

SDNS Newsletter

Quarterly Publication of the ASA Section on Defense and National Statistics

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Letter from the Chair



Dear SDNS Members (all 395 of you!) and Friends of SDNS,

That's right, there are 385 members of SDNS – professional statisticians, data analysts, programmers, those in government service, managers, educators, and, I suspect, a few mathematicians thrown in too! We certainly have all the makings for a tight-knit yet diverse community that is actively contributing to issues at the intersection of statistics and national security. In fact, over the past year, SDNS has hosted several activities to foster this community:

- A gathering of defense officials, government statisticians, and SDNS members called "Meeting within a Meeting" at JSM 2009 (see article in this newsletter on page 3) aimed at focusing our statistical skills on unsolved problems in the defense realm.
- Two days of stimulating talks and keynote addresses focused on defense and security analyses at our "Quantitative Methods in Defense and National Security (QMDNS) 2010" conference.
- Numerous sessions, meetings, and events held in conjunction with JSM 2009 in Washington, DC last August.

All 385 of us have had these opportunities to engage with our colleagues and benefit from their ideas. These engagements can often spark a new way of thinking about our own problem sets – I for one

come away from SDNS events invigorated and ready to dive back into my work with newfound insights. But I believe SDNS can do more for the 385 of us. That's why we have several new initiatives underway this year aimed at member outreach. You've already noticed our first initiative – this newsletter (thanks to Calandra Tate Moore for pulling this together)!

We hope it provides useful information and we welcome your feedback. Our website is also being expanded and enhanced. We've created a standing committee on member outreach that is charged with engaging all 385 of us, fostering our community, and meeting our needs for information and collaboration opportunities. (Are you a 'member outreach' kind of person? If so, contact me to volunteer!) We are also hosting a mixer at JSM in Vancouver (see advertisement page 5). When we were pulling this mixer together, I'd heard from ASA staff that the Biopharm section has by far the most "hip and happening" mixers, so I sought the advice of the biopharm leadership – how did they do it? What was their secret to building a cohesive, fun, collaborative group? Answer: free food and booze! We can do that! So bring your discerning pallet and enjoy some fine Vancouver cuisine, wine, and beer on 2 August!

But are 385 of us enough to tackle the problems of our day? Honestly, I'd love to add a few more. So we ask you to flip through your rolodex to find that colleague who should really be a part of SDNS. Bring them to the mixer, a few of our sessions at JSM, and QMDNS 2011 in Santa Monica, CA next May. Please help us make SDNS the best it can be for all 385 (and counting) of us!

-Lara Schmidt



Bioterrorism Threat Assessment at the Department of Homeland Security

David Banks, Duke University

Maintaining acceptable body mass index (BMI) levels is an important health requirement for military personnel. As weight problems grow in the US population, there are concerns that the pool of people who meet military BMI standards will shrink below the levels required to sustain the armed forces, in terms of both recruiting and retention. Military manpower analyses are underway, including those conducted by Bing Han and Nelson Lim at RAND Corporation. Their analyses focus on 18 to 45 year olds' ability to meet Army standards for BMI. Han and Lim estimate the proportion of the population eligible for military service by employing a fully nonparametric empirical estimator. Their analyses also take into consideration factors such as education, disease, and aptitude. More details of the method and case study can be found in **Han B & Lim N. (2010). "Estimating Conditional Proportion Curves by Regression Residuals," Statistics in Medicine, 29, pp. 1443-1445.**

I think, I hope, that statisticians can have a positive impact on U.S. security. But there are many obstacles, and success requires compromise. One has to both educate and learn, and to gradually build trust. As Max Weber said about politics, working with security agencies is "a slow boring of hard boards".

But sometimes, things sort of work out. I joined the ASA Section on Defense and National Security (SDNS) when it was founded in 2003, and started trying to build the kind of kind of profile and skills that would let me contribute to work in counterterrorism. My initial steps were to use contacts within the SDNS in various ways---I helped to organize a conference on the topic, I started some research collaborations, and I networked with others (both statisticians and non-statisticians) who were active in this area. Many of these first steps fizzled, but as Persi Diaconis says, "honest work is never wasted," and eventually I developed a bit of a reputation in this area.

The scope of that early work was broad---I touched on data mining, social network models, game theory, and risk analysis. The latter topic was what drew me into the project that may have been the most important. It began in 2006, when the National Academies convened a panel to review the risk analysis methodology used by the Department of Homeland Security (DHS) to evaluate bioterrorism threats. I was fortunate to be

Security (DHS) to evaluate bioterrorism threats. I was fortunate to be working with two other SDNS members on that panel, Alyson Wilson and Nozer Singpurwalla, as well as world-class experts in operations research, military intelligence, risk analysis, and medicine.

