

CCEB Newsletter



Computerized Provider Order Entry (CPOE) is summarized by one of its leading proponents, who has written extensively on the subject.

A Quarterly Newsletter

Vol. 3, No. 3 — Summer 2008

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An Introduction to Computerized Provider Order Entry (CPOE)

Ross Koppel, PhD, is Adjunct Professor of Sociology, University of Pennsylvania School of Arts and Sciences, and an Affiliate Member in the CCEB. As lead author, he has written extensively on CPOE in collaboration with various members of the CCEB in several published articles.

Computerized Provider Order Entry (CPOE) systems allow the physician or other healthcare providers to submit medication orders directly to the pharmacy. The computers may be in the hospital, the medical office, or anywhere there is internet access. CPOE is heralded as a

breakthrough that cuts medication prescription errors and promises a long list of benefits, including: the end of handwriting identification problems; faster and direct connection to pharmacies; fewer errors associated with similar drug names; easy integration into medical records and decision support systems; drug-drug interaction warnings; identification of prescribing physicians; ability to avoid specification errors, such as trailing zeros; data availability for immediate analysis; and significant economic savings. In addition, with online prompts, CPOE systems can link to algorithms that emphasize cost-effective medications, reduce underprescribing as well as overprescribing, and reduce incorrect drug choices.¹ Several published studies have reflected CPOE-linked prescribing error reductions of 50% to 83%.²⁻⁴

But a more complex picture has emerged in the last few years. A study by Koppel et al. of one CPOE system documented 22 different error-enhancing aspects of that system.¹ In another study, Han et al. reported a doubling of infant mortality after the introduction of a CPOE system, probably resulting from increased time to enter orders, reduced communication among nurses and doctors, and the loss of advance information previously radioed in from the transfer team before the patient arrived at the hospital.⁵ Likewise, Nebeker et al. found high rates of adverse drug events (ADEs) in the highly computerized Veteran's Administration Administration system.⁶ Shulman and colleagues conducted a classic before-and-after study of a CPOE system in a Veterans Affairs Medical Center. They found a 50% reduction in prescribing errors and a 25% reduction in ADEs.⁷ (Continued on page 5)



Faculty Profile:



Ray Boston, PhD, MSc, Professor of Biostatistics, Senior Scholar, CCEB

Ray Boston, PhD, MSc, is based at Penn's School of Veterinary Medicine

Ray Boston was born in Melbourne (pronounced Melbən), Australia and liked the second most populous city in the country and state capital of Victoria so much that he stayed throughout his formal education. Ray feels very fortunate to have been zoned (zoning in Australian education was a means by which students were assigned the educational institutions they could attend) out of the most “illustrious” of boys’ secondary education centers in Victoria, forcing him to fall back on a “second-tier” school. This small school, Camberwell High School, had about 600 students, with an equal distribution of boys and girls. Ray was lucky with this move insofar as he was graced with the “most creative, sensitive, and caring teachers imaginable,” who stood out with regard to interest in their students, subjects, and the school.

Approaching grade 10 in that school, he (like *Seinfeld’s* George Costanza) wanted to be an architect but the prospects for such a career arc seemed pretty grim. Ray confesses that he was devoid of the requisite artistic skills at that time. Fortunately, having tried various school sports (and along the way broken a leg on the school’s junior football team) and having decided that the safety of rowing was a selling point, he joined the tiny rowing club and started rowing in various crews, much to his enjoyment. The next year (his junior or “leaving” year in Australian terms) both rowing and studies became more serious and he was faced with some uncertainty... not sure what he would pursue if his artistic talents weren’t up to par. He was preparing for a rowing practice early that year when his coach, an All-Australian Olympic Oarsman, out of the blue said, “Ray, are you going to be a physicist?” His coach taught physics at school and Ray was actually enrolled in physics but he didn’t really think that this made him a physicist. “It didn’t. It simply implied that you were one of Camberwell’s physics students... nothing more.”

Ray’s rowing team wound up winning all of the high school regattas, and Ray did end up studying physics for 10 years at Melbourne University. Among other lessons at Camberwell, where he made the most delightful collection of supportive and loyal friends imaginable, Ray, who still cherishes the time he spent there, learned what can be achieved under the guise of education.

In 1964, Ray received a bachelor’s degree in physics, which included a significant statistics component. He was awarded a master’s degree in physiology in 1966. There was also a high statistical concentration in this program in which he studied firing rates and regularity of motor units. Ray continued his academic work through a stint as a pilot officer in the Royal Australian Air force, and, in 1970, he earned a PhD in physics. In 1971, as his first career appointment, he was extremely fortunate to be awarded a research fellowship in statistics in the Institute of Advanced Studies at Australian National University to work with Dr. Ted Hannan, the world authority on time series analysis at the time, to investigate a variety of time series-related problems. It was there that Dr. Boston expanded his expertise by studying flight features of the delta wing airplane (crafts with one wing in a broad triangular shape extending beyond both sides) and he was led to explore how pilots could prevent them from plunging from the sky when encountering severe downdrafts associated with mountain-originated atmospheric turbulence.

