Capabilities

Communicating the Science of Prosthetics and Orthotics

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EUGENE F. MURPHY (1913-2000) POLYMATH OF PROSTHETICS

By Dudley S. Childress, PhD.

One of the rare polymaths of prosthetics is deceased. Dr. Eugene F. Murphy died December 18, 2000 in Ithaca, N.Y. at the age of 87. It has been suggested that Leibniz was the last man to know everything about everything. Eugene F. Murphy was probably the last man to know everything about the field of limb prosthetics research and development in the United States. Murphy was not only a man of knowledge but also a man of integrity. Lewis Thomas, in his book *The Medusa & the Snail* has said, "Integrity is the most personal of qualities; groups and societies cannot possess it until single mortals have it in hand." Eugene F. Murphy had it in hand, and society has been the better because of him and individuals like him.

Eugene Murphy received his B.S. degree in Mechanical Engineering (M.E.) at Cornell U. in 1935, the Masters in M.E. from Syracuse U. in 1937 and the Ph.D. from the Illinois Institute of Technology (IIT) in 1948. After a couple of years with Ingersoll-Rand Co. ('37-'39) he took a teaching position at IIT ('39-'41) in Chicago, which was followed by a stint at the University of California Berkeley (UCB), ('41-'48). He became interested in prosthetics while teaching with Howard Eberhart, an acclaimed mechanical engineering professor at UCB, who had lost a leg below the knee in a WW II research accident and whose orthopaedic surgeon was Dr. Verne Inman of UCSF. Consequently, Murphy became closely connected with Dr. Inman's 1945 landmark studies of human walking and with the productive lower limb research at UCB in subsequent years; work that remains visible 50 years after its initiation. As a result of Ph.D. studies in Chicago, he also became closely allied with early (1945) prosthetics studies at Northwestern University under Paul Klopsteg. Later (1954) he was much involved with preparation of the classic American book on prosthetics, *Human Limbs and Their Substitutes*, which was edited by Paul E. Klopsteg, Ph.D. and Philip D. Wilson, M.D.

With his excellent engineering background and close association with prosthetics research and development—from its beginning in the USA—it was natural for Murphy to become associated in 1945 with the Committee on Artificial Limbs of the National Academy of Sciences as a staff engineer, and to join the VA in 1948

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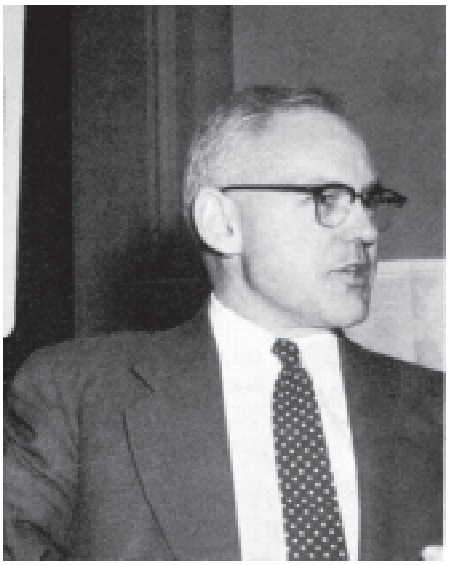
as Assistant Director for Research in the Prosthetics and Sensory Aids Service (PSAS) where he was also involved with vision research and visual aids development. It is interesting to note that prosthetics research became an official VA activity ten years before the medical research program was written into law in 1958. From 1954 until 1973 Murphy was Chief or the Research and Development Division of PSAS. The VA had a contractual program until 1973, and Murphy oversaw the contracts, working out of New York City. He was active in visiting projects, sharing ideas, fostering collaborations and expediting activities. He became Director of the Research Center for Prosthetics until 1978, and from 1978 until retirement in 1983 was Director of Technology Transfer with VA. In 1968, he started the *Bulletin of Prosthetics Research* (later the *Journal of Rehabilitation Research and Development*), and remained its editor until he retired from the VA. Helene, his wife and partner preceded him in death. He is survived by a daughter, Anne, and a son, Tom. He was buried in the family plot in DeWitt, N.Y.



