



RESEARCH CURRENTS

Research News from the U.S. Department of Veterans Affairs



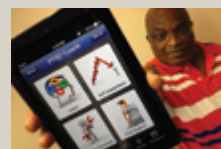
High-tech prosthetic arm wins FDA approval

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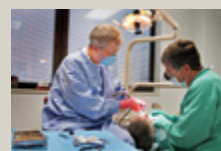
Fred Downs Jr., a Vietnam Veteran and former chief of prosthetics and sensory aids for VA, wears the DEKA prosthetic arm as he meets with an Iraq Veteran and quadruple amputee at Walter Reed Army Medical Center in 2009.

Photo by John R. Borlik Jr.

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U.S. Department of Veterans Affairs
Veterans Health Administration
Office of Research and Development



Study urges reduction in use of routine pelvic exams for women

A review by VA and university researchers of 52 past studies found scant evidence to support routine pelvic exams, outside of cervical cancer screening, for women who are at average risk with no gynecological symptoms.

The study, funded by VA and the American College of Physicians, has led to a new clinical practice guideline being issued by the physicians' group.

"For many decades, women have undergone pelvic exams as a routine part of preventive care," said lead author Dr. Hanna Bloomfield, of the Minneapolis VA Health Care System. "With the exception of cervical cancer screening, our findings challenge the use of the exams for many routine purposes. We believe the findings and the new guideline will have a significant positive impact on women's health care."

Many providers and patients believe pelvic exams should be part of annual well woman visits. But the review study found little evidence to support that view. Outside of cervical cancer, the review study found no data showing that the exams stem sickness or death from any condition. (*Annals of Internal Medicine*, July 1, 2014)

Screening tool could help predict violence risk

A team at the Durham VA and the University of North Carolina has developed a brief screening tool they say could help clinicians quickly and systematically identify Veterans at higher risk for violence, and prioritize them for more thorough assessments.



Dr. Eric Elbogen

Photo by Linnie Skidmore

The researchers pinpointed the factors in Veterans' histories that appeared to predict later violence. They boiled those factors down to a set of five questions. The questions cover financial instability, combat experience, alcohol misuse, a history of violence or arrests, and anger linked to PTSD. The test is called the "VIO-SCAN."

"When we hear about a Veteran being violent, there is a knee-jerk reaction that it stems from PTSD," said lead author Dr. Eric Elbogen in a university news release. "The VIO-SCAN shows that PTSD is relevant to screening risk but is only the tip of the iceberg. Non-PTSD factors need to be looked at, such as alcohol abuse or past criminal behavior, just like in civilians."

He and his coauthors stressed that the tool "does not replace fully informed clinical decision making; instead, it provides a springboard for further assessing risk and protective factors and identifying the need for a more comprehensive risk assessment. ..." (*American Journal of Psychiatry*, online May 16, 2014)

Behavioral therapy for insomnia

Older Veterans with insomnia showed lasting improvements after taking part in a five-session therapy program delivered by non-specialists.

Behavioral therapy for insomnia has been shown in past studies to work well, but it is usually delivered by sleep medicine specialists. The new VA intervention was designed to be given by non-specialists, such as health educators. This will help make it more widely available. It involves five sessions delivered over six weeks, to groups or individual patients.

In the study, nearly 160 patients received either group or individual therapy, or just sleep education but no therapy. The results from the group or individual sessions were similar to those reported with hypnotic drugs.

"This intervention provides an effective and safe option for the management of chronic insomnia in older adults," said the researchers, from the VA Greater Los Angeles Healthcare System. (American Geriatrics Society annual meeting, May 2014)

Study of second-line diabetes treatments finds insulin riskier

A VA database study that looked at more than 178,000 Veterans with diabetes found that when a second drug is needed for tighter control of blood sugar, insulin may be the riskier of two common options.

The study included Veterans who were on the drug metformin (sold as Glucophage) as a first-line diabetes treatment. Of these, nearly 3,000 added insulin, and nearly 40,000 added a sulfonylurea drug such as glimepiride (Amaryl) or glipizide (Glucotrol).

The insulin group had a higher rate of death from any cause than the sulfonylurea group. The incidence of heart attack or stroke was similar between the groups. The researchers adjusted for clinical and demographic characteristics to ensure they were comparing similar patients.

“Our study suggests that intensification of metformin with insulin among patients who could add a sulfonylurea [those with a hemoglobin A1C level under 10 percent] offers no advantage in regard to risk of cardiovascular events and is associated with some risk,” wrote Dr. Christianne Roumie and co-authors.

The study was based at the Geriatric Research, Education and Clinical Center at the VA Tennessee Valley Healthcare System. (*Journal of the American Medical Association*, June 11, 2014)



A VA research team in Los Angeles produced an “evidence map” of the effects of acupuncture.

Photo: Getty Images

‘Super review’ sums up evidence for acupuncture

Thousands of studies have been conducted on acupuncture in the past several decades. But sorting through the results isn’t easy. That’s where review studies come in—they analyze the results from multiple studies and forge conclusions.

Now, a VA team in Los Angeles has reviewed the most recent review studies on acupuncture—167 in all—and summed up where the strong and weak evidence lies for the ancient Chinese healing art. They created a visual map of the results for other health professionals.

The team found clear positive evidence for acupuncture for chronic pain, headache, and migraine.

There was a *potential* positive effect for a number of other conditions, such as cancer pain, menstruation pain, insomnia, smoking cessation, depression, schizophrenia, and nausea after surgery.

Despite numerous trials, there was unclear evidence for back and neck pain, post-surgery pain, fibromyalgia, cancer-treatment side effects, irritable bowel syndrome, nasal inflammation, high blood pressure, menopausal problems, and opiate addiction.

Overall, the researchers concluded that “the therapeutic effectiveness of acupuncture is unclear and further research is needed regarding a substantial number of specific clinical indications related to wellness and mental health.”

(International Research Congress on Integrative Medicine and Health, May 2014)



For more information on diabetes research, visit www.research.va.gov/research_topics/diabetes.cfm



The DEKA arm features six programmable grips that allow users to do a variety of everyday tasks, from handling small, delicate objects to using tools.

