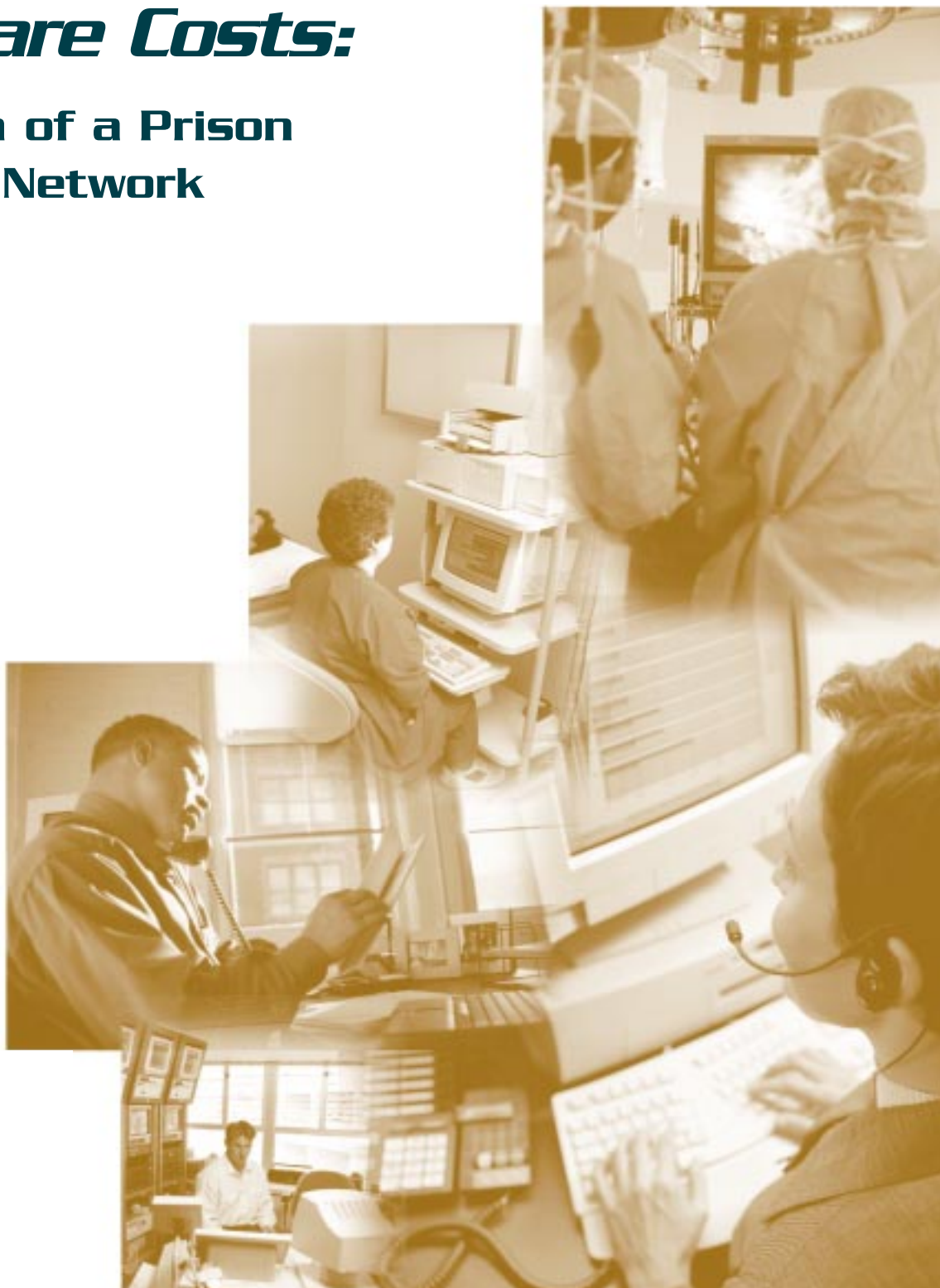




Telemedicine

Can Reduce Correctional Health Care Costs:

An Evaluation of a Prison Telemedicine Network



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Telemedicine Can Reduce Correctional Health Care Costs:

An Evaluation of a Prison Telemedicine Network

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Foreword





Medical science changes quickly. Evening news broadcasts inform us regularly about newer and better drugs, new diseases, better ways to scan the body, foods to avoid or consume, and more. The methods for delivering medical treatment are changing, too: It is no longer necessary for the two parties involved in a medical encounter, a patient and a health care provider, to be in the same location simultaneously. The telephone has enabled doctors to practice limited aspects of medicine over vast distances without travel, a benefit of great importance to persons in remote areas. With further advances in digital and communications technologies, the number of health care applications that can be administered remotely is increasing rapidly. Today's telecommunications infrastructure of satellites, the Internet, and telephone wires, coupled with advances in the ability to capture, store, transmit, and display electronic representations of medical information, allow doctors to do many things remotely that they have traditionally done in person.

Because the problems associated with traveling to deliver or receive medical care are substantial, *telemedicine*, loosely defined as the remote delivery of health care via telecommunications, is a concept that is rapidly becoming a practical method of health care delivery. Suppose people in Florida could visit the Mayo Clinic in Rochester, Minnesota, without leaving their home State? Suppose an American sailor on an aircraft carrier in the Mediterranean could be treated onboard by doctors at Bethesda Naval Hospital without leaving the ship? What if x-rays taken at a rural clinic in Colorado could be transferred electronically to an urban medical center in Denver for immediate diagnosis by a radiologist? These are not medical fantasies; rather,

they are technology applications currently in practice worldwide.

America has many disturbing health care problems, among them cost and access. Estimates from 1996 are that Americans spend approximately 14 percent of their annual earnings on health care, up 4.4 percent from 1995. The U.S. Department of Health and Human Services estimates that approximately 24 percent of Americans live in rural areas with limited access to health care services. For obvious reasons, many in the health care profession need to know if telemedicine's advantages could offer solutions to these two vexing health care problems.

Prisons are in some respects a microcosm of American society, and thus telemedicine offers prison managers a viable means of addressing the issues of cost and access to specialists. Prison officials are required by the constitution of the United States to provide health care for prisoners. Health care costs for prisoners are increasing, just as costs of medical care in free society are increasing. Prison population demographics show a trend toward older offenders who are serving longer sentences and who have greater health care needs. Furthermore, prisons are often located in remote geographic areas where access to health care specialists is difficult to arrange. Providing specialized medical attention may entail an expensive trip outside the secure perimeter for the prisoner, or a time-consuming and expensive visit to the prison by specialists.

Telemedicine is promising for prison use in a number of ways. This technological innovation is seen as a possible solution to rising health care costs, which can compose 20 percent or more of total prison operating costs.

It also offers additional security advantages, since some prisoners may use outside medical trips to attempt escape. The use of telemedicine provides medical advantages for prisoners that should help to create more tranquil and manageable prison environments. Difficult medical cases that could take months to resolve under normal circumstances can be treated more quickly because the pool of specialists is larger and more accessible.

The Federal Bureau of Prisons' (BOP's) interest in telemedicine began some years back after a dramatic escape attempt occurred when an inmate from the Federal Penitentiary at Lewisburg, Pennsylvania, was on an escorted medical trip to a local hospital. An escort officer was murdered during the incident, making the event especially tragic and the need to do something to protect escort staff more salient. BOP considered adding telemedicine to its health care regime, but at the time, telemedicine equipment and communication costs were prohibitively high. BOP elected instead to make significant improvements to escort security procedures.

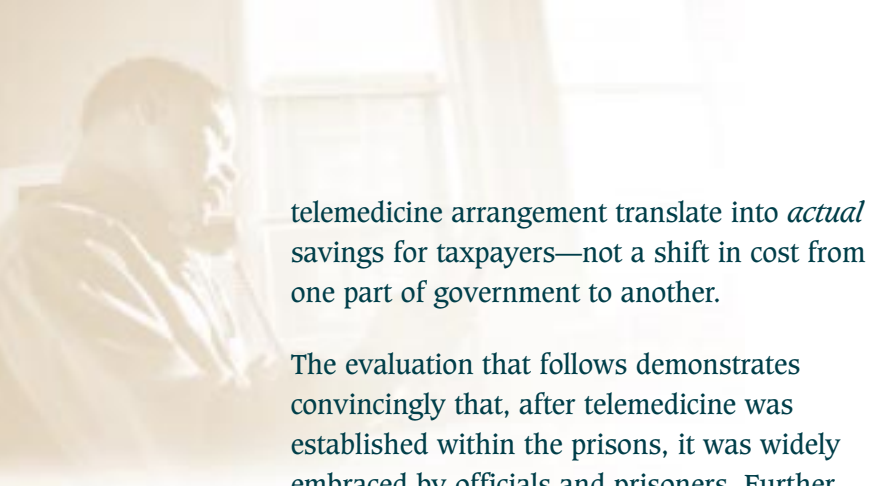
BOP's interest in telemedicine continued, however, and officials noticed that costs were falling and technology was improving. But officials were reluctant to make a wholesale change without compelling evidence that a new approach could replace conventional medicine at a reasonable cost. There were no scientific investigations to consult to help them make a decision.

The U.S. Departments of Defense (DoD) and Justice (DOJ) have a preexisting agreement to jointly develop and demonstrate emerging technologies of mutual interest to both law enforcement and the military. The National Institute of Justice (NIJ) is DOJ's lead agency,

while the Defense Advanced Research Projects Agency (DARPA) is the lead agency for DoD. NIJ and DARPA determined that a demonstration of telemedicine technology in Federal prisons would have relevance to State and local prisons and to military operations. They agreed to jointly sponsor and manage the demonstration through a special program team, the Joint Program Steering Group (JPSG).

To develop and implement this program, JPSG assigned the Department of the Navy's Space and Naval Warfare Systems Command (SPAWAR) Center in Charleston, South Carolina, as the technical agent. Through an existing SPAWAR Systems Center services contract, Tracor Systems Technologies, Inc., was awarded a delivery order to design, procure, install, and evaluate a telemedicine system. Tracor subsequently issued a subcontract to Abt Associates Inc. to evaluate the telemedicine demonstration.

BOP agreed to participate in the demonstration by allowing the modification of medical practices in three Federal prisons in Pennsylvania and one prison medical center in Kentucky to accommodate a telemedicine network. The remote sites in the network are linked to the Department of Veterans Affairs (VA) Medical Center in Lexington, Kentucky, where VA specialists provide medical services to BOP at a cost that is generally lower than could be obtained in communities near the prisons. The reimbursement BOP pays the VA is "unsubsidized," hence the VA receives an amount for services that offsets the total amount the VA actually pays for doctors, including fringe benefits. Fees for communications and equipment also are unsubsidized. The absence of subsidies is very important because it means that projected savings resulting from this



telemedicine arrangement translate into *actual* savings for taxpayers—not a shift in cost from one part of government to another.

The evaluation that follows demonstrates convincingly that, after telemedicine was established within the prisons, it was widely embraced by officials and prisoners. Further, the evaluation establishes that a correctional agency such as BOP can add telemedicine to its medical program with the expectation that taxpayer dollars will not be wasted and, if anything, substantial savings associated with the new technology may be realized. At the moment, BOP continues to practice telemedicine, and more than 1,600 consultations have occurred since the network was established. The network has been transitioned smoothly from the JPSG project team to BOP, and utilization levels remain stable. The evaluation that follows will help BOP and State, local, and military entities determine what future role telemedicine might play in their health care delivery systems. NIJ will release subsequent reports and documents from JPSG's Biomedical Technology Program to provide guidance on implementing a telemedicine network.

Many Thanks

Douglas McDonald and his colleagues at Abt Associates Inc. conducted this evaluation. Some of the people who made the demonstration possible may not have contributed directly to the Abt evaluation, and hence they escaped notice in the Acknowledgments section of this report. We want to make sure these people receive the recognition they deserve.

Several people in BOP's Health Services Division (HSD) contributed significantly to the demonstration. Senior Deputy Assistant Director Ron Waldron has had a longstanding interest in testing telemedicine in prisons, and his assistance and support were crucial to the success of the project. HSD's Health Care Specialist, Rad Clark, worked diligently to see that the necessary agreements were in place. We also want to thank Assistant Director and Chief Medical Officer Kenneth Moritsugu and BOP Director Kathleen Hawk-Sawyer for providing their support as well as access to health care resources underscoring the importance of the demonstration. In BOP's Contracts Division, Chief Contracting Officer Craig Unger, his staff, and Contracts Specialist Vernon Smith provided valuable assistance.

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At the VA Medical Center in Lexington, Kentucky, Helen Cornish, Director, and William Hogerty, Special Assistant to the Director, deserve recognition for having the vision to enter into this challenging partnership

with the other agencies; their support throughout the demonstration was invaluable. The many fine VA physicians who provided consultant services should also be mentioned. Foremost among them are Drs. Herbert Kaufer, Margaret Terhune, Malkanthie McCormick, Craig Chasen, and Charles Zimmermann.

The demonstration produced many deliverables, but none of greater significance than the evaluation that follows. Abt Associates Inc. prepared the report. We are indebted to them for their excellent work.

Finally, we wish to thank the implementation team—an amalgam of persons from various organizations. Eddie Broyles from SPAWAR Systems Center, Charleston, South Carolina, was Senior Systems Engineer and Technical Agent for this demonstration; he was responsible for management of project funding and overall implementation, including management

of the prime contract. Herman Walker, Project Engineer with Tracor Systems Technologies, Inc., was responsible for executing the contract with SPAWAR. Under his direction, Tracor provided nearly all of the services necessary to procure, install, and evaluate a telemedicine network. He was responsible for the daily implementation and problem solving associated with a project of this size and for management of various Tracor employees and subcontracts. Tracor employees Roddy Traxler and John Smith assisted him. Tracor consultants Allan Turner and Jordana Bernard performed many important duties in the areas of program development and implementation, training, evaluation, equipment selection, report development, and liaison. Finally, from Systems Planning Corporation, Chris Tillery helped with project funding and preparing documents and agreements necessary for interagency coordination.

Peter L. Nacci, Ph.D.


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- Herman Walker, Project Engineer, Tracor Systems Technologies, Inc., responsible for administration of the prime contract.

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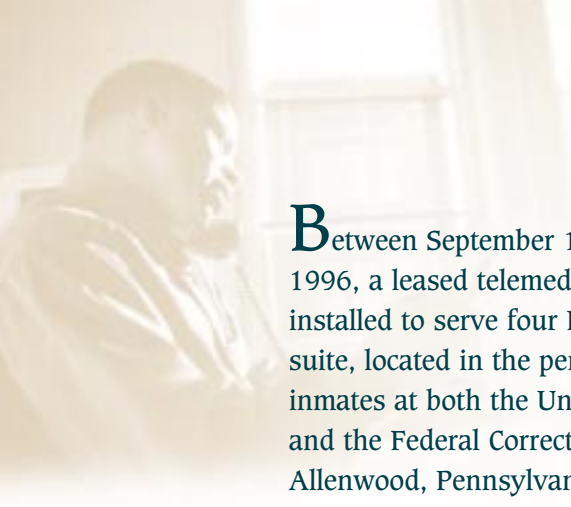
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Summary





Between September 1996 and December 1996, a leased telemedicine network was installed to serve four Federal prisons. One suite, located in the penitentiary, served inmates at both the United States Penitentiary and the Federal Correctional Institution in Allenwood, Pennsylvania; another served inmates at the United States Penitentiary in Lewisburg, Pennsylvania; and a third served inmates at the Federal Medical Center (a prison health care facility) in Lexington, Kentucky. All of these sites were networked for telemedicine with the Department of Veterans Affairs Medical Center, also in Lexington. The VA and Federal Medical Centers in Lexington served as the hubs in this network, providing specialist physicians and other health care practitioners for remote (telemedical) consultations with prisoners in the three Pennsylvania prisons. These telemedical consultations were conducted during the period September 1996 through December 1997.

The purpose of this demonstration was to test the feasibility of remote telemedical consultations in prisons and to estimate the financial impacts of implementing telemedicine in other prison systems. Abt Associates Inc. was contracted to evaluate the demonstration and estimate the costs and savings associated with the use of telemedicine in these selected prisons.

As in most Federal prisons, medical care in the Pennsylvania prisons was traditionally delivered through a combination of four types of providers:

- Routine primary care was largely the responsibility of prison employees. Telemedicine was not intended to substitute for any of these encounters.

- Specialty care was provided in regularly scheduled, in-person clinics for which the prisons entered into annual contracts with local specialists.
- Inmates requiring other less common specialties or hospital care were transported outside the prison to nearby health care facilities (usually hospitals).
- Some inmates who needed more extensive care were transported to a Bureau of Prisons (BOP) Federal Medical Center—by air charter, if necessary.

During the demonstration, a fifth mode of care—remote encounters with specialists via telemedicine—was added to determine whether the prisons could use telemedicine to overcome local problems in accessing needed specialists and improve security by averting travel outside the prison walls. The demonstration was also designed to supply data on costs and utilization to support a decision about whether and where to implement telemedicine in other prisons.

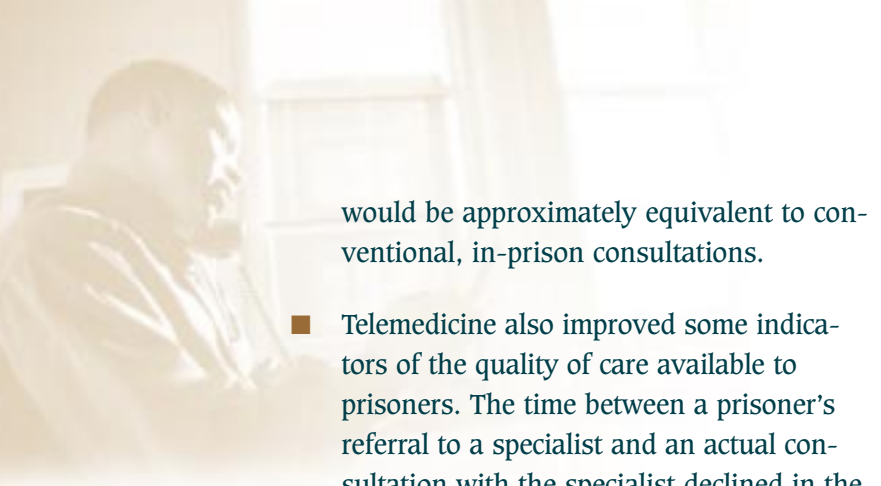
To evaluate this demonstration, Abt Associates staff analyzed data extracted from BOP management information and accounting systems, data collected by telemedicine site coordinators, additional cost data developed by the Bureau and by the telemedicine prime contractor (Tracor Systems Technologies, Inc.), and anecdotal data collected by interviews with health services administrators and clinicians involved in the demonstration. Analysis revealed that:

- Telemedicine was adopted quickly and used frequently in several medical specialty areas. By the end of the demonstration, 1,321 teleconsultations had been conducted.

- Physicians reported that telemedical consultations were effective substitutes for direct, in-person consultations in some specialties (e.g., psychiatry and dermatology), but less than adequate in others (e.g., cardiology and orthopedics). Consequently, a nearly complete substitution of telemedicine for in-person psychiatric care took place quickly. Telemedical consultations were also used routinely for dermatology and orthopedics, although conventional consultations in these specialties continued. Telemedical consultations were used with several other types of specialties, but relatively infrequently.
- About 35 trips to local specialists were avoided by the use of telemedicine during the entire demonstration. Because most trips to local specialists are for care that includes invasive tests and procedures or specialized equipment that cannot be brought into the prison, telemedical consultations were rarely seen as appropriate substitutes for such trips.
- The use of telemedicine averted 13–14 transfers by air charter to a Federal Medical Center. Nearly all of these transfers would have been for psychiatric reasons. The availability and skill levels of prison psychiatrists at FMC-Lexington contributed to better management of psychiatric patients at the demonstration prisons. These prisoners would have been transferred to the psychiatric wards at MCFP-Springfield had telemedical services not been available.
- The projected total costs and savings of an operational telemedicine system were estimated using the experience on costs and utilization patterns gained in the demonstration. We applied these data to assumptions about purchase and installation

costs of a purchased, rather than leased, system (as was used in this demonstration) and found telemedicine much less costly than conventional BOP practice. The average cost of a telemedicine consultation would be \$71 if slightly different telemedicine equipment were purchased rather than leased, if the telemedicine coordinators' tasks were taken over by BOP employees, if Integrated Services Digital Network (ISDN) lines replaced the switch 56 service used in the demonstration, if the two Lexington hubs were consolidated into one, and if the number of air transfers and local trips out were averted as observed in the demonstration. Even if part-time telemedical coordinator staff were added, the average cost of a teleconsultation in these conditions would be about the same as a conventional, in-prison consultation.