Eugene F. Murphy, circa 1960.

Dr. Murphy was a member of the National Academy of Engineering and received many awards, including the Silver Medal from the City of Paris, the Meritorious Service Award of the VA in 1971, and the VA Distinguished Career Award in 1983. He was a Fellow of the ASME, the Acoustic Society (Am), the Optical Society (Am), the American Society of Testing and Materials, and the Rehabilitation Engineering Society of North America (RESNA). He received a Fulbright lectureship to Denmark ('57-'58), and a Professional Achievement Award from IIT (1983).

Dr. Murphy had polio as a youngster. He wore orthoses and walked with canes for much of his life but nothing held him back from an active and productive life. He often related stories about meeting Franklin D. Roosevelt during therapy sessions at the polio treatment center in Warm Springs, Georgia, a location where much activity in orthotics development originated.

I first met Dr. Murphy in 1966, when he had already been connected with the field of prosthetics for more than two decades. He visited our laboratory regularly, reviewing our contract. In addition, I saw him frequently at meetings of the Committee on Prosthetics Research and Development (CPRD) of the National Research Council and at professional meetings. Of course, we had many long conversations on the telephone. He enjoyed talking by phone. At his retirement dinner in 1983 I kidded him that the Bell Telephone Company was going to regret his retirement. I learned a lot from our conversations. Murphy was well versed in science as well as engineering and in the history of science and technology. He introduced me to the great German book on rehabilitation technology, Ersatzgleider und Arbeitshilfen (Limb Substitutes and Work Aids) and taught me history of rehabilitation technology, for which I've always been grateful. He told me about the greats and the near greats of the field. He was highly literate, academic, somewhat schoolteacher-like, and a fine editor, often correcting my English usage. Dr. Murphy didn't overly care for myoelectric control, my initial research area, and he always said that myoelectric control was just the bait for bringing me, an electrical engineer, into prosthetics so that I could work on other things. I never argued with him about it. I always enjoyed talking with him because he listened so intently and wrote down everything I said. That gave me a sense of real importance even though I knew he did this with everyone and even though I also knew he didn't have to write anything down because he had a photographic mind that remembered absolutely everything. In the 1980s

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Continuing the Challenge to Improve Prosthetics and Orthotics

Biomedical Engineering Students Use Previous NUPRL & RERP Research as a Base for Knowledge to Improve Prosthetics and Orthotics

By Jan Little

Students exploring research topics in work leading to their master's and doctorate degrees in biomedical engineering at Northwestern University's McCormick School of Engineering and Applied Science have the benefit of a rich basis for their projects. This foundation has been created by the Northwestern University Prosthetics Research Laboratory and Rehabilitation Engineering Research Program (NUPRL & RERP) research projects conducted in three focal areas in prosthetics and orthotics: Upper Limb Prosthetics, Walking and Aided Ambulation and Computer Aided Engineering in Prosthetics and Orthotics.

The Biomedical Engineering Curricula at McCormick School of Engineering and Applied Science attracts applicants from the top undergraduate schools in the United States and, in fact, around the world. Each year several of the graduate students pursuing master's or doctoral degrees choose to focus their graduate research in the area of prosthetics and orthotics which complement previous research. Work is carried out under the direction of Dudley S. Childress, PhD, the Director of NUPRL & RERP and senior staff members. This academic year, NUPRL & RERP has another group of outstanding graduate students conducting research.

Laura Miller is focusing on function of crutches as the topic for her doctoral dissertation.

Laura A. Miller earned her master's degree in biomedical engineering from Northwestern University. Her thesis was titled, "A Biomedical Analysis of a Vertical Compliance Shock Pylon for a Below Knee Amputee System". Laura is now working toward her doctorate degree with her project titled, "Theories of Human Ambulation with Application to Swing-through Crutch Gait." Her goal is to develop models of propulsion which may enhance future designs of ambulations aids. She has completed the Northwestern University Prosthetic-Orthotic Center (NUPOC) course in preparation for certification and is now doing a residency at the Rehabilitation Institute of Chicago (RIC). She also is an instructor at NUPOC.

