

Healthcare at Home (Part I)

A major trend in medicine is to move treatments and monitoring out of the hospital or even the doctor's office and either attach them to the patient or enable it to be done in the home. Of course, this relies on medical device technology in order to make it possible. In this month's Perspectives feature, we asked the industry what device designers could do to aid this effort and what technologies would help to enable it.

How will medical device design continue to aid the shift in healthcare from the hospital to the home and what technologies will play the largest roles in this effort?

Tom KraMer

Principal Design Engineer and President, Kablooe Design



As medical device designers, we are constantly thinking about how products will be used outside of the hospital. We strive to provide the patient with greater freedom by letting them fulfill their healthcare needs in a convenient and respectful way. As we strive to design products that are easier for patients to understand and use, and less reliant on a physician's knowledge or hospital equipment, we begin to allow for a higher frequency of in-home treatments. Good design will always take a user-centered approach to the product, and knowing that the patient will be using the device in the home gives designers a different set of criteria to use to drive the design. Careful attention to these criteria will give us a good in-home device result.

We have found that wireless transmission technologies have been extremely useful in allowing a patient to monitor or treat themselves at home, and then transfer the information to their physician or hospital. Activities that in the past required hospital monitoring or evaluation can now be done remotely. This can include everything from physical therapy to the administration of medication. The use of clever mechanical development is also a great way to take tasks that were once cumbersome and complex, and put them into the hands of the patient.

Tom O'Brien

Industry Manager, Healthcare, SABIC Innovative Plastics

As healthcare delivery continues to shift from inpatient to outpatient settings, manufacturers of therapeutic and diagnostic devices are offering intriguing solutions for home healthcare applications. Some are benefiting from new materials and advanced processing technologies that meet home users' needs for portable, reliable, lightweight, durable, attractive, and easy-to-use devices. Although this is a long list of criteria, specialized resins and compounds allow manufacturers to address each of these items.

First, as devices continue to increase functionality and usability, there is a greater demand placed on internal components, calling for uniquely matched lubricious materials.

Second, with the increasing performance requirements of critical electronics—particularly wireless—that require EMI/RFI shielding, traditional metal plating can be successfully replaced by more cost-effective, lightweight compounds featuring stainless steel fiber.

Third, as devices continue to miniaturize, high performance materials are used to manufacture housings using thin wall molding to reduce the weight, cost, and size of the device and ensure adequate impact performance of the thinner parts.

Finally, consumers want home-use devices that blend into their décor, are easy to operate, and can stand up to daily use. Today's resins, with molded-in colors and effects, offer manufacturers a huge array of aesthetic choices while avoiding secondary operations such as painting and coating. These resins keep their attractive appearance even after repeated exposure to common household products. Further, there continues to be advances into material combinations that enable processes such as overmolding a soft thermoplastic elastomer onto a hard substrate that can improve ergonomics and comfort.

Anthony Kalajakis

Global Industry Director Medical, Hypertronics Corp.

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We are seeing the shift of medical therapy from the clinic or hospital to the home setting for a few reasons. First, patients respond better in the home environment if set up properly. Patient involvement and satisfaction levels increase when they can actively participate in care based from home. Health maintenance in a holistic approach will drive a lifestyle approach to healthcare integrated into daily life.

Utilizing home-based healthcare significantly reduces outpatient costs, a keen topic from the healthcare provider, insurance, and employer. Home healthcare lowers the cost of Medicaid and lowers the high cost of monitoring chronic aging patients by providing increased accessibility to information and treatments.

The form factor reduction and portability of medical instruments is making it more practical for home use. Each component and manufacturer continues to supply the industry with smaller components. Miniaturization of every component has allowed medical designers to produce smaller products that are portable. Where in the past, a patient had to come to the hospital to monitor blood levels or heart rate, present technology produces small portable and/or implantable devices that can record and transmit the patient monitoring data between all parties.

The emergence of several specific technologies and trends has impacted the use of home based healthcare as a viable solution to reduce costs and increase patient satisfaction.

Wireless and telemetry devices will allow for unencumbered locomotion for patients while still being connected to monitoring and therapeutic devices.

There is also a growing trend towards migration from "on the patient" to "in the patient" treatments; insulin pumps, VAD, pacemaker, neuro stimulation, diabetes control, etc. This trend will increase the opportunities for the expanded use of home-based healthcare devices and systems.

Robert Hctor

Vice President of Medical Devices, Johnson Electric



Home-based self healthcare is on the rise, and medical device design is playing a major role in the transition with a number of factors contributing to this move. The shortage of clinical staff coupled with the aging population almost requires that devices take the place of clinicians in some instances. To step up to the role, devices are becoming smarter and new medical device designs are certainly trending in this direction.

Some good examples can be found in the drug delivery arena, with wearable devices that deliver medications to patients. These devices are also tracking the dosage information and monitoring conditions, and some are even capable of sending the data to the physician's office via Internet connection for monitoring.

Advances in home dialysis devices also demonstrate how procedures that once required an office visit can now be done in the convenience of the home. Such devices are scrubbing the patient's fluids via the peritoneal cavity while they sleep, moving dialysis from the hospital or clinic to the home.

Several key technologies are enabling home care devices. Most notably, innovative motion and motion control elements, miniaturization, automation, and electronics are leading the way. Tiny, precise motors are enabling portable devices to quietly perform tasks that once required larger machines. Through new designs and advances in motion components, the new generation of medical devices have also become affordable to patients and even consume less energy than their predecessors.

As the medical device industry continues to raise the bar in designing smart devices and increasing portability, we will see many further innovations that benefit patients and clinical professionals.

James Bleck

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Rapid cost reduction of consumer and telecommunications electronic components is connecting patients to caregivers through automated monitoring. We are designing products that use voice, imaging, sensors, and low cost electronics for these applications. We are moving beyond the pendant call buttons. New product designs focus on keeping patients out of the hospital after they go home, or preventing a hospital stay. It is not just about transitioning from hospital to the home.

We are still in the early stages and opportunities abound. It is uncharted territory without a clear winning strategy. For product developers, we should expect rapid evolution for the next several years with successes and failures.

One danger with these new products is too much information and communication. Doctors and caregivers have limited time. Patients can't get an unrealistic impression of the monitoring that occurs. Too much automated machine driven discipline aggravates patients and is counter productive. Product design for home medical devices must be human interaction centric. Patients need to be motivated to take on responsibility, and not solely rely on a machine. Human touch, intuition, and the hands of care givers are difficult to replace by machines.

Those over 80 might be technology challenged now, but within 10 short years, this group will be technically sophisticated. Look for devices that capitalize on the growing elderly population that intuitively understand technology. This doesn't mean they want complexity. The cable TV remote control is not the right model. Graphical interfaces that mimic known cell phone and computer experiences might become common.

A rock-bottom cost product strategy will be needed. The large potential market will attract competition. Look at how Walmart came to dominate home rehabilitation furniture with low cost products. It only took a few years for this to happen. It will take market knowledge, user experience research, and design know-how to win this race. Business planning in this market must assume rapid product evolution as we learn about the market and winning strategies emerge.

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