Brainstorm: Medical Electronics

What future technologies will reduce healthcare costs?

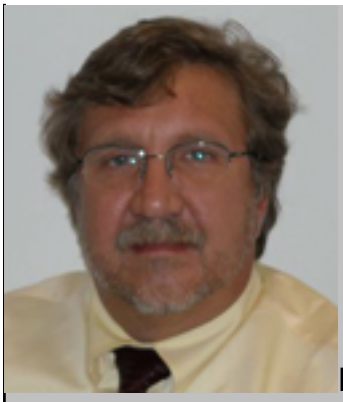
Tony Zarola, Analog Devices, www.analog.com [1]

With millions of baby boomers coming of age—retirement age that is—the effort to monitor and improve the health of the population is more prevalent today than at any other time in history. And home healthcare devices are playing an increasingly important role in the endeavor to help people maintain their health.

Home healthcare devices can monitor blood pressure, glucose levels, and heart rates, alerting doctors to problems, eliminating or reducing the need for costly office and hospital visits, and providing big benefits for patients who don't live near a doctor or hospital. Healthcare devices designed for home use enable people to monitor themselves, obtaining timely warnings of illness so that they can go to their physicians early—when intervention will do the most good. For doctors, it means more efficient and effective healthcare driven by patients who take greater responsibility for their own health.

Trends toward increased computing power and smaller size of electronic components have made possible the design of home healthcare devices that are mechanically simpler and increasingly more powerful. Cutting-edge technology developed by semiconductor companies is enabling the design of portable and affordable home healthcare devices that benefit millions of people around the world. These underlying semiconductor technologies include ultralow power sensors, digital signal processors, and high-performance linear components.

As an example, a "calorimeter" combines body worn sensors—based on accelerometer technology—that use novel measurement techniques to track movement and determine calorie consumption, allowing the wearer to easily record daily exercise and nutritional intake. The results can be wirelessly transferred in real time to a physician, fitness coach or nutritionist. This type of device brings effective personal health management a step closer for all of us.



Nick Lukianov, Avnet Electronics Marketing Americas, www.avnetexpress.avnet.com [2]

From a patient modality perspective, the development and integration of more sophisticated MEMs (Micro Electromechanical Systems) technology continues to drive new developments in patient monitoring, therapy and wellness applications. For example, MEMs are being utilized for fall detection, motion and mobility tracking and capture, implantable drug delivery infusion pumps, cardiac and respiratory monitoring, wound care systems, and smart bed technology to name a few. Extensive research is also underway for the management of microfluidics, body implantable systems and DNA micro assay systems.

Several semiconductor companies are developing smart sensor technology, by integrating low power microcontrollers and precise signal conditioning in order to provide a highly integrated solution, be it specific to an accelerometer, gyroscope, pressure or temperature based micro electromechanical solution.

MEMs based infusion pump technology in particular stands out not only as a potential healthcare cost savings but also from a quality of life perspective by truly providing a generational shift in patient therapy. Certain neurological conditions may potentially be treated with pharmacological agents that are not absorbed well under classic infusion techniques or ingestion methods, but will respond to deep brain implantable devices that deliver location based targeted drug dosage.

Inherently these potential patient therapies and diagnostics are intended to provide a cost savings through either a more precise metric thereby providing a more definitive diagnosis, or a more precise and targeted therapy.

Edmund Suckow, Fairchild Semiconductor, www.fairchildsemi.com [3]

Portable medical electronic trends are the enabler for reduced health care costs. Non-invasive battery-powered sensors are mobile and, when coupled with on-board memory, can capture a complete data pattern for a given symptom. Due to the continuous advances in ICs, these units are getting smaller, lasting longer, and therefore are more easily deployed into the field

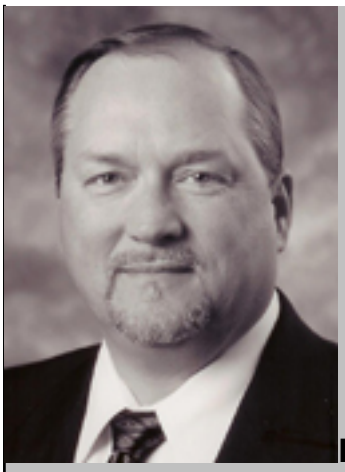
After a patient leaves the hospital, it is back to life as normal. The physician recommends rest for a few days, keeping your heart rate down, take it easy, etc. All to often we find ourselves pushing the limits, be it intentional or unknowingly. On the opposite spectrum, we may be advised to get the heart rate up and pick up the pace. A simple patient monitoring system may be a win-win for both patient and healthcare, resulting in fewer hospital visits while bring more value to those visits that do occur.

