

## Mobile Device Software Uses Games to Help Patients Monitor Diabetes

*Effective diabetes self-management relies on patients controlling their diet, exercising appropriately, and monitoring their blood glucose level and other health indicators. Still, many diabetics struggle to manage this chronic disease. A team of U.S. and Chinese researchers is designing a smartphone-based software application that will include games and innovative logging features to help elderly diabetics in China manage their health and enhance their knowledge of diabetes.*

**D**iabetes is among the most prevalent health issues in the People's Republic of China, afflicting more than 40 million Chinese. By 2025, that number is expected to rise to 60 million, due in large part to China's fast-growing elderly population as well as an increase in obesity nationwide.

These trends continue to impose a significant burden on China's healthcare system. In many rural communities, diabetic patients have limited access to information about the disease and are often treated at facilities that lack diabetes specialists. In large cities such as Shanghai and Beijing, where a primary-care physician might see 50 or more patients per day, doctors have little time to counsel diabetics about diet, exercise and other lifestyle habits that can help control the disease.

With financial, software and technical support from Microsoft External Research, an interdisciplinary team of researchers at Saint Louis University (SLU) in Missouri and Old Dominion University in Norfolk, Virginia, is working with healthcare providers in China to design and develop smartphone-based software that can help elderly diabetics take a more direct role in managing their condition.



*The Chinese Aged Diabetic Assistant software will include a game in which patients choose a traditional Chinese mask that matches their mood, which is an important health indicator for diabetes.*

### Fast Facts

#### Project Principals:

**Maggie Jiao Ma, Ph.D.**, assistant professor, Saint Louis University

**Cynthia LeRouge, Ph.D.**, associate professor, Saint Louis University

**Joseph Flaherty, M.D.**, associate professor, geriatrics division, Saint Louis University School of Medicine and U.S. Veterans Administration

**Gianluca De Leo, Ph.D.**, assistant professor, Virginia Modeling, Analysis and Simulation Center, Old Dominion University

#### Web Site:

<http://www.cadaproject.com>

#### Profile:

Researchers are developing software that helps elderly Chinese diabetes patients track their diet, mood, exercise and other health indicators. Designed to run on Windows Mobile-based smartphones, the technology will use games to encourage patients to log important information and enable them to easily share that data with their healthcare provider.

### Microsoft External Research

The Microsoft External Research Division within Microsoft Research partners with academia, government and industry to advance computer science, education and scientific research aimed at helping address some of the world's most urgent and significant social and technological challenges. Along with investing cash, software, hardware and research expertise to enable ground-breaking projects worldwide, Microsoft External Research is committed to providing the advanced technologies and services needed to support every stage of the research process. Efforts are focused in four research areas—including Health and Wellbeing, which explores technologies that advance healthcare and help people make better choices about their health.

**Microsoft External Research**  
<http://research.microsoft.com/en-us/collaboration/>

"Mobile technologies can empower elderly people to better understand diabetes, track their health indicators more closely and follow a healthier lifestyle," says Maggie Jiao Ma, an assistant professor at SLU's Parks College of Engineering, Aviation & Technology. "Once patients are able to self-manage their diabetes, physicians and nurses can free up more time for providing advanced care."

The research team is capitalizing on the widespread use of mobile phones and Internet access throughout most of China to create an interactive diabetes self-management system called the Chinese Aged Diabetic Assistant (CADA) for use with smartphones running on the Microsoft® Windows Mobile® platform. CADA will use games and innovative data logging techniques to enhance diabetes knowledge and encourage diabetes patients to more consistently monitor and report important information about their condition.

"We are using persuasive design techniques, such as taking advantage of the 'fun factor' in gaming, to motivate patients to use this system and encourage positive behavior changes," says Cynthia LeRouge, associate professor of decision sciences and information technology management at SLU.



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Maggie Jiao Ma, assistant professor,  
Saint Louis University

In an effort to make CADA as age appropriate and culturally relevant as possible, Ma and LeRouge traveled to China in 2008 for several weeks of interviews with elderly Chinese diabetes patients and medical personnel in Beijing and nearby rural communities. Dr. Joseph Flaherty, a physician and associate professor of internal medicine in the geriatrics division at the SLU School of Medicine, also has contributed his observations from working with patients and physicians at hospitals in Chengdu, Shanghai and Beijing in recent years.

The team learned that patients in rural communities typically have more misconceptions about diabetes and tend to see a medical provider about their condition less often than patients who live in urban areas. Also, the researchers quickly realized that their device design would need to accommodate the needs of users who have varying levels of education and familiarity with technology. With these patient-centered design requirements as a guide, the researchers are using Microsoft Visual Studio® 2008 development tools to create a prototype CADA device for testing by patients and physicians in China and the United States.

"Our goal is to make CADA easy to use for patients," says Gianluca De Leo, assistant professor in the Virginia Modeling, Analysis and Simulation Center at Old Dominion University. "As much as possible, we will employ images instead of text and a touch screen in place of keyboard commands."

Tracking changes in blood glucose is integral to diabetes management, and the ability to compare that data with variations in a person's mood, diet, exercise, weight and blood pressure can help physicians provide better overall care. "However, many diabetes patients don't bring this information to their doctor visits," says Flaherty. Part of the challenge is that patients in China and elsewhere typically log health information in handwritten journals, which can be a tedious task. As a result, they might keep only sporadic and incomplete records.

CADA's interactive data-gathering approach includes a game in which patients view pictures of Chinese masks depicting various moods—happy, sad, angry, frustrated, tired—and choose one based on how they are feeling. Next, they are asked to enter what type of exercise they have done and for how long. As an incentive to record their information, patients get to superimpose their chosen mask on an animated character and watch it dance on screen to Chinese opera music. "We think games like this will motivate patients to learn about controlling diabetes and make logging their health information more fun," says Ma, whose mother is diabetic and lives in Beijing.

In the future, CADA users will be able to send the data via text message to their physician's office or hand the device to a receptionist or nurse during their next visit. Later versions of CADA could also allow care providers to send reminders to a patient's device about upcoming appointments, advice on living a healthier lifestyle and other topics.

In addition to publishing its findings about the user-centered design requirements of elderly patients on the project Web site and in research journals, the team plans to make the prototype CADA software available for download at no charge. The team is also conducting a survey in urban and rural China to better understand which types of people will readily adopt CADA and to identify potential barriers to its use. Ultimately, the researchers hope CADA can be further developed into a viable commercial product. They also believe the technology could be useful in other areas of doctor-patient communication and health information tracking beyond diabetes care.

"Many people already carry a cell phone, so this is the next logical step in transforming how doctors and patients interact," says Flaherty. "CADA has the potential to help older patients take charge of their own health and give physicians a valuable tool for treatment and education."

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