In 1973, Dr. Boston became a senior lecturer in computing and statistics as well as the Biometrician in Agriculture at La Trobe University in Victoria, Australia. Working at this agricultural institution for the next 12 years, in addition to teaching, he advised on experimental design and on the development and interpretations of statistical techniques. During this period, Dr. Boston gradually took on an increasing level of work and interest in biological and mathematical applications of statistics.

In 1985, he moved on to Murdoch University, in Perth, Western Australia, to become the Foundation Professor of Computer Studies. This allowed him to

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Faculty Profile:

Laura Balcer, MD, MSCE, conducts wide-ranging research on the neuro-ophthalmologic aspects of multiple sclerosis (MS)

Laura Balcer was born and raised in Baltimore, Maryland. Born at The Johns Hopkins Hospital, Dr. Balcer returned there for Medical School and graduated in 1991. In between, she attended Dulaney High School and the College of William & Mary in Williamsburg, Virginia, receiving a degree in biology with Highest Honors and the Lord Botetourt Medal for Distinction in Scholarship in 1987.

As one of two children (her brother is a computer software designer in California), Laura decided at the age of nine years that, much to her grandmother's delight, she would become a physician rather than a major league baseball player. During her high school years, a pediatric cardiologist gave Laura the opportunity to observe in her clinics and rounds (and to ride to work in her MG convertible). Struck by how early leaders, such as Dr. Helen Taussig, had fundamentally changed their field (developing the Blalock-Taussig shunt, for example) yet had done so using persistence and a one-day-at-a-time approach, Laura got a first glimpse of how success in academic medicine often involves a series of small but important deeds and accomplishments.

Dr. Balcer completed her medical internship and neurology residency at Penn in 1995. Following a one-year clinical fellowship in neuro-ophthalmology in 1996, she was appointed to the Penn Faculty

as an Assistant Professor of Neurology and Ophthalmology in 1997. During this time, she earned her MSCE degree here at the CCEB. She credits her mentors and colleagues in neuro-ophthalmology, neurology, ophthalmology, and biostatistics (Dr. Maureen Maguire), for providing many opportunities for success on her career path.



Laura Balcer, MD, MSCE, Assistant Professor of Ophthalmology and Neurology, Senior Scholar, CCEB

As a neuro-ophthalmologist, Dr. Balcer was introduced to the field of multiple sclerosis (MS) by her mentors as well as by her own patients who despite having 20/20 visual acuity also described their vision as “not quite right.” Her MSCE thesis project was based on examining MS patients’ visual function using low-contrast letter acuity, a new version of the visual acuity chart that has light gray rather than black letters on a white background, and determining whether this new method of visual assessment was reliable. Dr. Balcer developed this concept further with her first R01 and found that low-contrast letter acuity was more sensitive than standard visual acuity, color vision, or visual field testing in patients with MS. Through this work, low-contrast letter acuity testing has be-

come recognized as the candidate visual outcome to be added to the MS Functional Composite measure (a new neurologic scale for MS trials that includes a timed 25-foot walk, 9-hole peg test, and paced auditory serial addition test), and has been incorporated successfully as an exploratory outcome in several phase 3 MS clinical trials. In two recent MS trials, low-contrast letter acuity testing demonstrated treatment effects and was sensitive to sustained changes in visual function. Because of her work, Dr. Balcer serves on international committees focused on refining the MS Functional Composite and other MS clinical outcome measures.

Dr. Balcer is especially excited about her current work in which she leads a three-center and growing collaboration with MS experts Dr. Peter Calabresi from Johns Hopkins and Dr. Elliot Frohman from the University of Texas Southwestern in Dallas. Data from her collaborative studies support a potential role for ocular imaging as a complement to the low-contrast acuity testing in capturing axonal loss in MS. Optical coherence tomography (OCT) and scanning laser polarimetry measure thickness of the retinal nerve fiber layer, a unique structure within the central nervous system that consists of unmyelinated axons. Dr. Balcer’s research has taught us that retinal nerve fiber layer thinning, a marker

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From the Director:



Brian L. Strom, MD, MPH

I am pleased once again to introduce the CCEB's quarterly Newsletter. For those who are new to the School of Medicine, our Newsletter provides us with an opportunity to identify services and programs sponsored by the CCEB that may be of interest to faculty, residents, and fellows within UPHS as well as those external to Penn. In each issue, we highlight one of the services we offer. We also present feature articles on a few members of our faculty, identify newsworthy events likely to be of broad interest, and provide feature articles on topics of interest. Prior Newsletters can be found on our website at the following URL: <http://www.cceb.upenn.edu/news/?category=2>.

