STRENGTH IN NUMBERS:

Biostatistics Faculty Are in Great Demand in the SPH and Beyond

EVEN WITHIN A FIELD AS INTERDISCIPLINARY AS PUBLIC HEALTH, THE EXPERTS IN MAKING SENSE OF COMPLEX DATA STAND OUT FOR THEIR LINKAGES THROUGHOUT THE SCHOOL AND THE UCLA CAMPUS.

Among the members of the school's Department of Biostatistics faculty (clockwise starting from lower left): Drs. Catherine Sugar, Thomas Belin, William Cumberland, Angela Presson, Catherine Crespi, Donatello Telesca, Dorota Dabrowska and Abdelmonem A. Afifi.

Molecular Toxicology

School of Nursing

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School of Dentistry

"The ability to take data – to be able to understand it, to process it, to extract value from it, to visualize it, to communicate it – that's going to be a hugely important skill in the next decade. ... Now we really do have essentially free and ubiquitous data. So the complementary scarce factor is the ability to understand that data and extract value from it."

— Hal Varian, Chief Economist, Google

To the layperson, the biostatistician is rarely seen or heard in the coverage of health-related studies. But those involved in the studies – and the agencies that fund them – know that having someone skilled in understanding and extracting value from data, to paraphrase Google's chief economist, is essential.

Biostatisticians are involved in planning population surveys and in optimally designing experiments. They ensure that data are properly collected and they play a key role in making sense of it – determining what conclusions can be gleaned and the strength of those conclusions, through the use of analytic tools that they and their colleagues have developed and honed.

"It's all too easy to draw incorrect conclusions from data if you haven't been trained in how to interpret them properly," says Dr. William Cumberland, professor and chair of the Department of Biostatistics in the UCLA School of Public Health. For scientists well versed in statistics, he adds, "It's a way of understanding that even when there's a lot of randomness in data, you can often reach conclusions about the general health of the public."

"Biostatistics is a discipline that tries to identify the real explanations for what's going on," says Dr. Thomas Belin, another professor in the department. That often means taking into account factors that could influence a statistical outcome, he explains. For example, if a group of people receiving an experimental intervention fares better than the "control" group not receiving it, was it the intervention itself that made the difference or were other factors at play, such as disparities in education? "If you're trying to identify the real explanation for something you have to rule out other possible explanations," says Belin, "including that the result was due to chance."

The department's research falls into two categories. The first category involves biostatistics faculty working closely with non-biostatistics researchers as collaborators on their studies. In so doing, they encounter statistical problems for which there is no easy solution. These problems become the basis for the second category, biostatistics-specific research, wherein the department's faculty develop new methodologies and improve established ones.

Even within a field as interdisciplinary as public health, the Department of Biostatistics stands out for its linkages throughout the school and beyond. All of the school's departments and centers have long-term collaborations with one or more of the school's biostatisticians, as do many departments within UCLA's David Geffen School of Medicine, School of Nursing and School of Dentistry; major campus entities such as UCLA's Jonsson Comprehensive Cancer Center, UCLA AIDS Institute and UCLA Semel Institute for Neuroscience and Human Behavior; and numerous individual faculty, departments and groups across the UCLA campus.

Biostatisticians focus on applied studies in public health and medicine, often specializing in a specific discipline. The tools they develop tend to be motivated by the collaborations. Survival analysis, the area of expertise for faculty in the department such as Drs. Gang Li and Dorota Dabrowska, has become an integral part of clinical trials for its ability to measure the time to a specific event such as death. Faculty such as Dr. Weng Kee Wong specialize in other aspects of clinical trials design. With this expertise, the Department of Biostatistics is recognized as one of the top programs in the country.

But even when they specialize, most of the department's faculty find themselves answering calls from wide-ranging sources. Dr. Robert Weiss, a professor of biostatistics who has co-authored scholarly articles with researchers from 19 different departments, notes that it's helpful for the biostatistician to have expertise in the topic being studied, but more important to develop the type of working relationship in which the statistician and his or her collaborators are educating each other. "It's difficult to become expert in two subjects," Weiss says, "so we become expert in statistics and in communicating statistical concepts and tools to colleagues, who in turn educate us about their discipline."

In the best cases, Weiss explains, the biostatistician is brought in from the start – participating in discussions on the science and the impetus for the study, the data that need to be gathered and how to collect it, and other details of the study's design – rather than coming in only at the time of data analysis. "Often, we're the ones who know what kinds of questions can be answered, and by being involved at the beginning we can help scientists do a better job with their research," Weiss says.

For more than five years, Weiss has been a key contributor to the studies of Dr. Pamina Gorbach,

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associate professor of epidemiology. Gorbach's research on the high-risk sexual behaviors of individuals in intimate partnerships produces complex data because it involves multiple measures: For each study participant, Gorbach's group collects information at different points in time as a way of detecting behavioral changes; what's more, this information often covers different behaviors with more than one partner. Data on the partners are also collected. Thus, a study of 200 people is likely to encompass some 900 partnerships over the course of a year. The statistical approach used to make sense of this type of complicated data, longitudinal analysis, is Weiss' specialty.

Over time Weiss has taken on a growing role as Gorbach's collaborator, providing more intensive input on the design of the studies. "Rob's expertise has allowed me to collect more complex behavioral data," Gorbach says. "We've developed a common language and it's really strengthened our work, so that data that come out are both epidemiologically useful and statistically interesting."

