow-up work is much more likely to end up at the local pharmacy or laboratory. The level of this increased income can be significant.

To estimate this increased income, typical follow-up procedures and medications resulting from psychiatric and radiology visits are listed in Table 6 based on discussions with site physicians. Site physicians also provided estimates of the percentage of patients requiring these follow-ups. Low and high cost estimates for the tests and prescriptions required are gathered based on publicly available price lists. This information is converted into a yearly cost based on an assumed number of yearly encounters (84 psychiatric visits, 2,400 teleradiology reads), which will vary by hospital facility. One inherent assumption is that no additional work would have been performed locally in the absence of telemedicine. The serious nature of the follow-up tests for teleradiology indicates that most individuals would not wait to return to their local community to have them performed. Further, these tests are most often required from X-rays of “severe” patients, who would have been sent to the nearest interpretation facility as opposed to waiting for a weekly radiologist visit. This assumption can easily be altered by lowering the percentage of patients using follow-up work to account for some individuals who may have had their work done locally regardless of where their initial consultation occurred.
Table 6. Local Lab / Pharmacy Work Due to Telemedicine

<table>
<thead>
<tr>
<th>Telepsychiatry</th>
<th>Number of Yearly Encounters</th>
<th>% of Patients Using</th>
<th>Monthly cost per prescription</th>
<th>Yearly Costs (assuming 3 months)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Aderall</td>
<td>84</td>
<td>50%</td>
<td>$85</td>
<td>$350</td>
</tr>
<tr>
<td>Xanax</td>
<td>84</td>
<td>20%</td>
<td>$60</td>
<td>$300</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Teleradiology</th>
<th>Number of Yearly Encounters</th>
<th>% of Patients Using</th>
<th>Monthly Cost</th>
<th>Yearly Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Blood Work</td>
<td>2400</td>
<td>10%</td>
<td>$100</td>
<td>$1,200</td>
</tr>
<tr>
<td>MRI</td>
<td>2400</td>
<td>2%</td>
<td>$400</td>
<td>$4,000</td>
</tr>
<tr>
<td>CT Scan</td>
<td>2400</td>
<td>5%</td>
<td>$400</td>
<td>$2,000</td>
</tr>
<tr>
<td>Biopsy</td>
<td>2400</td>
<td>2%</td>
<td>$300</td>
<td>$1,200</td>
</tr>
<tr>
<td>Pain Medicine</td>
<td>2400</td>
<td>30%</td>
<td>$50</td>
<td>$300</td>
</tr>
</tbody>
</table>

Source: Discussions with radiology / psychiatry personnel at 5 rural hospitals

Table 6 indicates that for a rural hospital performing even a small number of telepsychiatry visits per year, the impact to their local pharmacy can be significant, ranging from $10,000 to $40,000 per year. Similarly, typical follow-up procedures for radiology can result in dramatic revenue increases to the local laboratory, from approximately $100,000 for all four additional tests to over $750,000 per year if all tests were high cost in nature. Although not all rural facilities offer MRI and CT scan service, most have access to a mobile lab for as-needed cases. Pain medication for radiology patients also has the potential to generate additional income for a local pharmacy, potentially up to $200,000 per year. It is worth noting that the large variance in the cost...
of medication and follow-up procedures can lead to dramatic differences in estimates. Additionally, while the data above show the importance of teleradiology and telepsychiatry visits, more specialized forms of telemedicine such as telepodiatry and telecardiology have the potential to generate even larger revenue streams for the local pharmacy or lab. This is because of the higher likelihood of lab or pharmacy work in these more specialized fields.

Summary

The four categories of impacts discussed above will vary based on the community where telemedicine is employed. In particular, the number of encounters, distance to nearest substitute location, and average wage rate will be different for various rural communities interested in telemedicine. Each of the four categories is applied to five distinct rural hospitals in Table 7 below to summarize the impacts discussed above and to illustrate the importance of community differences. It is worth noting that the pharmacy / laboratory totals used here are the low-end estimates discussed in the methodology above. Thus, actual annual impacts could be significantly larger than those shown here.

