Preface

In the months after September 11, 2001, in the aftermath of the attacks on the World Trade Center in New York, counterterrorism became a research interest for a broad range of Western scholars, statisticians among them. At the same time, the U.S. government, still in shock, repeated the same question during multiple hearings in Washington, D.C.: “All the data was out there to warn us of this impending attack, why didn’t we see it?” Data became a large part of the response to 9/11 as Americans tried to regain a rational grip on their world. Data from flight recorders was collected and analyzed, timelines were assembled to parse out explanations of what happened, sensitive data was removed from government websites, and the White House debated what data to release to investigators and the American public. “Data” was a frequently heard term in the popular media, one of the many things that we had to protect from the terrorists, and one of the most important things that we could use to defeat them.

In the statistical community, professionals wondered how they could help the government prevent terror attacks in the future by developing and applying advanced statistical methods. The federal government is a sizable consumer and producer of statistical data, as the 9/11 commission report noted.

> The U.S. government has access to a vast amount of information. When databases not usually thought of as “intelligence,” such as customs or immigration information, are included, the storehouse is immense. But the U.S. government has a weak system for processing and using what it has. [KH04, pp. 416–417]

Additionally, government decision-makers are often skeptical about statistics. Understanding that the Washington audience wasn’t always receptive, the statistical community pondered how to put what they knew to work for the country. They felt specially qualified to help decision-makers see the important patterns in the oceans of data and detect the important anomalies in the seemingly homogeneous populations. At a round-table luncheon at the Joint Statistical Meetings in San Francisco in 2003, almost two years after

9/11, a dozen statisticians ate and pondered the same questions. "How do we get in the door?" "How do we get someone to let us help?"

It was hard to get in the door, because Washington was still trying to figure out what a response to terrorism in the homeland would begin to look like. The threat paradigm had shifted enough that no one quite knew what the appropriate questions were, let alone the appropriate responses. Potential bioterrorism is a case in point. Dread diseases like smallpox had been conceptualized and studied as diseases, as public health problems, and as potential battlefield weapons, but had not been extensively studied as agents terrorists might set loose in a major population center. When a set of anthrax mailings followed close on the heels of the World Trade Center bombings, it was as if our world-view had been fractured. Many old questions of interest faded away, many new ones appeared, others were yet to be discovered. Biologists, epidemiologists, biostatisticians, public health experts, and government decision-makers woke up the next day wondering where to begin. The same was true across many fronts and many lines of inquiry in those months. The U.S. government wound up organizing an entirely new Department of Homeland Security to address the raft of new problems that emerged after 9/11. In the decision-maker's estimation, the new problems were different enough that existing structures like the Federal Bureau of Investigation, Centers for Disease Control and Prevention, and Immigration and Naturalization Services were not sufficient or appropriately specialized to address this new threat.

At the time of this writing, the science of counterterrorism is also still unfolding. The government has begun to engage the country's research community through grants and collaborative opportunities, but across the sciences, and in statistics, the interesting problems and viable methodologies are still in a very speculative stage. Speculative is also exciting, though. Researchers feel lucky to be able to help define the landscape of a new research enterprise. This book encompasses a range of approaches to new problems and new problem spaces. The book is divided into four sections pertinent to counterterrorism: game theory, biometric authentication, syndromic surveillance, and modeling. Some of the chapters take a broad approach to defining issues in the specific research area, providing a more general overview. Other chapters provide detailed case studies and applications. Together they represent the current state of statistical sciences in the area of counterterrorism.

Game theory has long been seen as a valuable tool for understanding possible outcomes between adversaries. It played an important role in cold war decision and policymaking, but the opening section of this book rethinks game theory for the age of terrorism. In a world of asymmetric warfare, where your adversary is not a country with national assets and citizens at risk in the event of retaliation, the stakes are different. The section on game theory presented in this text provides an overview of statistical research issues in game theory and two articles that look specifically at game theory and risk analysis.

Biometric authentication has become a more prominent research area since 9/11 because of increased interest in security measures at border entry stations and other locations. Authentication of fingerprints, faces, retinal scans, etc., is usually an issue in the context of identity verification, i.e., does this passport match the person in front of me who is trying to use it? Beyond the logistics of collecting the information on everyone who applies for a passport or visa, storing it on the identity documents in a retrievable form, upgrading the computer equipment at all border crossings, and training border police to use the new technology, the issues of accurate identification are still to be worked out. Security agencies would also like to be able to use face recognition to pick known terrorists or criminals out of crowds using video cameras and real-time analysis software. The stakes for false positives are high — a man suspected as a potential terrorist bomber was held down by police and shot in the head in the London subway in 2005, and many individuals have wound up in long-term detention under the mere suspicion that they were members of terrorist organizations. Current technological shortcomings also have strong cultural implications: fingerprint authentication works less well with laborers who have worn skin and calluses on their hands; retinal scans work better with blue eyes than with brown. The section on biometric authentication in this book provides an overview of the history of its use with law enforcement and the courts and outlines some of the challenges faced by statisticians developing methods in this area. The two papers both address reducing error rates, specifically for authentication, although there are a myriad of other applications.

Syndromic surveillance has long been an issue of interest for biostatisticians, epidemiologists, and public health experts. After 9/11, however, more government funding became available to study issues related to sudden outbreaks of infectious diseases that might be the result of bioterrorism. Traditionally, research in this area would have looked at things like normal seasonal influenza cases, perhaps with an eye to preparing for possible flu pandemics caused by more virulent strains. But in the case of a bioterrorist incident, the concerns are a little different. For example, you want to be able to detect an outbreak of smallpox or cluster of anthrax infections as soon as possible so you can begin to respond. This may involve collecting and monitoring new data sources in near real-time: hospital admissions of patients with unusual symptoms, spikes in over-the-counter sales of cold medicines, etc. Collecting, integrating, and analyzing such new types of data involves the creation of new infrastructure and new methodologies. The section in this book on syndromic surveillance provides an overview of challenges and research issues in this growing area and includes articles on monitoring multiple data streams, evaluating statistical surveillance methods, and the spatiotemporal syndromic analysis.

Modeling is the bread and butter for many working statisticians and naturally is being applied to address issues in counterterrorism. Many of the speculative questions researchers and decision-makers have about terrorism can be more practically and efficiently tested in computer models as opposed to actual physical experiments. As the section overview points out, "we cannot expose a population to a disease or chemical attack and see what happens." This overview highlights the main issues addressed in the section and suggests future research directions. The section includes articles on developing large disease simulations, analyzing distributed databases, modeling of the concentration field in a building following release of a contaminant, and modeling the sensitivity of radiation detectors that might be deployed to screen cargo.

We would like to thank David Banks for suggesting this monograph, Sallie Keller-McNulty and Nancy Spruill for their ongoing support, and Hazel Kutac for her tireless editorial and production work.

Reference

[KH04] Kean, T. H., and L. Hamilton. 2004. *The 9/11 commission report.* Washington, DC: National Commission on Terrorist Attacks upon the United States.

Los Alamos, NM *Alyson Wilson*
Los Alamos, NM *Gregory Wilson*
Monterey, CA *David Olwell*

January 2006

Springer
http://www.springer.com/978-0-387-32904-8

Statistical Methods in Counterterrorism
Game Theory, Modeling, Syndromic Surveillance, and Biometric Authentication
Wilson, A.; Wilson, G.; Olwell, D.H. (Eds.)
2006, XII, 292 p. 14 illus., Softcover
ISBN: 978-0-387-32904-8