In this issue, our services article describes our Biostatistics Analysis Center (BAC), which operates as a Service Center within the Biostatistics Unit of the CCEB, designed to provide professional MS- and PhD-level biostatistics support for collaborative research projects for faculty, residents, and fellows

throughout UPHS. While the BAC generally operates on a fee-for-service basis, some faculty, residents, and fellows may qualify for short-term assistance at no cost. Additional information about the BAC, beyond what is provided in the article, can be found at the following web site: <http://www.cceb.upenn.edu/services/bac/>. For questions about the BAC, please feel free to contact the BAC's managing director, Amy Praestgaard, MS (215-573-4859, praestga@mail.med.upenn.edu).

We also include in this issue a feature article about computerized provider order entry (CPOE), which is an automated system allowing physicians and other healthcare providers to submit medication orders directly to the pharmacy. This article, written by Ross Koppel, PhD, an Adjunct Professor of Sociology at Penn and affiliate member of the CCEB, identifies some of the reduced medication errors in hospitals as well as unintended consequences resulting from the utilization of CPOE systems.

A second feature article focuses on the Diversity Initiative in Research for Underrepresented Minorities (DRUM), a program in operation since 2000. This program, led by Jesse Chittams, MS, a member of the
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for axonal degeneration, is a strong correlate to visual loss in MS. Based on their data, Dr. Balcer and her collaborators have taken on leadership roles in the design of ongoing clinical trials in MS and acute optic neuritis that have incorporated low-contrast acuity and OCT imaging. Upcoming trials that examine neuroprotective agents, the next generation of therapies for MS, will likely use the anterior visual pathways as a model for determining efficacy.

In addition to the handful of grants on which Dr. Balcer is a principal investigator, she has much work and many grants in the pipeline. She and her colleagues will be analyzing

longitudinal data to further define the roles for visual function testing and ocular imaging in MS and examining how changes in these measures impact quality of life for patients. They will also be using their knowledge applied to other neurogenetic disorders such as Friedreich's ataxia and Parkinson's disease and will combine updated ocular imaging with MRI techniques to address, *in vivo*, how the timing of axonal loss relates to dysfunction, neuronal degeneration and demyelination in MS.

In addition to all of this cutting edge research, Dr. Balcer has served as a mentor for more than 20 trainees including two Doris Duke Clinical Re-

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after study of the transition from paper to CPOE system.⁷ They found that, compared to paper-based systems, CPOE was associated with fewer inconsequential errors, but also with more serious errors.

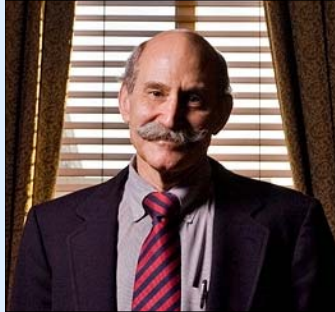
Ash et al., Campbell et al., and Aarts et al. have found unintended consequences from CPOE systems to be the rule rather than the exception.⁸⁻¹⁰ David Bates, one of the most respected advocates of CPOE, in writing about his own experience stated, “After implementing CPOE, we routinely tracked errors and problems that were created, and made thousands of changes to the original application. If I had one thing to ‘do over’ in our CPOE implementation, it would be to have devoted more resources to this area – it is just impossible to ‘get it all right’ at the outset, because the processes involved are so complex.”¹¹ He added that while health information technology (HIT) is “an extraordinarily powerful tool” it is “only a tool, and... for it to have the desired impact socio-technical factors must be considered and addressed.”¹¹ Nemeth and Cook agree: “If it exists, error is a *consequence* of interaction with IT systems... The core issue is to understand healthcare work and workers.”¹² They also acknowledge that while “healthcare work seems to flow smoothly,” the reality is “messy.”

Link of CPOE with Decision Support Systems

Although Decision Support Systems (DSS) are additions to CPOE, they are often considered a part of CPOE and are briefly noted here. DSS, sometimes called Clinical Decision Support Systems (CDSS), provide alerts for prescribing physicians of under- or over-dosing, drug allergies, and drug-drug interactions. In theory, they are a wonderful error-reducing, life-saving contribution. And they have absolutely prevented millions of errors and even saved many lives. In reality, however, their use has been problematic. Several recent studies have reported that DSS medication error alerts are over-ridden about four-fifths of the time.¹³⁻¹⁶ These studies also found

that most overridden medication error alerts were overridden for medically appropriate reasons, meaning that the alerts were frequently off target.