Photo courtesy of dekarsearch.com



DEKA advanced prosthetic arm gains FDA approval

A futuristic prosthetic arm funded by the military, developed by a private company, and rigorously tested by VA is now approved by the FDA

A futuristic prosthetic arm funded by the military, developed by a private company, and rigorously tested in a four-year VA study has now been approved for the commercial market by the U.S. Food and Drug Administration.

The FDA approved the DEKA Arm System in May 2014, paving the way for the device to be manufactured, marketed, and made available in the VA health system. The cost for the system is not yet known—that will depend partly on licensing and manufacturing arrangements—but VA is expected to offer it as an option for any VA-enrolled Veteran who can clinically benefit from it. The time frame for the arm to be brought to market is also unclear at this point.

The arm was developed by DEKA Integrated Solutions Corporation, based in Manchester, N.H., with \$40 million in funding from the Defense Advanced Research Projects

Agency (DARPA), through its Revolutionizing Prosthetics Program. The program is also funding another sophisticated arm, being worked on at the Johns Hopkins Applied Physics Laboratory. That device is still in development.

A LEAP FORWARD FROM EXISTING TECHNOLOGY

The DEKA system is a huge leap forward in technology from existing prosthetic arms and hands. Still today, most upper-limb amputees use a hook or split-hook prosthesis that offers only limited function, or an artificial hand that looks natural on the outside but provides no finger movement or grasp. The DEKA arm offers a variety of firsts: It has multiple powered joints and degrees of freedom and can carry out several movements at the same time. It uses an array of sensors and switches and has wireless control.

The wrist and fingers adjust into six different grips, enabling users to perform a range of everyday functions: picking up a grape or a glass, holding a tube of toothpaste, turning a key in a lock, using a power tool.

“Many features of this arm are unprecedented,” says Dr. Linda Resnik, who led VA’s study of the arm. She is with the Providence VA Medical Center and Brown University.



A more detailed discussion of the DEKA arm and its capabilities can be found in a May 2009 VA Research Currents article at www.research.va.gov/resources/pubs/docs/va_research_currents_may_09.pdf

Researchers collected data on the arm over four years at four VA sites—New York, Tampa, Long Beach, Calif., and Providence, R.I.—and at the Center for the Intrepid, a military rehabilitation site in San Antonio. The study findings have been published in a number of journal articles, including two earlier this year in VA’s *Journal of Rehabilitation Research and Development*.

The study was the largest ever evaluation of a new upper-limb prosthesis.

Resnik says: “The big story is how we collaborated with DARPA—which involved the agreement with DEKA—and how we mobilized VA’s clinical research network to conduct a rigorous study on this device. We wanted to ensure that

the arm is optimized to best suit the needs of Veterans with limb loss.”

RESEARCH STUDY ONGOING

Some three dozen Veterans who had lost an arm took part in the research. Some evaluated both the latest version of the DEKA arm, the Gen 3, and an earlier version, the Gen 2. VA researchers worked closely with DEKA engineers to refine the prototype based on the first round of feedback.

The resulting model incorporates a number of features recommended by the Veteran testers, ranging from internal batteries with longer life, to improved control systems and more reliable components. The latest model is also wireless and waterproof, and has improved “cosmesis,” or external appearance.

Resnik says the arm may continue to undergo slight improvements leading up to its commercial release. In fact, she and her team are continuing their study. In the newest phase of the research, based in New York, Tampa, and San Antonio, participants learn how to use the arm at the clinic and then take it home for 12 weeks, with researchers monitoring their progress. The study is expected to last another year and a half and is now recruiting participants.

“It’s an important study for us in VA,” says Resnik. “We’ll learn more about who can really benefit from this arm, and in what ways.”

For more on the DEKA arm’s unique control system, see the next page. ►

‘I was a one-sided person’

In a VA Research video, Army Veteran Artie McAuley talks about his experience in the DEKA arm study. McAuley, who lost his arm in an auto accident, says that before using the arm, “I was just a one-sided person.” The video also features Dr. Linda Resnik, lead researcher on VA’s DEKA arm study, and Christopher Fantini, lead prosthetist at the New York Harbor Healthcare System.



View the video at <http://youtu.be/KCUwoxuAdYQ>



HOW IS THE DEKA ARM CONTROLLED?

One of the key advances in the DEKA arm is its variety of control options.

- **Most users take advantage of foot controls** (see image). The latest version used in the DEKA arm has “inertial measurement units,” worn on the shoes. The units translate foot movements into commands for the arm, so when a user moves his or her feet in specific ways, the prosthesis moves. The units can also detect when the user is walking and temporarily disable foot-controlled movements of the arm.
- **Some users also have electrodes** that pick up signals from muscles in the residual arm or shoulder area. An internal computer decodes these into signals to move the prosthesis, or to open and close the fingers. So when the user contracts the correct muscle, the prosthesis moves.*
- **Other controls include manual switches** that the user can simply operate with the other hand, or pneumatic bladders—small bags that fill with air to relieve pressure or provide more stability.

* **These types of control are not considered direct brain or “mind” control.** That would probably require a surgical implant of tiny electrodes in the brain’s outer layer, whereas the current DEKA model is “strap and go”—no surgery is required. Researchers in VA and elsewhere are working on direct brain control—for example, the BrainGate system, also based at the Providence VA and Brown University. This approach may one day be an option to operate the DEKA or other robotic arms.



Study: 9 in 10 users happy with PTSD Coach smartphone app

It’s been downloaded more than 150,000 times by people in more than 80 countries. It’s received high ratings from both iPhone and Android users. It’s even won two big awards.

But the PTSD Coach smartphone app had never been formally studied in a sample of Veterans with posttraumatic stress disorder—until recently.

A team with VA’s National Center for PTSD (NCPTSD) conducted a survey and focus groups with 45 users, all in residential treatment for PTSD. The findings appeared in the journal *Military Medicine* earlier this year. The researchers say the study is preliminary and should be followed up with further research, with more Veterans.

‘PARTICIPANTS WERE VERY SATISFIED’

Overall, “participants were very satisfied with PTSD Coach and perceived it as being moderately to very helpful with their PTSD symptoms,” wrote the study authors. They

found that almost 90 percent of the Veterans were “moderately to extremely satisfied.”

Lead researcher Dr. Eric Kuhn points out that the app was initially designed with input from nearly 80 Veterans with PTSD. They talked about what they wanted to see in the product.

