On the Digital Road to Improved Home Healthcare

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Editor's note: This is the first in a series of articles covering technological advancements in home healthcare. Here, the authors provide an overview. Subsequent articles will expand on the details of individual subtopics.

Treating illness at home is a tradition that has recently been revitalized by a number of factors. Specifically, telecommunication tools, financial imperatives, quality initiatives, staffing constraints, and patient preference are among the leading drivers for this transition. Successful program outcomes depend on a number of issues, with knowledge, leadership, and management being paramount. Technological advancements will change the way we practice medicine and facilitate the effective transition to homecare in select populations.

Historical Perspective

Up until the early 19th century, the United States economy was primarily agricultural. In this often expansive rural landscape, most healthcare was provided by a household member, who was sometimes relegated to the role of fulltime caregiver. Although there were limited institutions for the sick in urban areas during this time period, they were primarily intended for the marginalized and poor.

Medical scientific advancement, development of professional standards, and improved facility conditions, enhanced the credibility of hospitals which dramatically grew in number from 120 hospitals in 1873 to 4,300 in 1909.[1-6] Amid this growing popularity of hospital based care, the 'house call' remained a dominant factor for a short period,

accounting for 40% of encounters in 1930, but falling rapidly to 10% in 1950s, and reaching less than 1% of older patients in the 1990s.[7]

Cost Pressures

The unsustainable increasing costs of hospital-based care has prompted numerous federal policy changes. For example, in 1983 Medicare dramatically changed reimbursement policy with a newly implemented payment system of 'diagnosis-related groups' which reimburses hospitals based on the expected complexity of care and not number of days. This historic change has incentivized hospitals to discharge patients as soon as possible.[8] However, the costs for transitional and long-term healthcare options outside of the hospital are also high, with recent U.S. estimates ranging between $210.9 billion[9] and $317.1 billion annually.[10] Of further concern, the number of people utilizing these types of services is projected to increase from 15 million in the year 2000 to 27 million in the year 2050.[11] Therefore, this extraordinary financial burden is a major concern for all stakeholders,[12-14] and as a result, efficiently caring for these patients is becoming an increasingly important topic in healthcare reform and policy.[15-18] Home telehealth programs offer an appealing alternative or extension to subacute care centers and long-term care or nursing home facilities. With appropriate discharge planning and coordinated follow up, effective home health programs may also reduce the likelihood of hospital readmission. Even though telehealth programs have the potential to dramatically reduce cost, lagging federal reimbursement policies are a barrier to implementation.

Shift Back to Home Healthcare

There are additional overarching benefits which are driving the shift back toward home based care. From a clinical perspective, providing care in a patient's own residence reduces the risk of acquiring nosocomial infections, which may be antibiotic resistant. In addition, there are clinical conditions ranging from Alzheimer disease to autism, which may be more effectively treated in the home. Geographic disparities that would otherwise limit access to specialist may also be eliminated and thereby making healthcare more equitable.[8] Virtual visits also improve access to basic care by

overcoming transportation constraints which may otherwise limit the ability for patients to participate in routine follow-up. In addition, wellness programs and preventive measures may be more accessible and utilized to a greater extent if made available in the home. Importantly, a digitally connected home can empower independence and promote a sense of security. It is therefore not surprising that there is a growing desire among many consumers to shift their healthcare to the familiar comfort and convenience of their own residence.[17-19]

Spectrum of Home Health Patients

Currently, the majority of home health services address the chronic needs of older patients.[20-22] As a result, the majority of diseases encountered in this setting parallel national geriatrics demographics, with home telehealth services for diabetes, hypertension, heart disease, stroke, cancer, arthritis, COPD, atrial fibrillation, dementia, and depression encountered at the highest frequency.[23]

Although elderly long-term care is projected to be a major target for home health services, the same basic concepts and infrastructure may be transferrable to different patient populations. To this end, numerous programs are being developed for other health needs ranging from urgent care, pediatrics, rehabilitation medicine, and general wellness.[24-26]

Technological Advances

Fortunately, recent technological advances in miniature sensors, low-power integrated circuits, and wireless communications have enabled the development of low-cost mobile health data gathering tools that can efficiently monitor many specific illnesses.[27,28]

In addition to technological solutions designed for individual diseases, there is also a growing need to manage more complex patients with multiple illnesses.[29] In this situation, it is not uncommon for patients to have several caregivers to address a variety of ailments and comorbidities. Unfortunately, when there are different specialists working in isolation, an unintended consequence may be uncoordinated care that can

lead to life-threating problems such as inappropriate polypharmacy, the incidence of which is high in older home health patients.[30-33] This challenge underscores the need for an integrated and interoperable enterprise health information platform that connects caregivers and facilities to help prevent medical errors.

Providing Value

Healthcare providers are being asked to do more with the same or decreased funding and resources. Many health specialties are also projected to have major shortages in staffing which, if not augmented by technological advancement, will result in poorer patient outcomes.[34-37] At the same time, patients and payors are looking for greater value in both outcomes and overall experience.

