If we have to be hospitalized, most of us hope to leave healthier than when we entered – or at least well on the road to recovery. But not everyone does. Some patients head home and find themselves getting sicker instead of better, requiring even more treatment. Some even end up back in the hospital. What’s the difference between patients who make a full recovery and patients who don’t? One major factor is what doctors and nurses call “frailty” — a constellation of factors that include age, nutrition, psychological health, social supports and more.

When UNCG Assistant Professor of Nursing Deborah Lekan did her dissertation on frailty several years ago, she did a painstaking analysis of information drawn from electronic health records, which had just begun to change how nurses and other providers cared for patients. “I basically had PDF copies of nursing documentation and physician notes,” she says.

Getting the information was time consuming and limited by how many records she could analyze herself. But now, she and collaborators at UNCG and in Greensboro’s Cone Health System are harnessing the power of computers, sophisticated statistical techniques, and machine learning to dive much deeper.

The goal: Identify patients at risk of not fully recovering, in real time, and improve the care nurses and others provide for them. “The tool we’re working on would allow clinicians to strategically target interventions based on the risk factors present for an individual,” Lekan says.

Her collaborators include Cone Health’s Director of Nursing Research Marjorie Jenkins, as well as statistician Thomas McCoy and computer scientists Somya Mohanty and Prashanti Manda at UNCG.

Using cutting-edge data science techniques, the team is analyzing reams of information from patients — everything from physician notes to lab results and medications.

Data scientists can help us make smarter decisions about some of society’s most vexing problems.
UNCG researchers are also using big data to turn an inquisitive lens on academia itself. Assistant Professor Prashanti Manda, in collaboration with Mohanty, is teaching computers how to read complex academic journal articles. The goal is to make research more accessible, cut down on duplicative research, and help scientists expand their knowledge faster.

In the last few decades, academics have published increasing numbers of papers on all sorts of topics. That means that while there’s more knowledge out there, it’s also harder to sort through the volume of information available.

A scientist focused on honeybees genetics, for example, might be interested in a very narrow topic, such as the role of a specific gene or protein. But finding the relevant research can be very time consuming.

Papers are sometimes marked up in ways that make searching them electronically difficult. In those cases, a person can go through and tag up the paper with specific terms, say “protein” or “disease.” While that makes the papers more searchable, it is tedious and time consuming.

With support from a UNCG Giant Steps Research Development Grant, Manda is working with Dr. Olav Rueppell, a UNCG biologist and honeybee expert, to make the large volume of bee research more accessible to scientists.

“With how many papers get published each day, each year, nobody can keep up,” Manda says. “I want to develop text mining and natural language processing methods that can automatically ‘read papers’ and do this annotation themselves.”

While the results of that process won’t be perfect, it will produce annotated papers that people can double-check for accuracy much faster than they can do markups by scratch.

**TACKLING COMMUNITY CHALLENGES**

Researchers at UNCG are using data science to deepen their impact on some of our region’s most vexing issues, in areas such as housing, opioid abuse, and even government budgets.

Many of these projects are part of the Metrolab initiative, a partnership between the University and Guilford County. (Photo: UNCG researchers meet with Guilford County Budget Director Michael Haltford.) Through the initiative, students and professors are developing tools to help local government understand the data they have better, and in the process create better services to community problems.

In one of the first Metrolab projects, researchers at UNCG partnered with local law enforcement, emergency medical services, and other first responders in Guilford County to tackle opioid overdoses. The ambitious GCSTOP program, funded by an R.C. General Assembly allocation, collects and shares data across agencies to allow for rapid, targeted interventions. “In year one, we want to reduce opioid-related deaths in the county by 20 percent,” says program leader Chase Holloman.

Researchers are also tracking evictions in the county and connecting people to those needed. The data help guide the decisions of the pilot Eviction Diversion Program, a collaboration among UNCG, the Greensboro Housing Coalition, the 10th Judicial District, and Guilford County.

