Practical Training Exercise

ANALYZING AND MANAGING RISKS IN LIFE SCIENCES RESEARCH

This exercise was developed by Center for Science, Technology and Security Policy at the American Association for the Advancement of Science (AAAS).

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Learning Objectives

1. Develop the skills to think critically about risks and risk mitigation strategies needed in your own scientific environment;

2. Enhance your ability to identify risk management strategies and approaches that minimize identified risks and maintain the high-quality and utility of the scientific activity; and

3. Apply the risk analysis framework to your own or your peers’ scientific activities.
Participant Expectations

By the end of this exercise, you will have familiarity with:

1. The definitions of different types of risks associated with laboratory, field, and public health research.

2. The process of risk analysis—risk identification, assessment, management, and communication—including:
   – How to identify and assess risks by considering the possible likelihood and consequences of risks, and the risks versus benefits of a research activity,
   – Strategies for managing risks, and
   – Who, when, and how to communicate risks.

3. How to apply the risk analysis framework to your own scientific activities.
Ground Rules for Participation

1. Prior to starting this exercise, participants should have read the case study article.

2. Ask the facilitator to clarify questions about the case study article.

3. Focus on understanding and analyzing the diverse risks involved in the research rather than on critiquing the methodologies or research choices of the authors.

4. Interact with one another in a way that encourages open communication and exchange of ideas. For example, listen to everyone’s ideas respectfully.

5. You may want to take your own notes to enhance your ability to actively participate in the training activity.
Biorisk Glossary

These definitions are from the WHO’s *Responsible Life Science for Global Health Security: A Guidance Document*.

**Additional concepts:**
- Protection of human subjects
- Protection of animal subjects
- Responsible research/responsible conduct of research
Risk Analysis Framework

Your risk review will follow these 4 stages:

1. Risk Identification
2. Risk Assessment
3. Risk Management
4. Risk Communication
1. Risk Identification

process by which researchers consider all possible internal, external, and organizational risks.

Asks the question:

• What are the possible risks associated with the research?

2. Risk Assessment

process by which researchers identify needed resources and consider biosafety/biosecurity recommendations.

Also defined as the “process of evaluating the risk(s) arising from a hazard(s), taking into account the adequacy of any existing controls and deciding whether or not the risk(s) is acceptable.” (OHSAS 18001: 2007)

Asks the questions:

• How likely are the risks to occur?
• What are the potential consequences if the risks occur?
• Do the risks outweigh the benefits?
3. Risk Management

process by which researchers consider regulations/guidelines, training, and SOP compliance issues.

Asks the question:

- What risk management strategies could minimize the likelihood that the risk will occur or the consequences if the risks occurred?

Possible strategies: physical barriers, personnel training or vetting, regulations and laws, and/or alternative experiments.

4. Risk Communication

process by which researchers consider communication strategies, non-compliance issues and approval/modification processes.

Asks the questions:

- What risks should be communicated with ethics or other research review committees prior to project initiation?
- What risks should be communicated to research participants or fellow researchers during the research project?
- What risks, if any, might come from sharing research data or results?
- What strategies could be used to minimize the risks?
Risk Analysis Chart

Risks

- Laboratory Biosafety
- Laboratory Security
- Bioethics
- Human Subjects Protection
- Animal Subjects Protection
- Research Integrity

Risk Analysis Framework

1. Risk Identification
2. Risk Assessment
3. Risk Management
4. Conduct Project
5. Present Publications
6. Risk Communication

Risk Analysis Questions

- What are the possible risks associated with the research?
- How likely are the risks to occur? What are the potential consequences if the risks occur? Do the risks outweigh the benefits?
- What risk management strategies could minimize the likelihood that the risk will occur or the consequences if the risks occurred?
- What risks should be communicated with ethics or other research review committees prior to project initiation? What risks should be communicated to research participants or fellow researchers during the research project? What risks, if any, might come from sharing research data or results? What strategies could be used to minimize the risks?
CASE STUDY

Age-specific Seroprevalence of Hepatitis A Among School Children in Central Tunisia

Outline of Case Study

Part 1: Research Question/Hypothesis
Part 2: Background Information Overview
Part 3: Research Methodology
Part 4: Risk Analysis in the Research Article
Part 5: Research Results and Conclusions
Research Question/ Hypothesis

Research Statement:

Epidemiologic data available for the prevalence of Hepatitis A in Tunisia is “fragmentary and limited to studies on acute symptomatic Hepatitis A infection.”

