Telemedicine in the Era of Population Health Management
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Introduction

As the US health care system shifts increasingly toward value-based care and risk bearing by providers, nontraditional models of care provision utilizing asynchronous and remote modes of care delivery are becoming increasingly valuable. These models provide financial benefits, starting with reductions in readmissions and inappropriate utilization. They can reduce the need for costly in-person visits, including patient travel costs. They can also enhance the quality of patient care, for example by improving the safety of care transitions, improving access to care in rural areas, enhancing patient-provider communications, and providing specialty care services electronically.

In this report we revisit the role of telemedicine in the world of population health management. We present a simple conceptual framework that illustrates the relationship between a telemedicine application’s technical complexity and its degree of workflow impact and implementation difficulty. Finally, we review a range of other factors to take into consideration when contemplating a telemedicine initiative, including business case, technical obstacles, and legal and regulatory issues.

I. Definition of Telemedicine

There are many definitions of telemedicine, varying principally in the range of technologies and processes that authors choose to include. For our purposes, we will define telemedicine as remote care provision directly enabled by digital communication technologies. By "remote care" we mean that the clinician providing care services is physically remote from the patient at the time of care provision. Thus these technologies permit provision of clinical services across distance and/or time. Telemedicine includes care delivered by telephone, text messaging, secure messaging, remote and home monitoring, and procedural technologies.

Telehealth is a broader term that, while sometimes used interchangeably with telemedicine, is generally considered to include a wide range of different capabilities, such as patient and professional education, public health administration, and others topics not directly related to patient care delivery; we exclude these from our discussion. Similarly, we exclude technologies such as electronic health records and health information exchanges from our definition.

II. Telemedicine Comes of Age

The history of telemedicine can be summed up as "a solution in search of a business case." This is primarily because a fee-for-service economic model has dominated American medicine—and remote services did not qualify for reimbursement. For decades, rural areas have run telemedicine programs supported by government funding, providing access to care that was otherwise unavailable. Some academic medical centers generated revenue by performing remote diagnostic services (e.g., image interpretation) for paying overseas customers. Other models have been constructed by companies for provider organizations where telemedicine-supported remote service provision is deemed more efficient than local provision or where it provides access to specialty services that are otherwise unavailable (e.g., e-ICU).

With the advent of population health management, and specifically, risk bearing by provider organizations, traditional financial incentives are being turned on their heads. US health care is moving inexorably toward care models that incentivize reductions in unnecessary utilization and integration of care across the continuum. Providers are
increasingly taking responsibility not only for the quality of care provided but ultimately, for patient outcomes. In addition, providers are expected by payers and consumers alike to provide patient-centered and patient-friendly care.

In this context, any service provision model that enhances access to care, bridges gaps in the care continuum, enhances patient centeredness, or improves care quality becomes newly attractive even in the absence of a clear reimbursement model. At the same time, legislative action is leading to more lenient reimbursement rules and reduced obstacles to the practice of distance medicine. The following are some of the ways telemedicine may provide real value in this new environment:

- **Addressing current and future declines in the number of available caregivers.** Demographic projections show an anticipated reduction in the number of physicians at a time when patient demands will increase; remote and asynchronous care provision via telemedicine will be part of the answer to how we will care for an aging population.

- **Bridging gaps in the care continuum** not addressed by health information exchange or other connectivity. Transitions in care—from hospital to home, for example—are the highest risk occasions in the ambulatory environment. Technologies that connect providers on each side of a transition to their counterparts on the other side can reduce information loss and misinterpretation of data. Such technologies can thus improve care quality and reduce inappropriate utilization (e.g., by reducing ED utilization and inappropriate admissions/readmissions).

- **Providing more efficient, higher quality, cost-effective care.** Teleradiology has succeeded in the market because companies can provide timely, consistent, high-quality care regardless of location and regardless of locally available resources. The e-ICU model can provide critical care oversight of equal or better quality compared with traditional models. Home monitoring services for fragile patients can reduce ED utilization and unnecessary hospital readmissions. Reducing latency in care can improve efficiency, for example, permitting a patient to obtain a consultation without the need for another office visit.

- **Providing patient-centered care.** Remote care enables patients to seek consultations at times and places of their choosing, freeing them from the onerous demands of the in-person office visit.

- **Increasing competition in the market.** As they grow accustomed to the concept of remote care delivery, patients will likely become choosier consumers, perhaps reserving in-person visits for special or complex problems.