Laura's bachelor's degree is from Tulane University in New Orleans, Louisiana. She is originally from Atlanta, Georgia but has become an avid Chicagoan and hopes to remain in the Northwestern University and RIC setting after earning her doctorate.

Georgios A. Bertos is completing work toward his doctorate degree with a project investigating how the

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mechanical impedance of the human leg changes with different walking speeds. The results of this study may help in the design of adaptive shock absorption characteristics in components of lower limb prostheses.

Georgios Bertos, who designed a microprocessor-based controller for use with upper limb prostheses as part of the requirements for his master's degree in electrical engineering, is now working toward his PhD in biomedical engineering.

Georgios, a native of Athens, Greece, earned his master of science degree in electrical engineering from Northwestern University with his theses reporting his design of a microprocessor-based extended physiological proprioception (e.p.p.) position controller for upper limb prostheses. Georgios, who earned money to pay in part for his studies at the National Technical University of Athens as a waiter in a legendary rock bar in Athens, plans to return to Greece. However, after earning his PhD, he will attend courses at NUPOC to become a certified prosthetist and orthotist. He then hopes to return to Greece and establish a rehabilitation facility there to specialize in prosthetic and orthotic research and application.

Andrew H. Hansen's work in analyzing roll-over shape and alignment of transtibial prostheses was published in more detail in the July 2000 issue of *Capabilities*. Andrew, who earned his bachelor's degree in biomedical engineering from the University of Iowa, Iowa City, Iowa, also earned his master's degree in biomedical engineering from Northwestern University. He notes that his research has been built on the work of another Northwestern University graduate in biomedical engineering, Erick Knox, PhD. To Knox's studies of the mechanics of prosthetic feet and resulting discovery

Andrew Hansen uses the VACMARL in the NUPRL area to examine the effect of roll-over shape on the alignment of transtibial prostheses.

of the significance of foot shape on walking, Hansen is adding examination of roll-over shape. He is studying human foot/ankle systems under various conditions: walking at different speeds, wearing shoes with different heel heights, walking up and down inclined surfaces and walking while carrying extra weight. His goal is to more clearly define the function and adaptability inherent in human foot/ankle systems so that similar functions can be designed in prosthetic feet and ankles.

Andrew relaxes after long hours in the research laboratory by becoming Andy – the drummer and vocalist in the rock band DUFF. Even his leisure pursuit has connections

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Orthotics and Prosthetics Users' Survey (OPUS) Ready for Nation-wide Testing in 2001

By Camille M. O'Reilly
Northwestern University, Evanston, IL. USA

Outcome measures evaluate progress in personal ability and performance of orthotic and prosthetic components

Efforts continue at the Rehabilitation Institute of Chicago's (RIC) Rehabilitation Services Evaluation Unit (RSEU) in the development of sound outcome measures for the assessment of prosthetic and orthotic services. This work is part of the Rehabilitation Engineering and Research Center (RERC) grant in Prosthetics and Orthotics headed by Dudley Childress, Ph.D. Now in its third year, clinicians, educators, fellow researchers, and consumers have enthusiastically supported this project. Everyone seems to understand the importance of being able to effectively measure and communicate the quality care and services provided by the O&P community.

The goal of this project is to develop both measures and a process for conducting meaningful evaluations for O&P. Whether these evaluations look at functional outcomes, reimbursement issues, service delivery, or clinician training, they need to be built upon a solid foundation of measurement, that is, measures that are both reliable and valid. A reliable measure is one that, time after time, consistently measures the desired attribute. A valid measure is one that is in fact measuring the attribute in question and not some other factor.

Mathematical model improves reliability, validity

To date, the RSEU project, called the Orthotics and Prosthetics Users' Survey (OPUS), has developed outcome measures for four different attributes: upper extremity function, lower extremity function, health related quality of life, and service satisfaction. Crucial to this process is the rigorous analysis method used to ensure the measurement quality of the instruments. The method being used is known as rating scale (or Rasch) analysis after George Rasch (1960) who developed a mathematical model for transforming ordinal level data into equal interval level data. Researchers at RIC use Rasch analysis to improve the reliability and validity of the instruments developed.