The charge to the panel was to review the methodology developed by Battelle, a DHS contractor, for evaluating the risk of various bioterrorist agents (such as smallpox, ebola, the bubonic plague, and so forth). The contractor had developed a complex computer model that simulated terrorist decision-making, pathogen acquisition probabilities, pathogen production distributions, interdiction probabilities, exposure and contagion processes, and many other things, ultimately producing a (normalized) number that expressed the relative risks of the different diseases that were being considered. The computer simulation was slow, and its production had been very expensive. The costs were on-going, since DHS regularly renewed the contract, asking for more complexity (economic consequences, additional diseases, etc.). DHS was very proud of this effort, and wanted to extend it to the analysis of chemical, radiological, and other threats.

But our panel was less impressed. The full report is available from the National Academies (Parnell et al., 2008), but the gist of it was

methodology was completely unreliable. At a high level, there was concern that the model was churning detail in order to create a false impression of accuracy. For example, one component of the simulation was a compartmental model for disease transmission. This component had dozens of compartments---it included a "bucket" for people who received vaccine, but for whom the vaccine did not work, and who then went on to catch and spread the disease. No doubt this can happen, but the panel did not feel that this kind of micromodeling provided any useful information for estimating the number of people who would die if, for example, smallpox were released in Baltimore.

There were other concerns. The decisions of terrorists were treated as random events, rather than reasoned responses to news, resources, and opportunities. The simulation had virtually no "what-if" capability, so that decision-makers could not explore the impact of mitigation measures. The normalization to produce relative risks meant that the actual magnitudes of the threats were not provided, only their relative rankings. And, most dishearteningly, when we looked under the hood we found that the contractor's code produced randomness by generating event probabilities (usually from beta distributions elicited from experts), but that these probabilities did not add to one. (For example, in a given iteration of the simulation, the code would randomly select a target city. The probabilities for each of the cities was itself random, being *(Continued on next page)*)

(Banks article, continued)

drawn from expert opinion about the chance of an attack on, say, New York City or Washington D.C. or San Francisco. But the probabilities of the cities were drawn independently, and thus did not add to one, indicating grievous mistakes in the coding logic. Given the size and complexity of the program, the panel had no confidence that other aspects of the code were not comparably flawed..)

After about a year's worth of meetings, site visits, and deliberation, the panel wrote its report. The report was strongly critical, and DHS was not happy. The DHS agreement with the National Academies prevented publication until after DHS had reviewed the report to ensure that none of the classified information given to the panel was visible in the report. DHS received the report in December, 2007; by June 2008 the security review had still not been signed-off upon, and the panel was worried that this delay was an attempt to suppress criticism of a very costly project. The National Academies relayed this concern to DHS, and the security review was quickly completed. But DHS had used the time to commission a new report from CREATE (the DHS research center at the University of Southern California) that challenged our National Academies report, and this surely confused the situation. For readers who are interested in details, the CREATE report is by Ezell and von Winterfeldt (2009), and there is a rebuttal to their rebuttal in Parnell et al. (2009).

But despite a certain amount of sturm und drang along the way, I am fairly confident that this panel, and especially the statisticians on this panel, had a positive impact on national security. DHS heard what was said, and it is my understanding that they have rethought their methodology in sensible and constructive ways. A change in administration may have helped, yet it could not have happened without smart and able professionals at DHS who worked through the problem. Similarly, the contractor was not particularly at fault---they worked to specifications that had been developed by DHS contracting officers. No one likes criticism, but I think the ultimate response to it has been admirable.

The main lesson that I took away was that the defense community needs more statisticians. The initial missteps in the BTRA project could have been easily and inexpensively avoided if DHS had better access to the statistical community. At the time that our panel worked, I don't believe there was a single statistician in DHS, yet their managers were boldly writing specifications and large checks for a complex simulation system that clearly needed in-house expertise on the strengths and limits of statistical modeling.

REFERENCES

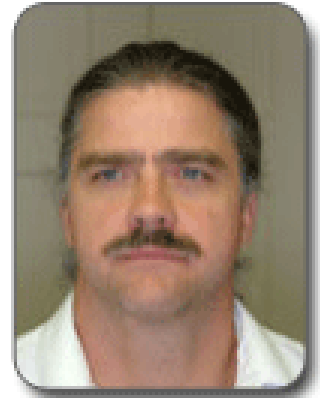
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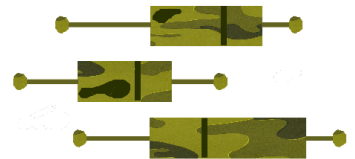
SDNS Congratulates

Dr. Carey Priebe



Recipient of the 2010 SDNS Distinguished Achievement Award. This award will be presented to Dr. Priebe at the Joint Statistical Meetings in August.