“One of the things they said they wanted was tools they could use whenever or wherever they were experiencing symptoms—like standing in line at a store,” says Kuhn, with NCPTSD’s Dissemination and Training Division in Menlo Park, Calif. The group led the development of the app. The Department of Defense’s National Center for Telehealth and Technology also played a role.

“Manage Symptoms” is one of four main features in the app. Users can rate the distress they are feeling at the moment, and choose from a number of quick evidence-based coping tools, some derived from cognitive behavioral therapy. They include, for example, breathing and progressive



A Veteran checks out the **PTSD Coach smartphone application**. In a VA study, most users said they were very satisfied with the app and that it helped their symptoms.

Photo by John R. Borlik Jr.

muscle relaxation exercises, or suggestions for stress-busters such as taking a walk.

The other main sections offer users options to learn more about PTSD, assess and track their own symptoms, and find support, in the form of emergency and crisis numbers or personal contacts.

SUITABLE FOR ALL GENERATIONS

The 45 men and women who took part in the study ranged in age. Some used the app on their own phones, while others borrowed an iPod Touch as part of the study. Kuhn says these factors confirm that the app is a potentially valuable tool not only for younger Veterans, but also for Vietnam-era or older Veterans who may be less well-versed in the world of smartphones and apps.

The study didn't include a formal clinical assessment of the Veterans' PTSD symptoms, so Kuhn and colleagues can't say whether the app actually reduces symptoms over time.

They recommend further research to look specifically at that question.

In addition to its high user ratings online, PTSD Coach has received an award from the Federal Communications Commission for enhancing accessibility, and one from the American Telemedicine Association for innovation.

To download the app or learn more about it, visit the NCPTSD website at www.ptsd.va.gov/public/materials/apps/PTSDCoach.asp. ★

IN THEIR OWN WORDS

Below is a sampling of what Veterans in the PTSD Coach study had to say about the app.

- **"I used it at night** when I had nightmares. The relaxation exercise was really helpful."
- **"I thought it helped tremendously.** When I had anxiety, the breathing helped."
- **"I like the explanation on PTSD.** I had some revelations."

A few Veterans commented on things they didn't like about the app, and offered suggestions:

- **"With my chronic pain,** I can't take a walk or dance [options offered as pleasant events], so I got frustrated. It would be great if you could put in your physical problems."
- **"It is frustrating when you have to look for the tool** that you want, especially when you need it."

Overall, most said they would recommend it to others:

- **"I called my friend who has PTSD** and told him to download it."
- **"I was pretty stoked about it.** I even told some of my friends in the military about it via Facebook."



Dental assistant Freda Reutz (left) and Dr. Ronald Pleis attend to a patient at the **Central Arkansas VA Healthcare System**.

Photo by Jeff Bowen

Fluoride initiative takes bite out of cavity rate

Thanks to a performance measure launched in 2009, VA is doing a better job of providing preventive fluoride to those Veterans at highest risk for cavities

It's no news that appropriate use of fluoride prevents cavities. What *is* news is that 8 in 10 VA dental clinics are now meeting a high standard for ensuring that those Veterans at highest risk for tooth decay are getting preventive fluoride treatment. The group includes many poor and minority Veterans, and many with multiple medical problems. Thanks to the new initiative, their fluoride use is up, and their need for new fillings is down.

A study of the impact of a VA-wide fluoride performance measure was published in May 2014 in the *Journal of the American Dental Association*.

"Our findings show this program has had a very substantial positive impact," says lead author Dr. Gretchen Gibson, who directs the VA Oral Health Quality Group, part of the national Office of Dentistry. Based in Arkansas, she also works as a dentist at the Fayetteville VA Medical Center.



'Part of our success may stem from just an increased awareness of prevention overall.'

The performance measure went into effect in fiscal 2009. It calls for all VA dental clinics to identify Veterans at highest risk for cavities—namely, those who have already had two or more fillings in a year's time. The goal is to boost the percentage of these Veterans who get a fluoride application. It could be a varnish during a dental visit, or a prescription paste or gel to be applied at home.

While regular fluoride toothpaste is helpful in preventing cavities, the treatments given or prescribed by dentists have a higher concentration of the enamel-protecting mineral.

In the first year, the performance measure required clinics to meet the goal of providing fluoride to at least 60 percent of high-risk patients. The target rose gradually to 90 percent by fiscal 2012.

To lay the groundwork for clinics to ramp up their efforts, the national VA dental program offered increased education to VA's more than 800 dentists and more than 300 dental hygienists. A research team reviewed the literature on fluoride use and shared the results. All the providers were invited to webinars, and every clinic received educational posters.

REDUCED NEED FOR NEW FILLINGS

The study of the performance measure's effect found that 81 percent of VA dental clinics met the goal in 2012. In other words, 8 in 10 clinics gave preventive fluoride to at least 90 percent of their high-risk patients.

Another facet of the findings: Fluoride use for high-risk patients rose from around 52 percent to 94 percent between 2008 and 2012.

Most important, this all translated into a reduced need for new fillings, both for the target high-risk population and VA dental patients in general. The impact was modest but significant, say the study authors. Among the high-risk Veterans, there was nearly a 10-point drop in the rate of new fillings. Before the performance measure launched in 2009, the percentage of high-risk VA dental patients needing new fillings had been on the rise.

INCREASED OVERALL AWARENESS OF PREVENTION

Gibson points out that because system-wide performance measures in VA are driven by computerized data, there was a need to identify the high-risk patients based on information in their medical records—specially, their history of cavities and fillings. But she says it appears from the study's findings that a wider cross section of patients benefited from the fluoride initiative.

"It has been our mantra to the field throughout this process that we catch the obvious patients with the performance measure, but it is also a trigger to make providers more aware of everyone who might benefit from extra fluoride," says Gibson.

"Part of our success may stem from just an increased awareness of prevention overall. This might help explain the drop in needed restorations [fillings] for all patients, and not just those deemed high-risk by the computer data."

Gibson and her coauthors say further research can home in on what type of fluoride treatments work best for which patients, and how often they should be applied. ★

Male breast cancer: A rare disease, on the rise

“I woke up in the morning with a good-sized lump in my chest. At that point in my life I had no idea men could get breast cancer. I contacted my doctor and we set up the same test women usually get—a mammogram and an ultrasound followed by a core biopsy. The doctor called me to let me know I had breast cancer. It was the first time I knew I had breasts. ...”