The data collected in rating functional status are usually ordinal, meaning that there is an implied order or hierarchy to the response categories. Often numbers are assigned to these categories i.e., 1 = independent; 2= minimal assist; 3= moderate assist; 4= maximum assist; 5= dependent. These numbers, though, are merely labels and differences in the amount of improvement required to progress from one category to the next are not necessarily equal. That is, the interval between independent and minimal assist may represent a greater level of improvement than the interval between minimal assist and moderate assist, even though the difference between the two labels is the same. The same applies to any sum of these ordinal values. As such, ordinal scales are not appropriate for arithmetic operations such as addition or subtraction or parametric statistics.

The rigor provided by Rasch analysis, in which both item difficulty and person ability are evaluated vis-a-vis each other, enables one to establish a hierarchy of items in terms of their difficulty. This kind of hierarchy would show, for example, that walking 50 feet would be less difficult than climbing a flight of stairs. Only when this type of analysis has been performed, can useful measures be constructed. It is this level of rigor that researchers at RIC are using in constructing both the outcome measures and the integrated set of data elements to be included in OPUS.

New data elements recently incorporated into OPUS

Recently incorporated into OPUS are data elements routinely assessed by O&P clinicians: skin condition, range of motion, and clinical treatment goals. Systematic documentation of orthotic goals such as maintain current alignment or improve mobility/gait and of prosthetic goals such as improve function/ADL's or improve appearance/self image brings into focus the overall reason for treatment. Having clearly defined goals is imperative in outcomes management. For it is the process and procedures employed to attain the goal that are often being evaluated. Clinical pathways grow out of this sort of research, as do improved devices and services.

Testing of OPUS on a national basis is scheduled for early 2001. Approximately ten O&P facilities will collaborate with RIC researchers to collect the following lower extremity orthotics and lower extremity prosthetics data: past health information, lower extremity functional status, health related quality of life, clinical assessment and treatment goals, and follow-up satisfaction with services. For additional information on this research, please contact Allen W. Heinemann, Ph.D. at a-heinemann@northwestern.edu.

Rasch, G. (1960) Probabalistic models for some intelligence and attainment tests.[Danish Institute of Educational Research 1960, University of Chicago Press 1980, MESA Press 1993] Chicago: MESA Press.

Adding to the Knowledge... NU Graduate Students

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to prosthetics and orthotics. Lead guitarist and other vocalist in the band is Steve Duff, a prosthetist in the clinical prosthetic and orthotic service of the Rehabilitation Institute of Chicago.

Pinata Hungspreugs, from Edina, MN, defended her master's project at Northwestern University in November 2000. Like other graduate students, Pinata built her project on previous work done at NUPRL & RERP. Her master's work developed a computer program to be used by prosthetists to help choose components needed to create an upper limb prosthesis system for clients and is based on work done in the past by Michael Redding, another graduate of Northwestern University, and Craig W. Heckathorne. That system is the Prosthetic Arm Design and Simulation System (PADSS), which Heckathorne wrote about in more detail in the April 2000 issue of *Capabilities*. Pinata is using the work Heckathorne and Redding conducted in the early 1990s and is developing graphic and platform capabilities to extend the PADSS to personal computers. User friendliness is a main goal of the project according to Ms. Hungspreugs. She will validate her programs by working with Heckathorne in cooperative efforts with the RIC clinical prosthetic and orthotic services as people are fitted with upper limb systems.

Pinata Hungspreugs is working to make the NUPRL& RERP PADSS more user friendly to facilitate clinical use of the program.

Pinata is taking the winter quarter off from Northwestern to work with Honda Corporation in California to develop a neuromusculoskeletal human computer model. She will return to Northwestern to pursue her doctoral degree after her work at Honda. She is hoping she may gain ideas about improving the PADSS system and – she adds – maybe she will gain enough experience to explore developing a human model for walking.