U.S. Army Conference on Applied Statistics



20-22 October, 2010
Cary, NC

CALL FOR PAPERS

Submissions due by
September 7
Visit

<http://www.armyconference.org/>
for more conference and
submission information



Highlights of SDNS Member Initiative

Wendy Martinez, Past Section Chair

The Section on Statistics in Defense and National Security received a 2009 Member Initiative to host a workshop that was organized along the lines of the popular JSM 'Meeting within a Meeting' for teachers. Our target audience was those who make decisions and set policy in the Department of Defense (DoD) and the Department of Homeland Security (DHS).

One of the main goals of this workshop was to educate decision-makers who might not be familiar with how statistics and statisticians can help them in their profession. We also hoped to motivate statisticians to work on defense and national security problems.

Conducting this workshop fulfilled one of the recommendations made by the task force convened during the term of ASA President (past) Sallie Keller-McNulty, as well as several goals in the ASA Strategic Plan.

We had a good turnout for the event. Dr. Nancy Spruill of the Office of the Secretary of Defense (OSD) of the Secretary of Defense (OSD) brought several executives from OSD, and all of them gave talks on subjects ranging from how statisticians can contribute to DDR&E (Director, Defense Research & Engineering) to data issues. Dr. Nozer Singpurwalla (DARPA/GWU) gave an excellent keynote talk on historical contributions from statistics to defense and national security and where we should go in the future. We also had several statisticians who gave talks on novel uses of statistics. One of these was given by Dr. Jeff Solka (NSWCDD), who talked about performing scientometric analysis through document clustering and dynamic graph visualization.

Mr. Alan Shaffer (Principal Deputy Director, DDR&E) gave an informative talk that outlined the DDR&E vision, which is "to develop technology to defeat any adversary on any battlefield." He stressed the fact that the word 'any' in the vision is meant to convey that the adversaries we will engage with and the battlefields we will fight on go beyond the traditional ones and encompass cyber, space, physical, methodology was completely undersea, and more.

Some of the problems Mr. Shaffer brought up include:

- Developing metrics or ways to quantify aspects of these (adversaries & battlefields), so we can prioritize the problems that are addressed and the technologies that are supported.
- Modeling the battlefields of the future to determine what technologies are needed to fight on them and win.
- Understanding the root causes of terrorism, so we diminish the pool of people who conduct acts of terrorism.

Not surprisingly, the main theme that seemed to come up in several discussions had to do with data. This included the following problems that statisticians might think about.

- Large, complex and time-sensitive data sets provide many challenges to statisticians and analysts. Analysts often have to use messy data – inconsistent, duplicated, and missing data – so how do we deal with them.
- Most data sets are collected opportunistically and not with a statistical experiment in mind, so traditional methods are inappropriate.
- The need to utilize all available data in testing and evaluation – including experiments, models and other sources.

The workshop concluded with an open forum and discussion on various issues, and many suggestions were offered. These included the need for (a) student support to encourage a life time of working on defense and national security problems, (b) ASA and DoD/DHS fellowships, (c) a mechanism where people (researchers, statisticians, warfighters, etc.) can input information about what they see as the next-generation challenges and research areas, (d) better ways to share data, and (e) improving the way we communicate results of a statistical analysis to decision and policy makers.

PLEASE JOIN US!

SDNS Mixer @JSM



Location
Vancouver, British Columbia, Canada

August 2, 2010
6:00 pm

Door Prizes! Food! Fun!

**Interested in
Becoming a
Member?**

All section memberships are handled directly through ASA. Membership forms can be found at:

<http://www.amstat.org/membership/pdfs/ChapterSectionApplication.pdf>

Newsletter Submissions....

The SDNS Section Newsletter features peer-written, substantive articles relating to the use of statistics in defense and national security. The Newsletter is published quarterly by the Section and distributed to Section Members free of charge as a benefit for members of the Section

We welcome items for publication consideration. Please send all such requests to caltatemoore@gmail.com

We hope that you find this information useful and we look forward to the next issue. ***Enjoy JSM!***

Calandra Tate Moore,
Newsletter Editor

Upcoming Events...

- SDNS Mixer, JSM, 2 August 2010, 6pm
- SDNS Business meeting, JSM, 3 August 2010, 7:30am
- ACAS, Cary NC, 20-22 October 2010
- QMDNS 2011 Conference, Santa Monica CA, 25-26 May 2011
- MORS 79th Symposium, Naval Postgraduate School Monterey, CA 20-23 June 2011



For more Information on SDNS:

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We're on the Web!

See us at:

<http://www.amstat.org/sections/sdns>