That’s how one hard-boiled Marine recalls the beginning of his bout with male breast cancer. His story, along with that of others affected by the condition, is found on the website *semperfialwaysfaithful.com*.

A recent study led by Dr. Anita Aggarwal, an oncologist at the Washington, DC, VA Medical Center, is the most extensive look yet at the prevalence of the disease among VA patients. She and her colleagues combed the VA Central Cancer Registry to learn more about how many men in VA have the disease, and how it compares with breast cancer among female Veterans who receive care in VA. Aggarwal presented the findings at a meeting of the American Society for Clinical Oncology in June.

A SHARP RISE IN RECENT DECADES

“In the general population, it’s very rare,” points out Aggarwal, noting that fewer than 1 percent of breast cancer cases occur in men. She says it’s on the rise, though, with data showing a 26 percent increase from 1975 to 2010.

Scientists don’t yet have a handle on why that is, but they do know that men with breast cancer are typically diagnosed at a later stage than their female peers.

“With men, there’s a delay in detection,” says Aggarwal. “There’s less awareness, no screening. And men don’t palpate their breasts every month, as do many women. All these factors combine.”

A quick biology lesson: Men not only have breasts, but they also have milk ducts. And that’s where the majority of male breast cancer originates. It’s a form of the disease called invasive ductal carcinoma.



Dr. Anita Aggarwal at the Washington, DC, VA Medical Center led a study comparing breast cancer in male and female Veterans.

Photo by Robert Turtill

And just as the BRCA genes, among others, can help predict which women are at risk for hereditary breast cancer, the same is true of men. It turns out that men who test positive for the BRCA 1 or BRCA2 mutations are also at higher risk. But men are far less likely to proactively get the test. Some do if they have a family history of breast cancer.

The similarities extend to treatment. As with women, surgery is one option, especially when the cancer is still localized to the breast and hasn’t spread. “Because they only have a small amount of breast tissue, in most cases they end up getting a mastectomy [removal of the entire breast] instead of a lumpectomy [removal of only the cancerous lump],” says Aggarwal.

And although men and women have a different hormone mix, men do have some estrogen and progesterone. So men whose breast cancer is driven by those hormones can get hormone therapy similar to that given to women. The side effects, though, can be more troubling for men.

“Men can get hot flashes from the hormone therapy, and this is very distressing to them—they don’t want to go out in public with this, because they see hot flashes as a woman’s condition,” says Aggarwal.

A TOUGH MEDICAL AND EMOTIONAL BATTLE

This is just one facet of the emotional turmoil that men with breast cancer may endure, suggests Aggarwal.

“They get very distressed,” she says. “In my experience,

the first questions they will ask are, ‘Why do I have breast cancer? Are you sure that’s what it is?’ They tend to get depressed and socially isolated.”

Says Aggarwal, the psychosocial aspects of the disease can be especially difficult for male Veterans when they also have posttraumatic stress disorder or another mental health condition.

Fortunately, there is help on the emotional front. Aggarwal notes that at her VA medical center and others, support groups for breast cancer patients attract men as well as women. By the same token, men with breast cancer can attend general cancer support groups. Much of the information will be the same, and they still have the opportunity to bond with other men who face potentially life-threatening cancers, whether prostate, lung, colon, or other forms.

Aggarwal is now seeking to connect with oncologists and others in VA who work with breast cancer patients to do a more extensive study.

‘With men, there’s a delay in detection. There’s less awareness, no screening.’

“I would like to do a nationwide male breast cancer study,” she says. “It would need to be a wide collaborative effort, since the total number of cases at any one VA or in any one region would be too small. We could look at

Breast cancer in VA

	Male	Female
Total cases in the VA Cancer Registry 1998 – 2013	1,123*	5,320*
Average age at diagnosis	70	57
Caucasian	75%	75%
Later stage (III or IV) at time of diagnosis	40%	24%
Patients in registry who died of the disease during study period (1998 – 2013)	355 (32%)	791 (15%)

*Because the VA patient population is predominantly male, this breakdown does not reflect the gender distribution of breast cancer in the general population. Male breast cancer accounts for less than 1% of all cancers in men, and less than 1% of all breast cancer.

Source: “Gender disparity in breast cancer: A veteran population-based comparison,” presented at the American Society of Clinical Oncology 50th Annual Meeting

epidemiology, chemical and radiation exposure, biology of the cancer, and psychosocial factors.”

Another federal study is already underway, by the Agency for Toxic Substances and Disease Registry of the Centers for Disease Control and Prevention, to determine whether male breast cancer is linked to toxic exposures at Camp Lejeune in North Carolina, a Marine base where the water supply was chemically contaminated from the 1950s through the 1980s. The results are expected in 2015. Meanwhile, VA’s Public Health website has health care eligibility information for Veterans and family members who may have been affected. See www.publichealth.va.gov/exposures/camp-lejeune. ★

Kidney disease education

A VA study found that patients with end-stage renal disease who had taken part in an education and preparation program had better survival rates than patients who had not participated.

Read more at www.research.va.gov/currents/spring2014/spring2014-35.cfm

Photo by Curt Campbell



A look ahead to the future of rehabilitation research

During 2014, VA's *Journal of Rehabilitation Research and Development* is celebrating a half-century of publishing. To mark the milestone, JRRD is running a series of guest editorials that look back to the early years of rehabilitation research and discuss the progress that's occurred since.

What about the future? *VA Research Currents* asked experts in rehabilitation to share their perspectives on what lies ahead. Brief excerpts follow. Check out the full version at www.research.va.gov/currents/spring2014/spring2014-28.cfm



WHEELCHAIR TECHNOLOGY

Dr. Rory A. Cooper

Director, Human Engineering Research Laboratories, University of Pittsburgh and VA Pittsburgh Healthcare System

“Current research studies give us some insight into the future. In the next 5 to 10 years, some of the biggest changes will relate to cloud-based computing, smart phone technology,



Dr. Rory Cooper

and alternative power sources that will permit greater software customization, be more environmentally friendly,

and increase reliability at lower cost. Wearable and cloud-based computing will improve clinical practice, provide better maintenance, and facilitate more frequent and custom upgrades to software.”



