

Mapping Bioterrorism Agents Research Literature

Yan Dang, Nichalin Suakkaphong, Yulei Zhang, Roopali Wakhare, Hsinchun Chen, Cathy Larson

Artificial Intelligence Lab, Department of Management Information Systems, Eller College of Management, University of Arizona

OBJECTIVE

This paper describes a research effort to map the literature of bioterrorism agents research worldwide using bibliographic analysis, content map analysis, and co-authorship analysis based on Medline data. The objectives of our research are to (a) identify researchers who have expertise in the research domain of bioterrorism agents from the world, (b) identify major institutions and countries where these researchers reside, and (c) identify emerging topics and trends in bioterrorism agents research.

BACKGROUND

Since the Anthrax attacks following 9/11, bioterrorism has been given a high priority in national security. Bioterrorism involves bioweapon attacks against a civilian population. Such attacks against civilians are usually intended to cause widespread panic and terror [1]. Given the potential significance of bioterrorism events, biodefense initiatives has received significant attention from both government agencies and research communities. One critical problem in biodefense research and practice is that biomedical research used for defense purposes can also be applied towards biological weapons development. To mitigate risk, the U.S. Government has attempted to monitor and regulate biomedical research labs, especially those that study bioterrorism agents/diseases [2, 3]. The system we created can help the government monitor bioterrorism agents and diseases and discover new research and expert researchers.

METHODS

The bioterrorism agents/diseases article abstracts were retrieved from the Medline database. For human bioagents, we searched article abstracts and titles using 58 keywords from CDC's list of agents by Category; for animal bioagents, we searched article abstracts and titles using 58 keywords from OIE's list of diseases by species. We parsed the authors and institution data of each article using dictionaries of countries, states, city, and institutions. After data retrieval, parsing, and filtering, we used (a) bibliographic analysis to analyze the productivity of authors, institutions, and countries, (b) co-authorship analysis to study the collaborations between researchers, and (c) content map analysis to study active research topics across different time periods. We used NetDraw to visualize the co-authorship analysis results. The content mapping was based on

the multi-level self organization map algorithm [4] developed by the Artificial Intelligence Lab.

RESULTS

We retrieved 178,599 publication records about human agents research from Medline (1964-2005), and 135,774 publication records about animal agents research from Medline (1965-2005). Based on our analysis, the U.S. has the most publications, followed by Japan and United Kingdom for both the human and the animal agents research collections. For the human agents collection, Harvard university has the most publications, followed by the University of Wisconsin-Madison and Institut Pasteur, Paris; for the animal agents collection, CDC, Atlanta has the most publications, almost twice as many as National Taiwan University and Institut Pasteur, Paris in the second and third rank. We also identified the top researchers with expertise in bioterrorism agents research domain from each region of the world and their co-authorship. From the content map analysis, we found that (a) a shift of research interest towards the use of anthrax spores and biological weapons after 2001, (b) Botulinum has been a research focus since the 1980s, (c) *Francisella tularensis* has been a research focus since the 1990s, and (d) Ebola Viruses have been a research focus since the late 1990s.

CONCLUSIONS

Using bibliographic analysis, content map analysis, and co-authorship analysis, we were able to identify key researchers who have expertise in this domain, and the major institutions and countries where these researchers reside. We also identified emerging topics and trends in bioterrorism agents research. We plan to increase our collections on both human agents research and animal agents research, and analyze additional human and animal diseases.

REFERENCES

- [1] H.C. Lane, J. LaMontagne and. A.S. Fauci. Bio-terror: A clear and present danger. *Nature Medicine*. 7(12), 1271-1273 (2001).
- [2] US DHHS : 42 CFR Pt. 73, Possession, Use, and Transfer of Select Agents and Toxins— Reconstructed Replication Competent Forms of the 1918 Pandemic Influenza Virus Containing Any Portion of the Coding Regions of All Eight Gene Segments. *Federal Register*: V.70, No.202, 10/20/2005, Rules and Regulations.
- [3] <http://www.cdc.gov/OD/OHS/biosfty/biosfty.htm>
- [4] Chen H., C. Schuffels & R. Orwig. 1996. Internet categorization and search: A machine learning approach. *J. Visual Commun. Image Rep.* 7(1), Special issue Digital Libraries