Garg et al. reviewed 100 DSS studies.¹⁷ Their results support two conclusions: 1) many studies of various types of DSS showed no statistically significant benefit; and 2) even where the benefit was statistically significant, the magnitude was often small. Perhaps more remarkable than these results themselves was the realization that the probability a system will be found efficacious increases considerably if its evaluators are also its creators. In their multivariate analysis, Garg et al. found that creator-as-evaluator was one of only two factors to predict success.



Ross Koppel, PhD, Adjunct Professor of Sociology, SAS, and an Affiliate Member in the CCEB

In defense of DSS, it must be acknowledged that creating warnings for dosing is extremely difficult. Obese patients, patients with high opiate tolerances, patients with multiple organ-system problems, or patients with involved chemotherapy histories require complex decision making. Undoubtedly, as we learn to titrate the DSS alerts with greater sensitivity, we shall reduce “alert fatigue” and improve the effectiveness of both DSS and the CPOE systems they assist.

Summary

That CPOE systems can reduce errors is well established. But to maximize the benefits and minimize the unintended consequences requires arduous and ongoing vigilance and work. Even a “perfect” CPOE system must constantly adapt to changes in other IT systems, staff, nursing processes, workflow, protocols, medications, and interior space utilization. The inherent risk-reward tradeoff requires ongoing attention to both patient safety and efficient medical care delivery.^{18, 19} Perhaps most importantly, it has to be recognized that these cannot be seen as turnkey systems, to be installed and forgotten. They need to be tailored to the local environment, evaluated, modified, re-evaluated, and then modified and evaluated again in a continuous process of quality improvement.

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Faculty News and Notes

Several CCEB faculty have appeared in the news recently. A brief summary dating from late June follows in alphabetical order.

Peter Groeneveld, MD, Assistant Professor of Medicine in the Division of General Internal Medicine, University of Pennsylvania SOM, Associate Scholar, Epidemiology, CCEB, was the lead author of “Drug-eluting compared with bare-metal coronary stents among elderly patients,” published in the May 2008 edition of the [Journal of the American College of Cardiology](#). His study was cited in a June 25th article in [The Washington Post](#) that focused primarily on a report published in the June 25th issue of [JAMA](#) comparing patients who received drug-coated cardiac stents with those who received bare metal stents. Unlike the *JAMA* report, Dr. Groeneveld’s study found an overall reduction in mortality among patients who received drug-coated stents.

§

Scott Halpern, MD, PhD, a Fellow in the Division of Pulmonary, Allergy and Critical Care, HUP, and a Faculty Fellow, Epidemiology, in the CCEB, and Arthur Caplan, PhD, Director of the Center for Bioethics, University of Pennsylvania SOM, were quoted on the 25th of June in an [MSNBC](#) online story about their article “Informing Candidates for Solid-Organ Transplantation about Donor Risk Factors,” which was published in the June 26th edition of [The New England Journal of Medicine](#). The authors are calling on the United Network of Organ Sharing (UNOS) to create new standards that would expand the way potential transplant recipients are informed of surgical risks to include discussion of the risks linked to the use of “suboptimal” organs (from people at risk of infectious diseases such as HIV, or individuals with high blood pressure or diabetes), and having them decide when they’re placed on the transplant waiting list whether they would accept such organs.

§

Ross Koppel, PhD, Adjunct Professor of Sociology, University of Pennsylvania School of Arts and Sciences, and Affiliate Member, CCEB, was quoted by [The Philadelphia Inquirer](#) on the 1st of July in its article about the practical problems associated with hospital bar codes and recommendations to overcome the so-called “work-arounds” that emerge and sometimes undermine the system. The article was based on the paper “Identifying and quantifying medications errors:

evaluation of rapidly discontinued medication orders submitted to a computerized physician order entry system,” published in the July/August issue of the [Journal of the American Medical Informatics Association](#) and authored by Dr. Koppel with CCEB colleagues **Charles Leonard, PharmD, A Russell Localio, JD, MA, MPH, MS, PhD, Abigail Cohen, PhD, Ruthann Auten, and Brian L. Strom, MD, MPH**.

Dr. Koppel was also quoted on the 22nd of July by [Medpage Today](#) and heard in an audioclip on the web story that focused on the quick reversals of medication orders that were addressed in the *JAMIA* article.