A system developed at the Human Engineering Research Laboratories that includes a power wheelchair fitted with robotic arms would help wheelchair users who have limited use of their upper body.

Photo by Warren Park

REGENERATIVE MEDICINE

Dr. Audrey Kusiak

Scientific Portfolio Manager, Translational and Spinal Cord Injury and Regenerative



Dr. Audrey Kusiak

Medicine Programs, VA

“Imagine being able to regenerate your own tissue, or at least being able to provide cells to repair tissue

that has been damaged. The field of regenerative medicine is making great progress in this area of research, even being awarded a Nobel Prize in 2012 (Drs. Shinya Yamanaka and John Gurdon) for the discovery that mature cells can be reprogrammed to become ‘stem cells’ that can create almost every tissue in the body. Use of this technology or cell-based therapies in general, combined with task-specific rehabilitation, can be used to maximize the recovery of an individual following injury. Thus, integrative, functional neural rehabilitation is fast becoming a technology of the not-so-distant future.”

REHABILITATION AFTER SEVERE BRAIN INJURY

Dr. Theresa Pape

Deputy Associate CoS and Clinical Neuroscientist, Edward Hines, Jr. VA Hospital Research Service; Adjunct Associate Professor in Physical Medicine

and Rehabilitation, Northwestern University Feinberg School of Medicine

“Neurorehabilitation of severe brain injury in the next 10 to 20 years will be a substantive departure from current standards. I believe that this shift will be enabled by evidence indicating that neurorehabilitation of severe brain injury requires the combination of traditional rehabilitation services with targeted interventions that (1) create a healthy neural environment, (2) modulate neural activity, and (3) shape modulated activity into a functional skill.”

BRAIN-MACHINE INTERFACES

Dr. Robert L Ruff

Professor of Neurology, Case Western Reserve University School of Medicine; Acting National Director for Neurology, VA

“Over the next 20-plus years we will see progressive advances in brain-machine (or nervous system-machine)



Dr. Theresa Pape.

Photo by Jerry Daliege

interface technology (BMIT) to improve people’s lives.

“The technology has begun to allow output from the severed nerve stumps of amputated or severely damaged limbs to interface with and drive ‘smart’ prosthetic devices. Newer advances include having the prosthesis connect to surviving peripheral nerves so that the person is able get sensory feedback from the artificial limb.

“Applications now in development

include using BMIT to allow a person to drive mobility-enhancing devices, such as motor wheelchairs, and having thought direct a prosthetic limb, exoskeleton, robot, or avatar.”



Dr. Robert Ruff

BIOENGINEERING

Dr. Ronald J. Triolo

Executive Director, VA Advanced Platform Technology Center (at the Louis B. Stokes Cleveland VA Medical Center); Professor of Orthopaedics and Biomedical Engineering, Case Western Reserve University

“The biggest advance over the next 20 years will be a sea change in prevailing social attitudes and policies toward disability and personal restorative technology. The stigma previously associated with technology has been



Dr. Ronald Triolo

slowly disappearing, and devices once stared at as novelties are increasingly commonplace and publically acceptable. The trends

initiated by the advent of the cellphone, mobile computing, and wearable sensors and systems will continue, and we can look forward to their widespread application in new socially acceptable assistive or augmentative technologies that significantly enhance societal participation.” ★



In a study by Brown University and VA researchers of a brain-computer system called BrainGate, a woman who had been paralyzed by a stroke for 15 years used her thoughts to control a robotic arm.

Photo courtesy of BrainGate2.org

Are computers a third wheel in the exam room?

VA research looks at clinicians' use of electronic health records

VA is redesigning its pioneering electronic medical record. As part of the process, researchers are gathering input from end users: clinicians who use the technology every day with patients

VA researchers used some old-fashioned interviewing and observation to identify challenges with some very modern technology—VA's electronic health record. “We wanted to identify both barriers and best practices with VA's electronic health record in a clinical setting,” says Dr. Jason Saleem, a usability specialist with VA's Office of Informatics and Analytics.

Saleem, who conducted the study while working as a research investigator at the Richard L. Roudebush VA Medical Center in Indianapolis, observed and interviewed 20 care providers in three geographically distinct VA medical centers to see how they were using the VA's electronic health record, the Computerized Patient Record System (CPRS).

VA is currently redesigning CPRS into a next-generation health record and, as part of that transformation, is incorporating end-user feedback into the process.

Saleem's study, published in the February 2014 issue of the *Journal of the American Medical Informatics Association*, applied human factors engineering research in an effort to improve the program design. “In a nutshell,” describes Saleem, “we took into account human cognitive and physical capabilities and limitations, because if you're going to ask doctors and nurses to use the electronic health record, when every minute counts, then you'd better design it with them in mind.”

“The most surprising thing we discovered was the sheer amounts of variation in how primary care providers are using the computer,” says Saleem. “It varies not only by medical center, but by clinics and even individual physicians and nurses. Some physicians are adept and prefer to use it while they're with a patient, while others won't touch the computer when they're with a patient.”

EASE OF USE IS CRITICAL

Ease of use, or, as Saleem describes it, the walk-up factor, of the CPRS is something that came up consistently in the interviews. “Ideally these systems should be very easy



Dr. Mark Schwartz says that while VA's electronic medical record is intuitive, “it's definitely something you learn on the job.”

Photo by Lamel Hinton



Dr. Erin Krebs says that if the electronic record is going to shift the focus away from the patient, “save it for after the visit.”

Photo by April Eilers

to use,” he says. “If they’re overly complex, then that’s a problem because for the most part, there is only a minimal amount of training available for new staff or residents to use the electronic health record.”

In addition to interface redesign and changes to drug, disease, and allergy alerts, Saleem and his team were also able to identify some best practices for primary care providers who regularly use the CPRS.

“Physicians who use CPRS before a patient encounter were more prepared and didn’t have to focus as much on the computer during the encounter,” says Saleem. “That was a major benefit.” The study also suggests that physicians who started their documentation while they were with a patient were able to save time and avoid mistakes, relative to those who waited until after an encounter to enter their notes.

Saleem has some additional advice for clinicians on how to use the computer to maximum advantage: “The main thing is to think of the computer as a third party that



Dr. Howard Gordon, says it can be a challenge when exam-room ergonomics force physicians to turn away from patients to use the computer.

