

- **HIGHER NURSE STAFFING LEVELS AND INCREASED NURSE EDUCATION REDUCE PREVENTABLE HOSPITAL DEATHS**

In the largest study of its kind to date, scientists conducted a detailed analysis of patient outcomes associated with nurse staffing and education. Using data from nearly 500,000 patients who underwent common surgeries in 300 hospitals in nine European countries, and from surveys of over 25,000 nurses, the study found that an increase in nurses' workload by one patient increased the likelihood of in-hospital death within 30 days of admission by 7 percent. The study also determined that for every 10 percent increase in nurses on staff with bachelor's degrees, the likelihood of patient death decreased by 7 percent. The study underscores the potential risks to patients of cuts in nurse staffing levels and suggests that an increased emphasis on bachelor's level education for nurses could reduce hospital deaths.^{viii}

- **A HEALTHY LIFESTYLE INTERVENTION INCREASES PHYSICAL ACTIVITY, REDUCES OVERWEIGHT, AND IMPROVES PSYCHOSOCIAL OUTCOMES IN HIGH SCHOOL STUDENTS**

A teacher-delivered intervention program (COPE-Healthy Lifestyles TEEN [Thinking, Emotions, Exercise, and Nutrition]) promoting healthy lifestyles improved health behaviors, body mass index, social skills, severe depression, and academic performance in high school adolescents. Routine integration of such programs into health education curricula in high school settings may be an effective way to prevent high-risk teen populations from becoming overweight or obese, and could lead to improved physical health, psychosocial outcomes, and academic performance. This was one of the first studies to report multiple immediate improvements that were sustained over time using a teacher-delivered, cognitive-behavioral skills-building intervention program incorporated into a high school health education class.^{ix}

- **DISCONTINUING STATIN THERAPY FOR PATIENTS WITH LIFE-LIMITING ILLNESSES IS FOUND TO BE SAFE AND BENEFICIAL**

In a multicenter trial, researchers in the NINR-supported Palliative Care Research Cooperative Group (PCRC) examined the safety of discontinuing statin therapy in patients with advanced, life-limiting illness. They found no significant differences in mortality between patients who had discontinued statin therapy and those who had not. Those patients who discontinued statins also reported improved quality of life, and health care costs were reduced. These findings provide important evidence needed to inform decision making about statin therapy at the end of life, and highlight the need for providers to have meaningful discussions with patients about treatment options and maximizing their quality of life—key concepts in palliative care.^x