Table 7. Summary of Telemedicine Economic Impacts

<table>
<thead>
<tr>
<th></th>
<th>Number of Beds</th>
<th>Community Population</th>
<th>Tele-radiology</th>
<th>Tele-psychiatry</th>
<th>Personnel Costs</th>
<th>Missed Work</th>
<th>Travel Time</th>
<th>Pharmacy / Lab</th>
<th>ANNUAL TOTALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bristow</td>
<td>26</td>
<td>4,325</td>
<td>6,600</td>
<td></td>
<td>$41,000</td>
<td>56,674</td>
<td>$115,236</td>
<td>$389,400</td>
<td>$582,310</td>
</tr>
<tr>
<td>Hugo</td>
<td>34</td>
<td>5,536</td>
<td>9,600</td>
<td></td>
<td>$146,400</td>
<td>123,679</td>
<td>$296,122</td>
<td>$566,400</td>
<td>$1,132,600</td>
</tr>
<tr>
<td>Idabel</td>
<td>90</td>
<td>6,952</td>
<td>1,500</td>
<td></td>
<td>$80,000</td>
<td>925,290</td>
<td>$2,025,360</td>
<td>$63,750</td>
<td>$3,094,400</td>
</tr>
<tr>
<td>Poteau</td>
<td>76</td>
<td>7,939</td>
<td>27,600</td>
<td></td>
<td>$128,000</td>
<td>293,167</td>
<td>$497,959</td>
<td>$1,628,400</td>
<td>$2,547,526</td>
</tr>
<tr>
<td>Waurika</td>
<td>25</td>
<td>1,988</td>
<td>1,740</td>
<td></td>
<td>$24,480</td>
<td>53,037</td>
<td>$121,731</td>
<td>$106,740</td>
<td>$305,988</td>
</tr>
</tbody>
</table>

Source: Community Population from U.S. Census Bureau, 2000 Census; cost savings methodology as outlined above.
In general, each community recognizes at least $300,000 a year in savings generated by telemedicine services. Smaller locations, including those with Critical Access Hospitals such as Waurika, tend to obtain the majority of their savings from travel time that is no longer required and increased laboratory / pharmacy revenues from additional work performed locally. The dominant economic impact for communities with larger hospitals will vary based on the type of telemedicine they offer. For hospitals that only offer teleradiology (like Poteau), additional pharmacy and lab work created by the X-rays are the leading source of income, while for a telepsychiatry only facility (such as Idabel), savings from missed work and travel are the prevailing factors. The economic impact is quite large for areas with the larger hospitals, with total annual savings ranging from $2.5 - $3.1M. Clearly, the addition of telemedicine services to a rural hospital not only improves the medical services offered, but can be an economic boon for the local community.

IV. Other Issues

This section will focus on other issues that rural hospitals and communities need to be aware of when considering whether to implement telemedicine in their area. Primary among these issues are equipment costs and reimbursement issues relating to Medicare, Medicaid, and private insurance carriers. In addition to these financial concerns, medical licensing requirements and limitations are addressed along with information regarding practitioner / patient satisfaction and acceptance trends.
Equipment Costs

The cost of providing telemedicine equipment in rural hospitals has long been seen as a significant barrier to implementing this technology. However, federal and state governments realized the importance of this field and were relatively quick to provide “seed money” in the form of grants. This grant funding has been instrumental in setting up many telemedicine networks around the country. Oklahoma hospitals and medical facilities were no exception, taking advantage of both state and federal grants to set up the telemedicine networks currently in existence. In 1990, the Oklahoma State Legislature signed Senate Bill 832 which created the Telemedicine Advisory Council that formed the Oklahoma Telemedicine Network (OTN) in 1993. Federal grant funds of $4.3 million were awarded to the OTN in 1994, which provided the infrastructure linking Oklahoma’s rural hospitals and creating capabilities to support telemedicine (Fullingim, 2007).

Equipment funding and assistance were also provided to the Oklahoma remote sites through federally-funded programs including the United States Department of Agriculture’s (USDA) Rural Development, Distance Learning and Telemedicine Program which provides direct and guaranteed loans and grants. The mission of this USDA program is to help develop the information superhighway in rural America, particularly for schools, libraries, clinics, and hospitals. Since 1993, USDA Rural Development has provided 645 grants totaling $184M in rural areas across the nation as part of its Distance Learning and Telemedicine program (USDA, 2007).

In addition, the U.S. Department of Health and Human Services, Health Resources and Services Administration’s Office for the Advancement of Telehealth has
provided on-going grant support for the Oklahoma State University Telemedicine Network since 2001. This type of support is typically needed to help fund some of the start-up costs for a telemedicine network. To illustrate some of these expenses, equipment costs for two common types of telemedicine currently utilized in Oklahoma State University’s Telemedicine Network are presented in Table 7.