Photo by Robert Gonzalez

can mediate between the provider and patient. So if you’re talking about lab results, use the computer to communicate that to patients. Show them the results.”

Understanding how different providers with varying workflows are using the CPRS is key, according to Saleem, to ensuring the next version provides both physicians and patients with what they need.

Read more insights from Drs. Schwartz, Krebs, and Gordon on the electronic health record: www.research.va.gov/currents/summer2014/summer2014-2.cfm

“When a Veteran comes in to see their primary care provider, they only have a limited time there,” says Saleem, “and if we’re taking up that time working through a computer, we’re eating up the time that provider has to focus on the Veteran and their medical concerns.” ★



‘If you’re going to ask doctors and nurses to use the electronic health record, you’d better design it with them in mind.’



Dr. Barry Uretsky, an interventional cardiologist with the Central Arkansas Veterans Healthcare System, hasn't built a better mousetrap, but he has discovered what he thinks is a better way to implant a coronary stent.

Photo by Jeff Bowen

Cardiologist says small tweak to stent **technique** can up success rate

In a time when most doctors would be happy to reduce their workload, Dr. Barry Uretsky has some advice for his fellow interventional cardiologists: *Keep the pressure up.*

Air pressure, that is. Cardiologists use high-pressure inflation to place coronary stents—small wire mesh tubes that get threaded into narrowed arteries to prop them open and restore blood flow to the heart.

The stent is crimped around a limp balloon at the tip of a catheter. Doctors guide the stent toward the plaque build-up in an artery and then apply air to the balloon. As the balloon inflates and stretches the plaque, it also expands the stent

until it is pressed snugly against the lining of the blood vessel. Then the balloon is deflated and backed out, and the stent remains in place to scaffold the blood vessel.

How long should high pressure be applied to expand the stent? That question is not exactly a hot issue in the pages of cardiology journals. But Uretsky's research, published in March 2014 in the journal *Catheterization and Cardiovascular Interventions* and presented at some recent conferences, suggests maybe it should be.

Uretsky says the duration of the pressure can mean the difference between a stent that is properly placed and one

that is not. A poorly placed stent can heighten the risk of complications down the road, such as blood clots around the stent, or a re-narrowing of the artery.

His technique? Prolonged pressure—about 200 seconds, on average. That’s about seven times longer than the current practice. He says that’s what it really takes to thoroughly expand the stent.

“We think that the way stents are being implanted now by 99.9 percent of physicians all over the world is incorrect, and we think that the approach we’ve recommended is the correct technique,” says Uretsky, with the Central Arkansas Veterans Healthcare System and the University of Arkansas for Medical Sciences. “The reason is that it fully expands the stent, and it improves strut apposition.”

Struts are the super-thin individual strands that make up the mesh stent, and they are said to be “malapposed” when they are not neatly pressed up against the artery wall. Over time, if all goes well, tissue grows over the stent and it becomes almost like a natural part of the artery lining.

Notwithstanding his bold proposition about the fundamental flaw in how most cardiologists are handling the procedure, Uretsky points out that “this aspect of stenting has not received a lot of attention or interest in the medical community.”

He says once other cardiologists hear his explanations and see his findings, they seldom disagree.

Part of Uretsky’s evidence comes from a newer imaging method called optical coherence tomography (OCT). It uses light to create extremely high-resolution images of the inside of blood vessels. Heart doctors can examine a vessel as they do a procedure, and it’s almost like they’re examining the tissue under a microscope. Among other things, they can zoom in on the hundreds of individual struts in a stent and see how many are malapposed.

“OCT has enabled us to observe this problem more easily,” says Uretsky. “We already known about it from intravascular ultrasound, but OCT has much finer resolution.”

Stent in Coronary Artery

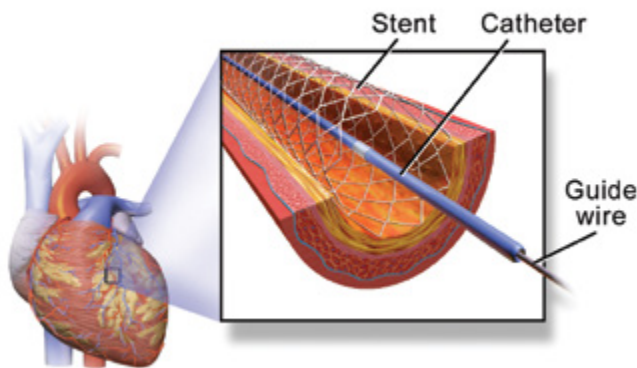


Illustration by Bruce Blaus, via Wikimedia Commons

In a recent study that involved 12 heart patients undergoing stenting, Uretsky’s team first placed the devices using the conventional method. They then did an angiography—the standard way cardiologists check to make sure a vessel is no longer blocked. They followed that with an OCT scan. Then they re-inflated the balloon until the same pressure that had been used previously

was maintained for at least 30 seconds, without any drop in pressure. That’s the sign, according to Uretsky, that the stent is no longer expanding. Anything short of that, he says, and the job is not complete. The stent is not fully pressed against the vessel wall as it should be.

The team completed the study protocol with a second OCT scan, so they could compare stent apposition before and after the prolonged pressure. The OCT pictures tell the story, with a clear advantage on the side of prolonged pressure.

“No one has questioned the data we provided in our article, but they do ask how it relates to outcomes,” says Uretsky. In other words, do small differences in the quality of stent placement really translate into better patient outcomes?

Uretsky says only a large clinical trial—say, with 10,000 patients or so—could answer that question definitively. He is not sure if such a trial will be organized anytime soon, but meanwhile he is preaching the gospel of prolonged pressure to whoever of his colleagues will listen. So far, his journal article on the topic has generated more than a few enthusiastic responses.

“From time to time physicians will write to me saying that after reading my article, they’ve actually modified their practice to maintain balloon inflation pressure longer during stenting,” says Uretsky. “I know anecdotally that people are picking it up.”

He recalls one email in particular, in which the doctor wrote, “I’ve been doing this technique [prolonged inflation] for years, and my partners say I’m crazy. So I’m glad to see your study—it validates what I know intuitively is true.” ★



Dr. Andrew Hansen of the Minneapolis VA Healthcare System has led efforts to develop a prosthetic foot that works with a variety of shoe styles, including high heels.

