

Foodborne Bioterrorism: Relevant Issues and Research Needs:

The U.S. food production and distribution system may present an opportunity for terrorists to introduce biological agents into the food system to cause physical, psychological, and economic harm to the nation. A Threat Assessment offers a systematic method for evaluating both the nature of the risks and the potential effectiveness of strategies to address them. This approach considers:

- What can happen?
- How likely is it to occur?
- What are the consequences of that event happening?
- How can the viable risks be mitigated or prevented?
- How and when should the public be engaged in the process?

We identify possible research needs in anticipation of potential foodborne bioterrorism activities following the September 11th events. The ideas presented below leverage the traditional risk assessment paradigm for evaluating the risk of foodborne hazards and alternative mitigation strategies. The overall framework for conducting the threat assessment is the farm-to-table characterization of the food system. Within the farm-to-table structure, the potential for different hazards to be weaponized and dispersed in order to produce a credible threat is evaluated:

A. Characterize the U.S. food system

- 1) Identify the elements of production, processing/manufacturing, transportation, and retail stages for major food categories.
- 2) Augment the elements to include imported foods.
- 3) Characterize each component of the system according to number, average size, geographic location and other distributional aspects for each of the major food categories.
- 4) Assemble these characterizations into a relational database.

B. Identify **potential agents** for foodborne bioterrorism

- 1) Characterize *traditional* agents of foodborne illness for their potential as bioterrorism agents.
 - i) Use of traditional agents of foodborne illness (such as *Salmonella spp.*) for bioterrorism is generally intended to cause panic through the usual morbidity/mortality disease patterns as well as through overwhelming the response capacity of our current public health system.

- ii) Traditional agents may be spread via unusual means, or genetically modified agents may be spread via traditional means.
 - iii) Other less common pathogens should also be the subject of a Threat Assessment to elucidate their potential as a foodborne bioterrorist weapon.
- 2) Identify *non-traditional* agents for their potential as bioterrorism agents through dissemination in the U.S. food supply.
- i) Identify new foodborne agents of bioterrorism that are not currently present in typical food-related outbreaks/illnesses.
 - ii) Potential agents for bioterrorism fit a different set of characteristics in comparison with the traditional foodborne illness paradigm. The psychology of bioterrorism indicates that the intent is less frequently to kill or harm but rather to make itself, and hence its cause, visible.
 - iii) Based on this construct, potential agents of bioterrorism should have the capacity for producing public health outcomes that are: massive, widespread, obvious, quick. These agents should also possess several characteristics including: availability or culturability, stability or resistance to the environment, disseminability, infectivity, and epidemicity.
- 3) Conduct a systematic evaluation of potential bioterrorism hazards which can be categorized according to their effect on public health or economic health. Examine and assess the potential of bioterrorists to deliver both traditional and non-traditional foodborne hazards; this would require evaluating the transmission potential as well as the viability of those hazards.
- C. Identify **potential routes** of dissemination and exposure potential
- 1) Potential foodborne routes of dissemination:
 - i) Must be effective (food medium and handling/cooking/packaging is capable of sustaining or supporting the viability of an agent without neutralizing it)
 - ii) Must be vulnerable (capable of being adequately contaminated)
 - 2) What are the potential release pathways and patterns?
 - 3) What is the feasibility (effectiveness) of various routes of dissemination?
 - 4) identify distribution routes of various foods.
 - 5) Conduct a vulnerability analysis of those routes identifying current protections (private or public) that are in place and the adequacy of those protective measures.

- 6) Identify the population at risk for effective and vulnerable routes and assess the likely impact on public health.

D. Identify the **risk management** options

1) Treatment/Abatement:

- i) What are the potential abatement procedures available? What private or public protections are currently in place and what modifications might be necessary to make these protections adequate?
- ii) What are the cost-effective options for abatement?

2) Prevention:

- i) What disaster contingency measures have been instituted in the private sector?
- ii) What are the public health infrastructural needs that have to be addressed by governmental agencies with food safety risk management responsibilities?