§

Shiriki Kumanyika, PhD, MPH, Associate Dean for Health Promotion and Disease Prevention, Professor of Epidemiology, Department of Biostatistics and Epidemiology, University of Pennsylvania SOM, Senior Scholar, Epidemiology, CCEB, was quoted by several news sources including [US News and World Report](#) and [ABCNews](#) on the 1st of July as primary author of an American Heart Association (AHA) scientific statement, “Population-based prevention of obesity,” made available electronically on June 30th ahead of print in the AHA’s journal [Circulation](#). Dr. Kumanyika recommended the incorporation of population-based initiatives at the local, state, and federal levels to prevent excess weight gain in children and adults. Along with her colleagues, she suggested, among other changes, modifying the areas in which people live (e.g., planning neighborhoods that are pedestrian-friendly and amenable to exercise), reducing portion sizes in restaurants, and reducing the easy availability of sweetened beverages, as well as high-fat foods and low-fiber foods.

Dr. Kumanyika’s work with colleagues from Johns Hopkins University in the July 24th edition of the journal [Obesity](#) was also cited by local [CBS 3](#) on the 30th of July. The study, which considered survey data collected from the 1970s to 2004, suggested that if current trends continue, 86.3% of adults will be overweight or obese and 51.1% obese by 2030, and total healthcare costs related to obesity would double

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The Diversity Initiative in Research for Underrepresented Minorities (DRUM) Program

By Ashley Precia and Jesse Chittams, MS

The Diversity initiative in Research for Underrepresented Minorities (DRUM), begun in 2000 by Jesse Chittams, is a program aimed at offering internship opportunities to undergraduate and high school students, with an emphasis on including underrepresented minorities from the Mid-Atlantic region. The main objective of this program is to expose students to several research and academic disciplines in the field of biomedical research. The DRUM program is led and operated by Jesse Chittams and Catherine Smith in the Biostatistics Analysis Center (BAC) of the CCEB in the University of Pennsylvania School of Medicine (SOM). With the help of research grants and CCEB faculty funds, the program enhances the presence of underrepresented minorities within the field of medical research and data management.



Ashley Precia, a 4-year intern of DRUM and BAC

The DRUM program offers a training and research component, in which students receive hands-on professional experience, gaining knowledge in epidemiology, biostatistics, and computer programming, specifically SAS, a statistical software package. DRUM also promotes and assists students in college and career planning. In addition, seminars and workshops are devised by DRUM gradu-

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CCEB's BAC staff, provides internships to high school and college students, with an emphasis on including underrepresented minority students. DRUM's primary aim is to expose students to biomedical research and to encourage them to consider disciplines within biomedical research for their career.

Two members of our faculty are featured in this Newsletter: Raymond C. Boston, PhD, and Laura J. Balcer, MD, MSCE. Ray is Professor of Applied Mathematics in the School of Veterinary Medicine (primary) and Professor of Biostatistics in the School of Medicine (secondary) and Senior Scholar in the CCEB. Ray's research interests include modeling biological systems across a wide spectrum of biological processes including cancer and nutrition-

The purpose and goals of DRUM include:

Allowing interns to develop data entry, management, and analysis skills with medical research projects in the CCEB and SOM.

Giving interns a chance to work with people in a variety of biomedical research fields to enhance their quantitative or qualitative research skills.

Helping interns who are high school seniors navigate the college admissions process by providing SAT preparatory assistance as well as mentors who succeeded in getting into college in previous years through DRUM. (This is DRUM's primary focus during the fall semester.)

Providing seminars and workshops for students participating in other diversity programs on campus designed to introduce the students to careers in medical research and statistics.

ates that focus on college planning and survival as well as SAT and ACT preparation.

"The coordination and organization of the program each year is dictated to some degree by the skill sets of the volunteer coordinators and the needs of the DRUM students selected," explained Mr. Chittams.

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related investigations. Laura is Associate Professor of Neurology (primary) and Epidemiology (secondary) and CCEB Senior Scholar. Her primary research focus is on the identification and development of clinical visual outcome measures for multiple sclerosis trials.

Other regular features of our Newsletter include a section on "News and Notes" and recent graduates from our graduate training programs in biostatistics and epidemiology.

I also would like to remind you to check our website regularly for announcements and other newsworthy events (<http://www.cceb.upenn.edu/>) and find potential faculty collaborators (<http://www.cceb.med.upenn.edu/faculty/>).

I hope you enjoy our Newsletter.

each decade to range between \$860.7 and \$956.9 billion by 2030.

