

Home Telehealth Systems: A Primer

Technological Development:

This subsumes four separate progressions: (1) the development of the diverse telecommunications and computer technologies used to provide home tele-health services; (2) the introduction of sophisticated electronic devices for measuring patient physiological parameters in-home; (3) the development over the past decade of electronic devices for administering drug and other therapies in-home; and (4) the increasing level of familiarity, comfort, and enthusiasm among providers all of these technological innovations.

The HTH Continuum

HTH spans "first responder" or "medical alert" systems to interactive care management systems. HTH systems cluster along a continuum of increasing complexity and technical sophistication.

1. *Personal Emergency Response Systems (PERS):*

This is an automated dialing system ("base unit") which can transmit one or more coded messages to a remote monitoring station when activated by the user or by a sensor (e.g., air temperature, smoke or fire). User activation is by means of a small, battery-powered transmitter that may be worn around the neck or on the wrist. The transmitter can send discrete signals (e.g., police or ambulance) to the base unit which initiates a toll-free call to the monitoring station, which in turn attempts to verify the emergency with the user and then contacts the appropriate emergency service in the user's community. Some base units are speaker phones and permit the monitoring station to stay in contact with the user until local help arrives. PERS is an in-home emergency service. It enables aged and disabled individuals to stay in their residences without caregivers and reduces hospitalization by facilitating early emergency treatment and transport.

2. *Monitored Medication Dispensing Systems (MMDS):*

This is a programmable device for scheduled dispensing of medications which alerts an off-site monitoring station of patient non-compliance by means of a coded telephone message. It consists of a medication storage compartment which holds from a one week to a one month supply of tablets or capsules. The compartment has a "lock out" feature to prevent access. The user's daily regimen is programmed by the provider. The dispensing device may simply release the designated scheduled dosage or it may display patient instructions on a small LED screen (e.g., a reminder to a diabetic to "take your insulin"). A common feature is an visual message and/or audio alarm or signal that alerts the user that it is time to take the required medication(s). When the patient does not take the medication the system notifies a monitoring station, which may call and give a "reminder" or an on-call nurse who will contact the patient.

3. *Medical Device Monitoring Systems (MDMS):*

This configuration permits off-site monitoring of in-home medical devices such as oxygen concentrators and drug delivery systems by a telephone connection which periodically transmit reports on device functioning and patient usage. "Tele-infusion" is an example of this type of system. The infusion device is linked to a telephone line. Solution administration and device operation can be monitored at a remote location. Troubleshooting can be done "on line." This minimizes in-home interventions and increases patient involvement in care and therapy. In other applications a monitoring device can be attached to a concentrator or a ventilator. These systems may be free-standing in terms of telecommunications capability or may have a "hardwire" or "wireless" connection to a PERS unit which provides the telecommunications capability.

4. *Therapy Tele-Management Systems (TTMS):*

This is a dedicated configuration involving the on-line real-time continuous monitoring of a single specific in-home therapy administration which would automatically track the patient's signs and adjust volumes and flows as indicated. One in-home oxygen conservation device has the ability to track the patient's oximetry on a real-time basis. If the system measures a rise in the patient's blood gas above a predetermined level it can reduce the flow of oxygen. When the patient's levels drop the system will adjust the oxygen flow accordingly. Systems of this nature need only a telecommunications link to find a place on the home tele-health continuum.

5. Patient Tele-Monitoring Systems (PTMS):

This involves the input of patient data at scheduled intervals to a device that either has telecommunications capability or attaches to a standard telephone. An application is to monitor asthmatics and other respiratory patients. Spirometry is performed by the patient in-home to measure Peak Expiratory Flow (PEF) and Forced Expiratory Volume for one second (FEV1). A typical unit provides a digital display of the results for the patient and transmits the data to monitoring station (which transmits the print-out by fax to the provider and physician) or directly to the provider which relays the read-out to the physician. Other applications involve telephonic sphygmomanometer for monitoring blood pressure and pulse and a telephonic stethoscopes to auscultate heart, lung, and bowel sounds.

6. Tele-Video Patient Management Systems (TPMS):

This is a video-phone configuration involving a standard television set, a digital color video camera, and a touch-tone telephone set to create an in-home video-conferencing capability for voice communication and the exchange of low resolution images of the patient and provider staff. They may use standard or ISDN telephone lines. They may also incorporate a wide range of instruments for measuring patient clinical parameters on-line.

Source:

Home Tele-Health Systems: A Guide for Home Care Providers
Springfield, PA: Home Care Management Associates, Ltd., 1998

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