- In an operational telemedicine system so designed, the savings generated by approximately 1,544 encounters would equal the purchase cost of the telemedicine equipment. The demonstration produced about 100 encounters per month; therefore, the initial cost of equipment would be recovered in approximately 15 months, with monthly savings of about \$14,200 thereafter. If all capital costs are included, the time to recover the costs is still less than 2 years.
- If telemedical systems were deployed to prisons that experience at least as many air transfers to Federal Medical Centers and trips out to local specialists as were observed in the demonstration prisons, and if the systems were similar to the one described above, telemedicine could reap substantial savings. In prisons that lack such numbers of air transfers and trips out, the average cost of telemedicine



would be approximately equivalent to conventional, in-prison consultations.

- Telemedicine also improved some indicators of the quality of care available to prisoners. The time between a prisoner's referral to a specialist and an actual consultation with the specialist declined in the demonstration prisons; probably specialists were more frequently available by telemedicine. The enhanced communications system also enabled the Pennsylvania prisons to obtain services in at least one specialty not available locally: infectious disease expertise for the care of HIV-positive prisoners. Even in fields in which specialists were locally available, telemedicine provided access to doctors with more experience in the treatment of prisoners.

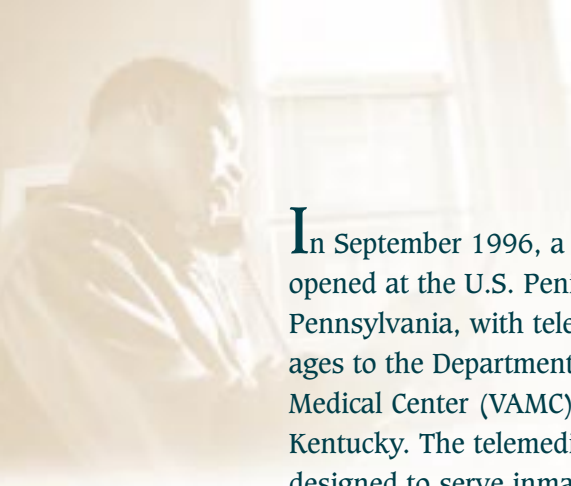
- Prison administrators in the project hypothesized that the prisons were calmer, with fewer incidents of violence because of the improved psychiatric care available through telemedicine. There were fewer assaults at FCI-Allenwood and USP-Allenwood after the demonstration began than in the previous year. However, we are unable to draw any consistent conclusions about the value of telemedicine in improving the social climate of the demonstration prisons.

We conclude that savings are most likely to result when frequent, individual transfers via air charter are avoided and when in-prison consultations are replaced by telemedicine consultations. Cost savings from trips averted to nearby medical facilities are more modest.

Chapter 1:

The Telemedicine Demonstration





In September 1996, a telemedicine suite was opened at the U.S. Penitentiary at Allenwood, Pennsylvania, with telecommunications linkages to the Department of Veterans Affairs Medical Center (VAMC) in Lexington, Kentucky. The telemedicine suite was designed to serve inmates at this prison and at the adjacent Federal Correctional Institution (FCI) at Allenwood. Four months later, in January 1997, a second suite was opened at the U.S. Penitentiary at Lewisburg, Pennsylvania. Telemedicine equipment was also installed during the closing days of 1996 in the Federal Bureau of Prisons' (BOP's) Federal Medical Center (FMC) in Lexington, Kentucky.

In this network, all four prisons served as remote sites, meaning that prisoners and health care providers there would initiate requests for services from the providers of telemedical specialist services at the hub site. VAMC was designated the major hub for this network, and planners secured agreements with VAMC's administrators to provide physicians in several specialties thought suited to telemedicine and the needs of the remote sites. In addition to serving as a remote site, the FMC at Lexington was also designated a minor hub, as it was to provide telepsychiatry services to the other three remote prisons.¹

The principal objective of the demonstration was to test the feasibility of using a sophisticated array of telemedicine equipment for remote specialty consultations and develop data from which to project the impact of telemedicine on health care spending for a prison population. Ancillary objectives of the demonstration were to:

- Reduce security risks associated with taking prisoners to community-based providers outside the prison walls for treatment or diagnoses.
- Provide access to specialists of a kind and quality not available locally.
- Reduce delays in prisoners' access to medical specialists.

The demonstration was jointly sponsored by the U.S. Departments of Defense (DoD) and Justice (DOJ) and managed by a steering group, the Joint Program Steering Group (JPSG). JPSG is staffed by both departments and managed by two lead agencies, the National Institute of Justice (NIJ) and the Defense Advanced Research Project Agency (DARPA). NIJ's objective in supporting the project was to provide information useful for State and local corrections, in addition to assisting BOP, its sister agency. DoD's research and development (R&D) community (DARPA among them) developed telemedicine and enabling communications technologies. DoD's objectives in supporting the project were greater than testing the utility of technology derived from its R&D community. DoD requires the same kind of access to medical information from remote areas, both in war and in operations other than war (such as providing humanitarian relief, giving disaster assistance, or detaining large groups of foreign nationals), as is available domestically. DoD also maintains a system of prisons and jails for incarceration of military law violators and many hospitals serving active military personnel and their families.

¹ A dietician at FMC-Lexington also used the system for group instruction.

Telemedicine Network Sites

USP-Lewisburg is a maximum-security prison that was built in 1932 in what remains a rural area. It housed a daily average of 1,349 male prisoners during FY 1997.

USP-Allenwood is newer, having opened in 1993 near White Deer, Pennsylvania. The average daily population at this facility was 1,037 maximum-security male prisoners during FY 1997.

FCI-Allenwood, which also opened in 1993, is located on the same BOP campus as USP-Allenwood. On any given day during FY 1997, it held an average of 1,100 low- and medium-security prisoners. Prisoners at the FCI are transported to the USP-Allenwood for telemedicine sessions.

The Federal Medical Center at Lexington, Kentucky, had operated as a Federal correctional institution since 1974 but was converted to a Federal Medical Center in 1991. This facility accepts patients, many of whom require specialized health care, from institutions in the Federal prison system. Its particular mission is to provide care to medium- and minimum-security prisoners with chronic illnesses. During FY 1997, the center's average daily population was 1,450. Most were men, but the FMC also houses a small number of female prisoners.

The Department of Veterans Affairs (VA) operates a network of hospitals for veterans and their dependents. The VA is interested in developing telemedicine capabilities to serve veterans in rural locations and provide remote consultant services to other public health care entities.

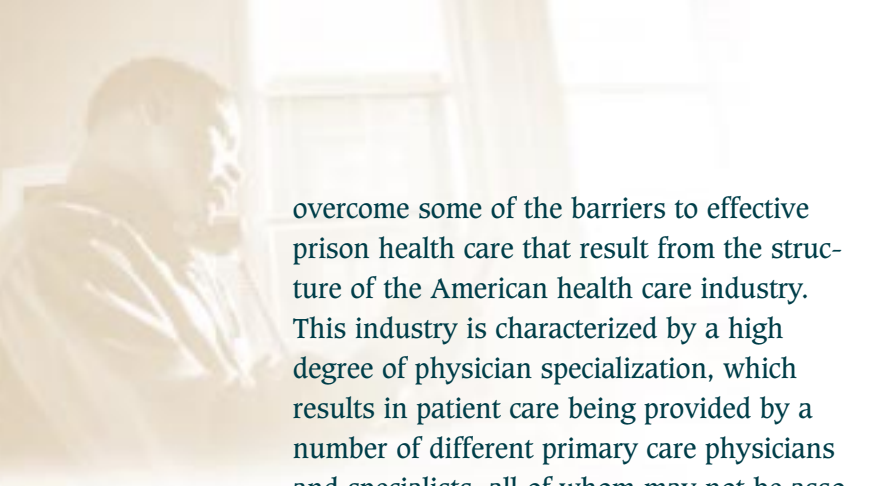
No single demonstration could successfully serve all the interests of such a diverse group of public agencies. However, the evaluation below has been structured to provide information that should be useful to BOP, State and local corrections, DoD, and the VA.

The technology used in this demonstration is standard, commercially available equipment, and although skill is required to operate it, physician assistants can readily gain proficiency. A physician is not required at the remote location. Consequently, a single specialist can serve a number of remote locations, and each remote location has access to all the specialists in the network.

The Demonstration's Rationale

Telemedical capabilities in prisons and other settings offer the prospect of expanding access to health care providers. Information about persons who need treatment and/or diagnostic services can be transmitted rapidly to physicians or other health care providers located in other parts of the world. The information so communicated can be as limited as a written report of laboratory tests. The information also can be as complex as a digitized x-ray image or a real-time, high-resolution video conference during which a physician sitting thousands of miles away sees a patient on a video screen and images produced by a wide variety of diagnostic devices, including ultrasound and optical fiber probes. Specialists can also remotely direct general physicians in the treatment of patients so presented.

Telemedicine's ability to broaden the supply of health care providers has the potential to



overcome some of the barriers to effective prison health care that result from the structure of the American health care industry. This industry is characterized by a high degree of physician specialization, which results in patient care being provided by a number of different primary care physicians and specialists, all of whom may not be associated with formal organizations or networks. Physician specialization has significant implications. First, the accessibility of specialist care is exceedingly limited in thinly populated regions of the country (where many prisons are located). Whereas the practice of an individual primary care physician requires a population base of between 3,000 and 5,000 people to support it, the population required to support certain types of specialists is much larger. Indeed, for some specialties, the required base exceeds the populations of many large urban centers. Second, in regions where specialists are rare, those who do exist acquire monopolistic powers over consumers. The ability of patient/consumers, or those who purchase services on their behalf, to negotiate the fees paid for services or the conditions under which they are delivered is correspondingly diminished.

If, by virtue of installing telemedical communications equipment, a remotely located health care provider can communicate directly with specialists located elsewhere, the consumer's leverage in the marketplace becomes greater. Consumers are no longer limited to the locally available medical care. More advantageous pricing may be available in this broader and, it is hoped, more competitive marketplace. If patients or those who manage their care actually use less costly specialists via the telemedicine network with sufficient frequency, in place of higher priced local providers, reductions in health care expenditures might be obtained.

These savings come at a substantial price, however, as the needed equipment and telecommunications charges can be quite costly.

A few State prison systems have installed telemedicine systems, and many others are evaluating the decision to use them. BOP had been considering the use of telemedicine but was unable to assess its merits because there was no reliable basis for estimating the cost of the system or whether it would meet prisoners' needs. This demonstration was primarily intended to supply the missing information to support that decision and develop a model for estimating the cost of telemedicine under different assumptions about costs and utilization. The costs of technology change rapidly. During the 2 years between the planning of this demonstration and its evaluation, the costs of the telemedicine equipment and communications services used for the demonstration fell significantly. Therefore, any future implementation will face cost conditions different from (and generally more favorable than) past experience. This report is intended to help prison administrators in Federal, State, or local governments assess the fiscal impact of implementing telemedicine in their correctional organizations.

It is certainly possible that telemedicine is not always cost effective but that other important benefits are obtained. For example, the availability of additional—and different—specialists through the telemedicine network may make needed care more accessible to patients and may lower the security risks associated with transporting prisoners out of prison.

Accessibility is of special significance in prisons. The Federal courts have ruled that prisoners in all correctional facilities—local, State, or Federal—have a constitutionally protected

right to similar levels of health care as are available to citizens not imprisoned. Failing to provide that access places departments of correction at substantial risk of lawsuits and court-ordered mandates. Where accessibility to health care providers is limited because of geography or other barriers, telemedical capabilities may facilitate better care. Even if the provision of this telemedicine capacity is costly, the benefits of improved access may be judged to outweigh the costs.

Implementing the Demonstration

Demonstration project planners chose this constellation of facilities and medical centers in part because administrators in each were interested in the project and were willing to host a test site. Because nonmonetary benefits, including better security, were important, the demonstration was run in high-security prisons where inmate transfers pose the greatest threat. FMC-Lexington has some specialists on staff who were available to prison health care providers in the three remote sites. VAMC also offers a deep pool of medical specialists. Because both are Federal agencies, services were available at cost, acquisition was simplified, and legal obstacles were eliminated.

To accommodate the equipment and the special needs of the demonstration, physical space in the Lewisburg and Allenwood penitentiaries and in FMC-Lexington and VAMC had to be renovated.

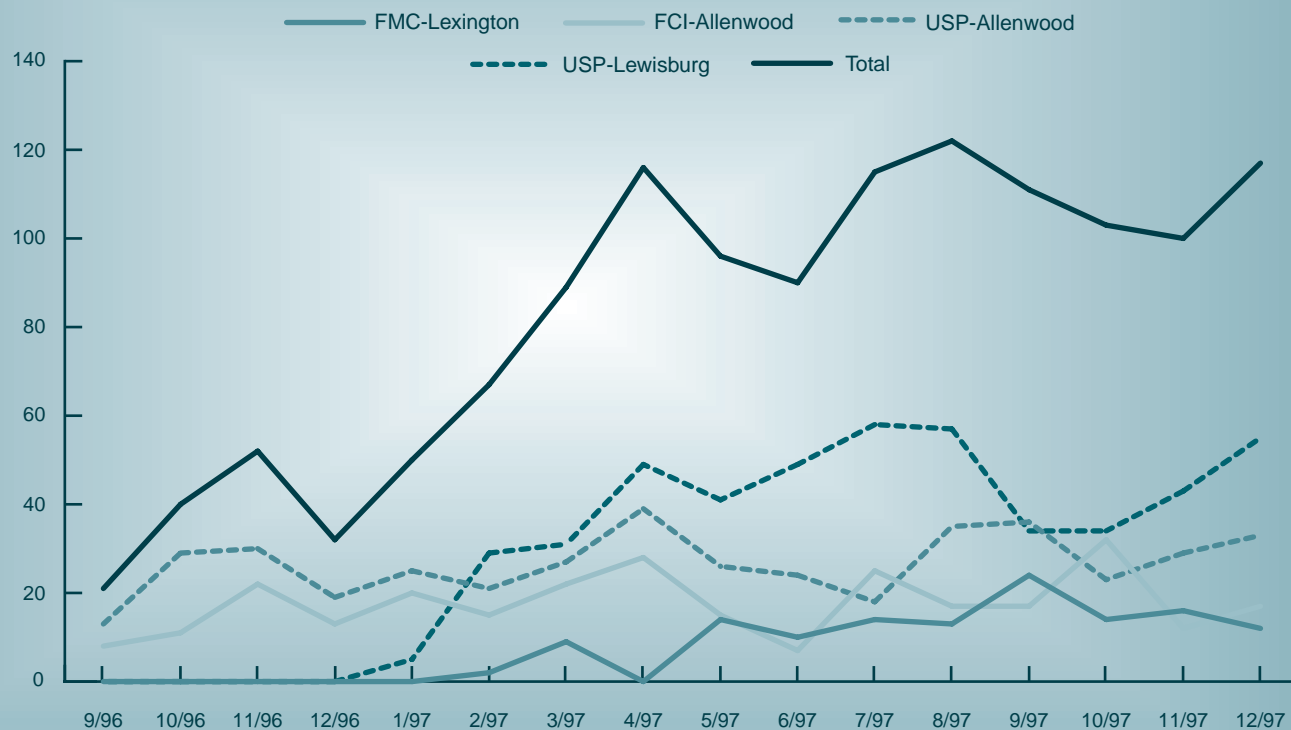
Telemedicine suites were created, soundproofing and air-conditioning were installed, and dedicated telecommunications lines were brought into the suites. At each of the four sites, a full-time telemedicine coordinator was hired to

operate the equipment and perform tasks associated with the demonstration, such as scheduling sessions, keeping records, and collecting data. These telemedicine coordinators were employed by Tracor Systems Technologies, Inc., the firm that implemented and operated the demonstration. Indeed, all the equipment, installation, and facility renovation costs were covered entirely by the demonstration project's funds. As a result, the cost perceived by the prisons was lower than the actual cost—a fact that made the telemedicine demonstration appealing and encouraged its utilization.

Each of the three Pennsylvania prisons began using telemedicine services as soon as they became operational and quickly integrated them into the provision of health care in the prisons. As time progressed, the frequency of use increased. Between September and December 1996, before the USP-Lewisburg suite became operational, 21 to 52 telemedicine encounters occurred each month (see table C.1 in appendix C). Numbers climbed higher during the first 4 months of full-scale implementation (January through April 1997), reaching 116 per month in April. From April onward, the total number of encounters ranged between 90 and 122 per month. Figure 1.1 shows the month-to-month frequency of telemedicine consultations at each of the four remote prisons throughout the demonstration period.

By the end of the demonstration, a total of 1,321 teleconsultations had been conducted. USP-Lewisburg had used telemedicine the most, with a total of 485 teleconsultations. The total volume throughout the entire period was slightly lower at USP-Allenwood (427 teleconsultations) and at FCI-Allenwood (281).

Figure 1.1 Number of Telemedicine Consultations for All Specialties Combined, per Month and by Facility, 9/96–12/97



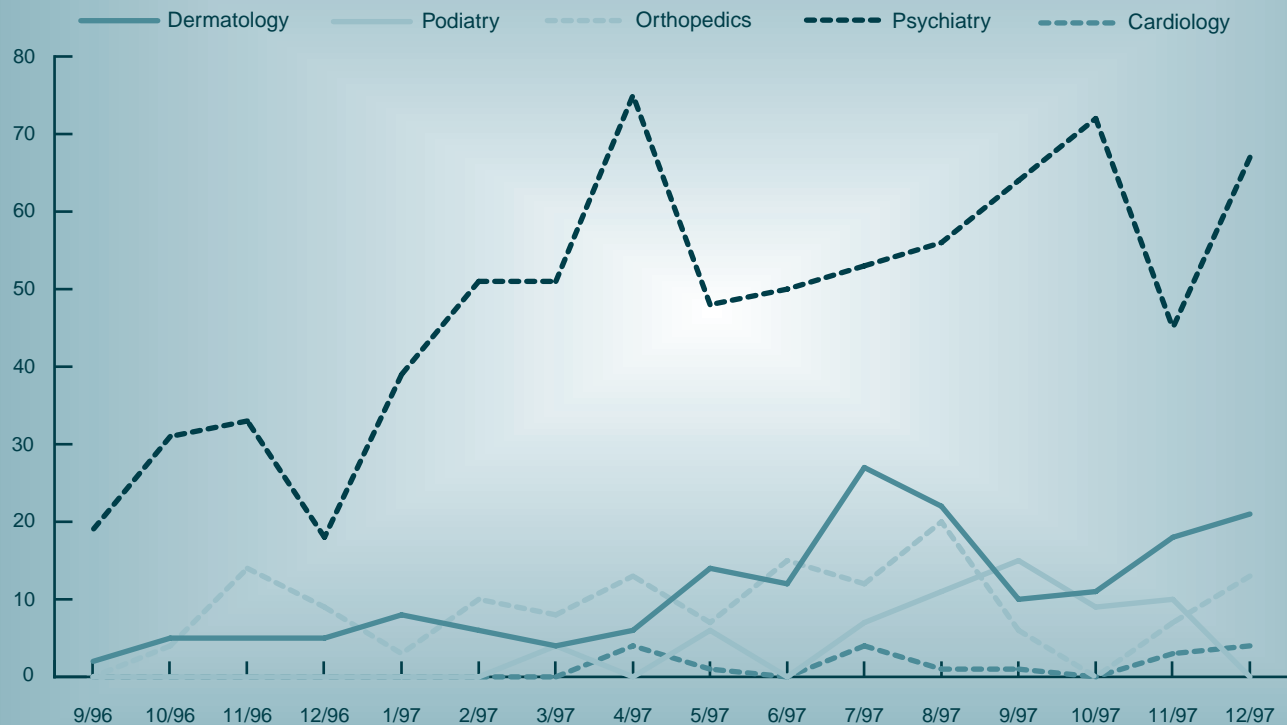
FMC-Lexington did not become an active remote site until later in the demonstration (February 1997). By the end of December 1997, FMC inmates had received only 128 telemedicine consultations from VAMC specialists. Health services administrators at FMC-Lexington chose to continue existing practices for specialist consultations. The facility’s budget for medical care is much larger than the budgets at the three Pennsylvania prisons, reflecting its mission as a medical center. A rich network of consulting specialists was already in place, and administrators were averse to disrupting it for the purposes of testing telemedicine. Consequently, FMC activity as a *remote* site focused on podiatry, a specialty not available there prior to the demonstration. FMC operated as an active *hub* site, however, and the FMC psychiatrists and dietician

provided many specialist consultations to Pennsylvania prisoners.

