Set-Top Box for Home-based Delivery of Health Care

Lawrence Keyes M.S.
Microdesign Consulting Inc.
lkeyes@mxdesign.net (802) 658-4673

Background and Description:

Program Summary
Our research centers on the use of multi-point videoconferencing, using small set-top boxes (the DocBox) which are placed in patient's homes. These units, about the size of a paperback book, connect to a home television and to a broadband internet connection. Our videoconferencing unit requires little or no interaction from the patient, and is controlled centrally by the health care or wellness provider. We are testing a second generation of our unit, after incorporating changes suggested by patients and providers. Based on feedback from the medical community, development is under way to incorporate monitoring of patient vital signs, and we've successfully tested a Bluetooth (wireless) enabled weight scale.

Videoconferencing has proven to be a useful supplement to traditional face-to-face patient care. Example applications include follow-up visits, managing of chronic conditions, physical therapy instruction, exercise programs, and support groups.

Trials
A prototype home unit was tested with a 15 week, 3 classes per week, 1 hour exercise class for senior patients who have experienced falls, or fear of falling. The test was conducted with 17 patients aged 78 – 93. The tele-class proved to be an effective way to deliver supervised instruction that would otherwise require patients to travel to a central lab or gymnasium for class.

A follow-up randomized-controlled study was completed in May 2009 with 65 patients participating. Patients were located in Chittenden and Franklin counties in Vermont, within a radius of 60 miles of Burlington VT. One patient participated from her home in Buffalo NY, after a family emergency required a move from South Burlington.

At the patient's home:
The unit sits on top of the patient's television, usually in a living room. This location allows space for the patient to perform exercise, and frequently has the largest TV screen in the house which allows the patient to easily see the instructor while standing or sitting at a distance from the screen.

The unit requires a broadband internet connection. DSL, cable and fiber connections have been tested. A minimum of 384Kbs is required, which conforms to typical consumer-grade broadband offerings from companies such as Verizon and Comcast.

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In the Instructor's Studio:
In our initial tests, exercise classes were broadcast from a video studio to up to eleven patients' homes at a time. Our Phase II tests originated from a lab space at the University of Vermont's Department of Rehabilitation and Movement Science using a Polycom VSX 7000 videoconferencing system connected to a Codian 4500 MCU. The DocBox is compatible with standard protocols allowing integration with existing hospital telemedicine systems. Video is in real-time in both directions; the participants watch and hear the instructor and the instructor can see and hear each participant. Transmissions are encrypted for security and privacy. Connections can originate from any H.323 compatible video device, including a laptop computer with a web camera.

About Microdesign
Microdesign was incorporated in Colchester, VT in 1998. Microdesign receives funding assistance for research and development from the National Institutes of Health/National Institute of Aging, and Vermont EPSCoR, and received SBIR (Small Business Innovation Research) Phase I and Phase II grants. Microdesign has been a resident client company at the Vermont Center for Emerging Technologies since October of 2007. www.mxdesign.net

Publications
Our Phase I project, Group Tele-Exercise for Improving Balance in Elders was described in the journal of the American Telemedicine Association *Telemedicine and eHealth*. URL at: http://www.liebertonline.com/doi/abs/10.1089/tmj.2006.12.561

Our randomized controlled study Comparison of Telecommunication, Community, and Home Based Tai Chi Exercise Programs on Compliance and Effectiveness in Elders at Risk for Falls was accepted for publication in the *Archives of Physical Medicine and Rehabilitation* in December of 2009, and will appear during 2010.

Presentations
International Congress of Biomechanics - Munich, Germany - 2006
Freedom2Connect - Washington DC. USA 2009
American Telemedicine Association - Las Vegas, NV USA 2009
FiberFête - Lafayette LA. USA 2010

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Frequently Asked Questions:

1. *Has the unit been used in any other trials?*
In March 2010 we conducted tests with COPD patients located in California who participated in a Yoga for COPD class originating from our Vermont location. This was part of a feasibility study conducted for a projected five-year NIH-funded study.

In February 2010 we participated in a diabetes education program conducted via our state's interactive television system. We provided two additional H.323 "endpoints" to connect to the state system; these sites are actually patients participating from home.

In January of 2007, we installed video connections between our university's department of physical therapy and students performing their clinical field work in four outlying clinics or hospitals. These links allowed the professor to consult with the students on a regular basis without the faculty member having to travel to the remote site.

2. *Can the DocBox be used for point-to-point calls?*
Certainly. The main point is that the DocBox, in its normal configuration, will only receive calls, there is no interface for making calls. However, the DocBox can receive calls from different sources; such as a physician, clinic, home-healthcare provider and family members. In the current configuration, the DocBox can receive calls from any H.323 or SIP compatible device. This would include typical high-end videoconferencing equipment from Polycom and Tandberg, as well as SIP compatible devices such as WiFi phones or other VoIP devices. The DocBox can also receive calls originated by computers running videoconferencing software such as Polycom PVX (Windows), Ekiga (Linux), or XMeeting (Mac).

3. *What do you mean, "there is no interface?"*
The DocBox has a single on-off button. If the DocBox is turned on, and tuned to the patient's TV set (like tuning a DVD player, or VCR), it is ready to receive calls. This makes the unit especially useful for patients who do not have access to, or ability to use, a personal computer.

4. *Why can't they just use Skype™?*
Skype requires a computer and, ideally, a connected headset / microphone combination. Our unit attaches to a TV, and requires no keyboard or mouse or handheld remote. During exercise classes the participant is typically ten feet away from the screen.

Skype does not support multi-point video calls, and thus is not suitable for the type of "classroom-like" experience that the DocBox can support.

5. *What about vital signs monitoring, such as weight, pulse-oximetry, blood glucose, etc?*
The DocBox currently accepts readings from the Tanita HD-351 weight scale via a Bluetooth wireless connection. We have plans for interfacing Nonin pulse-oximeters as part of the COPD project described above.