“We’re uncovering inequalities and opportunities for investment,” says Center for Housing and Community Studies Director Stephen Sills. “It helps us understand what we can do differently.”

As a Metrolab participant, UNCG belongs to a network of 44 cities, five counties, and 59 research universities. The research-driven, town-gown partnerships serve as testbeds for urban innovation.
Across campus, Dr. Aaron Beveridge in the Department of English is using homebrewed software to better understand how social media influences the media and popular opinions.

The project sparked a few years ago, while Beveridge was in graduate school, when he watched “Tonight Show” host Jimmy Fallon make a claim without any discernible evidence.

“He said something like, ‘We just caused this to trend worldwide,’” Beveridge recalls. The assistant professor, who focuses on digital rhetoric, was skeptical. “Can I question that? Because to say that something trends worldwide would be an interesting phenomenon and so powerful — to make that claim without giving data is an unfair thing to do.”

The notion that a particular idea is “trending” — in recent years, based on lists of trending items that show up in social media networks and online platforms — is used for more than just late-night laughs. Journalists cite the idea that something is trending in news stories to explain why it might be important. Politicians tout trends as social proof to buttress their positions.

Beveridge wanted to know what it really means when we say something is trending and what that tells us — or not tell us — about how widespread an idea is.

But there were some roadblocks. The sources of online trend data, social networks like Twitter and search engines like Google, produce far more information than a single professor like Beveridge — or even a whole building of professors — could realistically expect to digest just by clicking refresh in a web browser. Social media companies sell access to their aggregated data, but it’s expensive.

Beveridge, though, turned this problem into an opportunity. Working with a technically savvy collaborator, he helped produce free software that can be used to vacuum up data from Twitter, Google, Tumblr, and other sites. The software, MassMine, was developed with funding from the National Endowment for the Humanities.

“It’s been invaluable to his research since graduate school.”

“What I’m interested in, broadly, are the ways in which social networks are a macroscopic form of persuasion,” he says. Seeing something as a trend, he explains, creates authority behind it. Calling something a trend could even contribute to it trending.

Beveridge is now conducting a study on news articles that use tweets as evidence that a particular topic or idea is “trending.” He’s compiling data from Twitter to see if those topics are, in fact, a major part of online conversations.

“We’re going to show how often tweets become the implied evidence for a trend or a public opinion when it’s actually not a significant public opinion from a data standpoint,” he says. “Or maybe it is. We’re going to let the data speak.”

In Lekan and Jenkins’ patient frailty project, the goal is to let data speak for patients in a way that patients, their families, and their providers might not always be able to.

The project pulls together clinical measurements, notes from nurses and doctors, demographic information, and other data — and sets machine learning algorithms loose on them to see if they can predict which patients will need additional care to properly recover.

“One of the benefits of our models is actually tell us how important different features or variables are in making this decision,” Mohanty says. “We will be able to tell them ‘OK, this is a particular key variable which makes this a person who is at high risk of readmission.’

The project started about two years ago and is still in the early stages. Just navigating the legal and technical issues involved in using large amounts of real patient data has taken some time. This summer, analysis was done on a subset of the data, and now researchers are adding more records.

Patient readmission, especially among older patients, is a critical issue. Because of changes to how Medicare pays hospitals, they can face penalties if patients leave and then must be readmitted within a month. But the frailty project will break ground in other ways, too. One of the first research outcomes will be a kind of roadmap, illustrating how UNCG and Cone Health collaborated to tap into the massive amounts of data in Cone’s electronic health record system. It will provide a guide to the legal and technical issues that researchers and hospitals face in using such data.

Electronic health record systems have been widely adopted in the last 10 years, and the software Cone uses is one of the most commonly used systems, so the research could have applications at thousands of hospitals.

Lekan’s vision is an app on a hospital’s electronic health record systems that could improve care. “It could red-alert the nurse,” she says. “It could prioritize treatments and flag the care specialists we want to loop in. Timely interventions are critical.”

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