### III. IT Solutions for Telemedicine

We divide telemedicine modalities into five general categories: messaging, data exchange, telepresence, remote monitoring, and real-time interventions. **Messaging** includes email, text, and secure messaging between patients and providers. **Data exchange** involves the electronic sharing of data for the specific purpose of care provision (diagnosis and treatment), which may occur in real time or asynchronously. An example is remote interpretation of radiographs. **Telepresence** is the live interaction between patients and providers through two-way real time audio-video linkage; e-visits are an example. **Remote monitoring** is the use of digital medical devices for monitoring of patients in the home or at a remote facility, with data forwarded to providers who interpret it and provide care actions as needed. **Real-time interventions** include actions where actual interventions are accomplished via digital links, for example, telesurgery.

Technical complexity of telemedicine initiatives and implementation difficulty are related. Technical complexity includes the required devices, applications, infrastructure, and data
sources. Workflow implementation difficulty varies by impact on existing processes and the need for new processes. In general, more ambitious interventions in care require more complex technologies to transform care. Thus initiatives requiring more sophisticated telemedicine technologies are associated with greater disruptions to clinical processes and workflows, as well as more challenging implementations (see Figure 1).

Figure 1: Telemedicine Modality
Workflow Implementation Difficulty and Technological Complexity

IV. Telemedicine Considerations

Six dimensions should be considered when evaluating a telemedicine initiative; each is described in detail below.

Business Case

As mentioned above, most telemedicine encounters were not historically reimbursable by public or private payers. Many telemedicine projects in the US were employed to reduce the barriers to access in underserved communities; these projects were largely funded with government grants and programs. If an initiative is not to be funded by grants or other contributions, the first determination to be made in building the business case is whether services delivered will generate revenue through reimbursement by payers, or whether the service must yield financial returns through other mechanisms, such as cost avoidance. Business case considerations are as follows:

Costs of Telemedicine Programs

The costs of programs include those of technology purchases, implementation, and ongoing maintenance, plus the costs of redesigning and staffing clinical programs and processes.

Revenue Generation: Government Payers

CMS provides limited telehealth reimbursement to providers through Medicare and Medicaid. States can choose to cover two-way real-time communications between Medicaid providers and patients. Medicare reimburses telehealth services in designated areas. In addition, the Veterans Administration and the Department of Defense utilize telemedicine widely.
Revenue Generation: Commercial Payers and Self-pay

According to the American Telemedicine Association, 21 states mandate that private insurers reimburse for telemedicine services, and 9 states have proposed such mandates. The types of services covered vary between states; for example, New Mexico’s coverage includes dental telemedicine, Massachusetts includes telepsychiatry, and Arizona includes naturopрактиcs. The list of covered services will continue to grow.

In addition, a number of companies providing telemedicine services base their revenue model on the willingness of many patients to pay out of pocket for convenient and accessible care. Such models typically involve scheduled online appointments of 10 to 15 minutes with a licensed provider for which the patient pays a fixed fee.

Cost Avoidance

From the perspective of population health management, telemedicine’s greatest value is its potential to enhance operational efficiencies, improve quality, and produce cost savings elsewhere in the system. For example, secure messaging between patient and care team permits effective patient education and reminders following office visits and hospitalizations, reduces the time clinicians spend on the telephone, and is a significant patient satisfier. Text messaging, too, has been successfully employed in disease management, for example, for the monitoring of and advice to brittle diabetics who do not have access to patient portals. Such messaging applications support health maintenance and reduce the likelihood of unnecessary utilization—and both are wins for providers sharing risk.

In another example, e-visits are increasingly being adopted by organizations hoping to improve patient satisfaction and loyalty and to reduce unnecessary utilization of care. An example of the latter is one organization’s use of telemedicine to provide remote “curbside” consultation during a patient’s primary care visit. Early figures have shown substantial reductions in the number of referrals to covered specialties.

e-ICU is another telemedicine application that has been in use for years, primarily to cope with shortages of critical care specialists; until recently its effectiveness relative to standard ICU care has been unclear. However a major recent study¹ shows that e-ICU care can significantly reduce ICU mortality, ICU length of stay, and overall hospital length of stay; these improvements were linked to more rapid case assessment by a critical care physician, better adherence to best practices in the ICU, and more rapid response to alerts compared with the traditional model. Reduction in utilization of hospital services in general, and ICU services in particular, yields substantial reductions in cost of services to providers sharing risk for patient costs and outcomes.

Another excellent example of the value of telemedicine is the experience with home monitoring of patients with chronic diseases such as heart failure; telemedicine has been shown to keep these patients stable and reduce costly hospital readmissions.

In addition to cost avoidance, telemedicine programs may produce new sources of revenue for an organization, attracting more patients to them as their preferred care provider.