Table 7. Telemedicine Equipment Costs

<table>
<thead>
<tr>
<th>Type of Telemedicine</th>
<th>Equipment Needed</th>
<th>Equipment Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teleradiology</td>
<td>Digitizer</td>
<td>$7,000-$30,000</td>
</tr>
<tr>
<td></td>
<td>e-Film Software</td>
<td>$5,000-$10,000</td>
</tr>
<tr>
<td></td>
<td>Standard PC</td>
<td>$1,500</td>
</tr>
<tr>
<td></td>
<td>OneNet Connection</td>
<td>$200-$500/month</td>
</tr>
<tr>
<td>Telepsychiatry</td>
<td>Polycom Videoconferencing</td>
<td>$16,000</td>
</tr>
<tr>
<td></td>
<td>OneNet Connection</td>
<td>$200-$500/month</td>
</tr>
</tbody>
</table>

Source: Vendor quotes, discussion with hospital personnel.

The digitizer (shown in Figure 1) is an electronic device that scans and transmits the radiologic images. The costs of standard digitizers range between $7,000 and $30,000, with most standard models closer to $10,000. The software packages associated with the digitizers can range in cost from $5,000 to $10,000. Also associated with this function would be the cost of a standard personal computer estimated to cost $1,500. While the personal computer is necessary for this telemedicine application, it can also be utilized for multiple purposes within the hospital or health care facility.

The Polycom video conferencing system is a type of IATV used to support the delivery of telepsychiatry in Oklahoma. The cost of this system was estimated to be about $16,000. The MiMi system referenced earlier in the paper is used by the Oklahoma State University Center for Health Sciences (OSU-CHS) and is similar to this
type of IATV. The OSU-CHS typically seeks grant funding to pay for this equipment and then provides it to rural hospitals across the state.

The high speed data lines necessary for the delivery of telemedicine in Oklahoma can cost the facility between $200 and $500 per month. These OneNet (Oklahoma’s public digital network that serves education, government and health care institutions) lines provide 100 Megabits per second (Mbps) bandwidth, which is roughly 100 times faster than a typical digital subscriber or T1 line. Such high-speed lines are necessary to supply sufficient bandwidth to accommodate interactive multi-casts to and from multiple locations. Prior to the implementation of OneNet, the cost of high-speed lines was a prohibitive factor for many rural hospitals considering telemedicine, with a simple T1 or DSL connection costing several thousand dollars each month.

Reimbursement Issues

Reimbursement for telemedicine remains an issue for both public (Medicare/Medicaid) and private payers (Whitten and Buis, 2006). Legislation has brought some reform in reimbursement payments, including the Benefits Improvement and Protection Act of 2000 and the Consolidated Appropriations Act of 2001, which expanded the types of telemedicine services that could be reimbursed. However, there are still gaps in governmental and private reimbursement coverage that inhibit the use of telemedicine solutions to rural health care provision. In 2005, only 27 states reimbursed for telemedicine through Medicaid (Institute for Child Health Policy, 2005). Additionally, only 57 percent of telemedicine programs received payments from private
payers (Whitten and Buis, 2006). Additional information on these public and private methods for telemedicine reimbursement is included below.

1) Medicare

Medicare provides coverage for approximately 40 million Americans, and is currently providing most of the financing and reimbursement for telemedicine services in the U.S. (Center for Telemedicine Law, 2003). Legislatively, progress has been made with the passing of the Balanced Budget Act of 1997, which provided for coverage and payment for telemedicine consultations to Medicare beneficiaries in rural health professional shortage areas. However, a requirement that the practitioner be with the patient at the time of the consult, along with the sharing of the teleconsultant fees between the consulting and referring physicians, resulted in only real-time telemedicine reimbursements.

In an effort to amend the current law and further refine telemedicine reimbursement, Congress passed the Consolidated Appropriations Act of 2001, which contained House Resolution 5661, Section 223. Beginning October 1, 2001, H.R. 5661, also known as the Benefits Improvement and Protection Act of 2000, expanded the breadth of reimbursement, but limited reimbursement to individuals who received services at originating sites. Originating sites include hospitals, office of physicians or practitioners, critical access hospitals, rural health clinics, and federally qualified health centers. This indicates that, for most rural hospitals, Medicare will provide reimbursement for telemedicine procedures.
2) Medicaid

Within the Social Security Act are waivers that encourage states to find ways to deliver health care in cost-effective manners. These waivers allow for states’ control and flexibility in their administration of health care systems. Because of the efficiency and cost-effectiveness of telemedicine, at least 27 states have provisions to reimburse for telemedicine visits through the Medicaid program (Social Security Act of 1935, Section 12915(b) and Section 1115; Center for Telemedicine Law, 2003). In general, most of the reimbursing states allow reimbursements for teleradiology, but not necessarily telepsychiatry. Only 12 states reimburse for psychiatric visits (Institute for Child Health Policy, 2005).