Expanding the body of knowledge about walking which has been gathered by previous research projects is a goal of Steve Miff as he is defining a project for his PhD work. Steve's project for his Masters Degree in Biomedical Engineering (Northwestern University, 2000) studied the effects of step length, cadence, and walking speed on gait kinematics, kinetics, and energetics. He would like to add to the rocker-based inverted pendulum model for normal walking by further looking at different aspects of human walking. He plans to study initiation and termination of walking in an effort to better understand propulsion.

Steve Miff's doctoral research will add to the body of knowledge about human walking.

Steve was born in Cluj-Napoca, Romania and is now a resident of the Chicago area. His ultimate goal is to accept a position in academia, but feels a few years working in industry would add to his knowledge of his chosen area.

Brian Ruhe, a native of Greenville, Ohio, is studying the gait characteristics of persons with bilateral transfemoral amputation as he works toward his Master's Degree in Biomedical Engineering. Brian began his association with Northwestern University PRL & RERP in the summer of 1997, when he was awarded a Dole Scholarship. At that time, Brian was finishing his B.S. in Biomedical Engineering from Wright State University, Day-

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Congress Passes Biomedical Engineering Funding Bill

A bill which will create a new institute for Imaging/ Biomedical Engineering within the National Institutes of Health (NIH) was passed in a January session of Congress. Research projects in prosthetics and orthotics can now be funded under NIH as well as the National Institute on Disability and Rehabilitation Research and the Department of Veterans Affairs.

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he was able to recite from memory the names of the "el" stops in Evanston, all in perfect order, even though he had not ridden the elevated trains from Chicago to Evanston since the 40s.

Over the years we grew to be close friends. I was fortunate to have him, along with A. Bennett Wilson, Hector Kay, Joseph Traub, Anthony Staros, Colin McLaurin, Jim Reswick, Fred Hampton, Blair Hanger, Hans Mauch, Clinton Compere, M.D., Ernest Burgess,M.D., Claude Lambert, M.D., Thomas Aitken, M.D., Edward Grahn, and a host of other people as my mentors.

I believe Dr. Murphy's last visit to Chicago and to our laboratory was in 1992, after my invitation to him and his wife Helene to attend the ISPO World Congress here. We communicated periodically thereafter. Hans Bethe, the famous Nobel laureate in astrophysics, lived in the same retirement facility in Ithaca as Dr. Murphy and Helene. I attempted to get them together because Bethe's father, a well known physiologist in Germany between the wars, designed a clever artificial hand, the Bethe Hand. I thought this prosthetic hand provided Murphy with a perfect way to initiate conversation with Bethe, but as far as I know he never approached Bethe. Murphy was a proper man, much in the tradition of his era, and was, perhaps, somewhat shy. It's ironic that on December 19 the day after his death, the 106th Congress finalized and sent legislation to the President to create a new NIH Institute for Bio-imaging and Bioengineering research; because, Murphy was one of the first top-notch engineers in the country to immerse himself deeply in anatomy, biomechanics, physiology, human performance, and the life sciences. He was one of the founding fathers of engineering in medicine, particularly engineering in rehabilitation.

Dr. Murphy was a person who quietly and effectively contributed much to the field of prosthetics and orthotics (P&O). His influence on the P & O community reminds me of Jimmy Stewart's role as George Bailey in the movie, "It's a Wonderful Life". It's difficult to evaluate a person's impact on a community until one can see how different things would have been had he not been around. I feel that prosthetics and orthotics would be much the poorer if Dr. Eugene Murphy had not dedicated his life to this field. The field and those in it have benefited greatly because he lived. Persons with disability have been immensely helped because of what he did. Eugene F. Murphy is greatly missed.

Eugene Murphy was one of the finest human beings I have ever known. Murphy always had time for you, he was always "all there" for you—not wishing he were somewhere else—he had patience and endurance, he was satisfied with his lot in life, he took up tasks one at a time and completed them, and he stayed with projects to the end. Philosopher Douglas Steere of Haverford College would have called him a "collected person". When Murphy retired in 1983, I wrote a few short poems for the occasion. One is below. It's called, "The Collected Person".