Technical Foundation

Technical requirements for a telemedicine initiative include:

- **Basic IT Infrastructure.** This includes wireless and cellular networks; data processing and transmission capabilities; server storage space; wired network dependencies; real-time locating systems and devices, and the like. As we insert technology intimately into care delivery, system resilience becomes especially important. The technology on the remote end of the connection becomes critical, too: for example, for home monitoring, homes must be equipped with adequate bandwidth to support the desired functions.

- **Telemedicine infrastructure.** This includes computers, networking hardware, webcams, medical device monitors, remote physiologic monitors, videoconferencing equipment, and user devices (tablets, smartphones).

- **Software.** This includes applications for all the different potential clinical use cases, including versions for static and mobile platforms (smartphone, tablet, PACS for example); mobile device middleware if mobile platforms are to be used; etc.

- **Resource requirements.** Organizations will require technical expertise at necessary level for the specific technologies employed, as well as strong project managers. Help desks may play a role, and specialists in medical device management are essential. Supporting a number of remote end points (e.g., patients in their homes) is a major, new consideration for most IT organizations. Clinicians involved in any initiative should be instrumental in project design, and will also require training in the use of the technologies.

Some telemedicine services can be hosted remotely, outsourced, or delivered as a service, thus reducing the technical requirements for the provider organization.

Real-time Versus Asynchronous Care Interaction

In a real-time telemedicine scenario, data is captured and transmitted in real time to the provider, who is interpreting the data and responding in real time. In this regard, it is similar to a traditional face-to-face encounter. Examples of real-time telemedicine include e-visits, e-ICU, telesstroke, tele-emergency medicine, and remote procedural interventions.

Real-time telemedicine models often require new or radically different processes on the part of clinicians. For example, e-visits require providers to either fit a new visit type into their old office routine, with accompanying process changes, or more often, operate according to an on-call schedule devoted exclusively to tele-encounters. Critical care specialists staffing the e-ICU must adapt to a care model where they can no longer directly examine critically ill patients. Advantages of real-time models include immediate (or more rapid) results for the patient and possibly greater patient satisfaction.

In asynchronous telemedicine models, patient data is captured—usually in real time—and may be transmitted immediately or saved and transmitted by periodic batch. Clinician interpretation of the data and subsequent actions occur at a later time. Examples include teleradiology, home monitoring, and messaging applications. Asynchronous models are best used for processes that do not demand immediate attention and are amenable to completion around other scheduled tasks. For example, a clinician can plan in advance to spend one to two hours a day reviewing batch remote monitor alerts and messages. The principal advantages of asynchronous care models include convenience for both patient and clinician as they are freed from scheduling constraints, and lower utilization as services provided remotely may substitute or obviate the need for costly in-person services.

Implementation Timeline

The project timeline for a telemedicine initiative clearly varies with the complexity of the technology involved and the level of clinical process redesign required. In all cases, training—of both providers and patients—must be considered carefully. Provider IT organizations are used to training clinicians on the use of IT; they are less familiar with supporting patients. Even though clinicians will provide much initial patient training to...
patients in most scenarios, IT will often be expected to be a support backstop, fielding technical questions that clinicians cannot answer. Thus help desks, call centers, and other customer-facing parts of the IT organization may need to develop new scripts and procedures for supporting patients directly.

When evaluating different potential applications or models for care provision, providers must assess the importance to them of time to market: How soon can we begin to realize the benefits of the new initiative? What is the potential value of an earlier time to market? In addition, organizations must ask: What is the most sensible implementation approach to take—staged or “big bang”? Organizations should ask: Might it be valuable to operate at a small scale initially, permitting us to identify technical and process glitches early; handle the change management in stages; and assess the value of the service prior to investing at full scope? Or are the risks and benefits well enough understood that we feel confident in implementing at large scale immediately?

The major legal and regulatory requirements for telemedicine relate to provider licensing, federal and state reimbursement policies for different services, and FDA regulation.

**Licensing**

Physicians are licensed to practice medicine on a state-by-state basis, and are legally permitted to care for patients physically in their states of licensure. As telemedicine practice can easily cross state lines, this is an obvious constraint. Some states issue special-purpose licenses permitting telemedicine practice with patients in other states. In September 2013, congress introduced the TELEmedicine for MEDicare Act (TELE-MED Act of 2013), which proposes to permit certain Medicare providers licensed in a state to provide telemedicine services to Medicare beneficiaries in a different state. The bill has 55 co-sponsors, and as of the publication date, it was assigned to the House Ways and Means Committee for consideration by the chair. In practice, most companies and provider organizations offering telemedicine services across state boundaries deal with the constraint by licensing providers in multiple states.

