

# Perspectives on Device Design—Part 3

**How is the movement of healthcare out of the hospital and into patients' homes impacting device design?**

**Russell Engel**  
**Engineer, Compass Manufacturing**



Since the Nocturnal Oxygen Therapy Trial in 1980, home oxygen use has grown steadily. The study demonstrated that Long Term Oxygen Therapy improves both the length and quality of life of patients.

Financial pressures to reduce cost have come from many areas. Department of Veterans Affairs reduced reimbursement by 30% and competitive bidding rewards suppliers for cutting costs at all levels. Many patients who once enjoyed monthly visits from Respiratory Therapists now only receive quarterly visits or visits by non-clinicians.

Typically there are two different kinds of home oxygen customers; those that need oxygen at rest or sleeping and patients that need oxygen while exercising. Our experience is with electrically powered oxygen concentrators both stationary and portable.

The risk of responding to alarm conditions has typically fallen on the patient to call the supplier if there is a problem with the source of oxygen. We have been designing additional alarming features into oxygen concentrator operation and the ability to automatically notify family and suppliers of alarm events. Now if a power cable gets knocked out of a wall socket or a cannula gets bent cutting off oxygen flow, we've developed several options for alarm notification. Options include plugging a phone line into the concentrator so people can be called to an internal cell phone, WIFI access to a home network for email or instant messaging, or using an existing Zigby wireless network.

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Integrating new technologies into existing applications reduces alarming risk and provides the patients and their family with greater care and comfort in the home environment.

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### **Joe Spinozzi** **COO, Cyth Systems Inc.**



As the technology that powers hospitals begins to enter our homes, new products will be made available with unique characteristics to make them compelling to the end user. Just as consumer electronics clamor to entice us with features such as easier-to-read screens, battery life, and connectivity, people will expect the same capabilities in the devices that measure their heart rate and deliver their insulin. Much like the “dot-com” era where websites were tried and tested and the best survived, devices will be proposed employing novel variations of treatments and diagnostic techniques, selected for their worthiness, and developed with lofty promises and equal expectations. Yet, to succeed, they will need to meet requirements, work reliably, and perform their tasks simply.

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### **Erik Moses** **Strategist, Product Development Technologies**



As a medical device’s primary user shifts from medical professional to patient, one of the most critical considerations becomes the user interface (UI). With responsibility weighed heavily on the patient, operation and interaction with the

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device must be immediately understandable. The interface must be user-friendly and intuitive in order to minimize mistakes and guide the user through processes and operation. It should also be visually descriptive so a first-time user can easily understand the device's functions. Graphics, language and the flow of information should be designed to be appealing, yet simple and legible. Some queues can even be taken from consumer electronics, devices that have been designed to be easy, interesting or even fun to use. Basically, the human element needs to be brought into technology to soften the interaction with users.

Mobility and the user's setting are also taken into consideration. If the device must be large, how will it be transported into and around the home? Can it blend in with the décor of the home? Can the device be wearable if it is enabling constant monitoring? Additionally, the need for device connectivity and/or networking must be addressed as homes have varying levels and modes of internet access. Remote monitoring by nurses and physicians must be easy and reliable enough for them to update, confirm proper operation and receive data. Devices need to be constantly updated on a patient's status, and based on user setup, bring to attention key issues that need action.

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**Alex Brisbane**  
**President and COO, KORE Telematics**



A key factor in bringing effective healthcare into the home lies in the ability to reliably transmit information from the patient's medical device back to the caregiver. Devices are now being designed, or retrofitted, to enable 24/7 monitoring of everything from basic vital signs to specific conditions related to sleep apnea and glucose levels. Prescription containers are alerting care-givers if medications have not been accessed within the appropriate period of time. Wireless, wearable sensors are helping to quickly locate wandering Alzheimer's and autism patients.

The enabling factor in transmitting data between the device and the healthcare provider is wireless machine-to-machine (M2M) technology. A recent Parks Associates report predicts that the wireless home health market will grow from \$300 million in 2009 to an astonishing \$4.4 billion in 2013.

When designed with wireless capabilities, medical devices are breaking free from their wires and cords, allowing homebound patients to lead active lives while still

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reporting diagnostics to healthcare providers.

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### **Tim Chismar**

**Biomedical Engineer, 3M Littmann Stethoscopes, 3M Health Care**



For many years now, two critical components of medical device design have been the usability of the device as well as the presentation of its output to the healthcare provider. The friendliness of the user interface is directly correlated to product adoption while indirectly correlated to user error. In the past, medical devices were designed to be used by medical professionals who tend to have a high level of education and training. With the movement of medical devices into the home, the product developers now have to design a user interface with a different audience in mind, one that may have a limited education and no medical training. While the analytical aspects of the device must carry the same level of sophistication, the user interface must be presented in such a way that allows an untrained person to easily operate the device, observe and understand its output, and if necessary, communicate the information to a healthcare professional. Therefore, the user interface must be designed for a less sophisticated audience while enabling the device to communicate the more sophisticated information to a remote healthcare provider.

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