



John R. Feussner, M.D.
Chief Research and
Development Officer

A Message from the Chief Research and Development Officer

Within each generation of veterans who have served our country is a group with amputations, spinal cord injuries, traumatic brain injuries, hearing impairments, low vision or blindness and communications disorders. The challenge for the Office of Research and Development's Rehabilitation Research and Development Service (RR&D) is to treat and heal the whole person. Through the RR&D program we fund important research investigations that have impact on myriad areas of disability management including amputation prevention, joint replacement, efficient wheelchair propulsion, orientation programs for persons who are blind and early detection of hearing loss.

RR&D research focuses on concepts, products and processes that promote greater functional independence and improve quality of life for veterans who have been disabled as a consequence of trauma or disease.

In this IMPACTS Document are brief descriptions of recent RR&D studies that show great promise for improving veterans' health. These important RR&D impacts are organized by health care categories particularly prevalent in the veteran population that we serve such as aging and age related changes, special populations (e.g., women veterans, permanently disabled veterans, Persian Gulf veterans, homeless veterans, etc.), health systems (e.g., health care delivery, organization, quality and outcomes), chronic diseases, mental illness, substance abuse and addictive disorders, sensory disorders and loss, acute and traumatic injury, and military and environmental exposures.

We are pleased to share these accomplishments with you.

■ Acute and Traumatic Injury

Enhanced optical scanner will improve design and production of prosthetic sockets

Computer aided design and manufacturing technologies have resulted in better, more comfortable prosthetic sockets. Even so, replicating the remaining limb shapes prior to socket design remains a problematic process fraught with flaws. These flaws compromise the fit of the prosthetic socket and limit the function of the prosthesis. To accurately duplicate residual limb shapes, the VA has designed and built an enhanced optical scanner, which is being tested at five VA prosthetic clinics for accuracy, speed and replicability.

By eliminating the need for a plaster cast of the residual limb, VA's new optical scanner will cut in half the time required for limb characterization and measurement. Expedited design and manufacture of accurate prosthetic sockets using the new scanner will provide better, comfortable prostheses that will improve the function and independence of veteran amputees.

Other possible applications for this device include: the compilation of a quantitative prosthetics and orthotics database for use in improving prosthetic socket and orthosis designs; the development of a database of patient limb segment contours, areas and volumes to determine the efficacy of medical treatments and rehabilitation regimens; and its use as an educational tool in the analysis of clinical practices.

A more exact fit of prostheses will allow individuals with amputations a better quality of life and the ability to engage in far more activities of choice, including sports like running, skiing, and basketball.

Houston VL, Mason CP, Beattle AC, et al. The VA-Cyberware lower limb prosthetics-orthotics optical digitizer. Journal of Rehabilitation Research and Development, 32:55-73, 1995. A2068-RA

Prosthetic feet are designed to meet needs of dysvascular amputees

Amputees with dysvascular diseases such as diabetes or arteriosclerosis have special prosthetic needs. This project is concerned with designing prosthetic feet for dysvascular amputees that will improve their mobility and quality of life. This new design will place fewer energy demands on amputees, so that they will be better able to take care of themselves and perform everyday activities.

Rao S, Bontrager E, Perry J. Prosthetic ankle joint stiffness during weight acceptance in transtibial amputees. Gait and Posture, 4:187, 1996. A735-RA

Researchers seek to improve joint implants for arthritis patients

Arthritis is a debilitating condition of great concern to the aging veteran population. Suffering from arthritis may be alleviated with prosthetic joints to eliminate pain and stiffness. But subsequent joint dysfunction commonly causes these implants to loosen, necessitating revision surgery in more than 50 percent of patients within eight years. This project, which is nearing clinical trials, is using biochemical analysis to increase the longevity of these joint implants. By reducing the need for revision surgery, this research will profoundly reduce surgical costs and trauma for patients.

Engle JM, Georgescu HI, Evans CH. Induction and processing of interleukin-1 in rabbit synovial fibroblasts. Transactions of the Orthopedic Research Society, 22:447, 1997.

A052-8RA

Electrical assistive device provides an attractive alternative for ventilator patients

VA investigators are developing a fully implantable ventilatory assistive device that will greatly enhance the quality of life and independence of veterans who need ventilators. Stimulating electrodes implanted through the abdomen are used to activate the diaphragm muscle-freeing patients from the constraints of mechanical ventilators and reducing their risk for nerve damage and infection. In addition, this approach is expected to be much less expensive than conventional methods.

Mortimer JT, Peterson DK, Nochomovitz ML, et al. Long-term intramuscular electrical activation of phrenic nerve: safety and reliability. IEEE Transactions on Biomedical Engineering, 41:1115-1126, 1994.

B634-3RA

■ Chronic Diseases

New program facilitates treatment of stroke-related speech disorders

VA researchers have developed a software program that will help clinicians and patients evaluate and correct a variety of speech disorders associated with stroke. This diagnostic and treatment tool has made it easier for clinicians to more rapidly assess patients' conditions and to plan and facilitate rehabilitation treatment. This technology received a commendation from the Secretary of Veterans Affairs.

