Medical and Healthcare Robotics Roadmapping Workshop

The market for **therapy robots** is driven by (a) health care costs (one-on-one therapy accounts for 4% of U.S. health care costs), (b) a population shift that predicts increasing stroke incidence, and (c) the shortage of therapists.

<u>**Research Area 1 - Therapy Design**</u> Therapy robots have been developed for the upper extremity, lower extremity and individual joints (Bogey 2007; Brewer 2007). Technology has been able to be address the issue of computer controlled robots interacting with humans through impedance control and compliant actuators, e.g., (Salisbury 1980; Sugar T 2007). However, each therapy robot that has been developed has a different approach to the therapy strategy. This is not surprising since often developers of technology concentrate on the performance of their device and overlook the nuances of the application (Ferris 2007). Also, the content of one-on-one therapy for neurologically injured patients is quite variable between clinicians (Korner-Bitensky 2006) and the application of neuroscience research results to therapy application has been slow (Sullivan 2005). The results of early therapy robot studies indicate that they are not significantly better than current therapy approaches (Reinkensmeyer 2004; Bogey 2007). However, therapy robots have the potential to motivate patients with interesting tasks and games, measure performance, compliance with prescribed therapy, provide biofeedback and introduce the latest neuroscience results to practicing clinicians and thus revolutionize stroke rehabilitation (Werner 2007). **To accelerate the maturation of robot therapies, interdisciplinary activity is needed to translate neuroscience research results into therapy tasks. Robot researchers and manufacturers, neuroscience researchers, therapy researchers and clinicians should be involved.**

<u>**Research Area 2 – TeleRehabilitation**</u> – Intensive repetitive practice can be effective in improving the function of stroke survivors (Wolf 2006). Stroke rehabilitation therapy is usually very time-consuming and thus expensive. However, health insurance companies limit the time allowed for in-clinic therapy (Byl 2003). As a result more responsibility is directed toward patients and their caregivers to use home based treatments. Such treatments require that the patient comply with the therapy protocol and that the treatment be high quality. Therapy robots have the capability of providing therapeutic routines that adjust their difficulty as patient performance changes. The devices also can measure time of use and evaluate patient status. These are ideal properties for home treatment of stroke patients. Market drivers and the need for sustained therapy make the combination of robot therapy and telerehab an inevitable trend.

However, **reimbursement** issues and **interoperability of wireless transmission systems** are barriers to widespread application of telerehab therapy robots. Clinicians need to review the performance of and motivate patients at home. To do this CPT codes are needed for reviewing transmitted patient data. Academic, government and industry coordinated efforts addressing the issues of interoperable wireless systems and clinician reimbursement are needed.

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