§

Jesse M. Pines, MD, MBA, MSCE, Assistant Professor of Emergency Medicine at HUP, Assistant Professor of Epidemiology, University of Pennsylvania SOM, Senior Scholar, Epidemiology, CCEB, Associate Director, Division of Emergency Care Policy and Research Senior Fellow, Leonard Davis Institute of Health Economics, and Fellow, Institute of Aging, University of Pennsylvania, and Penn colleague Zachary F. Meisel, MD, MS, Assistant Professor of Emergency Medicine, co-authored the article “Waiting Doom: How Hospitals Are Killing E.R. Patients,” which was posted in the online magazine *Slate* on the 24th of July. On the same date, their article was quoted in the online Health Blogs section of *The Wall Street Journal*. In the article, the Penn authors discuss the “boarding” of inpatients in the ER and in calling for congressional hearings on the subject, suggest that hospitals should be required to reveal how long ER patients wait for inpatient beds.

Dr. Pines was also quoted in the summer edition of *ProtoMag*, a periodical by the Massachusetts General Hospital, in a story on ways in which emergency rooms are working to reduce crowding. In addition, Drs. Pines and Meisel participated in a live chat sponsored by *The Washington Post* on the 18th of September regarding their *Slate* article.

Notes

On June 26th, recent MSCE graduate **J. Nadine Garcia, MD, MSCE**, a pediatrician and violence prevention researcher at CHOP and an advocate for minority and disadvantaged populations, was appointed as one of the 14 *White House Fellows* for 2008-2009. The White House Fellows program was initiated in 1964 and provides experience in federal government, including an education program featuring trips to study U.S. policy in action as well as roundtable discussions with private and public sector leaders. Fellows are expected, after the fellowship year, to contribute to the country as public servants and national leaders.

The DRUM program partners with the SOM Summer Mentorship Program and Project EXPORT to strengthen the core of each individual program and maximize their impact on the students.

“The DRUM program has made me realize the importance of striving towards my goals despite various obstacles... I had numerous recommendation letters, my SAT scores had improved, and most of all I gained admittance to my dream school, Pennsylvania State University. I did not merely gain one mentor through my DRUM internship, *I gained a family*,” said Marlon Amponsah, a current DRUM student.

“Through my time with DRUM, I applied and was accepted into the University of Maryland, College Park, and received an academic scholarship from a fraternity in my community. The thought of going to such a university never crossed my mind prior to my time as a DRUM intern. Even though I am in school, I continue to work with DRUM, building a strong foundation in my understanding of statistical programming; which is something I could see myself doing once I graduate,” offered Benjamin Whitfield, a former DRUM student.



The DRUM 2008 summer session was a great success. With faculty input from Drs. Reneé Moore, Charles Branas, Douglas Wiebe, and Tom Ten Have, DRUM volunteer instructors Marlon Amponsah, Jesse Chittams, Shawn Fernandes, Quincy Greene, Catherine Smith, Benjamin Whitfield, Ashley Precia, and Tammie Precia presented a workshop series to 12 high school students from the Philadelphia area designed to introduce them to the fields of biostatistics and epidemiology. The students were selected by the SOM Office of Diversity and Outreach based on their academic achievements and career aspirations. In addition to receiving valuable advice on navigating the college admissions process, the students developed and administered over 150 surveys in one hour, and helped summarize the survey data designed to assess perceptions related to gun violence.

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CCEB's Clinical Research Services: Biostatistics Analysis Center (BAC)

The CCEB serves as an interdisciplinary resource for clinical research throughout the School of Medicine and offers a range of services, primarily to faculty, residents, fellows, and research staff within the University of Pennsylvania Health System, but also to clinicians and scientists throughout the Delaware Valley with interests in such services. These services are identified and described as a regular feature of this newsletter.

The clinical research services offered by CCEB faculty and staff include professional MS- and PhD-level biostatistical support provided by the Biostatistics Analysis Center (BAC). The BAC has been organized as a Service Center within the Biostatistics Unit of the Center for Clinical Epidemiology and Biostatistics (CCEB) and is led by Thomas Ten Have, PhD, MPH, and John Farrar, MD, PhD, as Faculty Director and Associate Faculty Director, respectively, and Amy Praestgaard, MS, as Managing Director and Senior Biostatistician. The BAC is staffed by 29 biostatisticians, SAS programmers, and administrative staff, in addition to Ms. Praestgaard.

The BAC specializes in statistical programming and analysis using various commercially-certified statistical software packages for data analysis support; statistical data management support of analytic activities at any stage of a research project, specifically the preparation of analysis files for statistical software packages; strategies for research proposals involving observational, experimental and survey research studies; selection and implementation of appropriate statistical methods for specific applications to research data; statistical and graphical analysis of data; technical report preparation, including the summarization of results and interpretations of statistical analyses of research data; and statistical review of manuscripts. In addition, the BAC recently expanded its range of services with the launch of its Data Management Unit (DMU). The DMU provides comprehensive, customized database development and management including case report form design and printing, data entry, data-

base set-up and tracking, data cleaning, and customized patient recruitment tracking.