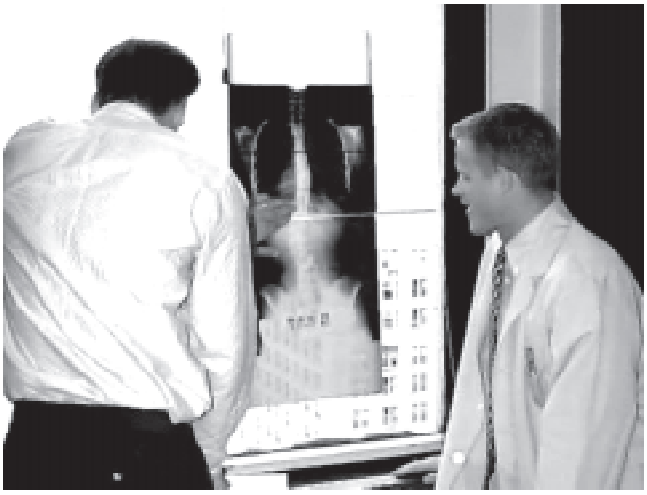
Some know the Universal
is found in the local,
the great in the small,
the first in the last.
They serve;
collect their lives,
inherit the earth. □

NUPOC

Change is in the Air: ABC Clinical Patient Management (CPM) Examination Undergoes Revision

The American Board for Certification in Prosthetics and Orthotics has introduced a major change in the clinical patient management (CPM) examination. This change was precipitated by the 1999 Practice Analysis Report in Prosthetics and Orthotics. The new practitioner profiles, based on the report, emphasizes direct patient evaluation and assessment, treatment implementation, and patient follow-up. Therefore the new examination will test candidates abilities in clinical patient assessment, psychomotor skills related to measurement and fitting, device recommendation specific to patient scenarios and patient follow-up care. Fabrication and other manual skills will be de-emphasized.

This change in the examination may come as a surprise to many certified practitioners. The previous ABC examination relied heavily on technical skills. Candidates were required to design and fit model patients with various types of orthoses and prostheses. This previous format, while very effective in assessing the actual outcome of fittings, did not address important elements of the practitioner profile The previous examination format took three and 1/2 days. The candidates were only assessed on the final outcome of their fittings. Little or no assessments of candidates took place during the initial patient interview, measurement, impression, model modification, and initial set-up and alignment. Candidates taking the previous CPM examinations had to bring many tools and instruments to complete the fittings. Material costs were very high for the prior examination.



Director of Orthotic Education, Bryan Malas, CO, (right), works with a teaching module.

Director of Prosthetic Education, Mark Edwards,CP, (left) uses a patient demonstrator to illustrate a point.

The newly structured examination will rely heavily on "real-life" patient treatment scenarios. The new format will take approximately 4 hours. Candidates will be assessed on written, verbal and demonstrated activities. Assessment domains include a 1-1/2 hour proctored component and a 2-1/2 hour clinical simulation in which candidates interact with both patient models and examiners. This format will incorporate 5 modules, or stations, and is similar in design to the OSCE . OSCE stands for Objective Structured Clinical Examination. This format is often used in medical schools and by certifying bodies to assess clinical competence. The OSCE allows examiners to be clear in their objectives and decreases chances for subjective influences. Scoring keys and checklists assists the examiners at each module. All candidates are guaranteed the same experiences.

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The American Board for Certification will rely heavily on the residency training programs set forth by the National Commission on Orthotics and Prosthetics. The NCOPE residency aims to insure common clinical experiences by all candidates while being supervised and evaluated by an experienced ABC certified practitioner. It is expected that during this residency, many of the technical tasks, which were a part of the prior examination, will now become integral aspects of the residency experience.

This paradigm shift requires those individuals, who volunteer to be residency directors, to carefully structure and thoughtfully mentor prosthetic and orthotic residents. Their future and the future of quality rehabilitative care for the disabled is in their hands.■

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ton, Ohio. During his research that summer, Brian found that little or no data existed about gait characteristics of people with tranfemoral bilateral amputations. After graduation from Wright State, Brian began the post-graduate course in Biomedical engineering at Northwestern.