In Oklahoma, Medicaid reimbursement is allowed to cover physician consultations using interactive video conferencing (such as used in the application of telepsychiatric visits) to in-state providers only (Institute for Child Health Policy, 2005).

3) Private Insurance Carriers

Reimbursement difficulties for telemedicine are also present in the private insurance sector. However, a survey conducted by American Medical Development (AMD) Telemedicine determined that as many as 100 private payers were reimbursing for telemedicine visits, with seven programs paying for visits and facility fees, and three programs reimbursing for store-and-forward encounters (American Telemedicine Association, 2003). This indicates that there are numerous private insurance companies that reimburse for telemedicine visits, and that hospitals should check into the
reimbursement policies of dominant local providers before implementing telemedicine in their facilities.

Only five states currently have laws in place mandating reimbursement for telemedicine visits. These states include: California, Kentucky, Louisiana, Oklahoma and Texas. Nevertheless, it is reported that reimbursements are being received across the country without statutory mandates. This is an indicator of the increasing popularity of telemedicine, and likely, the increasing number of requests for private reimbursement (Whitten and Buis, 2006).

Acceptance by Medical Community and Patients

While equipment costs and reimbursement issues present significant barriers that rural hospitals must overcome before successfully implementing telemedicine, perhaps no other element stands in the way of telemedicine acceptance more than approval by the individuals who use it on a daily basis. Regardless of the benefits of telemedicine, the technology will be doomed to obsolescence if people do not want to use it. Acceptance involves the perceptions of both the medical practitioners using the equipment and the patients receiving care through it. Several factors are involved in overall approval of the technology, including 1) medical licensure requirements, 2) practitioner acceptance, and 3) patient acceptance and satisfaction with services.

1) Medical Licensure Requirements

Barriers exist when physicians practicing telemedicine attempt to cross state borders. Most states require that a physician be fully licensed in their state if services are
provided to a patient in their state, regardless of whether or not they are performing
telemedicine. Some states have even gone a step further and required that only
physicians licensed in their state perform telemedicine visits within that given state
(Brown, 2005). Further, some individual medical facilities require that practicing
physicians be credentialed with their institution (The Health Law Resource, 1995).

There are limited exceptions to the licensing requirements, but a few states will
allow a physician not licensed in their state to consult with another physician licensed in
their state via telemedicine. However, if a physician consults directly with the patient,
state licensing would be required. Furthermore, different specialties may require different
types of licenses in a state – some specialties may require full licensing while other types
may require licenses that deal only with telemedicine-specific concerns. To address
differing state requirements, physicians who frequently perform teleradiology that crosses
state boundaries will generally acquire licensing in all 50 states to assure that malpractice
and legal liabilities are not risked, notwithstanding the cost and inconvenience to them
individually (American College of Radiology, 2007).

Economically, there are local incentives for states to limit the licensure and
credentialing of out-of-state physicians. By strictly regulating out-of-state physicians,
local physicians and other health care professionals can reduce competition in the local
marketplace. Unfortunately, free expansion and adoption of telemedicine is hindered by
this behavior (The Health Law Resource, 1995). In fact, the most common practice of
interstate telemedicine is teleradiology, where the freedom to send X-rays to another state
(or even country) where cheaper labor is available is one of the main benefits of such a
technology.
The Western Governors’ Association assembled an action committee to study the barriers to telemedicine within the U.S. and to make recommendations that can be implemented nationwide. The committee’s proposal to the U.S. legislature was to invoke a “Uniform State Code for Telemedicine Licensure and Credentialing,” and in this way create a standard form of licensing and credentialing for all 50 states (The Health Law Resource, 1995).