Typically, BAC services are provided on a fee-for-service basis, but some services are available at no charge for qualifying faculty and fellows who do not have access to financial resources to support the initial consultation and limited analyses. Funds provided by the Clinical and Translational Sciences Award (CTSA) are available for hands-on assistance with data analysis estimated to take 20 hours or less. Occasionally, longer-term projects also can be supported without funding. Unfunded analysis requests should be submitted through the [collaboration request form](#)

Normally, services are provided through funding built into grants or paid for by home departments. Fees can be assessed on an hourly basis, which usually is the case for short-term consultations, or for fixed-percent effort or task-based budgeting for longer-term projects. The BAC has dedicated project triage and budget development staff who provide estimates of the time required to complete data analysis, grant proposal development, data management, and outcomes measurement/methods projects.

To request the services of the BAC, researchers are asked to complete a [collaboration request form](#). The study protocol or other appropriate documents should be attached. Requesters will be contacted by BAC staff within three business days. Those with questions about BAC services and related issues should contact Ms. Praestgaard directly (215-573-4859, praestga@mail.med.upenn.edu).

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The DRUM program has both a short- and long-term impact. In the short term, we expect interns to return to their respective schools during and after their DRUM experience with a paramount sense of awareness and confidence and thus become better role models for other students within their community. This will extend the outreach of the project by increasing the probability of other students becoming interested and seeking career opportunities in biomedical research. In the long term, DRUM then helps to improve the likelihood that these underserved students

will attend and stay in college and become productive members of society.

Jesse Chittams, MS, is the Program Director of DRUM and a Senior Manager and biostatistician in the BAC within the CCEB.

Ashley Precia is a senior journalism major at Clark Atlanta University in Atlanta and has been working as an intern with DRUM and the BAC for the last 4 years.

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search Fellows, two FOCUS Fellows, and currently two MSCE students. She is the Program Director for a recently funded Neurologic Clinical Epidemiology T32 training grant. This training grant involves 34 Penn faculty and will train five fellows over the next five years. Dr. Balcer believes that long-term success in academic medicine requires resilience, a sense of responsibility, and a team approach, as well as a balance of confidence and humility. Her ideas of team approach are very evident in all of her work and her current collaborations, which have been cited as a

(Boston, continued from page 2)

further develop his burgeoning interests in computing and statistics as well as biology. While working at Murdoch, he also became an affiliate professor in bioengineering at the University of Washington in Seattle (from 1988 to 1990).

In 1991, Dr. Boston moved to the US to become Professor of Applied Biomathematics in the University of Pennsylvania School of Veterinary Medicine. He achieved a secondary appointment at Penn's School of Medicine in 1996. One year later, he was also named Professor of Biostatistics in the Department of Biostatistics and Epidemiology in the School of Medicine. That same year, Dr. Boston was bestowed an honorary professorship as a statistician in the Endocrinology Department of St. Vincent's Hospital in Melbourne. For two years, from 2002 to 2004, he was an honorary faculty member of the University of Sydney in Sydney, Australia. In 2004, Dr. Boston became a Senior Scholar in the CCEB. Currently, Dr. Boston is based at Penn's School of Veterinary Medicine in Kennett Square.

Some of his achievements over the years include: being awarded a series of contracts from the Laboratory of Theoretical Biology, National Institutes of Health (NIH), to develop, maintain, and enhance the well-known and first commonly available metabolic modeling software, SAAM; coordinating the conversion of this package from a batch style of operation to an interactive format; coordinating the development and release of the graphical version of this software, WinSAAM (NIH has actually now assigned control of this entire line of development to him); with his team at the School of Veterinary

model within the MS community for advancing the field.

While she's not at work, Dr. Balcer loves spending time with her husband, David Lynch, MD, PhD, Associate Professor of Neurology and Pediatrics, whom she met while here at Penn. Alongside her six-year-old daughter Abby, Dr. Balcer is learning how to play the violin. A first-grader at the Baldwin School, Abby would like to be an artist or chef when she grows up, perhaps explaining the family's affinity for watching the Food Network. Then again, Abby has been said by her teachers to always arrive with a "can-do attitude" in science class...