Telemedicine consultations were more frequent in some specialties than others. From the beginning, it was apparent that psychiatric services would be the specialty most commonly used in the prisons (see figure 1.2). At USP-Lewisburg, 54 percent of consultations were with a psychiatrist, as were 65 percent of USP-Allenwood’s consultations and 83 percent of FCI-Allenwood’s. FMC-Lexington served as the hub for psychiatry and hence received no remote psychiatry consultations. (See table C.1 in appendix C for the monthly telemedicine frequencies by specialty and by prison.)

By the end of the demonstration, 772 remote psychiatric consultations had been held, 58

Figure 1.2 Number of Telemedicine Consultations for All Four Prisons Combined, per Month and by Specialty, 9/96–12/97



percent of the total. Dermatologists accounted for 176 consultations (13 percent) and orthopedic specialists accounted for 141 (11 percent). The remaining consultations were with podiatrists (62); infectious disease specialists (20); pulmonary specialists (12); cardiologists (18); ear, nose, and throat specialists (16); gastroenterology specialists (9); and neurologists (11). In addition, the telemedicine system was used for consultations with a dietician located at FMC-Lexington (84 teleconsultations, or 6 percent of the total).

Judging from the frequency of telemedicine consultations alone, the project demonstrates that health care clinicians in the prisons found the technology a useful way to deliver a wide


variety of specialty medical services. (Health care providers found telemedicine to be more feasible for certain types of specialty consultations than others, as discussed in chapter 2). This quick start and heavy utilization resulted from the extensive planning and needs assessment that preceded selection and installation of the equipment; in addition, the inclusion of full-time telemedicine site coordinators eased the scheduling, paperwork, and inconvenience problems that have plagued many other telemedicine programs. A number of nonprison telemedicine demonstrations have been considerably less successful in realizing such high utilization so soon after being implemented.²

² Studies by Abt Associates Inc. of all rural telemedicine programs in the United States, including several that have prison sites, did not find comparable levels of utilization following implementation. See Hassol, Andrea, Gary Gaumer, Carol Irvin, Dena Puskin, Carole Mintzer, and Jim Grigsby, "Rural Applications of Telemedicine," *Telemedicine Journal* 3 (3) (1997):215–225.

Chapter 2:

Changes in Utilization of Specialists After Implementing Telemedicine





The telemedicine demonstration was implemented principally to reduce the number of prisoners seeing local consulting specialists who come into the prisons and to reduce the number of prisoners taken outside to see specialists. Shortly after the demonstration began, it became apparent that teleconsultations had reduced the number of prisoners being transferred to Federal Medical Centers for consultations and treatment. If teleconsultations were substituted for such conventional consultations in sufficient numbers, would the costs associated with these conventional practices decline to the point of offsetting the cost of adding telemedicine resources? This chapter examines the effect on the conventional practices of specialist consultation in the three Pennsylvania prisons, where nearly all the remote encounters occurred.

Teleconsultations Substituted for and Supplemented Conventional, In-Prison Consultations

Telemedicine consultations completely replaced conventional consultations in some specialties, but substituted for few, if any, conventional consultations in others. This yielded an overall increase in consultations provided by a combination of conventional and remote specialists.

Figure 2.1 shows *trends in* the numbers of monthly consultations provided conventionally by specialists visiting the three Pennsylvania

prisons prior to the initiation of telemedicine and afterwards, the number of telemedicine consultations each month after the demonstration began, and the total combined volume of both telemedicine and conventional, in-prison consultations.¹

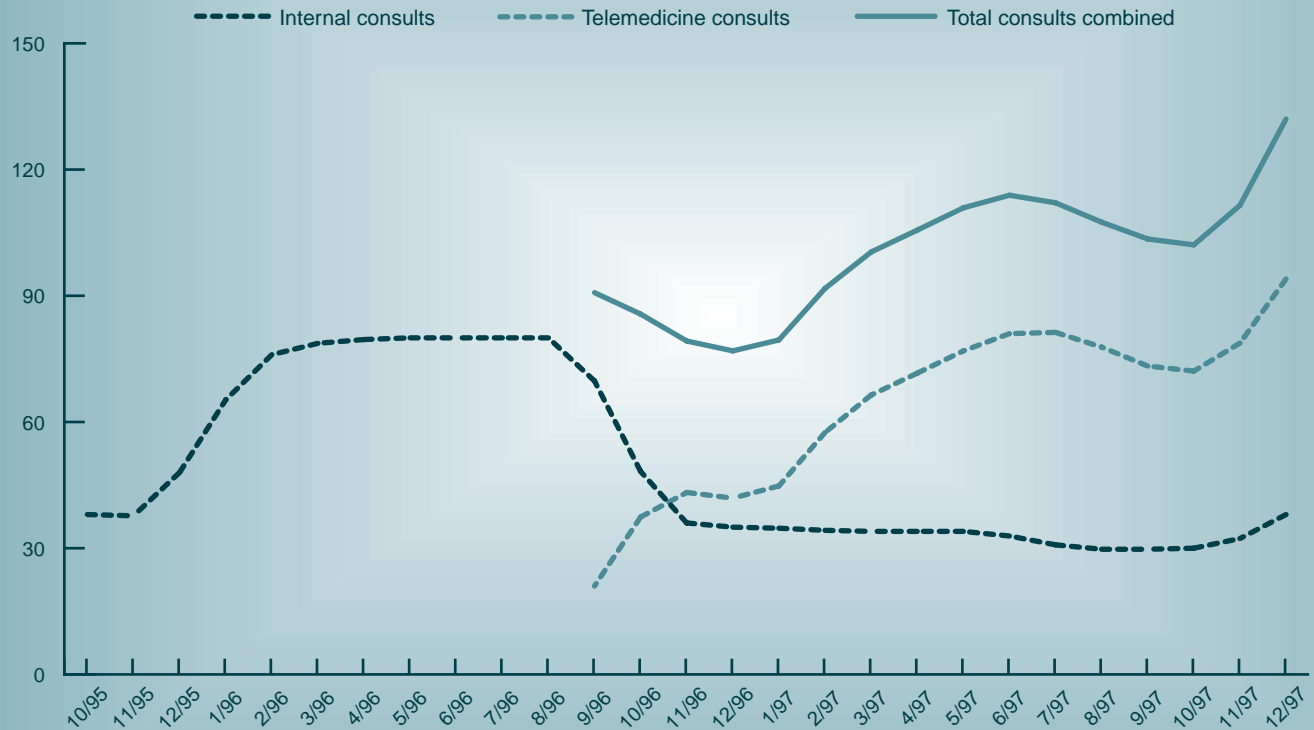
These counts of conventional, in-prison consultations are limited to those for which specialties could be identified in the BOP automated medical data files (the Sensitive Medical Data, SMD): psychiatry, dermatology, orthopedics, and cardiology. These specialties accounted for 84 percent of all teleconsultations. For purposes of comparing conventional and telemedicine consultations, all other specialties were excluded from the monthly counts of conventional in-prison and remote consultations.

As figure 2.1 shows, total consultations (conventional plus telemedicine) increased during the demonstration period, due to a combination of reduced conventional consultations and additional telemedical consultations. The change happened quickly. During the last 2 months of the demonstration, telemedicine consultations (and, therefore, all consultations) increased still further, although this pattern was not uniform at all remote sites. The numbers of conventional, in-prison consultations at USP-Lewisburg declined from March through December 1996 (see figure 2.2), the months before telemedicine became available.

When telemedicine became available in January 1997, it rapidly became the dominant form of specialty consultation, and the combination of telemedicine and some remaining conventional consultations provided about as

¹ The curves shown in figures 2.1 through 2.4 do not precisely indicate the numbers of different consultations in each month, but are smoothed to represent trends better. For actual numbers of consultations, see tables C.1–C.3 in appendix C.

Figure 2.1 Number of Conventional In-Prison and Telemedicine Consultations for Four Specialties in All Pennsylvania Prisons, 10/95–12/97



Note: Based on data in tables C.1, C.2, and C.3 in appendix C.

many encounters as had been delivered by conventional medicine alone in 1996.²

At USP-Allenwood, the frequency of conventional, in-prison specialist consultations had been increasing for a few months prior to the introduction of telemedicine. This trend eased, but the addition of telemedicine resulted in an overall increase in total consultations (see figure 2.3).

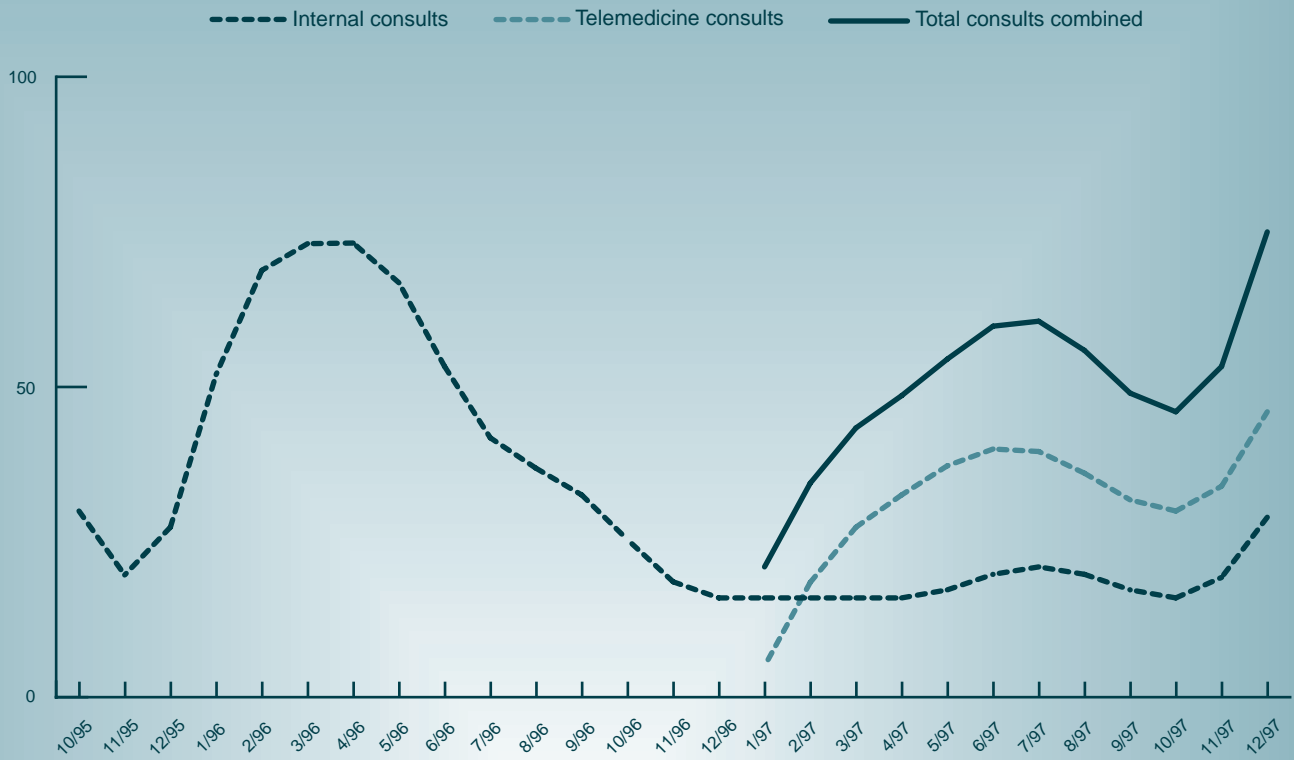
At FCI-Allenwood, there were fewer conventional, in-prison consultations during the year preceding the demonstration than at the other prisons. These consultations, which had been largely with psychiatrists, quickly dropped to zero when telemedicine was initiated

and were replaced with an equal number of telepsychiatry consultations (see figure 2.4). Conventional consultations then increased slightly, largely in cardiology—probably because more inmates needed cardiology services during the demonstration period. There appeared to be a complete substitution of telepsychiatry for conventional psychiatry, but little substitution of telecardiology for conventional cardiology.

Lewisburg would be expected to report higher numbers for specialist encounters because it has a larger primary population than the other two prisons. During the 12-month period preceding the demonstration, the average daily population was about 1,500, compared with

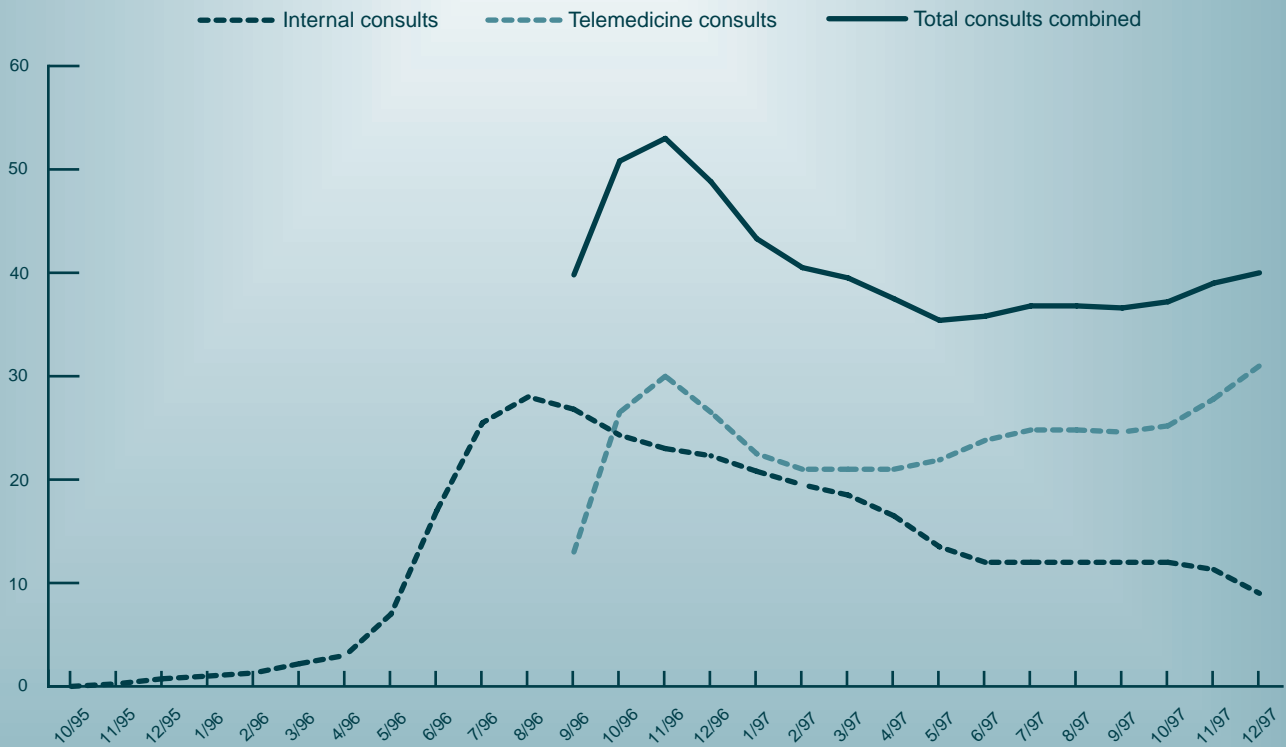
² Lewisburg's use of telemedicine in some months was severely restricted because of security problems unrelated to telemedicine.

Figure 2.2 Number of Conventional In-Prison and Telemedicine Consultations for Four Specialties at USP-Lewisburg, 10/95–12/97



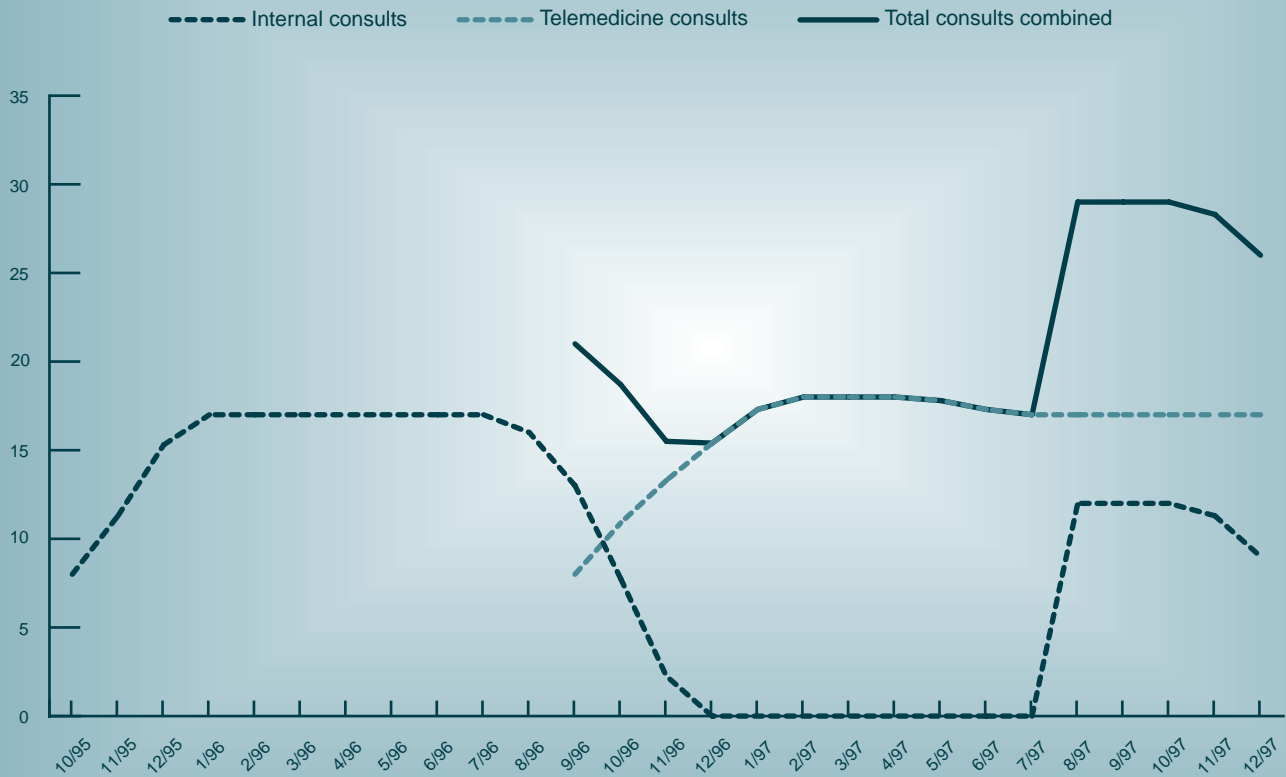
Note: Based on data in tables C.1, C.2, and C.3 in appendix C.