Sensors were too large to be considered for 24/7 monitoring several years ago, but advances in electronics are making them smaller and last longer on a single set of batteries. Glucose monitors and injectors are just the start, having very recently reached a closed loop test and administer insulin system. These tools are worn daily by Type I diabetes patients. This concept can be implemented much further than diabetes.

It will not be long before similar systems will monitor heart rate, blood oxygen, blood pressure, and temperature all in one sensor. It could be wireless or plugged into a USB port once a day to show a complete data trend. This offers a more accurate prognosis from the doctors, having been provided much more data than the single data point collected upon hospital admittance.

Compact battery technology has remained relatively unchanged over the last five years. Extending the life of these sensors has been a direct result of power supply design discipline and IC advances. Leveraging cell phone standards, these advances include: charging over USB, high efficiency DC/DC regulators, adoption of I/O standards (I2C, SPI, SDIO, etc), and display improvements.

The key is transparency through integration. A patient is more likely to implement a prescribed micro-sized adhesive sensor if it is unobtrusive but still cool enough to synchronize with a smart phone. While recycling existing technology and standards from recent cell phone advances, portable medical electronics will advance and bring value to both patient and to the overall health care system.

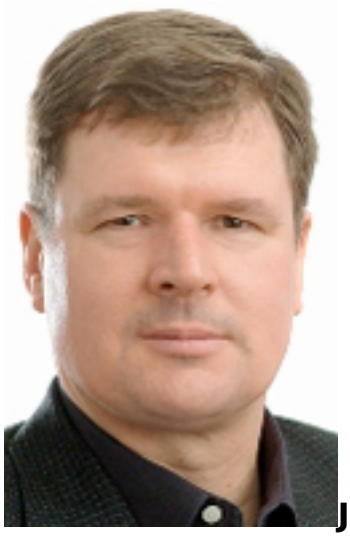
 **Bruce DeVisser, Fujitsu Components America, www.fujitsu.com/us** [4]

With the rising costs of healthcare foremost in many people's minds, the development of less-costly general medical devices could be a significant factor to reduce those costs.
The aging Baby-Boomer population is placing increased demand on the medical system, especially for late-life and end-of-life care in institutional facilities and in home care. In either case, the practitioner requires a minimum array of equipment to provide their services, and each separate piece of equipment has a defined cost.

If these various equipment types could be combined into a single, touch interface-based device with multiple functions, manufacturing and purchase costs could be less, utility could increase, portability would improve, and training requirements would be simplified.
For example, one such device could comprise blood pressure, heart rate, blood oxygen level, simple EKG, pulmonary function, and Automatic Electronic Defibrillator (AED) functions.

Imagine a portable device of less than one cubic foot volume with an effective battery life, a large rugged display, and a touch surface that is either single-touch or requires two-or-more simultaneous touches for specific operations such as AED function, has the ability to accept and record signature images when required, and can have secure Wireless connection to a central medical facility when needed.

Combining a highly functional display with touch technology provides the basis for implementing multi-level, context-sensitive, onscreen menus with integrated control functions, while offering ease-of-use, simplified training, and lower costs.

 **Jeffrey VanZwol, Micro Power Electronics,** www.micro-power.com **[5]**

Battery powered surgical devices will lower healthcare costs. We have seen a shift in product strategy within our surgical device OEMs. Many OEMs are taking larger, tethered, expensive surgical tools and replacing them with smaller, battery-powered, inexpensive disposable devices. These larger tools (i.e. cutters, staplers, reamers, drills) are traditionally reusable capital assets, and are maintained and sterilized by hospital technicians. Newer disposable tools are designed for one time use, then disposed after surgery. The advantage of this approach is the tool is sterilized and packaged at production, so no repetitive sterilization at the hospital is required. This eliminates the risk of contamination, and the cost of repetitive sterilizations. The one-time cost of the disposable tool is budgeted into the surgery cost, and the hospital's capital budget is reduced over time

Links:
[1] http://www.analog.com
[2] http://www.avnetexpress.avnet.com
[3] http://www.fairchildsemi.com
[4] http://www.fujitsu.com/us
[5] http://www.micro-power.com