Brian Ruhe is investigating the gait of people with bilateral transfemoral amputations.

Because Brian has bilateral transfemoral amputations (see "Getting Back to Life: First You Make a Plan" in the October 1977 issue of *Capabilities*), he feels that studying the compensatory actions of the hip and trunk while using two above knee prostheses may be helpful in enhancing the function of prostheses for people with unilateral amputations as well. To date, Brian has studied five people with bilateral transfemoral amputation using the VA Chicago Motion Analysis Research Laboratory (VACMARL) computerized motion analysis systems at NUPRL & RERP.

Brian is a member of RIC-Chicago Blackhawks and USA Sled Hockey Teams. He hopes to be chosen the United States Sled Hockey Team which will compete at the 2002 Winter Paralympic Games in Utah.

Regina (Gina) Konz, from Mt. Pleasant, Iowa, earned both her Bachelor degree in Biomedical Engineering and her Master's degree in Mechanical Engineering from the University of Iowa. After graduation, she moved to Chicago and became the research engineer and gait laboratory manager in the studies of joint arthroplasty at Rush-Presbyterian-St. Luke's Medical Center. In August of 1999, she joined the NUPRL & RERP staff to manage the VACMARL (See article in October 1999 issue of *Capabilities*). At Northwestern, Gina supervises use of the motion analysis system to study functions of prosthetic and orthotic systems. Her experience in the study of gait has led to her decision to pursue her PhD in Biomedical Engineering, with emphasis on rehabilitation in relation to lower extremity prosthetics and orthotics. Her goal is to become a professor in Biomedical Engineering.

Regina Konz's work in gait laboratories has led her to seek a doctoral degree in biomedical engineering.

Each of these current graduate students will add more information to the platform on which future research will be built. This progressive accumulation of knowledge is not accidental. From the inception of this RERP, the road map for projects has been one of ever deeper layers of findings about NUPRL & RERP's three core areas of prosthetic and orthotic research■

The VA Pres

News from the Department of Veterans Affairs

Coordinated by Robert M. Baum
Prosthetic Network Manager, P&SAS SHG,
VA Headquarters, Washington D.C.

Prevention, Amputation Care and Treatment (PACT): VHA's Efforts to Reduce Amputations in "At Risk" Patients

*By **Jeffrey M. Robbins**, DPM Director VHA HQ Podiatry Services,*
***Leonard Pogach**, MD Director VHA HQ Diabetes Program,*
***Leigh Anderson,** MD, Chief Consultant Physical Medicine and Rehabilitation*
***Gerald Hawley**, RN, MSN, Project Manager, Healthcare Analysis and Information Group*

The prevention of lower extremity amputations, especially in "at risk" patients such as those suffering from diabetes and peripheral vascular disease, has been set as a priority by several agencies. The Public Health Service has set goals in Health People 2010, the American Public Health Association in Healthy Communities 2000, the American Diabetes Association and the Center for Disease Control in their clinical guidelines. The Department of Veterans Affairs' effort in amputation prevention is seen in its clinical guidelines for diabetes, as well as in the Prevention of Amputation Care and Treatment program, VHA Directive 96-007: PACT.

Renewed emphasis on preventing amputation

It is generally accepted that most diabetic lower extremity amputations can be prevented. However, several studies utilizing a variety of amputation prevention strategies have reported only limited success. In 1993, VHA embarked on a multidisciplinary intervention and prevention strategy to prevent first amputation, and for patients who had undergone amputation, to prevent further amputation. In 1996, the PACT national directive was modified to include performance measures for the screening component. The three measures include 1. palpation of pedal pulses, 2. sensory foot testing, and 3. inspection for foot deformities.

Components of the Program

The components of the PACT program include 1. foot screening, 2. risk assessment, and 3. appropriate and timely referral.

Foot screening includes palpation of pedal pulses, sensory foot testing and inspection for foot deformities.