Figure 2.3 Number of Conventional In-Prison and Telemedicine Consultations for Four Specialties at USP-Allenwood, 10/95–12/97



Note: Based on data in tables C.1, C.2, and C.3 in appendix C.

Figure 2.4 Number of Conventional In-Prison and Telemedicine Consultations for Four Specialties at FCI-Allenwood, 10/95–12/97



Note: Based on data in tables C.1, C.2, and C.3 in appendix C.

about 1,000 at USP-Allenwood and about 1,100 at FCI-Allenwood. If the level of medical need was the same at each of the three facilities, and if the ratio of demand to services provided inside the prisons was the same, Lewisburg would be expected to experience about 50 percent more encounters each month with specialists. Indeed, Lewisburg had about 50 percent more consultations than USP-Allenwood, but FCI-Allenwood had very few consultations.³

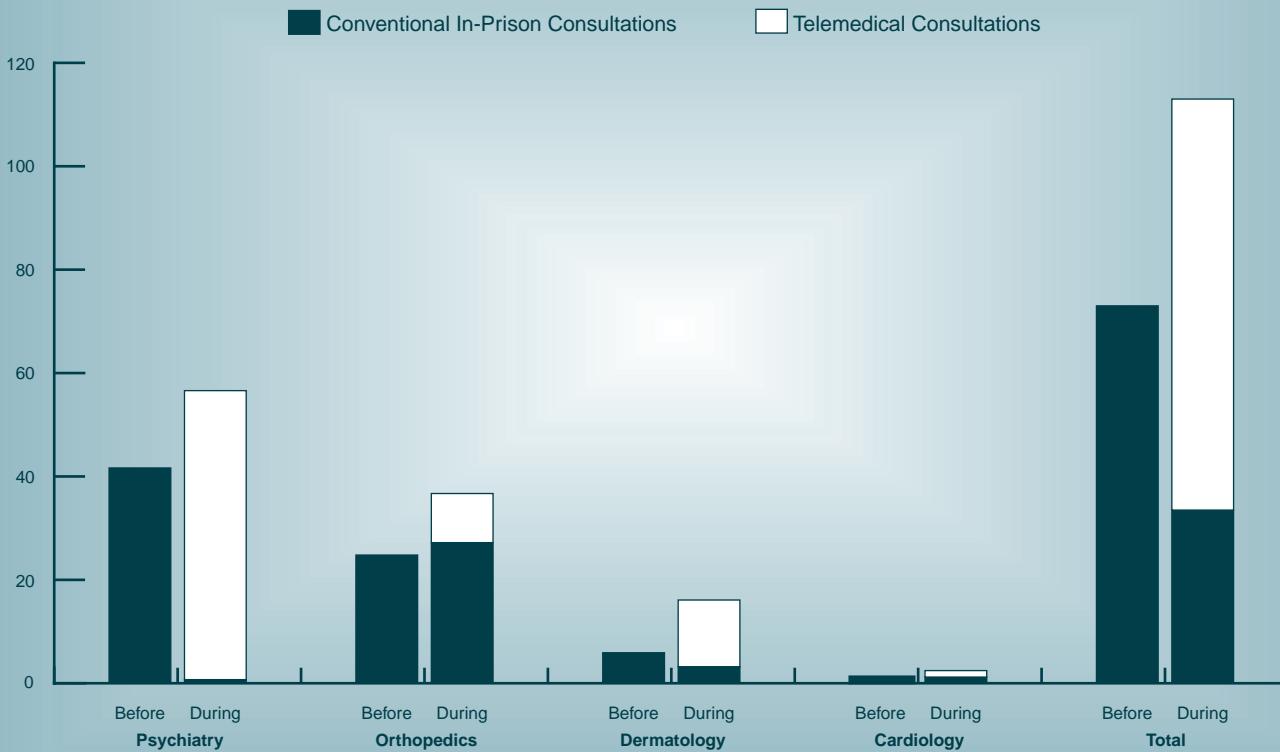
The effects of telemedicine on conventional, in-prison consultations were less significant at FMC-Lexington. As the earlier figure 1.1 indicates, the facility did not begin to function as a remote site until late in the demonstration

period. Half of the teleconsultations were with a remote podiatrist. Because SMD data do not indicate conventional encounters with podiatrists, utilization trends before and after telemedicine’s implementation could not be tracked. Because so few other types of telemedical consultations occurred between FMC-Lexington and specialists at VAMC, before-and-after trends were not mapped.

These differences in utilization rates may have reflected differences in the frequency with which specialist clinics were held in each of the prisons. For example, USP-Lewisburg brought in an orthopedist approximately twice per month before the demonstration began, while the Allenwood facilities each held

³ The inconvenience of transporting inmates from FCI to USP for telemedicine may have contributed to the reluctance to use telemedicine.

Figure 2.5 Average Number of Conventional and Telemedical Consultations per Month and by Specialty, Before and During Demonstration



Note: "During" refers to the period following full implementation (January 1997) of telemedicine at all three Pennsylvania prisons.

orthopedic sessions once every 2 months. USP-Lewisburg held eight dermatology clinics during the year preceding the demonstration, while USP-Allenwood held only one. There may have been differences in the morbidity in the populations at each of the three facilities, but other factors probably accounted for the different frequency of scheduled clinics:

- Administrative decisions to allocate budgets for care differently.
- Decisions to provide a greater proportion of care internally by staff physicians rather than consulting specialists.
- Difficulties in obtaining services from consultants willing to work inside the prisons.
- Differing reliance on specialists working in nearby hospitals.

For example, administrators at FCI-Allenwood reported that although they could have made good use of dermatology and cardiology services on a quarterly basis, they could not afford these specialists at local market rates. Therefore, FCI-Allenwood relied on primary care staff to handle dermatology cases and took small numbers of prisoners to cardiologists outside the prison walls when necessary.

The mix of telemedicine and conventional, in-prison consultations differed not only among the various institutions, but also among different specialties. Telemedicine virtually replaced the conventional prison specialist in psychiatry; in the three other specialties tracked unambiguously over time, the total volume of consultations *increased* (see figure 2.5).

Figure 2.5 compares the average *monthly* numbers of conventional consultations during

the year preceding the demonstration (“Before”) with the numbers of conventional and telemedicine consultations during the demonstration (“During”).

At all prisons, use of consulting psychiatrists coming into the prisons virtually ended with the introduction of telemedicine technology. The few such encounters reported during the telemedicine demonstration period occurred largely during the first weeks—perhaps because they were already scheduled. (See tables C.1 and C.2 in appendix C for the monthly utilization of telemedicine by specialty.) Prison staff in all three facilities reported being very satisfied with the psychiatrists located at FMC-Lexington, who served as the remote specialists for all psychiatric telemedicine encounters. Indeed, they were more satisfied with the quality of these psychiatric services than those delivered previously by the local consulting psychiatrist.⁴

At USP-Lewisburg, the number of psychiatric encounters was about the same before and during the demonstration; what changed was the technology for conducting them. In the predemonstration period, there was an average of 22 consultations per month with the visiting psychiatrist. Following the introduction of telemedicine, there were 22 per month, but all were provided by telemedicine. In the other two facilities, the introduction of telemedicine appears to have *increased* the total number of psychiatric encounters. At USP-Allenwood, for example, the total number grew from 6.5 per month prior to telemedicine’s implementation to 17 per month during the demonstration period. At FCI-Allenwood, the increase was less dramatic but nonetheless an increase: from 11 per month to 15 per month. Again, this may have resulted from

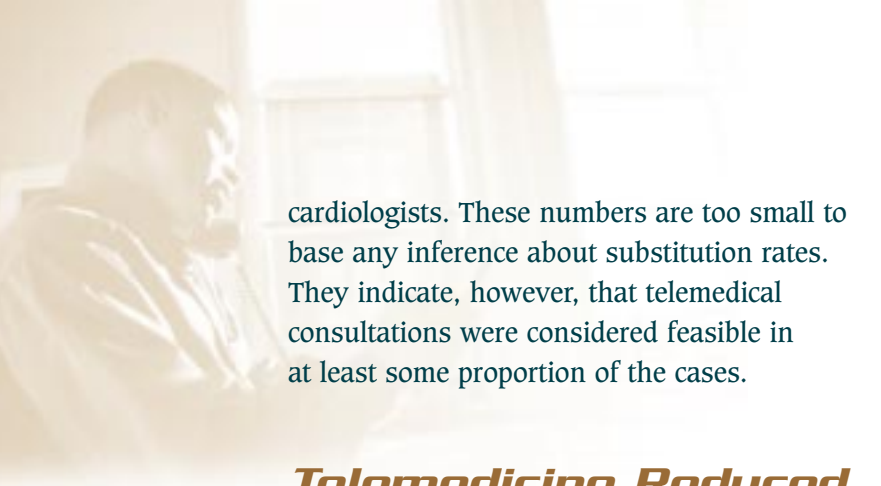
the perceived quality and competence of the remote psychiatrist, compared with his local counterpart, although changes in prisoners’ needs for care cannot be ruled out.

Telemedicine also substituted for in-prison consultations with dermatologists. An average of 6 dermatology consultations per month during the predemonstration period increased to 14 per month during the demonstration. Seventy-seven percent of the dermatology consultations during the demonstration period were provided via telemedicine.

Telemedicine also substituted for orthopedic consultations in all facilities, but conventional, in-prison orthopedic consultations also continued. Lewisburg averaged 19 monthly orthopedic consultations during the predemonstration period, and 16 per month during the demonstration—with 23 percent of the encounters during the demonstration provided remotely. At USP-Allenwood, the total number of orthopedic encounters increased from 3 to 16 per month, on average, with 20 percent of these provided remotely. (The increase in conventional orthopedic consultations was reportedly due in part to a new orthopedist who had a practice of ordering more followup visits.) At FCI-Allenwood, the number of monthly orthopedic encounters remained small (an average of three per month throughout the entire period); 28 percent during the demonstration period were provided remotely.

Very few (18) telemedicine consultations were held with cardiologists. These consultations were for patients with coronary artery disease or valvular heart disease and for secondary prevention, such as chest pain. During the year prior to the demonstration, there were very few in-prison consultations with visiting

⁴ Despite the near cessation of in-prison psychiatric consultations, prison administrators did not cancel contracts with local specialists because they did not want to dislocate those relationships entirely; this demonstration was being tested for only 12 months, with no guarantee that telemedicine would continue to be available afterwards.



cardiologists. These numbers are too small to base any inference about substitution rates. They indicate, however, that telemedical consultations were considered feasible in at least some proportion of the cases.

Telemedicine Reduced External Visits to Specialists

Telemedicine averted about 35 trips for inmates to see local specialists outside prison walls, for a savings of approximately \$27,500.

During the 11 months prior to telemedicine's implementation, Lewisburg inmates were taken out of the prison 419 times to meet with local specialists, either in their offices or in a community hospital (called external consultations because they occurred outside the prison walls). There were also 119 external consultations for USP-Allenwood inmates and 160 for FCI-Allenwood inmates.⁵ With this volume of external consultations, each of which requires extensive and costly security measures, one hope for the demonstration was that fewer inmates would need to be taken outside the prison to see local specialists after telemedical capabilities became available.

At the end of each telemedicine consultation, prison staff were asked what would have

happened had telemedicine not been available. In most cases, staff reported that the inmate would have eventually seen a visiting specialist; in a few cases, either an external consultation or a transfer to FMC was thought to have been avoided. Whenever it was suggested that one of these costly events was avoided, the health services administrator for the prison was asked to review the case and verify that an external consultation (or a transfer) would have occurred without the telemedicine session. Prison staff identified a total of 35 external consultations that were avoided by using the telemedicine system, all among inmates of USP-Lewisburg.⁶

The savings produced by avoiding such external consultations was calculated by identifying a set of comparable external consultations during the 11 months before the demonstration period that could reasonably have been attempted with telemedicine and by pricing the various components of these events (see appendixes A and C for discussions of these data). The average cost of external consultations during this period is estimated at \$788.⁷ This figure included medical care expenses averaging \$320, administrative expenses averaging \$197, and security/escort costs averaging \$271 per consultation. In summary, for the 35 avoided external consultations, the total savings during the entire demonstration period is estimated to be \$27,580.

⁵ Because FMC-Lexington used telemedicine in only a few specialties for which it otherwise would never approve external visits to specialists (e.g., podiatry), reductions in these external visits were not expected or sought.

⁶ The frequency of external consultations experienced at the three Pennsylvania prisons was higher during the demonstration period than during the 11 months prior to telemedicine's implementation. These differences reflect normal variation in numbers of cases requiring trips to hospitals or to specialists based there and should not be attributed to any effect of telemedicine on the utilization of these external resources. Furthermore, the rates of using consulting specialists prior to the implementation of telemedicine cannot be viewed as characterizing "normal" or "appropriate" levels of demand. For example, the penitentiaries were "locked down" for some periods of time; contracts with consulting physicians were not in force for part of the year; and primary care staff may have chosen to treat patients they would have otherwise preferred to send to specialists.

⁷ This calculation does not recognize some "hidden" costs associated with external consultations, such as additional staff time and the use of government vehicles and equipment for medical trips. In addition to the staff listed in the appendix tables, each trip involves unit clerical staff and receiving and discharge staff. The analysis also leaves out costs associated with the vehicles, including specialized handicap-equipped vehicles with motorized chair lifts. Considering these costs would slightly increase the advantage of telemedicine.

Why were so few of these costly consultations replaced by telemedical ones? To explore the reasons for this, the research team discussed lists of all external consultations with prison clinical staff and learned that the majority of them were for care that cannot be provided remotely. Emergency and trauma care, surgery, invasive tests and procedures, or care requiring special (nonmobile) equipment all necessitate transporting inmates outside the prison to specialists in hospital outpatient departments or in their own offices. USP-Lewisburg had the most external consultations and, hence, the most opportunity to reduce them. Telemedicine did not avert any external consultations at either of the Allenwood facilities, in the opinion of the health service administrators at those two prisons. Had the mix of prisoners or the decision rules been different, the number of external consultations and their distribution among the prisons might have differed from what was observed. These events therefore introduce an element of uncertainty into cost calculations.

Telemedicine Averted Costly Transfers to Federal Medical Centers

The use of telemedicine appears to have averted 13 to 14 costly air transfers to Federal Medical Centers from the three Pennsylvania prisons, thereby saving about \$59,000. All but one of these avoided transfers were psychiatric patients who would have been airlifted to MCFP-Springfield.

Two methods were used to estimate the number of transfers that would have occurred in

the absence of telemedicine. One was to consider each telemedicine session and ask, “What would have happened without this telemedicine session?” Health services administrators in each of the three prisons answered this question for every teleconsultation performed. The resulting tally showed 13 averted transfers: 11 at USP-Lewisburg, 1 at FCI-Allenwood, and 1 at USP-Allenwood. A second estimation method was to use BOP data on inmate movements from prisons to FMCs and to calculate differences between the 11 months preceding the demonstration and the months during the demonstration period. This exercise found 14 fewer air transfers of psychiatric patients during the demonstration period for all three demonstration prisons in Pennsylvania combined. The two methods therefore suggest that between 13 and 14 air transfers to FMCs were averted by telemedicine during the demonstration period.

The prisons were reportedly able to avoid emergency air transfers for psychiatric reasons because the level of ongoing prisoner care with telemedicine was reportedly higher. The availability of psychiatrists at FMC-Lexington, via telemedicine, and their expertise were thought to result in more effective medication and monitoring of prisoners suffering from psychiatric illnesses. With prisoners thus stabilized and monitored, crises were avoided. When prisoners became agitated, they had quick access to the remote psychiatrist, who was able to “talk them down,” thereby sidetracking a downward spiral and averting a transfer to the psychiatric ward at MCFP-Springfield.

Furthermore, the rates of utilizing consulting specialists prior to the implementation of telemedicine cannot be viewed as “normal”

Table 2.1 Savings Accrued From Averting Transfers to Federal Medical Centers

	Before Demonstration: Transfers/Year	After Demonstration: Transfers/Year	Difference (Averted Transfers)	\$/Transfer	Total Savings
USP-Allenwood	8.70	5.25	3.45	\$3,671	\$12,665
FCI-Allenwood	7.60	3.00	4.60	\$4,102	\$18,869
USP-Lewisburg	12.00	6.00	6.00	\$4,600	\$27,600
All Prisons	28.30	14.25	14.05	\$4,209*	\$59,134

* Weighted average of savings.

due to lockdowns at the penitentiaries, contractual issues with local physicians, and treatment decisions.

To estimate the financial savings incurred by these averted transfers, records were examined from the predemonstration and demonstration periods for inmates who were transferred to Federal Medical Centers. That is, the research team analyzed cost data for transfers that *actually* occurred and applied the average of these expenditures to the estimated number of transfers that were averted. The cost of transfers included air charter and flight crew, correctional officers accompanying the inmate (and returning), an armed lieutenant, a medical assistant, and chase and lead car escorts. The cost for air transfers to FMCs averaged \$4,600 from USP-Lewisburg, \$4,102 from FCI-Allenwood, and \$3,671 from USP-Allenwood. (No instances of averted transfers were observed among the inmates at FMC-Lexington.)

On the basis of these estimated unit costs and the estimated number of transfers that did not occur as a result of having telemedical capacity at each of the three Pennsylvania prisons, BOP saved \$59,134 in air transport costs (see table 2.1, which shows savings associated with averted air transfers to FMCs, using the second method of estimation).

Maintaining an inmate at an FMC costs more than maintaining the same inmate at a USP: approximately \$51,136 per year at MCFP-Springfield, compared with \$22,898 for the same number of days at USP-Lewisburg, \$22,688 at USP-Allenwood, and \$18,203 at FCI-Allenwood. The *marginal* cost of housing 14 more prisoners at FMC-Springfield would be less than this average per-inmate cost would suggest, however. This is because the facility could probably have absorbed 14 additional prisoners at little or no significant increase in cost. Therefore, no credit was imputed to telemedicine for reduced housing costs for these prisoners in the calculations. However, if telemedicine was implemented more widely throughout BOP, the decrease in the number of averted bed/days at FMCs would become substantially larger, and the marginal savings from averted FMC housing costs might produce noticeable savings as the FMCs downsized accordingly.

Some BOP administrators suggested that the budgetary consolidation of funds available for outside medical care with those for inside care (which happened just as the telemedicine demonstration was beginning) might have altered the way prisons resorted to transfers of inmates. That is, a reduction in transfers may have resulted from this policy change, rather than from telemedicine itself. If so, this

change should have been consistent across all BOP facilities (although in the Northeastern region, where the demonstration prisons are located, administrators did not implement this change as fully as in other regions). To test this hypothesis, data for psychiatric and medical transfers from four other USPs lacking telemedicine were examined to determine if there was a similar pattern of transfer during the same two time periods. The research team observed a large *increase* in psychiatric transfers from three of the four and a *decrease* in medical transfers at the four comparison prisons as well as at the three demonstration prisons. The team concluded that the budget policy changes had no consistent impact on the use of transfers to Federal Medical Centers and, therefore, that the estimated reduction in transfers at the demonstration prisons was the result of implementing telemedicine.

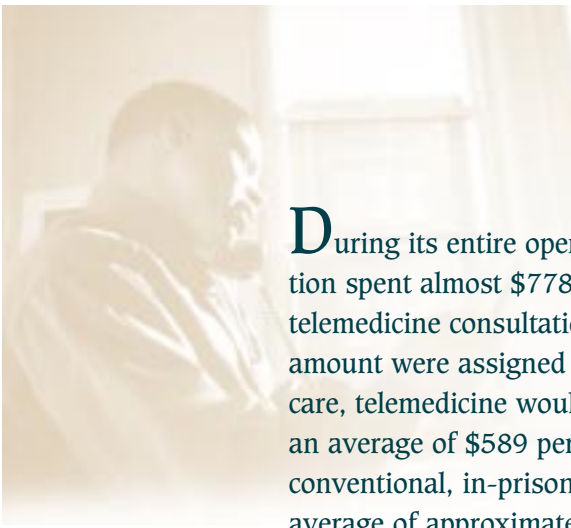
Summary

The research team estimated that the use of telemedicine averted a small but costly number of emergency air transfers to Federal Medical Centers and a small (and less costly) number of visits to nearby specialist physicians located beyond the demonstration prisons' walls. The majority of telemedical consultations were conducted either in lieu of a conventional, in-prison consultation or, in some undetermined numbers, in place of no consultation at all with specialists. Overall, the total numbers of specialist consultations, both telemedical and conventional, increased during the demonstration period, relative to the 12 preceding months.