The above factors directly relate to the principals of the "Triple Aim," which specifically calls for enhanced patient experience, improved health, and reduced per capita cost of care (Figure 1).[38] These three key objectives are also particularly pertinent to the overall goals of digitally connected home healthcare.
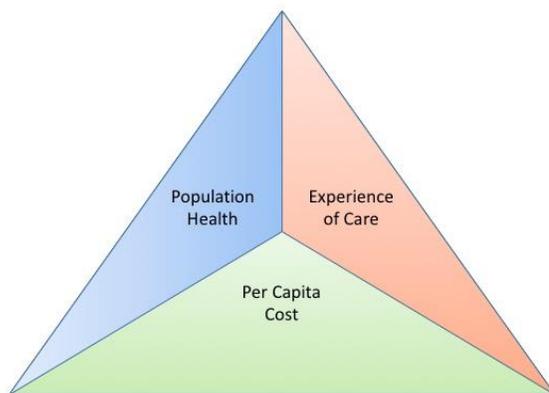

Figure 1. Developed by the Institute for Healthcare, the IHI Triple Aim is a framework that describes an approach to optimizing health system performance.

As an example, a pillar to many home health programs is remote video technology, which has been shown in many cases to be well received, cost-effective, and improve health.[39,40]

Although the promise of telehealth may seem intuitively obvious, there is also a critical need to continually and objectively evaluate assumptions. For example, a recent analysis reviewed 36 journal articles and found telehealth to be more expensive in 31% of cases. Importantly, the article authors suggested that the specific organizational model employed in the delivery of care was more important to the success of the program than the type of technology utilized.[41] In a separate study, the authors suggested that the lack of an effective infrastructure for case management was the pivotal factor in the lack of reportable benefit to telehealth monitoring.[15] These examples underscore the fact that technology by itself is not effective and tools need to be tested and implemented with the primary goal of quality patient-centered care. In the words of Jeffrey K. Liker, "Use only reliable, thoroughly tested technology that serves your people and processes".[42]

Leadership and Management

The skills of leadership and management are critically important to success because it can take as much time to implement the right solution as it does to create the wrong one. To this end, the required interplay between change and order are dependent on a number of complementary factors including clear communication, vision, empowerment, strategy, alignment and a deep understanding of the healthcare environment, as well as thoughtful evaluation, planning, requirements gathering, structure, and stakeholder involvement.[42-45]

Specific considerations such as potential technical limitations in broadband internet connectivity, interoperability with critical systems, the need for uniform standards between electronic health records, cost, relevance of the proposed solutions, reliability, user acceptance, as well as legal, ethical and facility-organizational factors need to be addressed. Understanding these types of variables and requirements will reveal

valuable information about the most successful path to implementation as well as the projected benefits and impacts.[46]

Planning for long-term maintenance and continual improvements based on open feedback and ongoing evaluation are also key factors to long-term achievement and sustainability.[47,48]

User Acceptance

The success of any program depends on user acceptance. In the case of technologically-enabled home healthcare, the end-users are varied and include patients, caregivers, support staff, and administrators.[49] To be successful, the solutions must meet the needs of each major stakeholder. Thoughtfully designed user interfaces tailored to the specific audience promote an effective, intuitive, and enjoyable experience, which also decreases the need for training and elaborate change management strategies. Tools should improve upon an existing framework and not produce an environment where people become subservient to technology.[42]

These issues are particularly pertinent to home caregivers who may already be overworked; home health nurses work more hours than nurses in nearly any other setting.[50] Importantly, it has been shown that improved managerial support of nursing practice and better relations with physicians, can translate to improved morale and patient outcomes.[51,52] Therefore, technological communication tools that bridge these gaps may also provide nonlinear paths to improved patient care.

Operational Challenges of Telehealth

The intrinsic geographically isolated nature of home healthcare requires advanced tools for the coordinated collaboration of patients, cross-functional teams, tools, and disciplines. To this end, a successfully implemented technological infrastructure is required to provide a platform for efficient communication and engagement for everyone involved.

Therefore, the availability and reliability of internet connections is a potential critical limitation to the deployment of specific solutions such as synchronous videoconferencing and biometrics tracking.[53,54] Nonetheless, in situations of limited internet access, a less desirable delayed information transfer to caregivers can still be achieved asynchronously in a "store-and-forward" process.

The connected benefits of telehealth also come with concerns regarding the security of protected health information that will be digitally transferred to offsite caregivers.[55,57] In addition, the various patient health metrics obtained will need to be presented to caregivers in an efficient, user-friendly format.[58,59]

Even with the most robust technical infrastructure, periodic in-person home visits by a caregiver are often part of a complete home health solution. However, the unstandardized home environment presents efficiency and safety challenges to visiting healthcare examiners and these issues also need to be systematically addressed.[54] In addition, the use of relatively low tech options such as railings, adjustable shower seats, and motion activated lights provide important levels of added patient safety and independence that should not be overlooked.

Future Technology Directions

Iterative improvements of existing technological solutions will drive greater value and user acceptance to this disruptive care model. However, new developments in the fields of machine learning, artificial intelligence, analytics, integrated networks, and robotics will drive a paradigm shift in how we practice medicine.

Conclusion

A number of interdependent factors have made home healthcare an attractive option for many. Leadership, management and technology are among key factors for success. Home telehealth programs not only hold the potential to solve an escalating demand at a lower cost, but also may achieve that goal with significantly improved outcomes.

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