2) Practitioner Acceptance

In general, practitioners (particularly physicians) are very interested in using the latest version of technology, and asking them to incorporate telemedicine into their practice is usually well-received. The OSU Center for Health Sciences encourages the practice of telemedicine by requiring coursework in telemedicine by all third-year students. Students receive web-based video lectures and use the teleconferencing equipment to participate in case presentations and other requirements of their training (OSU Center for Health Sciences, 2002). In fact, the use of telemedicine has been seen by some as a tool for recruiting and retaining health practitioners in rural areas (Daniels et al., 2007). However, some hesitancy can be expected from hospital personnel unfamiliar with the technology who feel that it may either overwhelm them or replace them. In these cases it may be beneficial to provide up-front training before the equipment even arrives to individuals who may be apprehensive.

As more evidence of practitioner acceptance of telemedicine, physicians used telemedicine technologies to provide health care to the Choctaw tribe in one of the first of 32 National Institutes of Health-funded Alzheimer’s Disease Centers across the U.S. In
an effort to study dementia and Alzheimer’s disease, initial trips to the Choctaw Nation Health Care Center in Talihina, Oklahoma, were made to conduct interviews and diagnostic tests with 212 Native American telepsychiatric patients. Interestingly, in this case, the physicians were traveling to see the patients instead of the inverse. Telemedicine services were then used to reduce the travel of the physicians and the patients. Both the patients and the practitioners were satisfied with the telemedicine solutions for the geographic and economic limitations to providing health care. The project demonstrated many of the claimed benefits of telemedicine: physicians can serve more rural patients, cut down on the inconveniences associated with travel time, and increase the quality of care provided to rural residents (University of Texas Southwestern Medical Center, 2005).

3) Patient Acceptance and Satisfaction with Services

Literature on the topic supports the view that telemedicine services are readily acceptable by the general patient population. In a national study of nearly 500 real-time consultations in telepsychiatry, Gustke et al. (2000) found that 98.3 percent of patients were satisfied with their telemedicine experience. Further, a study of seven rural, underserved communities in California indicates that local patients no longer feel the desire or need to travel outside of their community for health care services once telemedicine service is implemented (Nesbitt et al., 2005). Finally, a study conducted in Oklahoma in 2003 concluded that improvement in the quality of care (patient satisfaction), increased productivity, and health care delivery cost savings were facilitated by the application of health information technology, and in this particular case
telemedicine (Dhillon and Forducey, 2006). This general trend of patient satisfaction is well-documented, and patient dissatisfaction with the technology should not overly concern any community considering implementing telemedicine in their own hospital.

V. Summary and Conclusion

Telemedicine has long been hailed as a saving grace for health care in rural communities due to its ability to make distance irrelevant. A larger variety of services can be offered, the quality of physicians can be enhanced, and the hospital becomes much more marketable as telemedicine is introduced. In fact, it was qualitative benefits that were most commonly referenced during site visits to rural hospitals. The quantitative side, particularly money coming into the hospital, was viewed as having a minimal role. As this study has demonstrated, however, the economic impact of a rural telemedicine system can be significant to the community in which it is based. The impact is felt both directly (such as additional work brought in to the local laboratory or pharmacy) and indirectly (such as reduced costs for travel and missed work income). Detailing a composite picture of these impacts is essential to promoting telemedicine adoption in rural areas across the nation.

This study suggests a methodology to determine the economic impact of two dominant types of telemedicine in a rural community. Teleradiology, or digital transmission of X-rays, and telepsychiatry, or videoconferencing between psychiatrist and patient, are two forms of telemedicine that are relatively easy to set up and operate. While numerous issues remain for a hospital to investigate (including payment to third-party sites, high-speed line lease rates, Medicare / Medicaid reimbursement, and the cost
of actual telemedicine equipment), the methodology developed in this paper implies that there are significant economic benefits at the community level when telemedicine is employed. Our estimates show that rural communities whose hospitals choose to implement telemedicine can expect to see an economic impact of between $300,000 and $3,000,000 each year from the use of telemedicine services. The actual impact for a particular rural area will vary greatly depending on a number of characteristics, including the type and quantity of telemedicine encounters, distance to the “next-best” location, average county income levels, and percentages of patients using telemedicine services and requiring follow-up work. Combining this information with the techniques laid out in each of the four different categories will provide a rural hospital with an estimate of the economic impact that adopting teleradiology or telepsychiatry can have on their community.

Hospitals considering adopting telemedicine should take all relevant factors into consideration before making their decision. This includes the costs they will incur when setting up the telemedicine system, the potential qualitative benefits from its use, and also the quantitative benefits to the community. The methodology presented here should not be used as a stand-alone tool for evaluating telemedicine’s potential in a particular community, but rather in conjunction with other sources of information, to understand the overarching impacts of setting up a telemedicine system.
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