Chapter 3:

Estimated Costs and Savings of an Operational Telemedicine Configuration





During its entire operation, the demonstration spent almost \$778,000 to provide 1,321 telemedicine consultations. If this entire amount were assigned to the cost of clinical care, telemedicine would appear to have cost an average of \$589 per encounter. In contrast, conventional, in-prison consultations cost an average of approximately \$108 each. (See appendix D for an analysis of the actual costs of the demonstration.) This comparison distorts the actual costs of telemedicine, however. Many costs were incurred to set up and evaluate the demonstration. Moreover, the \$589 cost per encounter does not reflect savings in transfers and external consultations that telemedicine's use produced, which were estimated at \$7,200 per month. This chapter presents a summary of the costs and savings that would result if telemedicine technology and the associated staff were operationally deployed. In addition, the implications of study findings are considered for the expansion of telemedicine to other prisons in the Federal system, and the data required to apply a similar model to State prison systems are discussed.

A telemedicine system implemented for operational rather than demonstration purposes would be configured differently from the one observed in this study. (Refer to appendix E for additional information on the cost and configuration of the operational telemedicine system.)

- BOP would purchase, rather than lease, the telemedicine equipment.

- Lewisburg and Allenwood would each be equipped with a room camera; patient camera; monitor; and the communications equipment and software necessary for real-time, interactive video conferencing (\$64,500 each), plus a digital stethoscope (\$3,225) and an intraoral camera (\$5,375).¹
- The ratio of hubs to remotes would be optimized to maximize use of the telemedicine hardware, bringing the largest cost savings. The demonstration used two hubs because of the location of consulting specialists, but the equipment at each location could have accommodated a larger volume of encounters. The hub would be equipped with video conferencing capabilities similar to those in the prisons, but without the patient and intraoral cameras.
- Video conferencing communications would operate over four Integrated Services Digital Network (ISDN) lines per spoke. The entire network would operate at a cost of \$840 per month, including amortization of \$1,832 installation costs, plus \$0.60 to \$0.80 per-minute long-distance ISDN charges.²

To project the costs that would result from this configuration, the team developed a model of the total cost and savings of telemedicine. The model groups costs into two categories:

- **Equipment:** The purchase price of telemedicine equipment is amortized over its projected useful life. The fixed monthly

¹ These costs were current in January 1998. Considerable advances in technology are continuing, resulting in significant cost reductions in telemedicine equipment. Persons considering telemedicine should research the market for the latest products that meet their needs and provide the most value per dollar spent.

² Typical communication bandwidth for teleconsultations was 336 KB (1/4T1) using switch 56 service. The greatest bandwidth is needed when additional inputs, such as the electronic stethoscope, are used—hence the fourth ISDN line.

costs of ISDN communications equipment (and a monthly share of its installation cost) are included in the equipment category. This category also includes several small capital expenses, such as training and remodeling costs. (Appendix B provides a detailed definition of each component.)

- **Personnel and communications:** These costs vary directly with utilization, primarily payments to specialists and video conferencing line charges.

The demonstration incurred a third category of cost—payments to the demonstration site coordinators—that is assumed to be zero for purposes of projecting the cost of an operational system. As an alternative assumption, calculations of the cost using part-time (20 hours per week) and full-time site coordinators were also made. The effects of these assumptions are discussed below.

Offsetting the costs of equipment, personnel, and communications are two major savings:

- Averted external consultations.
- Averted air transfers to Federal Medical Centers.

In addition to the configuration assumptions described, model calculations reflect several assumptions about utilization:

- The telemedicine system would be utilized at the rate of 100 patient encounters per month that replaced conventional consultations in the prisons, approximately the average observed during the months when the demonstration system was fully operational.
- All encounters provided by telemedicine would have been provided conventionally

had telemedicine not been available. In other words, any costs associated with increased frequency of care resulting from telemedicine are excluded from the calculations.

- The operational system would avert external consultations and transfers to FMCs at the same monthly rate as that observed in the demonstration period. This would contribute four additional telemedical consultations each month, making the monthly total of patient encounters 104. (Some prisons had much larger numbers of referrals to FMCs than the ones in this demonstration. Savings at these institutions may be greater than those shown here.)
- Each averted external consultation or transfer would be replaced by a single telemedical encounter.

Table 3.1 shows that under these assumptions, the direct costs for specialist encounters (principally payments to the specialists and video conferencing line charges) would be distinctly lower using telemedicine than they were with conventional technology. The major savings, however, are associated with transporting inmates outside the prison walls.

It is also assumed that the numbers of averted external consultations and air transportations would be equivalent to those observed in the demonstration. Consequently, the substantial savings associated with these averted events (\$7,200 a month) would continue to accrue to the benefit of telemedicine at any level of utilization. These savings alone more than cover the cost of operation of the hypothetical system, even without considering the cost of conventional encounters. This has an important implication: These savings may be fixed and relatively independent of the volume of telemedical sessions. That is, the assumption

Table 3.1 Comparison of Average Monthly Cost and Savings of an Operational Telemedicine System and Conventional Care (Based on 100 Internal Specialist Encounters)

	Number of Events per Month	Cost per Month	Total Monthly Cost	Average Cost per Encounter
Operational Telemedicine				
Equipment	N/A	\$3,446		
Coordinators	N/A	\$0		
Consultations	104	\$3,913		
Total Cost			\$7,359	\$71
Conventional Care				
Consultations Inside the Prison	100	\$10,800		
Avoidable External Consultations	2.83	\$2,274		
Avoidable Transfers to FMCs	1.17	\$4,928		
Total Cost			\$18,002	\$173

Note: This calculation *assumes* that all 100 monthly telemedicine consultations would be provided conventionally in the absence of telemedicine. This one-to-one substitution did not occur in the demonstration. Chapter 2 shows that fewer consultations were actually provided before telemedicine became available.

is made that triage procedures in operation during the telemedical session would bring prisoners into telemedicine who needed immediate consultations. The research team assumed that the number of such encounters would continue, regardless of the number of patients seen for less urgent complaints.

Because the major costs (equipment) and savings (transfers and external consultations) are unaffected by the number of encounters, savings from telemedicine do not depend greatly on utilization levels. At the observed level of 104 patients per month, telemedicine produces an average savings of \$102 per patient (\$35 for the cost of conventional care, plus \$67 saved in averted transfers and external consultations).³ A 20-percent increase or decrease in utilization would affect this net savings by less than 10 percent.

Excluding the costs of equipment but including savings on transfers and external consultations, each telemedical encounter saves an average of \$142. At this rate, 1,544 encounters would save an amount equal to the purchase

cost of the telemedicine equipment. Including other capital costs (installation and training) would increase the required number of encounters to 2,368. The demonstration produced about 100 encounters per month, so the initial cost of the equipment would have been recovered in just over 15 months, and the total capital costs (equipment, installation, and training) in less than 2 years, with monthly savings of \$14,200 after that.

The scenario envisioned here assumes that regular prison health care staff assume responsibility for telemedicine coordination. Whether this can be done at no additional cost is open to question. If telemedicine was established permanently rather than on a demonstration basis, and if the data collection tasks associated with this evaluation were eliminated, the labor required to coordinate telemedical activities would diminish. Whether existing BOP staff could absorb these activities without additional hiring was not determined. However, even if part-time telemedicine coordinators were retained at the same hourly rate that prevailed during the demonstration, the

³ At equipment costs current in August 1998, telemedicine encounters would cost an average of \$64 each, bringing the savings to \$109 per encounter. Total capital cost (equipment, installation, and training) would be recovered in 16 months.

per-encounter cost of telemedicine would be competitive with the cost of a conventional in-prison consultation. A half-time coordinator would cost about \$43 per encounter (at the rate of 100 telemedicine encounters per month). Deducting this cost from the net savings associated with telemedicine—approximately \$102—still makes telemedicine less costly than conventional practice. The full cost of the coordinator could be absorbed without increasing the net cost of medical care over that now provided by the Bureau.⁴

Implications of These Findings for Expanding Telemedicine to Other Prisons

Prisons in this hypothetical telemedicine system would operate at substantial savings (about \$102 per encounter), because they would otherwise charter aircraft to transfer prisoners to Federal Medical Centers for psychiatric care and consultation and take prisoners to specialists outside the institutions. The research team did not examine how many other Federal prisons follow these practices in the quantities observed here. The team's analysis of transfer patterns at other U.S. penitentiaries, however, shows that some—Leavenworth and Lompoc, for example—experience high transfer rates of psychiatric patients. Telemedicine systems in these prisons might be especially cost effective, assuming that they were configured similarly to the hypothetical system described earlier.

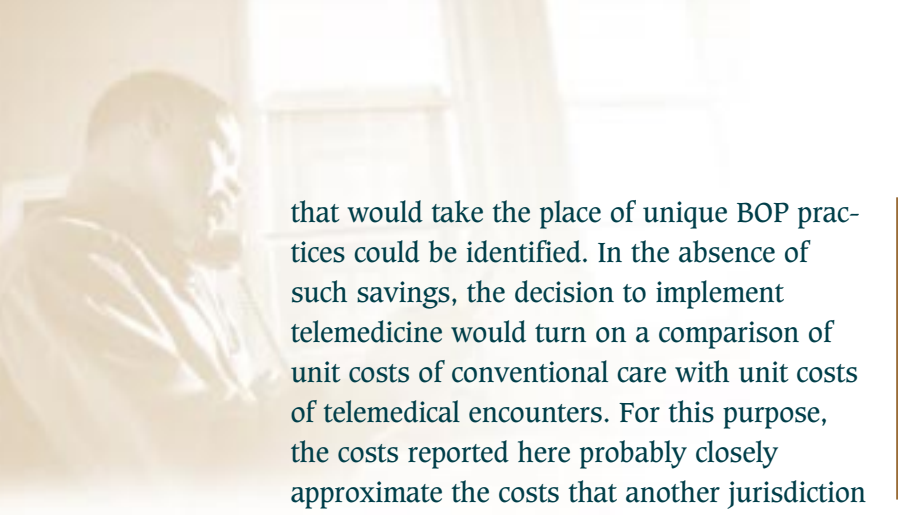
Where air charter transfers and external consultations are rare, the telemedicine system

envisioned here would still be competitive with conventional practice. Even if no air transfers or external consultations were averted, the estimated \$71 average cost per telemedical consultation still compares favorably to the average cost of a conventional in-prison specialist consultation (\$108). Unit costs of telemedicine (excluding savings from external consultations and air transfers to FMCs) would not reach the level of conventional care until utilization fell to fewer than 50 patients per month.

Although the team expected to find that telemedicine's benefits were highly dependent on the nature of the local market for consulting specialists, these benefits may be less sensitive to market conditions than anticipated. Analysis of contracts with specialist providers in a number of different Federal prisons indicates that the variation in compensation rates is quite narrow. In some regions, however, the availability of specialists at any price is limited. Telemedicine offers these prisons the ability to access such needed specialists. In addition, local market conditions may change in the future. Telemedicine offers access to specialists at government wages—through arrangements with VA facilities, for example, which may be more stable than those in the open market.

State and local correctional authorities rarely transport inmates great distances for medical care. Thus the largest single-cost saving in this analysis—the averted transfers to FMCs—would have no counterpart in many jurisdictions. To determine whether these results could be applied to State and local correctional institutions, researchers would first have to determine whether other structural savings

⁴ This assumes that the rate of averting external consultations and air transportations to FMCs continues at the same levels as observed during the demonstration.




that would take the place of unique BOP practices could be identified. In the absence of such savings, the decision to implement telemedicine would turn on a comparison of unit costs of conventional care with unit costs of telemedical encounters. For this purpose, the costs reported here probably closely approximate the costs that another jurisdiction

would face. Telemedicine, therefore, may save taxpayer dollars in systems hoping to reduce medical costs by averting prisoners' visits to local communities. However, the greatest savings would occur in correctional systems using air charters for individual medical trips over long distances.

Chapter 4:

Other Benefits of Telemedicine





A variety of suggested nonmonetary impacts of prison telemedicine were investigated during this evaluation. These include:

- Fewer security risks for transfers and external consultations.
- Shorter waiting times (or reduced delays) to see specialists.
- Access to better quality specialists and to specialty care not previously available.
- Fewer acts of inmate aggression, or use of force by guards, due to improved mental health services.
- Fewer grievances about health care or mental health care.

Shorter Waiting Times

In the absence of telemedical capacity, inmates who need to see specialists typically experience delays because specialists enter the prisons on a scheduled, periodic basis rather than as needed. (This is not the case with the most acutely ill patients, who are taken to local providers or are transferred to FMCs on short notice.) By adding telemedicine to the local supply of visiting specialists, more physicians become available, and waiting times can be shortened, absent any countervailing increases in demand.

In this demonstration, the impact of telemedicine on waiting time could not be observed directly because prison staff did not maintain lists of waiting patients. An electronic record was created in the electronic SENTRY file for each waiting inmate, but when inmates saw the specialist, the record was overwritten with information about the visit. Both referral date

and visit date are needed to calculate waiting times; the only surviving record of referral date was an inmate's paper medical record.

To measure waiting times, several hundred initial encounters between an inmate and a specialist were identified during the year preceding the demonstration and the demonstration period. Paper medical records of these inmates were searched for dates of referral to specialists. Most records were unavailable because many inmates had moved out of the system or to another prison by the time of data collection, and their paper records went with them or had been archived. Inmates needing extensive medical or mental health care were transferred to FMCs, for example, and these were among the records no longer available for the waiting-time analysis. Thus the team was not able to observe waiting times for the patients of most clinical concern. Ultimately, researchers were able to calculate waiting time for a total of 150 initial encounters during the year preceding the demonstration period and 165 initial encounters during the first half of the demonstration period. The inability to find records for transferred or released inmates may have biased the comparison, although the direction and extent of that bias is difficult to discern.

Across all specialties examined, the average waiting time to see a specialist was 99 days prior to telemedicine and 23 days after telemedicine was introduced, for those encounters the team was able to measure (see table 4.1). The greatest declines were in orthopedics and dermatology.

It is safe to attribute this improvement to telemedicine. The telemedicine demonstration was implemented frequently with clinics in several specialties, at reduced cost to the prisons. Increasing the frequency with which

Table 4.1 Average Waiting Time Between Referral and Initial Consultation With a Specialist, Before and After Introduction of Telemedicine, by Specialty

Specialty (All Prisons)	Before: Internal Consultations	Before: Average Waiting Time (Days)	Demonstration: Internal & Telemedicine Consultations	Demonstration: Average Waiting Time (Days)
Orthopedics	85	116	27	45
Psychiatry	39	17	98	10
Dermatology	25	166	40	44
All Specialties	149	99*	165	234*

* Weighted average.

specialists are available would naturally decrease waiting times. This effect could also have been achieved by increasing the frequency of local specialists' visits without relying upon telemedicine technology. There was no "supply constraint" on increasing use of local doctors, as the health services administrators at the three prisons agreed that their local visiting specialists would probably have been willing to come into the prisons more often. However, the prisons had to pay for the full cost of these visits by local specialists, but only for part of the telemedicine consultations. This no doubt created a special incentive to rely on remote sessions instead, and to do so frequently.

Quality of Specialists

In addition to more frequent specialist sessions and shorter waiting times, telemedicine offered prisons the opportunity to select physicians who would not otherwise be available. This feature could bring new and/or better quality care to the inmates.

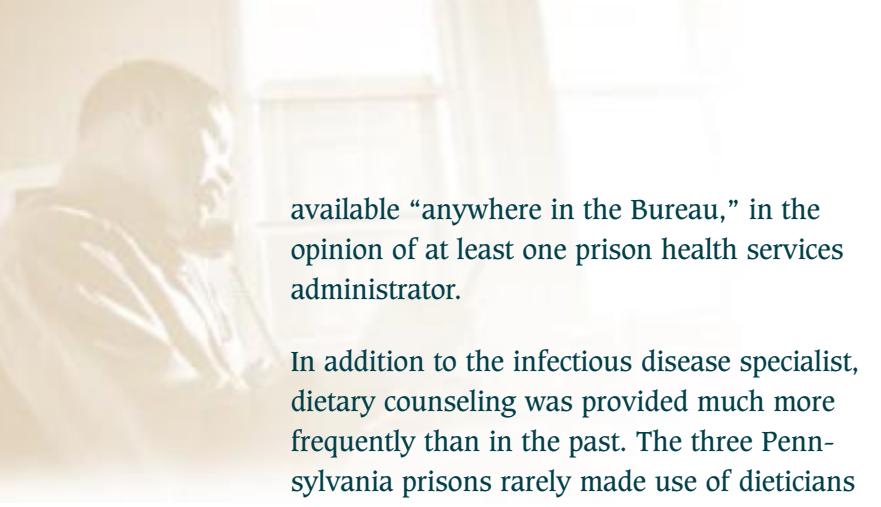
All three health services administrators at the Pennsylvania prisons agreed that the quality of psychiatric care was much improved with telemedicine. As a result, they either discontinued, or said that they intend to discontinue, contracts with local psychiatrists. The remote

psychiatrists reportedly offered several advantages:

- They were bilingual, a clear advantage when consulting with Spanish-speaking inmates.
- They were available by telephone as needed to revise medication orders.
- They were available via telemedicine on a weekly basis, and more often if needed.
- They reportedly had better medication management skills than did local psychiatrists under contract with the prisons.

Access to New Specialists

Some new clinicians not previously available to the prisons began to provide care via telemedicine. For example, HIV-positive inmates were previously cared for by prison staff physicians who did not have specialized training in infectious diseases. Because the standard of care in the community is to have specialists caring for HIV-positive patients, this pattern of care by general practitioners was not optimal. Through telemedicine, an infectious disease specialist became available and patients were able to receive the best care



available “anywhere in the Bureau,” in the opinion of at least one prison health services administrator.

In addition to the infectious disease specialist, dietary counseling was provided much more frequently than in the past. The three Pennsylvania prisons rarely made use of dieticians for counseling of hypertensive and diabetic patients. Because a dietician already on BOP’s staff was available via telemedicine at FMC-Lexington, the prisons made use of her skills and believed that their chronic care patients were getting better care as a result.

Acts of Violence and Use of Force

Some observers have hypothesized that the prisons were calmer, with fewer incidents of violence, because of the improved psychiatric care available through telemedicine. To test this hypothesis, the Bureau’s research division provided the research team with counts of incidents or acts of aggression (assaults) by inmates against either inmates or correctional officers—for the year preceding the demonstration and for the demonstration period—for each of the three Pennsylvania prisons.¹ Incident rates were compared using the monthly prison census as the denominator to account for differences in the size of the populations at each prison.

Major disturbances occurred in the prisons during a few months in the year preceding the demonstration and in the demonstration period. After removing the effect of these

unusual months, a pattern emerges. At the two Allenwood facilities, but not at USP-Lewisburg, there were significantly fewer acts of aggression per inmate-month during the demonstration period than in the preceding year.² The decline began before the demonstration was implemented but continued during the demonstration period.

Similarly, researchers obtained counts of incidents in which correctional officers used force to subdue an inmate or defuse a situation. These two measures—assaults and use of force—may at times be counting the same incident in two ways (once from the perspective of the guard and again from the perspective of the inmate), while at other times they indicate different events. At USP-Allenwood and FCI-Allenwood, use of force began declining well before the demonstration began—6 months before at FCI-Allenwood—and the new lower level continued throughout the demonstration. A new warden began service at FCI-Allenwood several months before the demonstration began, and her new practices regarding use of force may have contributed to the decline that was observed at that prison. In contrast, use of force increased slightly at USP-Lewisburg.