Photo by April Eilers

High heels a snap with new prosthetic foot

A team including VA researchers is hoping to give Veterans with lower-limb amputations more options for footwear, and they are starting with high heels

Whether we're heading to the gym or to a job interview, most of us take for granted the ability to match our shoes to the occasion. It just comes naturally, thanks in large part to the ankle-foot system's ability to adjust automatically to a variety of shapes and angles.

Now a team including VA researchers is hoping to give Veterans with lower-limb amputations the same options, and they are starting with high heels.

"Sixty-two percent of women say they wear heels over 5 centimeters," says Dr. Andrew Hansen of the Minneapolis VA Healthcare System. "For people with a lower-limb amputation, the situation is different. Their prosthetic limb is usually fixed to the given heel height of the shoe worn during alignment in the clinic. Patients can't easily change to a shoe with a different heel height without experiencing balance issues. That is if they can get the new shoe onto the prosthetic foot in the first place."

Hansen says his interest in prosthetics resulted from growing up in rural Iowa around farmers who had lost limbs in machinery accidents. He started working on a new kind of prosthetic foot while at Northwestern University and the Jesse Brown VA Medical Center in Chicago.

Hansen teamed with Dr. Margrit Meier, now with the Oslo and Akershus University College of Applied Sciences in Norway, and other researchers from Northwestern University to develop the original Shape & Roll prosthetic foot. Their more recent work expanded the Shape & Roll design, allowing it to accommodate a wide range of shoe heel heights. The results will be published later this year in the *Journal of Rehabilitation Research and Development*.

The foot takes advantage of some of Hansen's previous research. Shape & Roll prosthetic feet are designed to respond during walking like a natural foot would, curving upward with each step, like the rocker on a rocking chair.

According to Hansen, the Shape & Roll prosthetic foot is inexpensive to manufacture. To that end, Hansen and his colleagues have helped to make the original Shape & Roll prosthetic foot available in developing countries.

‘This study focused on high heels, but the results work just as well for cowboy boots.’

The project is simple enough that people could fabricate the prosthetic feet by themselves, eliminating the need to import components.

“In VA hospitals, it is more likely that a company would make them and VA would purchase and provide them to Veterans,” says Hansen. “But in resource-limited countries, all the material and information to make these feet is on the Internet.”

“Having the ability to change your shoes, whether for employment reasons or just for looks, is an important choice,” says Hansen. “That goes for men as well as women. This study focused on high heels, but the results work just as well for cowboy boots.” ★



Marijuana and lung disease

VA researchers reviewed the latest research available on marijuana use and lung health. Among the conclusions: The drug can cause respiratory problems but there's little evidence linking it to more severe diseases.



Read more at www.research.va.gov/currents/spring2014/spring2014-47.cfm

Photo: iStock



Dr. Tim O'Leary named VA's chief R&D officer

Dr. Timothy J. O'Leary was named chief research and development officer (CRADO) for VA, effective June 2014. He had been serving as acting CRADO since June 2013.

As CRADO, O'Leary will oversee VA's nationwide research program, based at more than 100 VA medical centers. The program, dating back to 1925, includes biomedical, clinical, and health services research. It has resulted in three Nobel prizes, seven Lasker awards, and many other national and international honors for its investigators.

O'Leary, a pathologist, first joined VA in 2004, as director of biomedical research. He had previously served more than 15 years at the Armed Forces Institute of Pathology. He was also a reserve member of the Public Health Service Commissioned Corps from 1979 to 2010, serving two tours on active duty.

His own research interests include analyzing genes and proteins, and developing ultrasensitive ways to detect biological toxins. The author or coauthor of more than 170 journal articles and numerous book chapters and technical reports, O'Leary is a past president of the Association for Molecular Pathology and serves as editor-in-chief for its *Journal of Molecular Diagnostics*. ★



Dr. Uzma Samadani is developing protocols to detect mild brain injury based on eye tracking.

Photo by Lamel Hinton

Tracking eye movements may help in diagnosis of otherwise invisible TBI

What do a music video by Colombian pop star Shakira and a 3,500-year-old Egyptian medical scroll have in common? They both relate to Dr. Uzma Samadani’s research on something called dysconjugate gaze—the inability to move both eyes in the same direction at the same time, which often happens following brain trauma.

Think of Wile E. Coyote, of cartoon fame, shortly after an anvil drops on his head. Whenever a person experiences head trauma, the eyes tend to exhibit a dysconjugate gaze. The folks at Warner Brothers knew this in the 1940s and 1950s and used it to depict concussion in the oft-injured Coyote. The Egyptians knew it in 1,500 B.C.E., when they

wrote what is now commonly known as the Edwin Smith Papyrus, which describes a deviation of the eye in a person with a head injury.

“It’s been really widely accepted for a long time,” says Samadani, chief neurosurgeon at the New York Harbor VA Healthcare System. “For centuries before radiographic imaging, brain trauma was identified by examining eye movements. It was a serious art and there were entire medical textbooks—such as Fred Plum and Jerome Posner’s *Diagnosis of Stupor and Coma*—with multiple chapters about eye movements.”

Newer technology such as CT scans and magnetic

resonance imaging (MRI) later became the gold standard diagnostic tools for brain injury, but optometrists and ophthalmologists have known for years that eye movements can still provide valuable information.

A NEW LOOK AT AN AGE-OLD APPROACH

Now, with the widespread availability of commercial eye-tracking cameras, experts are taking a new look at this time-honored approach to TBI diagnosis.

In 2010, Samadani and her colleagues developed an algorithm to track the eye movements of people while they were watching television. “We were doing a clinical trial involving patients with very severe brain injury and were trying to identify measures of recovery. When you have a patient in a vegetative state it can be very difficult to determine if they’re improving or not,” says Samadani. “We decided to use their ability to watch TV as a potential outcome measure.”

Researchers played videos on a computer monitor and simultaneously tracked the eye movements of the patients.

“We were hoping to get a percentage of time that they were watching—something quantifiable,” says Samadani. “We were very surprised to find that swelling in the brain, or really any trauma at all, led to abnormal patterns of eye movements that we could detect and quantitate with our algorithm.”