CITATIONS

- i. Drew BJ, Sommargren CE, Schindler DM, Benedict K, Zegre-Hemsey J, Glancy JP. A simple strategy improves prehospital electrocardiogram utilization and hospital treatment for patients with acute coronary syndrome (from the ST SMART Study). *Am J Cardiol*. 2011 Feb 1;107(3):347-52.
- ii. Goel N, Banks S, Lin L, Mignot E, Dinges DF. Catechol-O-methyltransferase Val158Met polymorphism associates with individual differences in sleep physiologic responses to chronic sleep loss. *PLoS One*. 2011;6(12):e29283. doi: 10.1371/journal.pone.0029283. Epub 2011 Dec 27.
- iii. Moser DK, Lee KS, Wu JR, Mudd-Martin G, Jaarsma T, Huang TY, Fan XZ, Strömberg A, Lennie TA, Riegel B. Identification of symptom clusters among patients with heart failure: an international observational study. *Int J Nurs Stud*. 2014 Oct;51(10):1366-72. Epub 2014 Feb 28.
- iv. Chin CD, Laksanasopin T, Cheung YK, Steinmiller D, Linder V, Parsa H, Wang J, Moore H, Rouse R, Umviligihozo G, Karita E, Mwambarangwe L, Braunstein SL, van de Wijgert J, Sahabo R, Justman JE, El-Sadr W, Sia SK. Microfluidics-based diagnostics of infectious diseases in the developing world. *Nat Med*. 2011 Jul 31;17(8):1015-9.
- v. Rantz MJ, Scott SD, Miller SJ, Skubic M, Phillips L, Alexander G, Koopman RJ, Musterman K, Back J. Evaluation of health alerts from an early illness warning system in independent living. *Comput Inform Nurs*. 2013 Jun;31(6):274-80.
- vi. Olivera A, Lejbman N, Jeromin A, French LM, Kim H, Cashion A, Mysleweic V, Diaz-Arrastia R, Gill J. Peripheral total tau in military personnel who sustain traumatic brain injuries during deployment. *JAMA Neurol*. Aug 3. doi: 10.1001/jamaneurol.2015.1383 [Epub ahead of print]
- vii. Rhee H, Miner S, Sterling M, Halterman JS, Fairbanks E. The development of an automated device for asthma monitoring for adolescents: methodologic approach and user acceptability. *JMIR mHealth uHealth*. 2014 June 19;2(2): e27.
- viii. Aiken LH, Sloane DM, Van den Heede K, et al. Nurse staffing and education and hospital mortality in nine European countries: a retrospective observational study. *Lancet*. 2014 May 24;383(9931):1824-30 epub 2014 Feb 26.
- ix. Melnyk BM, Jacobson D, Kelly S, Belyea M, Shaibi G, Small L, O'Haver J, Marsiglia FF. Promoting healthy lifestyles in high school adolescents: a randomized controlled trial. *Am J Prev Med*. 2013 Oct;45(4):407-15.
- x. Kutner JS, Blatchford PJ, Taylor DH, Ritchie CS, Bull JH, Fairclough DL, Hanson LC, LeBlanc TW, Samsa GP, Wolf S, Aziz NM, Currow DC, Ferrell B, Wagner-Johnston N, Zafar SY, Cleary JF, Dev S, Goode PS, Kamal AH, Kassner C, Kvale EA, McCallum JG, Ogunseitan AB, Pantilat SZ, Portenoy RK, Prince-Paul M, Sloan JA, Swetz KM, Von Gunten CF, Abernethy AP. Safety and benefit of discontinuing statin therapy in the setting of advanced, life-limiting illness. A randomized clinical trial. *JAMA Intern Med*. 2015 May;175(5):691-700.

NATIONAL INSTITUTE OF NURSING RESEARCH

Notable Advances

2011-2015



NOTABLE ADVANCES 2011-2015

Throughout its history, the field of nursing science has made countless contributions to improving the health and quality of life of individuals, families, and communities, and to providing the evidence base to support the practice of the largest healthcare profession. The National Institute of Nursing Research (NINR), the U.S. Government's primary supporter of nursing science, focuses its research efforts on topics such as symptom science, wellness, self-management of chronic illness, and end-of-life and palliative care research. This brochure provides a small, representative sample of some of the notable scientific advances supported by NINR in recent years, demonstrating the broad reach of nursing science, and the promise the field holds for improving the Nation's health now and in the future.

- **MODIFIED ELECTROCARDIOGRAM MONITORING IN THE PRE-HOSPITAL SETTING CAN PREDICT HEALTH OUTCOMES FOR PATIENTS WITH SYMPTOMS OF ACUTE CORONARY SYNDROME**

Because time is of the essence, it is recommended that paramedics acquire electrocardiograms (ECGs) on patients with symptoms of acute coronary syndrome (ACS) during transport to the hospital. A team of scientists developed a modified ECG technique that could quickly be administered by a paramedic with the results automatically transmitted to the hospital via cell phone. In a randomized trial conducted in a rural area, this strategy increased the percentage of patients with ACS receiving a pre-hospital ECG and decreased the time between the first 911 call and the hospital receiving the first ECG, compared to standard care. This allowed hospital personnel additional time to prepare for the incoming patient, potentially leading to faster treatment and improved patient outcomes.ⁱ

- **COMT POLYMORPHISM: A PUTATIVE GENETIC BIOMARKER FOR PREDICTING INDIVIDUAL DIFFERENCES IN SLEEP PHYSIOLOGY**

Understanding the biologic and genetic underpinnings of sleep, and the effects of poor sleep on health has long been a focus of NINR's research programs in symptom science. In one example, scientists studied individuals with an alteration in a protein called catechol-O-methyltransferase, or COMT, a protein involved in metabolizing neurotransmitters such as dopamine. This alteration is caused by a genetic mutation in the COMT gene. In healthy individuals subjected to partial sleep deprivation, those with the mutation exhibited different changes in their sleep physiology, including greater declines in brain waves potentially associated with the drive to sleep. This mutation in the COMT gene could therefore serve as a biomarker to predict individual differences in sleep physiology and further our understanding of the effects of sleep deprivation.ⁱⁱ