The research team concludes, with a 20-percent chance of measurement error, that fewer assaults occurred at the two Allenwood prisons after the demonstration began than in the prior year. It is possible that this decline was related to improved psychiatric care at the prisons, but it may also have been due to a combination of other factors that the team did not attempt to identify. Researchers also

¹ There were few homicides or suicides in any of the prisons—too few upon which to base any conclusion.

² Rather than the usual precision level of 0.05 or 0.10 (that is, a 5- to 10-percent chance that a finding happened due to chance alone), the research team chose a 0.20 precision level for this analysis. With small numbers of very important events, the team believes it is appropriate to accept more risk of measurement error to be able to observe a change over time.

conclude that although use of force by guards declined at the Allenwood prisons, the decline preceded telemedicine by several months and was probably unrelated. Because neither pattern was observed at USP-Lewisburg, the team is unable to draw any consistent conclusion about the value of telemedicine or telepsychiatry in improving the social climate of the demonstration prisons.

Grievances

Inmates can file grievances about many different aspects of prison services and can file them at the institutional, regional, or national levels. Grievances could therefore be considered a measure of patient satisfaction. Data were obtained from BOP on all new grievances filed each month during the year preceding the demonstration and during the demonstration period, and grievances about medical and mental health care were analyzed. Researchers were interested in testing two competing hypotheses: that patient satisfaction improved with telemedicine, leading to fewer grievances; or that patient satisfaction deteriorated with telemedicine, leading to more grievances.

The data indicate that although inmates complained about many aspects of prison life, they did not file many grievances about their medical or mental health services. No statistically significant difference was found in the rate of

grievances filed during the demonstration and during the preceding 12 months.

Summary

Low-cost telemedicine sessions offered frequently reduced waiting times for all specialties analyzed. It is possible that the same reduction in waiting time could have been achieved with local in-person physicians, but the individual prisons had little incentive to do so.

At least one important new specialty is now available to inmates via telemedicine to which they would otherwise not have access: infectious disease expertise for care of HIV-positive inmates.

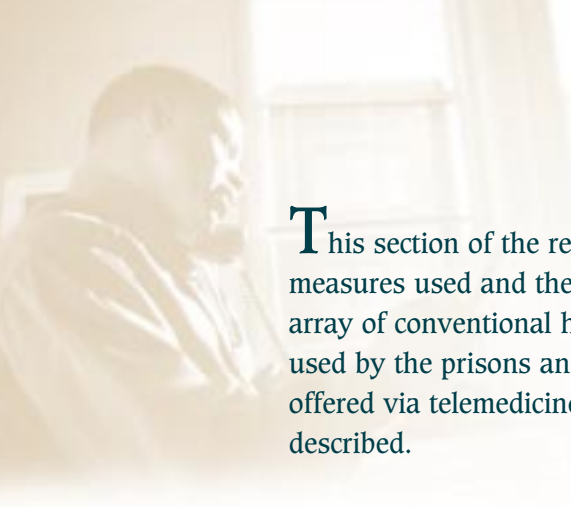
Aggressive acts by inmates seem to have declined at two demonstration prisons coincident with the introduction of telemedicine, but not at the third. Use of force by officers began to decline at the same two prisons well before telemedicine began but did not decline at the third. It cannot be concluded, therefore, that there was a consistent “calming” effect due to improved psychiatric care via telemedicine.

There were no significant changes in the number of grievances filed about medical or mental health care.

Appendix A:

Measures and Data





This section of the report describes the key measures used and the sources of data. The array of conventional health care services used by the prisons and the new services offered via telemedicine are defined and described.

Internal Specialist Encounters

Specialist physicians, generally working under contract to the Bureau of Prisons, periodically come into prisons to provide care to inmates. For this report, such contacts between a specialist and a patient are termed “internal specialist encounters”; the session during which a group of patients is seen by a specialist inside the prison is termed a “clinic.”

Service utilization is characterized not by type of diagnosis but rather by the specialty of the consulting specialist. This is done for several reasons: The Bureau’s automated medical data system—the Sensitive Medical Data (SMD)—is not reliable at the diagnosis level; there were insufficient numbers of encounters in any diagnosis category to support analyses at this level; and the costs for internal specialty clinics vary by specialist rather than by the type of case he or she treats.

The Bureau’s SENTRY data system collects information on many events in an inmate’s incarceration, including health care events. Every visit to a health professional, whether a Bureau employee, a consulting specialist, or a community hospital, is recorded. These paper records are then entered into a computerized database, which forms the SMD system. Although prisons do not enter data in exactly the same way, the contents of each SMD record generally include the following information:

- The date and time of the medical encounter.
- The type of clinician seen (physician, physician assistant, nurse practitioner, visiting specialist, external specialist).
- An International Classification of Diseases, 9th Revision (ICD–9) code classifying the medical condition involved.

Identifying the consulting physician’s specialty required some data analysis and inference because this information is not recorded in the SMD. By grouping ICD–9 codes, it is possible to infer the specialty of a consulting physician. Generally, if more than one ICD–9 code is indicated on the form, prison staff create separate records for each ICD–9 code rather than entering multiple ICD–9 codes in one record. For internal specialist encounters, the visiting specialist always sees more than one patient in a clinic. By grouping records chronologically and then by inmate identification number, the type of specialist consulting and the number of encounters (that is, the number of individual inmates seen) can be inferred. Medical records occasionally are needed for definitive inferences about the specialty of a visiting physician.

This report focuses on four specialties: psychiatry, orthopedics, dermatology, and cardiology. These specialties were selected for the following reasons:

- They can be identified in the SMD—some clinical sessions (for example, dietary counseling) were not recorded prior to the telemedicine demonstration, and others (for example, podiatry) cannot be extracted from SMD as a defined specialty.
- Each of the four specialties is being provided under contract with a visiting

specialist by one or more of the demonstration prisons.

- These four specialties are being offered using telemedicine, which might be expected to alter the patterns of internal encounters in these specialties.

Clinical staff employed at each prison also provide care, which can generally be categorized as primary care (although some facilities employ psychiatrists). Care provided by BOP employee clinicians was not analyzed for several reasons. First, SMD data are unreliable for clinician type; encounters with physician assistants cannot reliably be distinguished from encounters with physicians. Second, physician assistants run regular group sessions with inmates with chronic care problems—for example, hypertension counseling with cardiac patients. These appear in the SMD as individual encounters and not as the group sessions they really are; therefore, individual encounters between employee clinicians and patients cannot reliably be counted. Finally, these visits with staff clinicians are for primary care and occasionally result in referrals to specialists, including remote specialists. The primary care encounters are a prelude to specialist care, not a substitute for it. (Primary care is not being offered telemedically.) For all of these reasons, the analysis omits analysis of care provided by Bureau-employed clinicians.

Internal Specialist Encounters: Costs

Data source: Specialist contracts and bills.

Physician fees. Each prison contracts with specialists who come into the prison to see inmates; the specialties vary among prisons but include psychiatry, orthopedics,

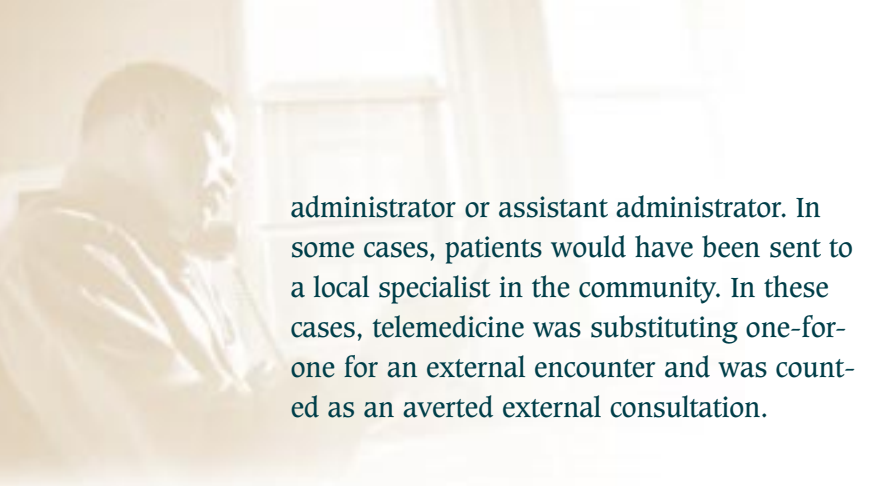
dermatology, and cardiology. Care that requires a specialist physician not employed by the Bureau at that prison and that can be provided inside the prison is nearly always handled by these visiting specialists. Contracts are generally negotiated on a per-clinic basis, with broad guidelines about the duration of each clinic (for example, 2–4 hours per clinic). That is, the specialist is paid a flat fee for each prison visit. The negotiated fees charged by specialists at the studied prisons were obtained. For purposes of determining the physician-fee portion of each patient's care, the flat, per-clinic rate a specialist has negotiated divided by the number of patients seen during each clinic was used.

Other. Other costs associated with internal specialist encounters are not as readily measured. These include pulling medical records and refiling them afterward and the costs of a physician assistant who accompanies the specialist during all encounters and follows through on all physician orders. The largest component of these costs is the physician assistant's time. Physician assistant and administrative costs did not change between baseline and intervention periods and have essentially equivalent counterpart costs for telemedicine clinics when a physician assistant presents each case to the remote specialist.

External Specialist Encounters Averted

Data source: Telemedicine encounter forms.

Site coordinators collected data during each telemedicine encounter. One item asked what would have happened in the absence of telemedicine. This information was supplied by the physician assistant presenting the case and verified later by the health services



administrator or assistant administrator. In some cases, patients would have been sent to a local specialist in the community. In these cases, telemedicine was substituting one-for-one for an external encounter and was counted as an averted external consultation.

Averted External Specialist Encounters: Costs

Data sources: Invoices and other financial records at each prison and administrative cost analysis conducted by Ronald Waldron and Al Turner.

The cost of external encounters was computed as the estimated cost of the specialist medical care, security, and other administrative costs incurred when an inmate goes outside the prison to a local health care provider. Assembling these costs required a set of cases to examine. External encounters in the year preceding the demonstration that might have been appropriate for telemedicine were identified. For each of these, several cost elements were collected.

Security/escort. At the Allenwood prisons, guards accompanying inmates on trips to local physicians are always paid time-and-a-half overtime; these overtime charges were obtained from the finance office of each prison for all external encounters of interest. At Lewisburg, staff are assigned to escort duty as regular employees (that is, no overtime); the average number of hours per trip and the number and Government Service levels of guards (average salary and benefits) were calculated to estimate security escort costs. A physician assistant always accompanies the inmate on external specialist encounters, and the cost of this individual (average hourly salary and benefits) was included.

Medical care. These data are taken directly from invoices and payments for each external specialist encounter.

Other. Mr. Waldron and Mr. Turner conducted a cost analysis at USP-Florence, Colorado, to calculate the time involved in processing an external specialist encounter, reviewing security needs, approvals, etc. The time and cost they calculated per external encounter are applied here to all such encounters, at all prisons.

With these data, an average cost of external encounters was estimated and applied to the number of directly avoided external encounters, to estimate total savings associated with such averted consultations.

Psychiatric Transfers Averted

Data source: SENTRY Admissions and Release Status (ARS) data.

When an inmate requires extensive care and cannot be maintained in the general population of the prison, he or she is usually transferred to one of several Federal Medical Centers. Inmates travel to the FMC by bus or air via the U.S. Marshals Service or by chartered aircraft. The latter is the method most commonly used for transfers of maximum-security inmates with psychiatric problems.

Every time an inmate's designation is changed (that is, when he or she moves from one location to another), prison staff create an entry in the ARS portion of SENTRY. Some movements occur from one unit to another within a prison; others occur from one facility to another. For this demonstration, it became apparent almost immediately that transfers of

psychiatric patients to FMCs were declining, as telemedicine improved the psychiatric care being provided in the prisons. Psychiatric transfers were therefore the focus of this analysis.

Bureau programmers supplied the research team with a file listing all inmates who had spent any time at demonstration or comparison prisons during the year preceding the demonstration and during the demonstration itself, and their ARS records for these periods. From these a chronology of events was created for each inmate, and transfers of inmates from a prison to an FMC were identified. ARS coding allowed identification of those transfers to FMCs for psychiatric care. The ARS coding also permitted distinction among transport modes.

Psychiatric Transfers Averted: Costs

Data source: Airbills and escort costs from prison financial records.

There are several cost elements for transfers to FMCs.

Air charter. At the demonstration prisons, air charter bills and security escort costs were collected for each psychiatric transfer to an FMC. Each flight was round-trip because the plane and crew needed to return. If two inmates were being transferred on the same flight for psychiatric care, the cost was distributed evenly between the two cases; thus a flight with two inmates had half the cost per inmate as a flight with one inmate. Some inmates remain at the FMC for a long time and others return to their initial prison or are relocated to another facility. These returns or relocations happen in a variety of less costly ways (commonly by

bus) and are not included in the costs of transfers.

Security/escort. Each flight, in addition to the aircrew, includes an array of guards and a physician assistant. Actual costs for all of these participants were included where records existed; for transfers lacking data, an average based on the existing data was used.

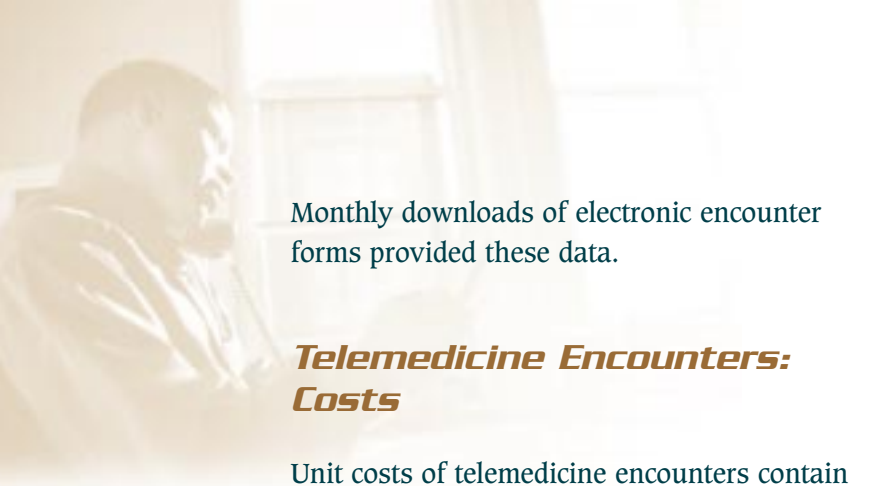
Other. Finally, because a transfer also involves considerable review and approval by prison officials, these costs for transfers were included, as were costs for external encounters (see above), in the calculation of unit costs.

Telemedicine Encounters

Data source: Encounter data collected by telemedicine site coordinators.

As stated previously, telemedicine site coordinators collected and entered a variety of information for each telemedicine encounter. These data included the following information:

- Date and time of each patient's telemedicine encounter, including time begun and time concluded.
- Specialty of the consulting physician.
- Likely action if the telemedicine encounter had not occurred (that is, the health service administrator's judgment about what alternative care would have been provided).
- Subsequent care required (namely, the specialist's orders for patient care).



Monthly downloads of electronic encounter forms provided these data.

Telemedicine Encounters: Costs

Unit costs of telemedicine encounters contain many elements.

Physician reimbursement. The Department of Veterans Affairs negotiated an hourly reimbursement rate for specialists providing care telemedically. The rate reflected the *actual* cost to the VA of a physician's salary plus expenses. The duration of each encounter in minutes was multiplied by the per-minute cost of the relevant specialist. For telepsychiatry encounters, where Bureau-employed psychiatrists at FMC-Lexington were providing care, psychiatrists' salaries, fringe benefits, and bonus payments were calculated at the hourly and per-minute level.

Equipment, personnel, and telecommunications costs. Tracor Systems Technologies, Inc., supplied costs of equipment leases, personnel (for example, site coordinators), and communications. These costs included hub and remote costs because both were necessary for each telemedicine encounter. These costs were calculated for each site at the hourly and per-minute level and multiplied by the duration of each telemedicine encounter.

Security/escort. Inmates from FCI-Allenwood were transported to USP-Allenwood for telemedicine sessions. This involved the same security and approval process as an external specialist encounter, although the escort array was minimized because the necessary guards on the transport bus were moving a number of inmates at the same time.

Other. A physician assistant accompanied each patient during an encounter, as was done for internal specialist encounters, and performed other tasks such as pulling and refiling medical records.

Waiting Time

Data sources: SMD, paper records, and telemedicine data.

Waiting time was calculated as the interval between the date of a referral to a specialist and the date the patient-specialist encounter actually occurred. For the period preceding the demonstration, SMD data were used to identify the first encounter between an inmate and a given type of specialist (for example, an orthopedist). Because data extended 6 months prior to this baseline period, the first encounter could be determined with some precision. SMD does not contain a field for referral date, but the consult referral form in an inmate's medical record has a space for the referral date. This was the source used to identify referral dates for the predemonstration period, from which the interval between referral and first encounter was calculated.

Only waiting times for the *first* encounter between an inmate and a specialist were computed because specialists often order followup visits on specific dates—for example, to return for followup in 3 weeks. The research team did not have access to all of these orders to see if they were followed, but it would be incorrect to label that 3-week wait as a delay, for it may be the proper interval between encounters. By focusing instead on the time to the *first* encounter, a more accurate representation of the accessibility of specialist services is obtained. Intervals between referral and

external encounters were not computed because there were very few telemedicine-substitutable external encounters to consider, and many of those medical records were no longer available.

Inmates relocate often within BOP prisons, and their medical records travel with them. By the time the research team arrived to look through medical records, a year had passed since the start of the predemonstration period and many medical records were no longer available. For those records that could be found, the referral date was entered on some but not all forms. There were very few observations for many specialties at each prison. Only a few specialties at each prison had sufficient data for the predemonstration period to warrant a comparison with the demonstration period. The data presented are for those specialties for which calculated waiting time was based on more than a handful of cases. During the demonstration period, some internal encounters continued; their referral dates were collected and waiting times calculated in this same manner.

For telemedicine encounters, researchers initially planned to use the same approach: relying on medical records as the source for referral dates. When the research team realized how problematic this strategy was proving to be for the internal encounter referral dates, the telemedicine site coordinators began collecting referral dates on the telemedicine encounter forms. This referral date was used to calculate waiting time for the first encounter between a remote specialist and an inmate.

Incidents and Grievances

BOP data were obtained on the following:

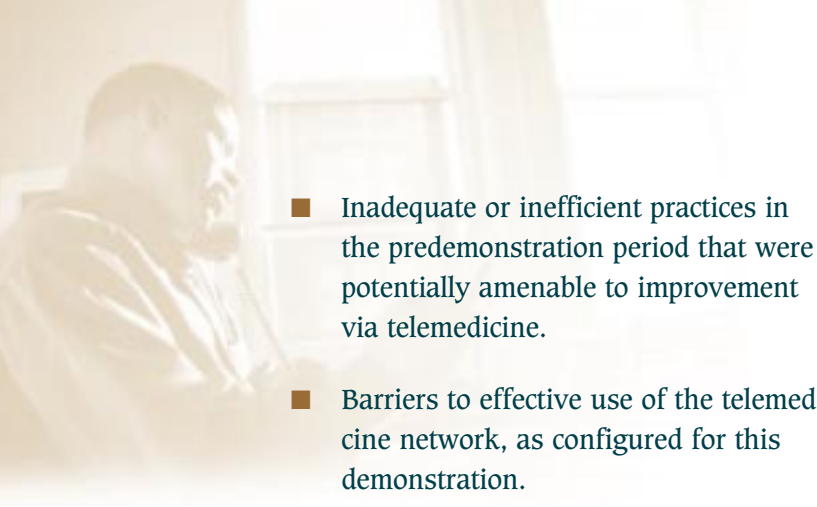
- Monthly counts, by prison, of incidents in which inmates assaulted other inmates or corrections officers and whether a weapon was used.
- Monthly counts, by prison, of uses of force by corrections officers.
- Monthly counts, by prison, of homicides and suicides.
- Monthly counts, by prison, of grievances filed complaining about medical or mental health care.
- The monthly census for each prison.