3) What is the effect of time-to-response on outcome?

4) Where should risk management efforts be concentrated?

E. Identify **risk communication** strategies to inform the public without causing undue panic.

1) Several factors are known to affect public perception (“outrage” to distinguish it from the scientifically-grounded terms “hazard” and “risk”), including the following:

- i) Process—The public is generally willing to accept higher risks when it is involved in the decision-making process but tend to be uncomfortable with decisions made on their behalf without their input.
- ii) Control—Having personal control imparts a general feeling of safety since people trust their own instincts in this regard more than they would trust the instincts of others.
- iii) Voluntariness—Risks that are chosen are generally perceived as safer than those that are imposed.
- iv) Fairness—The perception of an unequal distribution of risk generally evokes outrage and ultimately a perception of greater risk.
- v) Familiarity—Exotic risks tend to be perceived as more dangerous than familiar risks.
- vi) Community history—A history of risk-related problems and the satisfactory/unsatisfactory solution of those problems will influence the outrage factor.
- vii) Social environment—The nature of the community will influence how residents respond to potential threats.

- 2) Agencies with food safety risk management responsibilities may consider increasing efforts to communicate/educate the public on food safety in general and foodborne bioterrorism in particular. Efforts should not only present the scientific/technical aspects of risk but should address the risk perception factors described above.
 - i) Communication:
 - (1) Develop strategies and messages to communicate clearly what are/are not risks related to foodborne bioterrorism.
 - (2) This may also be an opportune time to increase communication efforts regarding proper handling of foods at home or in retail/institutional settings.
 - (3) Communication efforts can specifically address the risk perception factors associated with involvement in the process, fairness, familiarity, community history and social environment.
 - ii) Education:
 - (1) What kind of public education campaigns should be undertaken now and in the case of a bioterrorist attack?
 - (2) Develop education programs targeted at changing consumer behaviors while level of public attention to government authorities is at a high level.
 - (3) Identify food safety activities that can help consumers take an active role in dealing with the risk perception factors associated with regaining control and voluntariness of the risk.

We outline several studies that may be helpful in addressing the research needs identified above in anticipation of potential foodborne bioterrorism activities. The list of suggested studies is not inclusive and can be conducted in combination or independently of each other. In presenting these ideas, we hope to stimulate further discussion on the research needs to address current bioterrorism issues. These include the following potential methodologies:

- 1) Establish a panel of experts charged with conducting a risk ranking of potential foodborne bioterrorism agents and dissemination routes. Considerations should include developing a list of potential dissemination routes for foodborne bioterrorist acts and determining the probability of use of each potential route, the public health impact of each route, and the potential cost of that occurrence.

- 2) Interview major food companies to determine what disaster contingency measures or safeguards are currently in place to deal with possible foodborne bioterrorist acts.
- 3) Develop simulation models to help evaluate the risks of a bioterrorist act based on the top tier of potential agents and dissemination routes identified through a risk ranking approach. The models should incorporate information describing the probability of use of particular agents in a bioterrorist attack, an assessment of their potential dissemination strategies and routes, and an evaluation of their population-based implications.
 - i) For a select group of bioterrorist agents, simulate the most likely pathways for dissemination.
 - ii) For traditional foodborne illness hazards with potential as agents of bioterrorism, develop models to differentiate between naturally occurring foodborne illness outbreaks and outbreaks due to intentional contamination of food.
 - iii) Identify potential monitoring systems based on simulation model results.
- 4) Develop a benefit-cost analysis using the information obtained from the expert panel, interviews and/or simulation models for developing public health-based emergency response strategies. Specific recommendations should address resource allocation.
- 5) Develop an interactive website as a communication/education resource for consumers. The website can provide information to consumers including: a hazard index describing the potential risk for consumers; a comparison of the risk of foodborne bioterrorism versus other involuntary risks; information on public health outcomes from bioterrorist agents; proper handling, preparation, cooking or other measures that provide consumers with an active role in minimizing risk.