- **TWO CONSISTENT SYMPTOM CLUSTERS IN HEART FAILURE PATIENTS IDENTIFIED IN A LARGE INTERNATIONAL STUDY**

In order to better characterize the many adverse symptoms of heart failure across populations, scientists compared data describing the symptoms of 720 heart failure patients across China, Taiwan, the Netherlands, Sweden, and the U.S. They identified two groups of associated symptoms, or symptom clusters, which were consistent across all patients: 1) a physical capacity symptom cluster that included dyspnea, difficulty in walking or climbing, and fatigue, and 2) an emotional/cognitive symptom cluster that included worrying, feeling depressed, and cognitive problems. These findings, which indicate that symptoms of heart failure are consistent across cultures, are important for improving symptom recognition and acting early to avoid adverse outcomes.ⁱⁱⁱ

- **TECHNOLOGICAL INNOVATIONS LEAD TO A POINT-OF-CARE DIAGNOSTIC 'MCHIP' THAT IS ABLE TO RAPIDLY DETECT HIV AND OTHER INFECTIONS IN REMOTE SETTINGS**

NINR supported a team of scientists through two critical phases of the development of a novel "lab-on-a-chip" device for rapidly detecting HIV. This lab-on-a-chip, or mCHIP, device uses microfluidics and nanoparticles to simultaneously detect HIV and syphilis antibodies in a small amount of human whole blood, in an accurate and repeatable manner. The technique has proved highly successful, and the research team has gone on to refine and clinically test the device in resource-limited settings, such as Rwanda, and have adapted the test for use with a smartphone. These studies have demonstrated that the mCHIP can accurately, rapidly, and cost-effectively detect clinically infectious diseases in resource-limited settings.^{iv}

- **INTELLIGENT SENSORS EMBEDDED IN THE HOME DETECT CHANGES IN HEALTH STATUS AND CAN PROMOTE HEALTHY INDEPENDENT LIVING**

A nurse-led, interdisciplinary team of scientists conducted research on the development of a sensor system for use in apartments in a senior living community. A number of sensors are placed around a resident's apartment, and are connected to a computer that develops a model for the normal daily patterns of each resident. Changes in behaviors or patterns of daily life, such as restlessness in bed, time spent in bed, general activities, and time away from the apartment are noted. If behaviors are detected that differ from the resident's usual pattern, an alert is sent to the nurse-care coordinator and clinicians for review. These behavioral changes can signal alterations in health earlier than the appearance of clinical signs, and this knowledge can help to promote independent living for older adults.^v

- **TRAUMATIC BRAIN INJURY IN MILITARY PERSONNEL LINKED TO A BIOMARKER OF NEURO-DEGENERATION, MEASURED WITH A NOVEL AND SENSITIVE DETECTION METHOD**

A protein linked to short-term complications after traumatic brain injury (TBI), may also be responsible for long-term complications that can result from TBI. Using a novel and ultra-sensitive technology, researchers in NINR's Division of Intramural Research were able to measure levels of the protein, tau, in the blood months and years after military personnel had experienced TBI. They found that elevated tau levels are associated with chronic neurological symptoms, including post-concussive disorder (PCD) and chronic traumatic encephalopathy (CTE), independent of other factors such as depression and post-traumatic stress disorder (PTSD). This finding provides an insight into the underlying biology of TBI, and could someday lead to new strategies for mitigating TBI's debilitating symptoms.^{vi}

- **A MOBILE DEVICE "APP" THAT USES A NOVEL DETECTION ALGORITHM IMPROVES SYMPTOM MONITORING IN ADOLESCENTS AND MAY IMPROVE ASTHMA SELF-MANAGEMENT**

Accurately monitoring symptoms of asthma is important for proper self-management of the condition. However, this can be a challenge, particularly among adolescents. An interdisciplinary team of researchers developed and tested an automated device for asthma monitoring (ADAM), applying technology to help assess asthma symptoms objectively and accurately. The device utilizes an iPod, an external microphone, and an app that monitors symptoms including coughing and wheezing. The device was found to be a valid asthma monitoring tool, and was well-received by users. These results indicate that ADAM can improve self-management of asthma in adolescents.^{vii}