

# The Development of BTA-Specific Disease Profiles for Use in a Real-Time Disease Identification and Notification System

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## BACKGROUND

Real-time disease surveillance is critical for early detection of the covert release of a biological threat agent (BTA). Numerous software applications have been developed to detect emerging disease clusters resulting from either naturally occurring phenomena or from occult acts of bioterrorism. However, these do not focus adequately on the diagnosis of BTA infection in proportion to the potential risk to public health.

GUARDIAN is a real-time, scalable, extensible, automated, knowledge-based BTA detection and diagnosis system. GUARDIAN conducts real-time analysis of multiple pre-diagnostic parameters from records already being collected within an emergency department (ED). The goal of this system is to move from simple trend anomaly detection to an infectious disease-specific expert system [1] in order to assist clinicians in detecting potential BTAs as quickly and effectively as possible. GUARDIAN improves the diagnostic process for BTA infection through the capture and automated application of associated clinical expertise. The automated application of this knowledge provides the focus and accuracy necessary for effective BTA infection diagnosis. The continuity of this process improves the efficiency by which diagnoses of BTA infections can be made.

## METHODS

GUARDIAN's disease models were initialized using archived HL7 messages sent/received within the Rush University Medical Center Emergency Department over the past 5 years. This data, which included complete patient charts, lab results and radiology reports, provided a thorough understanding of non-BTA cases seen in an ED setting. However, to initialize the BTA models, we developed, as part of this project, profiles for the six Category A BTAs: Anthrax, Botulism, Pneumonic Plague, Smallpox, Tularemia, and Hemorrhagic Fever Viruses [2].

The core elements of the BTA profiles were collected by reviewing the literature and extracting case report data on each of the individual BTAs. This data was then used to create profiles which contained the clinical and laboratory characteristics most frequently found in confirmed cases of each of the BTAs.

## RESULTS

The GUARDIAN system is in the second year of a multi-year grant and is currently in active development. Due to the, thankfully, rare nature of BTA case histories, there is not sufficient data available to numerically validate these profiles. Therefore, we sought the expertise of a number of infectious disease specialists at RUMC. Through our collaboration with this group of experts, we are confident that the BTA profiles developed through this project are complete and accurate to the best of current medical knowledge.

## CONCLUSIONS

GUARDIAN effectively balances the dual challenges of early detection of individual threat agents and simultaneous detection of unusual patterns of disease occurrence in a target population. Active development of GUARDIAN will continue to improve and augment the capabilities of all of its subsystems. However, even in its current state, GUARDIAN is a modern, complex system that focuses adequately on the monitoring of Category A BTAs using multiple pre-diagnostic data.

## REFERENCES

- [1] P Jackson, *Introduction to Expert Systems* 3<sup>rd</sup> Edition, Addison-Wesley 1999.
- [2] L Rotz, A Khan, S Lillibridge, S Ostroff, J Hughes, *Emerging Infectious Diseases* 8, 230 (2002).

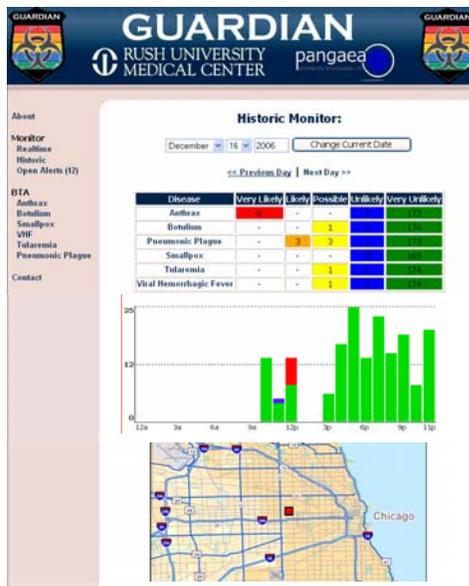


Figure 1 – Web-based User Interface