All of these measures were obtained for both the predemonstration and demonstration periods. Rates were created using facility census figures, and differences in rates between the predemonstration and the demonstration periods were tested.

Descriptive Information

To assist in the interpretation of the data obtained, prison staff were interviewed to discuss the following matters:

- Context of conventional health services delivery at each prison, in the predemonstration and demonstration periods.



- Inadequate or inefficient practices in the predemonstration period that were potentially amenable to improvement via telemedicine.
- Barriers to effective use of the telemedicine network, as configured for this demonstration.
- Clinical feasibility for various specialties.
- Other constraints that affected the cost-effectiveness of the demonstration.

Appendix B:

Cost Estimation Model





A simulation model was developed to estimate the costs of telemedicine and conventional care under various scenarios, both observed and hypothetical, and to distinguish the effects of changes in utilization patterns from different equipment and operations costs of telemedicine. That is, the model accurately reproduces the observed monthly operating costs of the telemedicine demonstration. In addition, by changing model assumptions, it shows how costs would vary with different telemedical equipment and personnel, different prices for resources, and different numbers of patients seen by telemedicine.

Costs per patient are estimated separately for telemedicine and conventional care. The relative costs of telemedicine and conventional care are assessed by comparing one model estimate of the cost per patient encounter of conventional care absent telemedicine with another estimate for per-encounter costs of telemedicine. Finally, a third model estimate of per-encounter telemedicine costs might be obtained if telemedicine were implemented in the same three Pennsylvania prisons on a permanent, rather than experimental, basis. The general model is expressed by equation B.1.

The equations exclude several costs of medical care that are the same in the two systems. Only care that differs between telemedicine and conventional care is modeled. The equation does not explicitly mention a time period because it is valid for any consistently defined accounting period. The costs discussed in this

report are allocated monthly, unless otherwise stated.

Each term in this equation is explained in the sections that follow.

Capital Costs

Capital costs are counted only for telemedicine because the other capital investments required of conventional consultations remain unchanged after the introduction of telemedicine. The equation for capital costs converts fixed investments into monthly values by depreciation. (See equation B.2.)

This substantially exceeds the cost anticipated for any larger scale use of telemedicine. Of the available alternative values for this cost, researchers chose the lowest—that proposed by the vendor for renewal of the lease after the initial commitment period has expired—because it most nearly represents the long-term cost of a large-scale implementation of telemedicine in many prisons.

These elements reflect costs that telemedicine imposes on the system even before the first patient sees a specialist. The largest of these fixed costs is the monthly lease for the telemedicine equipment itself. Telemedicine equipment for the demonstration was leased but could have been purchased. The model is used to estimate costs for equipment lease and then separately for equipment purchase, to test the impact of these different strategies for securing costly equipment. During the 15

Equation B.1

$$\text{cost per patient} = \frac{\text{amortized capital costs} + \text{operating costs} + \text{cost of transfers to FMCs} + \text{cost of external consultations} + \text{cost of internal consultations}}{\text{patients}}$$

Equation B.2

$$\begin{array}{ccccccc} \text{amortized} & & \text{installation} & & \text{equipment} & & \text{fixtures} \\ \text{capital} & = & \text{depreciated} & + & \text{depreciated} & \text{or} & \text{depreciated} \\ \text{costs} & & \text{over 20} & & \text{over 10} & \text{equipment} & \text{over 10} \\ & & \text{years} & & \text{years} & \text{leases} & \text{years} \\ & & & & & + & \text{training} \\ & & & & & & \text{depreciated} \\ & & & & & & \text{over 5 years} \end{array}$$

months of the demonstration period, \$356,047 was paid to lease the equipment used for the demonstration.

Had this not been an experimental demonstration of telemedicine, the equipment could have been purchased for approximately \$73,000 per site. When the model is used to simulate telemedicine with purchased equipment, the initial investment is translated into a monthly cost by straight-line depreciation over a 10-year useful life.¹

Fixed Operating Costs of Telemedicine

Fixed operating costs include those incurred by the site regardless of the volume of medical care delivered, as distinct from those that increase directly with each encounter. Fixed operating costs are expressed by equation B.3.

These operating costs are counted only for telemedicine, not for conventional care, because they remain unchanged by the introduction of telemedicine. Data on these costs were supplied directly by Tracor Systems Technologies, Inc., which also supplied

assumptions about how the costs might change in actual use as opposed to this experimental demonstration.

Transfers to Federal Medical Centers

When prisoners are transferred to Federal Medical Centers for psychiatric care, the costs of transportation and security for the transfer are included. The incremental cost of housing prisoners at the relatively more expensive medical center, rather than in ordinary prisons, is measured but not included. These transfers occurred under both telemedicine and conventional care, although there were fewer under telemedicine. The total costs of all transfers of psychiatric patients are therefore counted in equations for both conventional and telemedicine consultations. (See equation B.4.)

In the basic model, the per diem costs at Federal Medical Centers are assumed to be zero. That is, no additional housing costs at FMCs, as opposed to U.S. penitentiaries, are included.

Equation B.3

$$\begin{array}{ccccccc} \text{operating} & & \text{site operating} & & \text{voice} & & \text{personnel} \\ \text{costs} & = & \text{costs} & + & \text{telephone} & + & \text{costs} \end{array}$$

¹ In this and other accounting assumptions, the standards of OMB circular A-76 were followed.

Equation B.4

$$\text{cost of transfers to FMCs} = \text{number of patients transferred} * \left(\text{cost of transfer} + \text{difference in per diem costs} * \text{length of stay in FMC} \right)$$

External Consultations

Trips to local hospitals are treated similarly, except for reliance on reports from the prisons that identified telemedicine patients who would otherwise have been sent to a hospital. In the conventional care cost equation, patients who visit specialists in the local community are charged the full cost of an external consultation. Because it is assumed that all of these external consultations are averted by telemedicine, each external consultation in the telemedicine equation is replaced by the estimated telemedicine cost for the appropriate specialty. (See equation B.5.)

Cost of Direct Internal and Telemedical Consultations

The capital and operating costs associated with both conventional and telemedicine consultations must be paid regardless of the number of specialist encounters once telemedicine is introduced. The costs of in-prison or telemedical specialist consultations, however, are paid only when a patient sees a specialist directly or remotely. Both telemedicine and conventional medicine must pay specialists.

Telemedicine specialists are paid by the hour, and specialist costs for telemedicine are calculated on the basis of average length of telemedicine sessions. Conventional, in-prison specialists are paid each time they enter the prison, regardless of how many patients they see. With data on the number of patients seen by each specialist each time they come to the prison, an average physician cost per conventional care patient encounter was calculated.

Telemedicine incurs additional costs for the telecommunications line, which again varies by the length of each call; these costs are accounted for by the hour. Also included are small costs for the physician assistants who present the case to the remote specialist and for correctional officers who escort patients from FCI-Allenwood to USP-Allenwood for teleconsultations.

The costs that accrue to each conventional internal or telemedical consultation between a specialist and an inmate are represented in equation B.6.

The last two terms in this equation are zero for conventional care because communication and extra personnel costs exist only for telemedicine consultations.

Equation B.5

$$\text{cost of external consultations} = \text{number of external consultations} * \left(\text{cost of transfer} + \text{cost of medical care} \right)$$

Equation B.6

$$\text{cost of internal or telemedical consultations} = \text{number of patients} * \left(\text{specialist costs} + \text{telemedicine communications costs} + \text{telemedicine personnel costs} \right)$$



Appendix C:

Data Tables



Table C.1 Number of Telemedicine Encounters per Month, by Specialty and Facility*

Specialty	Facility	Number of Patients												Total	Percent				
		1996						1997											
		Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.			Sept.	Oct.	Nov.	Dec.
Podiatry	Lexington	-	-	-	-	-	-	4	-	6	-	7	11	15	9	10	-	62	4.69%
	Specialty Subtotal	-	-	-	-	-	-	4	-	6	-	7	11	15	9	10	-	62	
Orthopedics	FCI-Allenwood	-	-	4	3	3	-	-	4	-	-	-	-	-	-	-	-	14	10.67%
	USP-Allenwood	-	4	10	6	-	2	-	4	-	9	4	7	-	-	-	4	50	
	Lewisburg	-	-	-	-	-	6	3	5	4	2	3	11	-	-	3	6	43	
	Lexington	-	-	-	-	-	2	5	-	3	4	5	2	6	-	4	3	34	
	Specialty Subtotal	-	4	14	9	3	10	8	13	7	15	12	20	6	-	7	13	141	
Dermatology	FCI-Allenwood	-	1	1	1	5	-	-	-	-	-	5	4	-	-	4	-	21	13.32%
	USP-Allenwood	2	4	4	4	3	3	-	4	5	-	6	4	4	2	5	-	50	
	Lewisburg	-	-	-	-	-	3	4	2	4	9	16	14	3	7	9	16	87	
	Lexington	-	-	-	-	-	-	-	-	5	3	-	-	3	2	-	5	18	
	Specialty Subtotal	2	5	5	5	8	6	4	6	14	12	27	22	10	11	18	21	176	
Infectious Diseases	FCI-Allenwood	-	-	-	-	-	-	4	4	-	-	-	-	-	-	-	-	8	1.51%
	USP-Allenwood	-	-	-	-	-	-	1	-	2	-	-	-	4	-	3	2	12	
	Specialty Subtotal	-	-	-	-	-	-	5	4	2	-	-	-	4	-	3	2	20	
Pulmonology	FCI-Allenwood	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	3	0.91%
	USP-Allenwood	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	
	Lexington	-	-	-	-	-	-	-	-	-	3	-	-	-	3	2	-	8	
	Specialty Subtotal	-	-	-	-	-	-	-	3	1	3	-	-	-	3	2	-	12	
Cardiology	USP-Allenwood	-	-	-	-	-	-	-	4	-	-	1	-	-	-	-	-	5	1.36%
	Lewisburg	-	-	-	-	-	-	-	-	1	-	1	1	1	-	3	1	8	
	Lexington	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	3	5	
	Specialty Subtotal	-	-	-	-	-	-	-	4	1	-	4	1	1	-	3	4	18	

Table C.1 Number of Telemedicine Encounters per Month, by Specialty and Facility* (Continued)

Specialty	Facility	Number of Patients												Total	Percent				
		1996						1997											
		Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.			Sept.	Oct.	Nov.	Dec.
Gastroenterology	USP-Allenwood	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	
	Lewisburg	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	7	
	Lexington	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	
	<i>Specialty Subtotal</i>	-	-	-	-	-	-	-	1	-	5	-	-	-	-	2	1	9	0.68%
Ear, Nose, & Throat	Lewisburg	-	-	-	-	-	-	-	1	-	2	-	4	3	3	3	3	16	
	<i>Specialty Subtotal</i>	-	-	-	-	-	-	1	-	2	-	4	3	3	3	3	3	16	1.21%
	Lewisburg	-	-	-	-	-	-	-	-	-	-	-	3	1	3	3	3	11	
Neurology	<i>Specialty Subtotal</i>	-	-	-	-	-	-	-	1	-	-	-	3	1	3	3	3	11	0.83%
	FCI-Allenwood	8	10	17	9	12	15	18	17	15	20	13	17	32	8	17	17	234	
	USP-Allenwood	11	21	16	9	22	16	20	27	11	15	19	24	17	16	27	27	278	
	Lewisburg	-	-	-	-	5	20	13	31	22	29	24	23	23	21	23	23	260	
Psychiatry	<i>Specialty Subtotal</i>	19	31	33	18	39	51	51	75	48	53	56	64	72	45	67	772	58.44%	
	FCI-Allenwood	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	
	USP-Allenwood	-	-	-	-	-	-	6	-	7	-	5	4	4	4	-	-	30	
	Lewisburg	-	-	-	-	-	-	11	10	8	9	7	-	-	-	-	-	53	
Dietary	<i>Specialty Subtotal</i>	-	-	-	-	-	-	17	10	15	10	12	4	4	4	3	84	6.36%	
	Monthly Totals	21	40	52	32	50	67	89	116	96	115	122	111	103	100	117	1,321		

Source: Tracor Systems Technologies, Inc.

*The facilities not listed under a particular specialty received no telemedicine services for that specialty during the demonstration period.

Table C.2 Number of Conventional, In-Prison Specialist Encounters per Month in Three Pennsylvania Prisons During the Predemonstration Period (Principal Specialties Only)*

Specialty	Facility	Number of Patients												Total
		1995						1996						
		Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.		
All Specialties	FCI-Allenwood	8	10	17	17	8	17	6	19	17	17	13	149	
	USP-Allenwood	-	-	8	1	-	5	3	4	19	19	30	109	
	Lewisburg	30	18	23	69	65	87	73	69	20	51	37	542	
	<i>Specialty Subtotal</i>	38	28	48	87	73	109	82	92	76	87	80	800	
Cardiology	USP-Allenwood	-	-	-	1	-	-	3	4	-	-	-	8	
	<i>Specialty Subtotal</i>	-	-	-	1	-	-	3	4	-	-	-	8	
Psychiatry	FCI-Allenwood	8	10	9	7	8	17	6	12	17	17	6	117	
	USP-Allenwood	-	-	8	-	-	-	-	-	26	16	19	69	
	Lewisburg	30	4	10	42	48	51	46	23	3	11	-	268	
	<i>Specialty Subtotal</i>	38	14	27	49	56	68	52	35	46	44	25	454	
Orthopedics	FCI-Allenwood	-	-	8	10	-	-	-	7	-	-	7	32	
	USP-Allenwood	-	-	-	-	-	5	-	-	13	3	11	32	
	Lewisburg	-	14	13	27	12	24	16	26	17	27	33	209	
	<i>Specialty Subtotal</i>	-	14	21	37	12	29	16	33	30	30	51	273	
Dermatology	Lewisburg	-	-	-	-	5	12	11	20	-	13	4	65	
	<i>Specialty Subtotal</i>	-	-	-	-	5	12	11	20	-	13	4	65	

Sources: Computed from Bureau of Prisons' Sensitive Medical Data and inmate medical records.

*The facilities not listed under a particular specialty received no conventional consultations for that specialty during the predemonstration period.

Table C.3 Number of Conventional, In-Prison Specialist Encounters per Month in Three Pennsylvania Prisons During the Demonstration Period
(Principal Specialties Only)*

Specialty	Facility	Number of Patients												Total					
		1996						1997											
		Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.		Sept.	Oct.	Nov.	Dec.	
All Specialties	FCI-Allenwood	21	-	9	-	-	-	-	-	-	-	-	-	7	11	-	-	-	48
	USP-Allenwood	27	14	23	25	20	13	30	18	-	12	-	-	12	-	14	28	9	245
	Lewisburg	32	26	4	-	28	16	23	16	4	22	21	7	29	7	16	3	29	276
	<i>Specialty Subtotal</i>	80	40	36	25	48	29	53	34	4	34	21	48	18	30	31	38	569	
Cardiology	USP-Allenwood	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	5	9
	Lewisburg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	6
	<i>Specialty Subtotal</i>	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	11	15
Psychiatry	FCI-Allenwood	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13
	USP-Allenwood	9	-	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
	Lewisburg	-	-	-	-	2	-	-	-	-	-	-	6	-	-	-	-	-	8
	<i>Specialty Subtotal</i>	22	-	7	-	2	-	-	-	-	-	-	6	-	-	-	-	-	37
Orthopedics	FCI-Allenwood	8	-	9	-	-	-	-	-	-	-	-	7	11	-	-	-	-	35
	USP-Allenwood	15	14	14	25	20	13	30	18	-	8	-	12	-	14	28	4	215	
	Lewisburg	24	14	4	-	26	16	16	16	-	22	17	17	-	16	3	13	204	
	<i>Specialty Subtotal</i>	47	28	27	25	46	29	46	34	-	30	17	36	11	30	31	17	454	
Dermatology	USP-Allenwood	3	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
	Lewisburg	8	12	-	-	-	-	7	-	4	-	4	6	7	-	-	10	58	
	<i>Specialty Subtotal</i>	11	12	2	0	0	0	7	0	4	0	4	6	7	0	0	10	63	

Sources: Computed from Bureau of Prisons' Sensitive Medical Data and inmate medical records.

*The facilities not listed under a particular specialty received no conventional consultations for that specialty during the demonstration period.

Table C.4 Conventional, In-Prison Specialist Consultations: Medical and Indirect Expenditures at Three Pennsylvania Prisons During the Predemonstration Period (Principal Specialties Only)

Prison	Specialty	Average Clinics per Month	Other Cost per Clinic	Medical Cost per Clinic	Sum of Encounters	Average Encounters per Month	Average Encounters per Clinic	Total Cost per Clinic*	Average Cost per Encounter
USP-Lewisburg	Psychology	2.00	\$180.15	\$360.00	267	22.25	11.13	\$540.15	\$48.55
	Orthopedics	1.58	\$180.15	\$1,500.00	209	17.42	11.00	\$1,680.15	\$152.74
	Dermatology	0.58	\$180.15	\$1,140.00	65	5.42	9.29	\$1,320.15	\$142.17
USP-Allenwood	Cardiology	0.25	\$180.15	\$750.00	8	0.67	2.67	\$930.15	\$348.81
	Psychology	0.42	\$180.15	\$400.00	69	5.75	13.80	\$580.15	\$42.04
	Orthopedics	0.33	\$180.15	\$1,400.00	32	2.67	8.00	\$1,580.15	\$197.52
	Dermatology	0.00	\$180.15	\$1,500.00	0	N/A	N/A	\$1,680.15	N/A
FCI-Allenwood	Psychology	1.17	\$180.15	\$600.00	117	9.75	8.36	\$780.15	\$93.35
	Orthopedics	0.33	\$180.15	\$1,200.00	32	2.67	8.00	\$1,380.15	\$172.52
All Facilities	Cardiology	0.25	\$180.15	\$750.00	8	0.67	2.67	\$930.15	\$348.81
	Psychology	3.58	\$180.15	\$442.79	453	37.75	10.53	\$622.94	\$59.13
	Orthopedics	2.25	\$180.15	\$1,440.74	273	22.75	10.11	\$1,620.89	\$160.31
	Dermatology	0.58	\$180.15	\$1,140.00	65	5.42	9.29	\$1,320.15	\$142.17

Sources: Computed from Bureau of Prisons' Sensitive Medical Data, billing records, inmate medical records, interviews with prison staff, and Bureau wage data for the Pennsylvania region.

*Total cost per clinic (medical and other) changed between the predemonstration and demonstration time periods for conventional, in-prison specialist consultations. These changes were relatively small. There were, however, large changes over time in cost per conventional encounter, primarily caused by changes in the number of inmates per clinic. Specialists are paid a flat fee per clinic, regardless of the number of patients seen. The number of patients per clinic during the demonstration period increased in cardiology and orthopedics, lowering the cost per inmate. Conversely, the number of patients per clinic during the demonstration period decreased for dermatology and psychiatry, increasing the cost per inmate.