In testing new medical treatments, the randomized, placebo-controlled clinical trial is considered the gold standard for understanding whether any difference in outcomes can be attributed to the intervention. But in most biomedical studies – and virtually all public health research – such a setup isn't possible. As a result, "Much of the challenge of being a statistician is to make correct inferences even when information is missing or you haven't been able to collect exactly the data you want," says Dr. Catherine Sugar, an assistant professor in the Department of Biostatistics and director of the Semel Institute Statistics Core, which provides statistical support for researchers in UCLA's Department of Psychiatry and Semel Institute for Neuroscience and Human Behavior.

Statisticians create and extend tools that can be used to build bridges from data to conclusions. Biostatistics faculty members train all public health students to understand and interpret p-values (the lower the p-value, the more surprising it would be for the observed finding to be explained by chance alone, and hence the more significant the observed finding). More complex tools include longitudinal designs, which follow the same people over time and thus must account for variations between people and across time points. Belin specializes in methods for dealing with missing or incomplete data: how to account for non-responses to surveys, for example, or people who drop out of studies for any of a number of reasons. There are multivariate tools for combining different types of measurements, and models that wed these and the many other statistical models. Non-parametrics are used to reduce assumptions that go into the analysis. "Many of the challenges we deal with relate to the number of factors that can influence an outcome," says Belin. "How do you handle it when there are hundreds or thousands of quantities that might matter?"

Other challenges are related to the study type. A sample survey such as the California Health Interview Survey conducted by the UCLA Center for Health Policy Research (based in the School of Public Health), for example, depends on a strict methodology and sound design to ensure that it can provide a detailed and accurate picture of the health and healthcare needs of the state's population by racial, ethnic, geographic and other measures. For her studies, Dr. Christina Ramirez Kitchen works with both basic scientists and HIV clinicians to learn how the virus mutates in response to drugs, as well as how the immune system changes with changes in the virus. Using complicated mathematical formulas specific to statistical genetics, she is able to help the researchers draw conclusions about the interactions among the virus, HIV drugs, and immune response. True to the collaborative nature of biostatistics, Ramirez Kitchen has been sought for her expertise and, like many of her colleagues in the department, has ended up collaborating not only with UCLA faculty but also with researchers at UC San Francisco and UC San Diego, and with the New York State Department of Health.

When he was an undergraduate student, Weiss had trouble choosing a major. "Everything was interesting," he says. Then Weiss stumbled upon statistics, realized he had a knack for it, and ended up getting his Ph.D. "The nice thing is I still don't have to decide what discipline I want to work in," Weiss quips. "I get to continue learning different things from experts in different subjects."

Sugar had a similar experience: Although she had always loved mathematics, she had such an array of other interests that she would have been happy with a classic Renaissance education. As a biostatistician she sometimes feels as if she is getting one. "There are a lot of fields in which you have to focus narrowly on one thing, but as a biostatistician you can work on almost anything," Sugar says. "Every time I work with a new researcher or a new disease, I learn fascinating new things. And almost all of the work we do as biostatisticians has the potential to have an immediate impact on real people."

Dr. Robert Weiss, professor of biostatistics, has been a key contributor to the research of Dr. Pamina Gorbach, associate professor of epidemiology, for more than five years. Weiss has taken on a growing role as Gorbach's collaborator, applying his expertise in longitudinal analysis to enable Gorbach to collect more complex behavioral data.

For Sugar, one of the most rewarding parts of her work is being able to teach the basic concepts of biostatistics to students and, in the process, demonstrate how relevant statistics are to their everyday lives. "We're constantly getting data thrown at us, and knowing how to be an intelligent consumer of that information – understanding, for example, whether a conclusion being drawn from the data is reasonable – can be a very useful skill," she says. Since joining the school's faculty three years ago, Sugar has twice been honored for her teaching excellence with the Professor of the Year award given by the Public Health Students Association.

Those who have received advanced training in that skill from top biostatistics departments, including that of the UCLA School of Public Health, find themselves in high demand, and not just from Google. The vast majority of biostatistics graduates pursue positions in academia, government or industry – particularly biotech and pharmaceutical companies. If they are anything like their UCLA mentors, they keep busy. In addition to research and teaching responsibilities, the department's faculty devote considerable time to reviewing the scholarly work of their peers – whether through editorial work for journals as article reviewers and editors, participation on panels that review research grant applications, or service on doctoral dissertation committees. (Dr. Abdelmonem A. Afifi, professor emeritus in the department and former dean of the school, has served on more than 130 doctoral dissertation committees and is currently on two dozen more.)

Then there's the research. At any one time, Belin says, he is on as many as 30 or more studies, and he suspects that many of his department colleagues would report the same level of activity. Many of the faculty are kept busy in their roles heading statistical cores for clusters of like-minded investigators, often as part of research centers or programs. Through these entities, biostatistics faculty are often called upon by multiple researchers to provide consultation and support – and even one active researcher can keep a biostatistician fairly busy, Belin notes.

"We're quite popular – to get major grants, you almost have to have one of us on the application," says Ramirez Kitchen. She explains that at a time when competition for federal research funding is fierce, granting agencies want assurance that the protocols have a high likelihood of success and that data collection and analysis will unfold in a way that is sound. Not that members of the department's faculty mind the attention. "We are a very collaborative group," Ramirez Kitchen says. "We like to help people."

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