Then came Hurricane Sandy in 2012. The VA hospital was shut down for seven months. Samadani was forced to take her research to Bellevue Hospital in south Manhattan.

When she started up again, Samadani began looking at patients with relatively mild concussions. These are typically missed on CT scans because there is not the type of structural damage CT scans detect.

“We looked at three groups of people,” says Samadani. “Some had a CT scan that showed a structural brain injury. Some experienced head injuries but had negative CT results, and a third group was trauma patients with no evidence of brain trauma.”

Not only did eye tracking identify the patients with known brain trauma, it also identified milder concussions the CT scans had missed. Samadani presented the findings at the 82nd annual American Association of Neurological Surgeons meeting in April 2014.

In the study, patients were asked to watch 220 seconds

of video while their eye movements were monitored. One of the first clips selected by the researchers? Shakira’s music video for the 2010 FIFA World Cup.

“We just wanted something people would pay attention to,” says Samadani. “We used cartoons, highlights, sports videos—anything eye-catching and not too boring.”

As it turns out, Shakira was one of the most popular selections. Samadani says she has had excellent results showing sports highlights and Disney cartoons.

When the results came back—when Samadani realized how accurately she could diagnose brain injuries by tracking eye movements—she barely slept for two months, she recalls. She realized then that “this has the potential to be as important for diagnosing concussions and blast injuries as EEG was for seizures.”

She is actively working with collaborators at other institutions to verify her results, which remain preliminary until published in a peer-reviewed journal.

RESEARCHER ENVISIONS BATTLEFIELD USE

She imagines the technology eventually being used in the field, on soldiers who may have concussions or been exposed to blast. “These are the people the technology will help the most,” suggests Samadani, “the people who know they are not the same after trauma, but whose MRIs and CTs are normal. The ones who just want to be believed.”

“We want to make the technology as universally accessible as possible—get it onto a tablet or iPad,” she says, “but right now the portable cameras on those devices don’t yet have the resolution we need. It’s a matter of waiting for the technology to catch up,” something Samadani says is only a matter of time, given the development of eye tracking technology for video games and other big markets.

“The disruption of eye movements as indicative of brain injury was described in the oldest known surgical paper,” concludes Samadani. “It’s been known for so long and now we’ve developed an easy way to quantify it. If you can quantify the damage associated with radiographically invisible brain injuries such as concussion and military blast, then you can treat these conditions, and most importantly, you can figure out how to prevent them. That will be the greatest value of our technology—a chance that it will keep people from suffering from an otherwise invisible injury.” ★

Vietnam Veterans sought for study on head injuries, Alzheimer's

Dr. Michael Weiner, with VA and the University of California, San Francisco, leads the nationwide Alzheimer's Disease Neuroimaging Initiative (ADNI). The study, funded mainly by the National Institute on Aging and involving some 60 clinical sites across the U.S. and Canada, is giving clinicians new tools to detect Alzheimer's early on.

In the June 2014 issue of *Alzheimer's and Dementia: The Journal of the Alzheimer's Association*, Weiner and colleagues reported on new research to better understand the disease among Veterans. Specifically, do traumatic brain injury and posttraumatic stress disorder increase Alzheimer's risk as Veterans age? The largest study to date to examine this question, sponsored by the Department of Defense and now underway, is known as DoD-ADNI.

VA *Research Currents* spoke with Weiner about the research.

Is the current thinking that Veterans are at higher risk for Alzheimer's?

We know the two top risk factors for Alzheimer's are getting older and having certain gene variants. We don't think those factors are any greater in the Veteran population. But we have known for many years that TBI is a risk factor for Alzheimer's. If you've been knocked unconscious—say you fell out of a tree when you were a kid, or you suffered a concussion playing football—you're at much greater risk for Alzheimer's disease in your 70s than if you were never knocked unconscious. And there is also evidence to suggest that PTSD may increase the risk as well. As in TBI, we know that the more severe the PTSD, the more cognitive impairment there is. Interestingly, PTSD has been associated with changes to the part of the brain called the hippocampus, and we see similar changes—reduced volume in the hippocampus—in Alzheimer's.

How many Veterans will take part in DoD-ADNI, and what methods are you using to look for the onset of Alzheimer's in these Veterans?

We're expecting about 1,000 Vietnam Veterans to take part



Marines riding atop an M-48 tank cover their ears as a 90mm gun fires during a road sweep in Vietnam.

Photo: National Archives

in the initial screening interview and 500 to take part in the clinical telephone interview. Out of those, about 400 will be referred for in-person clinic visits. We expect a total of about 300 Veterans to complete the entire study. We're using all the diagnostic methods developed in ADNI. This includes biomarkers—amyloid imaging, lumbar punctures, MRIs—as well as neuropsychological tests and medical exams. In DoD-ADNI, we're also going to be focusing on diffusion tensor imaging [a form of MRI] along with structural and functional MRI. We know that TBI produces damage to the brain's white matter that can be detected by DTI. It's a major tool in the diagnosis of TBI, and that's why we're using it in DoD-ADNI.

How can Veterans learn more about DoD-ADNI?

They can visit www.adni-info.org/ADNIDOD. Anyone who is a Vietnam-era combat Veteran with a past or current diagnosis of TBI or PTSD, and who is interested in volunteering for the study, can call 1-800-773-4883. We encourage people to get involved. Our hope is that this research will eventually lead to better treatment and prevention strategies to reduce the long-term effects of TBI and PTSD. ★



Read more at www.research.va.gov/currents/mar-apr13/mar-apr13-03.cfm

Find these terms related to health research. They can read forwards, backwards, up, down, or diagonally. Not all the letters in the grid are used, and some may appear in more than one word.

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RESEARCH CURRENTS

Research News from the U.S. Department of Veterans Affairs



DID YOU KNOW?

Dr. Oscar Auerbach, a pathologist at the East Orange, N.J., VA Medical Center for more than four decades, was one of the leading scientists behind the Surgeon General’s first report on the dangers of tobacco. It was released 50 years ago, in 1964. The Surgeon General at the time, Dr. Luther Terry, would later recall that the report “hit the country like a bombshell.” It provided strong evidence—thanks, in large part, to Auerbach’s painstaking research—linking smoking to lung cancer and heart disease. Through today, it is credited with spurring a nationwide drop in smoking and saving hundreds of thousands of lives.



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