Till JA, Jafari M, Law-Till C. Effects of inspiratory airway impairment on continuous speech. In: Robin D, Yorkston KM, Beukelman DR (Eds.) Disorders of motor speech. Baltimore: Paul H. Brookes, 1996.

C468-4RA

New rehab therapy improves arm movement after stroke

A new rehabilitation technique developed by the VA is helping stroke victims regain movement in their arms. The technique, called "constraint-induced movement therapy," has produced substantial improvements for 50 patients who suffered mild or moderate strokes, losing the use of one of their arms. A significant level of movement was restored without the use of medication or surgery and without any side effects. Presently, no other treatment is available that can reduce motor impairment for these patients.

Taub E, Pidikiti RD, DeLuca SC, et al. Effects of motor restriction of an unpaired upper extremity and training on improving functional tasks and altering brain/behaviors. In: Toole J (Ed.) Imaging in neurologic rehabilitation. New York: Demos Publications, 1996.

B1692-RA

Researchers identify pathways linked to motor recovery from stroke

Research into the relationship between the central nervous system and motor function will have an important impact on the evaluation and treatment of stroke patients. This study has already supplied evidence that at least seven pathways in the brain play a major role in motor recovery following cortical stroke or damage. These findings will help clinicians make more accurate predictions about functional recovery following a stroke.

Strick PL, Hoffman DS. Effects of a primary motor cortex lesion on step-tracking movements of the wrist. Journal of Neurophysiology, 73:891-895, 1995.

B2013-RA

In-vivo cartilage regeneration will improve rehab for young veterans

A biological approach for preventing joint deterioration could be an attractive alternative to artificial joint replacement in young veterans whose projected life spans exceed the longevity of current implants. Researchers are experimenting with an in-vivo model to regenerate needed cartilage. If successful, this technique will improve rehabilitation results among younger veterans and reduce surgical costs.

A799-3RA

■ Sensory Disorders and Loss

Hearing impaired veterans benefit from VA hearing research, wisdom and experience

Senior VA audiologists at the VA Maryland Health Care System created and published a hearing aid buyer's guide. Highly popular, Practical Hearing Aid Selection

and Fitting, is a free “best seller” with over 11,000 copies in print and more to come. Targeted to veterans, physical therapists, and audiologists, it is also used in technical schools. The guide, written in lay language and based on the wealth of VA hearing research, answers many questions for veterans faced with the prospect of using a hearing aid.

Veterans Health Administration, Rehabilitation Research and Development Service. Practical hearing aid selection and fitting. Journal of Rehabilitation Research and Development, 34: Supplement, 1997.
RR&D

New visual rehab system uses laser technology

Vision loss is a tremendous problem for the veteran population. Some 93,000 veterans are legally blind, including a great number who suffer from macular degeneration. Rehabilitation for these patients is complicated by the need for clinically reliable assessment techniques. To meet that need, VA researchers are designing an effective and efficient low-vision rehabilitation system using a scanning laser ophthalmoscope. This technology is expected to facilitate cost-effective visual rehabilitation for patients with vision-loss problems.

Sunness JS, Schuchard RA, Shen N, et al. Landmark driven fundus perimeter using the scanning laser ophthalmoscope (SLO). Investigative Ophthalmology and Visual Science, 36:1836-1874, 1995.
C838-RA

SLO may prove useful in assessing capabilities of low-vision patients

Research on the effectiveness of low-vision reading assessments using a scanning laser ophthalmoscope (SLO) is shedding new light on the reading skills and abilities of patients with macular loss. Clinicians expect that using the SLO in this manner will help determine what visual function characteristics influence reading performance, training strategies or outcomes. This information will help low-vision clinicians devise and evaluate appropriate treatment strategies for their patients.

C849-2RA

Low Vision Enhancement System shows positive results in test study

A system developed by VA researchers to improve visual acuity for patients with poor eyesight is performing extremely well in a test study. Of 117 patients who were fitted with the new Low Vision Enhancement System (LVES), 112 experienced improved visual acuity over their best spectacle correction. The LVES consists of a head-mounted series of video cameras, displays and integrated optimal elements that may be adjusted by the pa-

tient for optimal viewing. The device was designed to improve the ability of patients with poor vision, including the legally blind, to perform everyday tasks and to reduce their dependence on low-vision aids. Further testing is underway to evaluate the impact of LVES on reading speed and time, visual motor tasks and activities of daily living.

Massof RW, Rickman DL, Lalle PA. Low vision enhancement system. APL Technical Digest, 15:120-125, 1994.
C638-2DA

Dark-adapting eyeglasses prove effective among visually impaired patients

Liquid-crystal dark-adapting eyeglasses designed by VA researchers significantly improved functional mobility, contrast sensitivity and acuity for visually impaired patients in this study. According to researchers, these positive results were particularly pronounced among patients with age-related macular degeneration which sometimes leads to blindness. Three private companies have expressed interest in manufacturing and marketing these dark-adapting eyeglasses. More than 100,000 veterans with visual impairment stand to benefit from this new technology.