The authors state that no age-specific seroprevalence data is available for Tunisia.

The authors proposed to “determine the age-specific seroprevalence of HAV [Hepatitis A virus] in a young population according to socioeconomic status, and to detect a likely change in the epidemiology of infection.”
Background Information Overview

Hepatitis A

- The Hepatitis A virus is highly contagious and causes liver disease. The severity and duration of illness ranges from mild (lasting a few weeks) to severe (lasting several months).
- Most infected individuals can recover after Hepatitis A infection, but a small number of people experience liver failure after infection.
- Hepatitis A infection is a major cause of morbidity and socioeconomic losses in many parts of the world.
- A Hepatitis A vaccine exists and is effective at protecting against viral infection.
- The Hepatitis A virus is transmitted through ingestion of “objects, food, and drinks contaminated by the feces and stool of an infected person.”

Hepatitis A Virus
Photo Credit: CDC
Background Information Overview

Global Distribution of Hepatitis A

- The virus is found throughout the world but endemic transmission is unlikely in developed countries.
- The risk of infection depends on the level of sanitation and personal hygiene.
- In developing countries where sanitation is poor, infection primarily occurs in young children.
- As the socioeconomic conditions of developing countries improve, the epidemiologic patterns of Hepatitis A infection are changing.
- As sanitation improves, transmission shifts to older populations.

Photo Credit: Blumberg
Incidence of Hepatitis A

- The incidence rate is indicated primarily by the presence of cross-reacting antibodies (i.e., seroprevalence).
  - In developing countries, “more than 90% of the population has acquired natural immunity before 10 years of age and often shows asymptomatic forms.” Most infection occurs in young children.
  - In regions with intermediate levels of Hepatitis A infection, 60-97% of adults have cross-reacting antibodies to Hepatitis A. In these emerging countries, infection primarily occurs in older adolescents rather than young children.
  - In industrialized nations, infection is low in childhood, but approximately 13-50% of adults have cross-reacting antibodies to Hepatitis A.
- As countries develop, the epidemiologic pattern of Hepatitis A infection begin to change, with predominant infection occurring in older individuals. In these countries, unvaccinated adults are vulnerable to epidemics and exposure to severe forms of the virus.
Research Methodology

- **Participant Inclusion:** Children and young adults between the ages of 5-23 years old in elementary and secondary schools.
  - Children from a random selection of schools and classes were selected in two stages. Schools were selected in the first stage and classes from each school were selected in the second stage. The sample size was 2400 children.
  - The participants were divided into three groups based on where they went to school: urban, suburban, and rural.

- **Participant Data Collection:** General information about the children (including gender, age, “education level, siblings, type of residence, source of water supply, and water sewage) and parents (including origin, education level, occupation, and insurance coverage)” were collected. Epidemiologic data were collected using questionnaires and school health/medical records.

- **Cross-reacting Antibodies in Blood Serum:** Blood samples were collected from participating children. Serum was separated from the blood and tested for the presence of cross-reacting antibodies to Hepatitis A virus using an enzyme-linked immunosorbant assay (ELISA).

- **Statistical Analysis:** The data was analyzed using commercially available software and standard statistical analysis methods.
Risk Analysis in this Research Article

While risk analysis is an important part of science, few scientific publications include in-depth descriptions of how the authors assessed and managed risk.

Today your task is to perform a risk analysis based on this research article.

To begin, answer the following question:
Based on your current knowledge of the experimental procedures or research purpose, what risks might be important to consider in designing, carrying out, or communicating this research?
## Risk Identification

### Age-specific Seroprevalence of Hepatitis A Among School Children in Central Tunisia

<table>
<thead>
<tr>
<th>Questions</th>
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<tbody>
<tr>
<td>What, if any, are the potential biosafety risks to the researcher and staff? Consider the research steps, including: collection and handling of human blood and serum separation.</td>
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<td>What, if any, are the potential risks to the general population? Is there a biosecurity risk or dual use potential for this research?</td>
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<tr>
<td>Participants were randomly recruited from public schools in Tunisia. What are the risks or ethical concerns, if any, associated from recruiting children from schools to participate in the research?</td>
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<tr>
<td>What, if any, are the possible risks (ethical or safety) to the children who participate in this study and to their families? What are the risks or concerns associated with gathering social and economic data from participant families?</td>
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## Risk Assessment