Table C-5 Conventional, In-Prison Specialist Consultations: Medical and Indirect Expenditures at Three Pennsylvania Prisons During the Demonstration Period (Principal Specialties Only)

Specialty	Prison	Number of Clinics	Other Cost per Clinic	Medical Cost per Clinic	Sum of Encounters	Average Encounters per Month	Average Encounters per Clinic	Total Cost per Clinic*	Average Cost per Encounter
USP-Lewisburg	Psychology	2	\$180.15	\$360.00	8	0.67	4.00	\$540.15	\$135.04
	Orthopedics	17	\$180.15	\$1,600.00	186	15.50	10.94	\$1,780.15	\$162.72
	Dermatology	7	\$180.15	\$1,200.00	46	3.83	6.57	\$1,380.15	\$210.02
USP-Allenwood	Cardiology	2	\$180.15	\$500.00	9	0.60	4.50	\$680.15	\$151.14
	Psychology	2	\$180.15	\$475.00	16	1.07	8.00	\$655.15	\$81.89
	Orthopedics	18	\$180.15	\$1,400.00	215	14.33	11.94	\$1,580.15	\$132.29
	Dermatology	2	\$180.15	\$1,500.00	5	0.33	2.50	\$1,680.15	\$672.06
FCI-Allenwood	Psychology	2	\$180.15	\$600.00	13	0.87	6.50	\$780.15	\$120.02
	Orthopedics	5	\$180.15	\$1,400.00	35	2.33	7.00	\$1,580.15	\$225.74
All Facilities	Cardiology	2	\$180.15	\$500.00	9	0.60	4.50	\$680.15	\$151.14
	Psychology	6	\$180.15	\$478.33	37	2.60	6.17	\$658.48	\$106.78
	Orthopedics	40	\$180.15	\$1,485.00	436	32.17	10.90	\$1,665.15	\$152.77
	Dermatology	9	\$180.15	\$1,266.67	51	4.17	5.67	\$1,446.82	\$255.32

Sources: Computed from Bureau of Prisons' Sensitive Medical Data, billing records, inmate medical records, interviews with prison staff, and Bureau wage data for the Pennsylvania region.

*Total cost per clinic (medical and other) changed between the predemonstration and demonstration time periods for conventional, in-prison specialist consultations. These changes were relatively small. There were, however, large changes over time in cost per conventional encounter, primarily caused by changes in the number of inmates per clinic. Specialists are paid a flat fee per clinic, regardless of the number of patients seen. The number of patients per clinic during the demonstration period increased in cardiology and orthopedics, lowering the cost per inmate. Conversely, the number of patients per clinic during the demonstration period decreased for dermatology and psychiatry, increasing the cost per inmate.

Table C.6 Estimated Costs of Bus Transportation From FCI-Allenwood to USP-Allenwood for Telemedical Consultations During the Demonstration Period

Staff Type	Salary Grade	Hours per Session	Rate Without Fringe	Fringe Rate	Average Costs ¹
Officer	GS-7	4	\$13.82	\$5.87	\$106.44
Officer	GS-8	4	\$15.32	\$6.51	\$117.97
Average Cost per Clinic	N/A	N/A	N/A	N/A	\$112.20
Average Monthly Cost²	N/A	N/A	N/A	N/A	\$561.02

Source: Bureau of Prisons' wage data, interviews with prison staff.

¹ Average cost per hour is equal to 1.5 times rate without fringe plus the fringe rate, averaged across staff types (GS-7 and GS-8).

² Average monthly cost assumes five bus trips per month.

Table C.7 Estimated (Weighted) Average per-Inmate Costs of Air Transfer From Three Pennsylvania Prisons for Psychiatric Purposes During the Demonstration and Predemonstration Periods

Prison	FCI-Allenwood	USP-Allenwood	USP-Lewisburg	Average*
Air Cost	\$3,134.96	\$2,729.52	\$3,401.00	\$3,127.43
Escort Cost	\$770.09	\$744.57	\$1,002.42	\$897.37
Indirect Costs per Inmate	\$196.85	\$196.85	\$196.85	\$196.85
Average Cost per Psych Transfer	\$4,101.90	\$3,670.94	\$4,600.27	\$4,221.65

Source: Air transfer billing records.

*These costs are weighted by the number of air transfers from each prison. Costs of transfers from FCI-Allenwood were estimated on the basis of cost data from the other two prisons.

Table C.8 Estimated Average per-Encounter Cost of External Specialist Consultations at Three Pennsylvania Prisons by Cost Element, During the Demonstration and Predemonstration Periods

	Medical Expenditure per Encounter ¹	Security Expenditures per Encounter ²	Indirect Expenditures per Encounter ³	Total Expenditures per Encounter
Expenditures	\$319.57	\$271.36	\$196.85	\$787.78

Source: Billing records for external consultations occurring during predemonstration period that were identified by prison staff as being likely candidates for telemedicine.

¹ A weighted average, by specialty, of medical costs. These figures are drawn directly from the Pennsylvania prisons' billing records.

² Based on interviews with prison security staff at the three Pennsylvania prisons as well as BOP wage data from the western Pennsylvania region.

³ See table C.9.

Table C.9 External Consultations: Estimated Average per-Encounter Indirect Costs for Administrative Staff Only

Staff Type	Salary Grade	Hours per Inmate	Rate* (No Overtime)	Cost per Inmate
Medical Records Technician	GS-7	2.0000	\$19.09	\$38.18
Health Services Administrator	GS-13	0.8750	\$40.30	\$35.26
Unit Manager	GS-12	0.6250	\$34.96	\$21.85
Central Inmate Monitoring Coordinator	GS-12	0.6250	\$34.96	\$21.85
Special Investigative Agent	GS-13	0.6250	\$41.58	\$25.99
Chief Correctional Supervisor	GS-13	0.6250	\$41.58	\$25.99
Associate Warden	GS-14	0.2915	\$49.16	\$14.33
Warden	SES-1	0.2083	\$64.32	\$13.40
Total				\$196.85

Source: Based on estimates developed by Dr. Ronald Waldron and Al Turner, using USP-Florence data, and on data developed by Abt Associates Inc. in interviews with prison staff.

*Rates are an average of all salary levels in each GS range.

Appendix D:

Cost of the Telemedicine Demonstration



The total cost of establishing and using telemedicine capabilities at the four demonstration sites was approximately \$778,000 for 16 months of operation.¹ This included the equipment and its installation costs, salaries of dedicated telemedicine coordination staff, an estimate of the value of labor contributed by BOP employees, payments to consulting specialists at FMC-Lexington and the VA Medical Center in Lexington, and the cost of the communications line carrying the telemedicine sessions. Some of these costs, however, were associated with gathering data for the evaluation and for other nonclinical purposes (see below). These latter costs were estimated and excluded from the calculation of costs attributable to health care alone.

For purposes of analysis, fixed monthly costs associated with the telemedicine demonstration were distinguished from per-patient costs that varied according to the volume of usage. That is, the telemedicine demonstration imposed some costs on the system even before

the first patient saw a specialist (see table D.1). The largest cost was the monthly lease for the telemedicine equipment itself. During 1997, the equipment lease for the four-site network averaged nearly \$25,000 per month, 90 percent of which was charged to the demonstration's clinical care.² In addition, the demonstration incurred about \$1,400 each month in other site operating costs.³ Fixed plant, equipment, and training costs for the demonstration were \$23,664 per month, after allowing for nonclinical uses of the telemedicine resources.

Telemedicine coordinators were hired for each site. At Lewisburg and Allenwood, these coordinators worked 40-hour weeks. The coordinators at the hub medical centers each worked an average of 35 hours per week. After making several adjustments to pay rates and hours billed, it was estimated that staff spent 68 percent of their time for telemedicine coordination, at a cost of \$10,939 across the network.⁴

The demonstration incurred additional costs associated with each discrete encounter that were not fixed (see table D.2). Most of these costs depended on the length of the encounter. Data recorded during telemedicine sessions were used to compute the average length of each encounter for each specialty. Across all specialties, encounters lasted an average of about 15 minutes per patient. Most of the per-patient cost of an encounter was for the communications lines, which averaged \$4.85 per minute, or \$70 per encounter. The demonstration arranged advantageous billing rates with VAMC in Lexington so that the average cost of a specialist over all telemedicine consultations

Table D.1 Fixed Monthly Costs of the Telemedicine Demonstration

Equipment Lease		\$22,381
Site Operating Costs		\$1,283
Amortized Installation	\$455	
Amortized Training	\$295	
Voice Telephone	\$266	
Other Site Operating Costs	\$266	
Telemedicine Coordinator		\$10,939
Total Fixed Costs per Month		\$34,603

¹ Tracor Systems Technologies, Inc., supplied cost data.

² The research team excluded 10 percent because the equipment was sometimes used for other purposes.

³ These include installation costs of various kinds that were amortized over a 20-year life, office equipment that was amortized over a 10-year life, and training amortized over 5 years. The procedures of OMB Circular A-76 were followed in these calculations. The same 10-percent discount for other nonclinical uses was applied to these site operating costs.

⁴ These employees spent some of their time in duties associated with evaluating the demonstration, rather than running it; the research team deducted 8 hours per week for the coordinators at the remote sites and 3 hours per week for the hub coordinators from the time charged to the demonstration,

was only \$74 per hour. At this rate, specialists cost an average of \$18 per-patient encounter.

Besides the specialist, a physician assistant was used to present the patient, and correctional officers were needed for escort security; these employees cost \$6 and \$4 per patient, respectively.

Costs per Encounter

During 1997, telemedicine sessions averaged \$431 per patient or encounter. Offsetting this cost were savings associated with expensive external consultations and air transports to Federal Medical Centers that did not occur as a result of telemedicine's use.⁵ If telemedical encounters were always substitutes for these more costly events, telemedicine would have reduced expenditures for specialist care substantially.

Most telemedical encounters were not used in lieu of these relatively rare types of consultations and treatment, however. Instead, a proportion was conducted in place of a conventional in-prison consultation with a visiting specialist. Other patients would not have seen any specialist at all if the new technology had not been available at little or no cost to the prisons. Each time telemedical consultations were used as substitutes for conventional, internal (that is, in-prison) consultations with specialists during the demonstration, the

Table D.2 Variable per-Encounter Costs Associated With the Telemedicine Demonstration

Communication Charges		\$70
Personnel Costs		\$28
Specialist	\$18	
Physician Assistant Presenter	\$6	
Correctional Officer Escorts	\$4	
Total per-Encounter Costs		\$98

Bureau avoided approximately \$108 in direct payments to physicians.⁶ To avoid spending \$108 for these consultations, however, the demonstration spent about \$431, on average, for each telemedicine encounter.

When telemedicine resources were used for patients who would not have seen a specialist otherwise, no savings at all would have accrued to offset even a fraction of telemedicine's costs. Because the proportion of telemedicine patients who would not have seen a specialist at all in the absence of the telemedicine resources cannot be estimated, the total savings and, thus, the net costs of telemedicine cannot be estimated with complete precision. In the best case, however, assuming that *all* patients would have been seen by a consulting physician inside or outside the prison (that is, in a local hospital or transferred to a Federal Medical Center), the net cost of each telemedicine encounter would have been approximately \$267.⁷

⁵ Health services administrators report that telemedicine averted an average of 2.8 trips to local hospitals each month for prisoners to see specialists. At 1996 average costs, these trips would have cost the Bureau of Prisons \$2,200 per month, all of which is saved by telemedicine. Transfers of psychiatric patients to FMCs declined from 2.2 per month in the predemonstration period to 1.2 per month in the demonstration period. The associated savings of such averted transfers averaged \$5,900 per month. This calculation ignores the possibility that housing these prisoners at FMCs costs more than incarcerating them at their regular prison. The average daily cost of incarcerating patients at FMC-Springfield is \$140, compared with an average of \$62 per day at the three prisons in this demonstration. If it is assumed that telemedicine saved 30 days of incarceration at FMCs, then this would increase the savings of averted transfers by about \$2,323 each.

⁶ Internal consultations during the predemonstration period averaged this amount. The prisons also incurred various other costs associated with internal consultations, but most of these significant costs were also incurred when specialists were accessed remotely, using the telemedicine capacity. For this reason, these common costs were not counted for either conventional or telemedical practice.

⁷ This assumes that 35 would have gone to local hospitals, 13–14 would have been transferred to an FMC, and all of the remaining encounters would have been conducted by consulting specialists inside the prisons, in the conventional manner. Researchers assume that these averted internal consultations would have produced savings of \$108 each.



The reasons for these significant cost differences are apparent in table D.3. This table compares monthly costs and associated savings for 100 telemedical consultations that replaced internal consultations plus 4 telemedicine consultations that replaced trips to specialists outside the prisons or transfer to Federal Medical Centers. This was close to the 97 consultations that the demonstration experienced during the April–December 1997 period.

What made this telemedicine demonstration costly was the expenditure for the communication lines, leased equipment, installation, and telemedicine coordinator—approximately \$34,600 per month.⁸ These accounted for 78 percent of telemedicine’s monthly costs, and all were fixed, not dependent on the number of patients seen.

Other costs associated with telemedical consultations were about the same as costs that would have been incurred for conventional in-prison consultations: approximately \$9,800 per month, compared with \$10,800 per month for conventional consultations (see table 3.1). Payments to physicians were much lower in the telemedicine demonstration. For example, during 1995–96, prior to the demonstration, psychiatrists were paid an average of \$61 per encounter for in-prison consultations. Once the demonstration began, telemedical consultations with remote psychiatrists were available at a cost of \$17 each.⁹ Payments to other types of specialists were similarly lower during the demonstration—less than \$25 per encounter, on average. Prior to the demonstration, these prisons were paying substantially higher per-encounter costs, ranging between \$160 for

Table D.3 Comparison of Average Monthly Costs of the Demonstration Telemedicine System and Conventional Care (Based on 100 Internal Specialist Encounters)

	Number of Events per Month	Cost per Month	Total Monthly Cost	Average Cost per Encounter
Operational Telemedicine				
Equipment	N/A	\$23,693		
Coordinators	N/A	\$10,939		
Consultations	104	\$10,229		
Total Cost			\$44,861	\$431
Conventional Care				
Consultations Inside the Prison	100	\$10,800		
Avoidable External Consultations	2.83	\$2,274		
Avoidable Transfers to FMCs	1.17	\$4,928		
Total Cost			\$18,002	\$173

Note: This calculation assumes that all 100 monthly telemedicine consultations would be provided conventionally in the absence of telemedicine. This one-to-one substitution did not occur in the demonstration. Chapter 2 shows that fewer consultations were actually provided before telemedicine became available.

⁸ As discussed in chapter 2, discounts were applied for nonclinical uses of the equipment and staff time.

⁹ Although the hourly rate of the remote psychiatrist was \$67, the average consultation lasted only about 15 minutes.

an orthopedist or dermatologist to \$350 for a cardiologist.¹⁰

Despite these significantly lower payments to specialists who consulted remotely, telemedical consultations incurred other high costs, apart from the equipment and fixed personnel costs. Physician assistants billed some portion of their time to presenting the patients (averaging \$6 per encounter), as did correctional officers who escorted inmates from FCI-Allenwood to the telemedicine suite at USP-Allenwood (\$4 per encounter). What overwhelmed all these expenditures were payments for using the communications lines. Each encounter incurred \$70, on average, for the communications lines.¹¹

Given such high fixed costs of equipment and the high per-minute costs of communications lines, telemedicine was far more costly than the preexisting practices of consulting specialists. Even counting estimated savings of \$2,300 per month for averted external consultations and an estimated \$4,900 per month saved as a result of averting air transfers, the net cost of each telemedical encounter after the startup phase of demonstration was about \$267 more than a conventional in-prison consultation with a visiting specialist. Such cost was incurred because this was a demonstration, not an operational system configured to minimize unnecessary costs. In the operational system projected for the Bureau of Prisons operation, the average cost per consultation is dramatically reduced to \$71 per encounter.

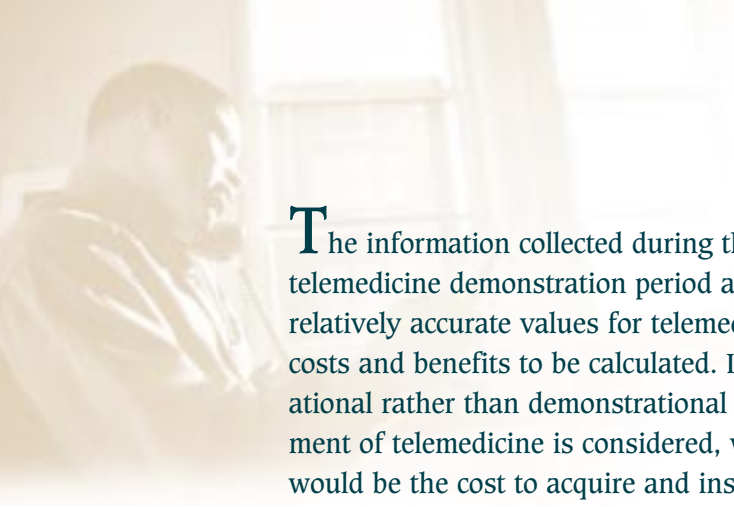
¹⁰ These specialists were engaged at favorable rates between \$72 and \$100 per hour, and telemedical sessions for all types of specialists other than psychiatrists averaged 15–20 minutes.

¹¹ The demonstration used communications lines for 314 hours of telemedical communications, at an estimated total cost of \$91,000.

Appendix E:

Operational Telemedicine System— Acquisition and Installation Costs





The information collected during the telemedicine demonstration period allowed relatively accurate values for telemedicine costs and benefits to be calculated. If an operational rather than demonstrational deployment of telemedicine is considered, what would be the cost to acquire and install the telemedicine network?

The research team makes the following assumptions about the telemedicine system, its installation, and its configuration of the telemedicine network:

- The telemedicine system must provide capabilities to support the same medical specialties used during the demonstration phase. The telemedicine equipment will be purchased, rather than leased. The telemedicine operational systems will provide all needed computational, display, and communication equipment. The remote system will also have a room camera, patient camera, intraoral camera, and digital stethoscope. The hub system will contain all provisions of the remote, except for the patient and intraoral cameras.
- The cost of installing telemedicine systems can vary widely, depending on the modifications and/or additions required at each facility. Because a “typical” installation could not be defined, researchers used the installation cost for the demonstration as the guideline for the operational system installation. This probably yields an excessively high installation cost because

four systems were installed for the demonstration, and other tasks (for example, building a holding cell at USP-Allenwood for FCI inmates) were performed that would not normally be required.

- The telemedicine network will consist of two remote systems and one hub system. This is similar to USP-Allenwood and USP-Lewisburg as remotes and the VA Medical Center as the hub. For this network, we assume use of ISDN (4 Basic Rate Interface) rather than switch 56, as was used during the demonstration.

Under these assumptions, the research team estimates telemedicine equipment and related costs of \$3,446 per month. This total consists of \$1,457 in site operating costs, less a 10-percent discount for other nontelemedicine uses of the equipment, plus \$2,372 as the monthly amortization of the equipment purchase price, again with a 10-percent discount. The site operating costs consist of \$97,000 in installation costs, amortized by straight-line depreciation over 20 years (except that equipment, fixtures, and freight are amortized over 10 years), plus training, amortized over 5 years. The principal remaining component of site operating cost is long-distance voice telephone charges (averaging \$328 per month).

Equipment charges reflect the amortized monthly value of \$73,000 (\$510) in each of three sites. In addition, the ISDN connection requires \$1,800 in one-time installation costs, which adds \$15 to the monthly cost when amortized over 10 years.

Table E.1 Amortization of Capital Investment

	Cost	Timeframe (years)	Salvage Value	Amortized Monthly Cost
Installation (3 Systems)				
Labor	\$21,270	20		\$89
Travel	\$13,464	20		\$56
Equipment	\$11,572	10	\$1,875	\$81
Material	\$20,594	20		\$86
Rental	\$7,358	20		\$31
Fixtures	\$21,135	10	\$3,424	\$148
Freight	\$1,883	10		\$16
Total Installation Cost	\$97,277	–		\$507
Training	\$19,674	5		\$328
Equipment (1 System)				
Baseline Telemedicine System	\$64,500	10	\$10,440	\$450
Digital Stethoscope	\$3,225	10	\$522	\$23
Intraoral Camera	\$5,375	10	\$871	\$38
Total Equipment Cost	\$73,100		\$11,833	\$511
Communications				
ISDN	\$1,800	10		\$15