Medicine at Penn, designing and implementing the first software to enable the repeatable and reproducible estimation of Insulin Resistance from the Glucose Challenge (the software was called MinMod Millennium); designing and developing the first database-driven kinetic software for the epidemiologic exploration of a specific disease, Metabolic Syndrome; and releasing the first modeling tool enabling the unbiased decomposition of the disposal and production consequences of glucose in conjunction with the glucose challenge [this software was known as AKA-TPG (for Two Pool Glucose)]. All of these efforts from Dr. Boston and his group at Penn have been directed toward enhancing the tools for the investigation of diabetes and pre-diabetes and thus improving the rate at which assistance might be brought to the 600,000,000 so afflicted. In all, Dr. Boston was funded by NIH from 1978 to 2004 to develop ideas and methods for the investigation of health and diseases issues using computer-based statistical and mathematical methods.

Dr. Boston has published over 200 peer-reviewed articles, 20 book chapters, and three books. The array of journals his articles have appeared in is lengthy and varied, representing a broad range of disciplines, including: agricultural science, allergies and immunology, analytical chemistry, anesthesia and analgesia, applied meteorology, cancer, cardiology, circulation, computers in medicine, critical care medicine, developmental physiology, diabetes, endocrinology, environmental science, enzymology, epidemiology, genetics, hazardous materials, health physics, information services, investigational new drugs, mathematical biosciences, magnetic resonance

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imaging in medicine, mass spectrometry, metabolism, neurology, nutrition, optics, pharmacology, radiology, reproduction, rheumatology, telecommunications research, ultrasound in medicine, and various topics in veterinary medicine including animal science, emergency and critical care, feed science and technology, fish diseases, internal medicine, parasitology, pharmacology and therapeutics, and zootechnology.

Dr. Boston's publications during 2008 include "Modeling circadian rhythms of food intake by means of parametric deconvolution: results from studies of the night eating syndrome," in the *American Journal of Clinical Nutrition*; "Cellular kinetics and modeling of bronchioalveolar stem cell response during lung regeneration," in the *American Journal of Physiology - Lung Cellular and Molecular Physiology*; "Dietary energy source affects glucose kinetics in trained Arabian geldings at rest and during endurance exercise," in the *Journal of Nutrition*; "A novel minimal model to describe NEFA kinetics following an intravenous glucose challenge," in the *American Journal of Physiology - Regulatory Integrative and Comparative Physiology*; "A novel minimal model to describe non-esterified fatty acid kinetics in Holstein dairy cows," in the *Journal of Dairy Research*; "Short communication: change in plasma ghrelin in dairy cows following an intravenous glucose challenge," in the *Journal of Dairy Science*; "Milk fatty acids II: prediction of the production of individual fatty acids in bovine milk," in the *Journal of Dairy Science*; "Kinetics of ruminal lipolysis of triacylglycerol and biohydrogenation of long-chain fatty acids: new insights from old data," in the *Journal of Dairy Science*; "Plasma aldosterone, vasopressin and atrial

natriuretic peptide in hypovolaemia: a preliminary comparative study of neonatal and mature horses," in the *Equine Veterinary Journal*; "Effects of long-term oral administration of levothyroxine sodium on glucose dynamics in healthy adult horses," in the *American Journal of Veterinary Research*; "Effects of an intravenous endotoxin challenge on glucose and insulin dynamics in horses," in the *American Journal of Veterinary Research*; "NEFA minimal model parameters estimated from the oral glucose tolerance test and the meal tolerance test" in the *American Journal of Physiology - Regulatory Integrative and Comparative Physiology*; "Cardiac output determination by use of lithium dilution during exercise in horses" in the *American Journal of Veterinary Research*; and "Evaluation of a compartmental model to describe non-esterified fatty acid kinetics in Holstein dairy cows" in the *Journal of Dairy Research*. These topics and titles reflect his current interests.

In addition to his prodigious writing output, Dr. Boston also currently holds several editorial positions. He is a consulting editor for the *Journals of Veterinary Medicine* of the AVMA, a statistical editor for *Radiology*, and an editor for the *Journal of Agricultural Science*, Cambridge, and served on the editorial board of the *American Journal of Physiology: Endocrinology and Metabolism*. In 1997, Dr. Boston was appointed as special guest editor, with his own subject choice, for *Biomathematics*, the Journal of the Franklin Institute.

Dr. Boston lives in West Chester, PA. His hobbies, including tennis and swimming, have taken a back seat to the numerous papers to which he has been consistently contributing to or writing.

Congratulations and best wishes to the following August 2008 graduates!

PhD in Biostatistics Degree Recipients

Carin Kim, MS
Wenguang Sun

MSCE Degree Recipients

Timothy Beukelman, MD
Jim Franciosi, MD
Ruchira Glaser, MD

Manish Gopal, MD

Eric Haas, MD

Ingi Lee, MD

Anthony Mato, MD

Nathan Merriman, MD

Emily (Carter) Paulson, MD

Michael Schwartz, MD

Irene Su, MD

Joseph Zorc, MD