### Age-specific Seroprevalence of Hepatitis A Among School Children in Central Tunisia

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<tr>
<td>In your opinion, what are the negative consequences that might result from the identified ethical risks?</td>
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<tr>
<td>In your opinion, what are the negative consequences that might result from the identified biosafety risks?</td>
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<tr>
<td>How likely is this experiment to result in a negative consequence for one of the children participating?</td>
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<tr>
<td>How likely is this experiment to result in a negative consequence for the research staff?</td>
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<tr>
<td>What are the resources, expertise, training, and tools that could be useful in assessing the risks identified for this research project?</td>
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## Risk Management

### Age-specific Seroprevalence of Hepatitis A Among School Children in Central Tunisia

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<tr>
<td>Are there any international, domestic, or institutional laws and/or regulations that would help manage risks from this study?</td>
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<td>What standard operating procedures (SOPs) and best practices for sample collection, treatment, and analysis should be used in this experiment to reduce the likelihood of a laboratory accident, such as a needle stick with blood?</td>
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<td>What other experiments, participant recruitment strategies, or data collection methods could be used to minimize the risks identified?</td>
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<td>What, if any, are specialized competencies, skills, and training needed to successfully enroll, interview, collect blood samples from participants, and analyze blood samples?</td>
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Research Results and Conclusions

Results

• The number of participants with cross-reacting antibodies to Hepatitis A varied by age and location.
  – The total number of participants with cross-reacting antibodies was 60%, with 44% in children under age 10, 60% in children ages 10-15, and 83% in children over 15.
  – Cross-reacting antibodies were identified in 40% children from urban areas, 69% children from sub-urban areas, and 90% of children from rural areas.

Conclusions

• The authors state that other factors, including quality of drinking water, waste water sewage, crowding, and housing conditions are significantly associated with seroprevalence of Hepatitis A.
• The study results suggest that the epidemiology of Hepatitis A in Tunisia has changed from a high to intermediate endimicity pattern.
## Risk Communication

### Age-specific Seroprevalence of Hepatitis A Among School Children in Central Tunisia

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<tr>
<td>What are the risks that should be communicated during this research? To whom?</td>
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<td>How would you communicate possible risks and reasons to participate to potential research participants and their families?</td>
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<td>What data and information protection measures should be implemented to protect the safety and anonymity of research participants?</td>
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<td>How would you communicate the research results to the public and/or public health officials? What sensitivities, if any, exist with communicating the study’s results to the public?</td>
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### Final Exercise: Risk in Your Own Research

Perform a risk analysis of your own research. Choose one past, ongoing, or future research project to analyze:

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<tr>
<td><strong>1. Identification:</strong> What are the primary risks you face in your research? Think about the risks to you and other researchers and technicians in the field, clinic, and/or lab, the general public, the environment and economy, your institution, and human and animal subjects.</td>
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<tr>
<td><strong>2. Assessment:</strong> What are the consequences of the identified risks if they occur? How likely are they to occur? Based on your assessment of the potential consequences, are there any risks that could harm people, animals, crops, or the economy? What resources, capabilities, and skills are needed to mitigate these risks?</td>
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<tr>
<td><strong>3. Management:</strong> What strategies could you use or resources you could refer to minimize or mitigate these risks? (These strategies should not decrease the quality of the research.) For ideas of possible strategies and resources, consider those discussed in this practical exercise and from your own experiences. Are there any risks associated with your research that cannot be adequately mitigated?</td>
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<tr>
<td><strong>4. Communication:</strong> What risks, if any, are associated with communicating your research during the design or conduct of the research? What risks, if any, are associated with communicating the research results at scientific conferences and in publications? What strategies could you use to mitigate the risks? Are there any stakeholders with whom you must share or should share the risks of your research? Your findings?</td>
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Example Risk Analysis Strategy

Communicate

Figure 1 — Risk assessment strategy

“Laboratory risk management.” CWA 15793: 2011
Reference List

Background Information

Centers for Disease Control and Prevention. Hepatitis A Information for the Public. www.cdc.gov/hepatitis/a/


Diagrams and Images