Risk assessment involves the classification or scoring of the risk of amputation based on relative risk factors identified during screening. A foot risk score (FRS) of 0 indicates there is no evidence of peripheral neuropathy, peripheral vascular disease, or foot ulceration. Although this patient was at the lowest risk for amputation, they still require at least yearly foot screening and regularly scheduled foot care if any condition exists. A FRS of 1 would indicate the presence of either peripheral neuropathy, and/or mild to moderate peripheral vascular disease, and mild to moderate foot deformities. This patient group does not have impending morbidity, but is at a significantly greater risk and therefore requires timely referral for foot care. Finally, a FRS of 2 would indicate presence of either peripheral neuropathy, and/or peripheral vascular disease, and/or foot ulceration (past or present), and/or surgical or neuropathic foot deformities. In this group ulceration is much more likely, and more immediate referral is indicated to the appropriate service depending on the patient's circumstance. (i.e., vascular reconstruction, preventive foot surgery, wound care of existing ulcers, etc.)

Coordination of care requires the effective communication between services of patient needs based on

the initial assessment and risk assessment. Since systemic factors must also be controlled, especially in the diabetic population, the overriding principals of the prevention of first amputation strategy include 1. identify at risk patients, 2. glycemic control or other systemic issues, 3. smoking cessation, 4. regular podiatric care and prevention that includes proper footgear, and 5. self care education. The overriding principals of the prevention of further amputation strategy include 1. glycemic control or other systemic issues, 2. smoking cessation, 3. regular foot care for the remaining limb, 4. self-care education, 5. limb salvage/bypass, 6. prosthetics and/or orthotics, and/or proper shoe.

Implementation Issues

Each medical center was directed to institute the program objectives based on locally available resources, and to create local policy to deploy this program. This has resulted in several different models based on the original national directive. Some stations created formal PACT clinics that are multidisciplinary, while others simply incorporated the components of screening, risk assessment, and appropriate and timely referral into their existing structures.

Results

The results of the amputation data from the HAIG report: Lower Extremity Complications in VHA (FY89-99) Part I: Lower Extremity Amputation (LEA) Rates, Progression, and Utilization have shown an overall reduction in amputation rates from 1997 – 1999 of 36.78%

Whether the PACT intervention is solely responsible for this improvement, it is unknown; however, it is assumed to be a positive factor. A more compelling factor may be the addition of the PACT foot screening into the performance measures for VHA, which includes: visual inspections, palpation of pedal pulses, and sensory testing.

It should be noted that the PACT program has not been uniformly instituted throughout the VHA system, and efforts are still underway to assist those medical centers that are having difficulty. Should you desire additional information, contact Jeffrey M. Robbins, DPM at 216-231-3286 or jeffrey.robbins@med.va.gov

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Northwestern Prosthetic & Orthotic Programs News

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Rebecca Stine is New Manager of VACMARL

Rebecca Stine has assumed the position of Manager of the VA Chicago Motion Analysis Research Laboratory (VACMARL). Ms. Stine comes to us from Motion Analysis Corporation of Santa Rosa, California where she has been Biomechanics Application Engineer for the last five years. She was Research Laboratory Manager of the BioDynamics Laboratory at the University of Kentucky for six years, prior to going to California.

Rebecca follows Regina Konz as manager of the VACMARL. Mrs. Konz resigned to pursue her PhD in Biomedical Engineering. Mrs. Konz is the mother of a new baby boy, Jacob Matthew, born December 30, 2000.

Stefania Fatone Joins PRL & RERP

Stefania Fatone, who earned her PhD at La Trobe University in Melbourne, Australia, joined the research staff of the NUPRL &RERP as a post-doctoral fellow in October. She is a Certified Prosthetist and Orthotist (CPO). Dr. Fatone's doctoral dissertation was titled "Gait Biomechanics and Prosthetic Management of Proximal Femoral Focal Deficiency (PFFD)". The laboratory greatly benefits from Dr. Fatone's presence. We now have two CPOs who also have PhDs. The other is Dr. Margrit Meier from Switzerland

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