**Reimbursement**

CMS has been gradually expanding the range of areas in which telemedicine services can be reimbursed by federal payers. Areas covered include designated rural health professional shortage areas (HPSA), counties that are not in metropolitan statistical areas (MSA), and participants in a federal telemedicine demonstration projects. In its 2014 Medicare Physician Fee Schedule Final Rule, CMS redefines rural HPSAs to align with Office of Rural Health Policy formulae, establishes annual review of telemedicine originating sites to determine eligibility, and adds further services eligible for reimbursement. As described above, many states are mandating commercial reimbursement for various telemedicine services, and the number is growing rapidly.

**The Food and Drug Administration (FDA)**

The FDA regulates Medical Data Device Systems (MDDS) utilizing a risk-based classification system. A telemedicine product is subject to regulation if it meets the

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3) [https://www.govtrack.us/congress/bills/113/hr3077#overview](https://www.govtrack.us/congress/bills/113/hr3077#overview)

definition of a medical device; many do. Depending upon the classification of such devices, manufacturers must adhere to regulatory requirements that range from ensuring proper labeling to pre-market FDA approval. While the onus for regulatory compliance rests with the manufacturer, a provider organization distributing devices incurs responsibility for upgrades provided by the vendor, and possibly in other use scenarios as well. IT leaders should evaluate whether any modification or reconfiguration is necessary for installed devices. Should such alteration occur outside the original manufacturer specifications, the organization would be considered a device manufacturer itself and subject to FDA regulation.

An Organizational Strategy for Telemedicine

Defining an optimal organizational approach to telemedicine is made complicated by the nature of many telemedicine initiatives—specifically, the telemedicine initiatives address separate, discrete clinical problems or opportunities, and the technology needs of projects often differ significantly. Thus, the sponsoring clinical groups must determine the operational structure for each initiative, and the specific IT requirements will differ between initiatives. Nonetheless, there is an argument for a central governance model rather than a purely distributed approach.

In most organizations, the IT organization is the closest thing to a sole single owner for telemedicine in the organization. This is particularly true when biomedical engineering is part of the IT organization; indeed, the requirements of managing telemedicine are a potent justification for such a reporting relationship. While end user technologies will vary widely, from webcams to bedside monitors to home health devices, most technologies will depend on a common connectivity infrastructure. Centralized management facilitates the required infrastructure planning and execution of the IT work. In addition, many initiatives will utilize technologies supplied by vendors with whom the IT organization has existing contracts, or if the technologies are new, the IT group should be aware of the connectivity and data exchange demands that the vendor will place on the organization and should be involved in mediating those arrangements. In addition, a single point of ownership can make it easier for different clinical departments using telemedicine to learn from each other. Some organizations have found that getting caregivers and/or business leaders to recognize the opportunities represented by telemedicine technology can be a substantial hurdle. Having a single focus of governance can help with cross-stakeholder education and promotion of innovative telemedicine efforts.

Communication and Marketing

Responsibility for communication and marketing strategies lies with the sponsoring clinical departments, the IT organization, and the marketing department. Strategies must be developed to cope with internal change management around redesigned clinical workflows and the impact of new data sources and types on IT’s data management strategy, as well as with patient recruitment, education, and training in the use of the technologies. The marketing department has the opportunity to assist with patient recruitment as well as organizational image promotion.
Summary

This report describes the relationship between technical and process complexity in telemedicine initiatives and proposes five corresponding categories for telemedicine applications. The framework is intended to aid organizations considering telemedicine investments in considering simultaneously the magnitude of both technical and clinical investments required to be successful. We have also reviewed the different types of value that telemedicine can deliver, particularly under risk sharing arrangements, as well as some considerations for governance and implementation. Future research will explore specific use cases of telemedicine for population health, and track the evolution of the legal and regulatory environment for telemedicine.

Action Items

• Develop an inventory your current telemedicine efforts.

• Develop a telemedicine strategy. Identify clearly the financial models and drivers behind your different telemedicine projects: external support (e.g., rural health initiatives), revenue generation, or cost avoidance. Insure that each initiative to be considered is in alignment with, and supports your organization's overall strategic direction. For example, initiatives that drive down utilization are supportive of the efforts of a Pioneer ACO to manage costs, but might not be supportive of revenue generation in an environment where fee-for-service care predominates.

• Consider establishing a central governance structure for telemedicine led by a clinical executive (such as the CMIO or CMO) and a senior member of IT leadership. Develop a common understanding of how IT professionals and clinicians will work together to design, implement, and operate telemedicine projects.

• Develop internal competencies in the basic technologies your organization adopts for telemedicine projects. Such an investment can make you less dependent upon vendors for dealing with day-to-day challenges in operating programs.

• Become familiar with the legal and regulatory requirements around telemedicine for the state(s) in which you operate. Work with industry groups to advocate for reforms that support the sensible needs of telemedicine practice.

• Educate your business and clinical leaders about the potential and challenges of telemedicine.