Mancil GL, Ross DA. Liquid crystal dark adapting glasses for persons with low vision. American Academy of Optometry, Annual Meeting, December 7, 1996.
C776-RA

Special Populations

Computer-aided wheelchair prescription system assures better fit for veterans

A computer software program developed by VA is an effective, easy to use and affordable wheelchair prescription aid, ensuring that veterans receive vehicles that meet their needs the first time around.

Users and prescribers of wheelchairs have a large and increasing selection of wheelchair models, each with a variety of accessories tuned to individual needs. Although users have the opportunity to select the wheelchair that is nearly ideal for them, that opportunity doesn't always translate into reality. Information overload is one reason. There are so many wheelchair models with configurable options that it is difficult to process all the available information on them. That information changes frequently as new models, options and manufacturers enter the scene and wheelchair standards are revised. In addition, prescription or purchasing errors may occur, particularly among inexperienced users.

Yet properly fitted wheelchairs are critical for patients who need them. Prescription or purchase errors may lead to pressure sores, blood clots, spinal problems and unnecessary limitations on mobility and lifestyle. The right wheelchair will improve patients' mobility, provide them with a chance to participate in sports, expand their employment opportunities and enhance their health and quality of life.

As the largest procurer of wheelchairs in the US, VA developed the Computer-Aided Wheelchair Prescription System (CAWPS) to supply easy access to accurate and comparable information on wheelchairs and to track data on client parameters throughout the purchasing and prescription process. CAWPS also provides assistance with the preparation of written reports and justification necessary to obtain funding for wheelchairs.

Use of CAWPS will help reduce the number of replacements made because of improperly fitted chairs and lower maintenance costs. VA has confirmed a substantial need among users for this type of program; some 20 organizations have requested that they be considered as beta test sites for CAWPS. VA currently is in negotiations with two companies to develop CAWPS as a product.

Shapcott N, Walker N. Incorporating digital video into a software based expert system. Proceedings, RESNA '96, June 7-12, 1996. B685-3DA

VA research seeks to reduce fractures among patients with spinal cord injuries

Research at the Palo Alto VA Rehabilitation Research and Development Center have produced new insights into the nature of bone loss in persons with spinal cord injuries (SCI) and their consequent higher risk of fractures. Therapies for preventing and reversing bone loss can be evaluated with a standard clinical CT imaging system in combination with computer algorithms for bone registration and beam hardening corrections. This tool has given investigators the most accurate information to date on the loss of bone mass in the SCI patient population. In a parallel study, a method for increasing bone fracture resistance through the repeated application of low-magnitude trauma forces was developed and recently patented. More work needs to be done to prevent fractures; VA research has shown that although reduced bone mass is a significant risk factor for patients with spinal cord injury, it is not the only one.

A501-4R and A201-4R

New FES technology will improve manual function for people with quadriplegia

Advances in upper extremity functional electrical stimulation (FES) systems for control of hand grasp and release have resulted in a second generation system which promises bi-manual function for persons with quadriplegia. The first generation FES hand grasp system was controlled by movement of the user's contralateral shoulder. Second generation FES systems are controlled by movement of the wrist on the same side of the body, so it is feasible to implant a system in each hand. Candidates for this system would need voluntary wrist movement on each side of the body. However, feasibility studies are underway to test whether signals recorded from the brain could control two FES implants, which could permit implantation in people who do not have voluntary control of both wrists.

Kilgore KL, Peckham PH, Keith MW, et al. An implanted upper-extremity neuroprosthesis: follow-up of five patients. Journal of Bone & Joint Surgery - American Volume, 79A:533-541, 1997. B011-5RA

Implant controls bladder and bowel function in patients with spinal cord injury

VA researchers hope that a new electrical stimulator implant will reduce complications of bladder, bowel and sexual function among patients with spinal cord injuries, improve their quality of life and increase their independence. The implant, which is being tested in 20 VA patients, is working well. Researchers expect that the device will improve bladder and bowel function and reduce the incidence of urinary tract infection and urinary incontinence, as well as the need for catheterization. In addition, improvements in patient health and independence may lead to significant reductions in resource needs.

United States experience with the Brindley Anterior Sacral Root Stimulator for bladder management in spinal cord injury patients. American Urologic Association, New Orleans, April 12-17, 1997. B804-RA

New bowel care/shower chair will help patients with spinal cord injuries

A new bowel care/shower chair designed by VA researchers for veterans with spinal cord injuries will improve quality of life, self esteem and physical well-being for these patients. A rigorous process of prototype development and clinical evaluation was used to develop two versions of this chair, a self-propelled and an assisted-care model. The new chair will also have a positive impact on care givers who perform bowel care procedures. VA researchers are collaborating with a manufacturer on the commercialization of this device.

Malassigne P, Nelson AL, Cors M, et al. Design development of a new bowel care/shower chair. Proceedings, RESNA '97, June 20-24, 1997. B768-2DA