Biosciences, Laboratory Biosecurity, and Biosafety in Asia

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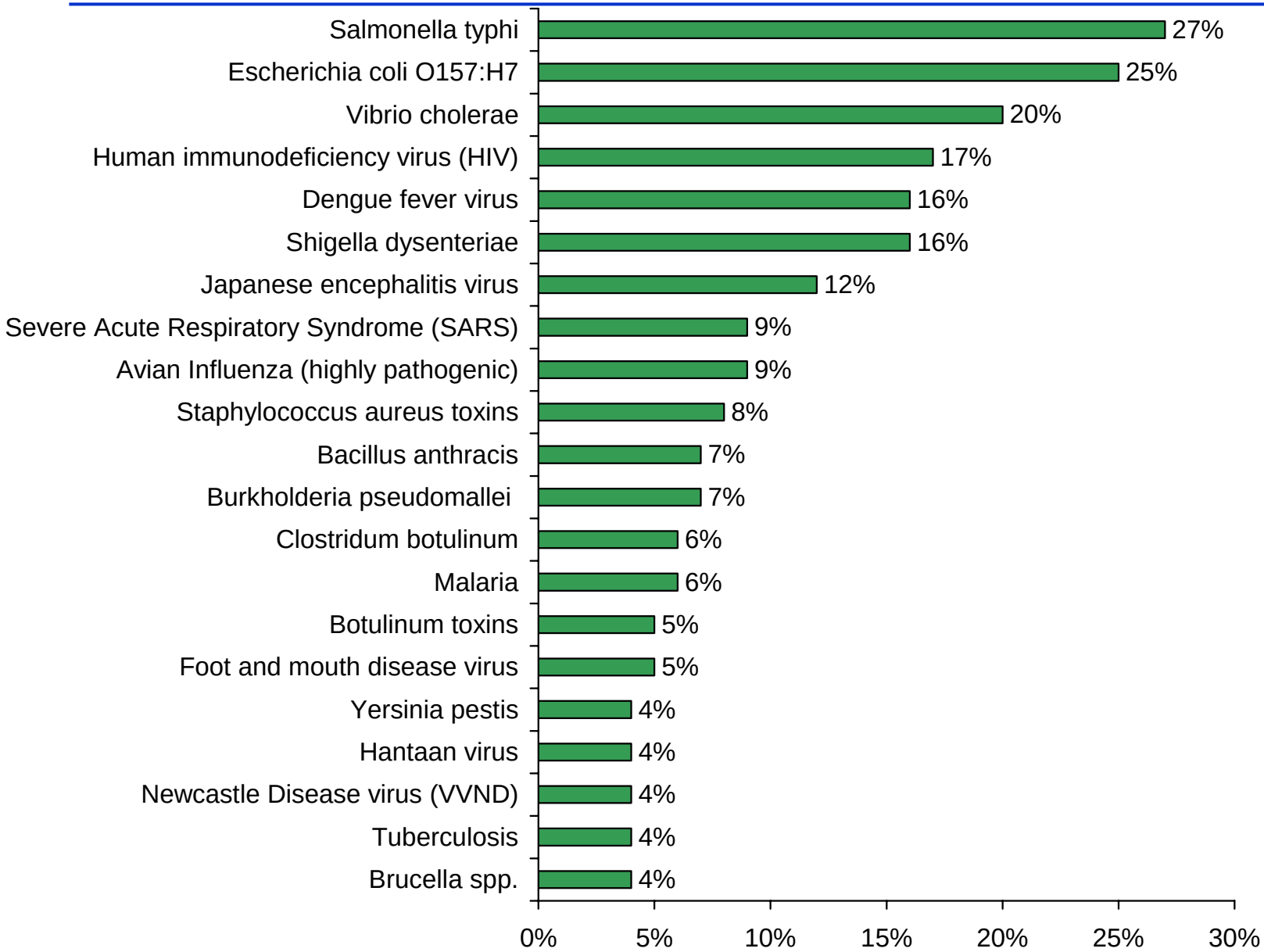
Survey Objectives

- Learn about the state of biosciences, laboratory biosecurity, and laboratory biosafety in Asia
  - Types of pathogens and toxins used in research
  - Research objectives for those agents
  - Laboratory capacity
    - Available tools and techniques
    - Personnel
  - Status quo for biosafety and biosecurity policies and procedures
    - "Biosecurity measures protect infectious agents and toxins against theft or sabotage"
    - "Biosafety practices are designed to protect laboratory workers, the public, and the environment from *accidental* exposure to infectious agents and toxins"
  - Perceptions of risk
- 300 Asian life scientists (72% PhD) – grouped into 3 tiers for analysis
  - *Advanced*
    - China, Hong Kong, Japan, Korea, Singapore, India
  - *Emerging*
    - Pakistan, Thailand, Taiwan, Malaysia
  - *Developing*
    - Indonesia, Cambodia, Vietnam, Bangladesh, Philippines, Sri Lanka

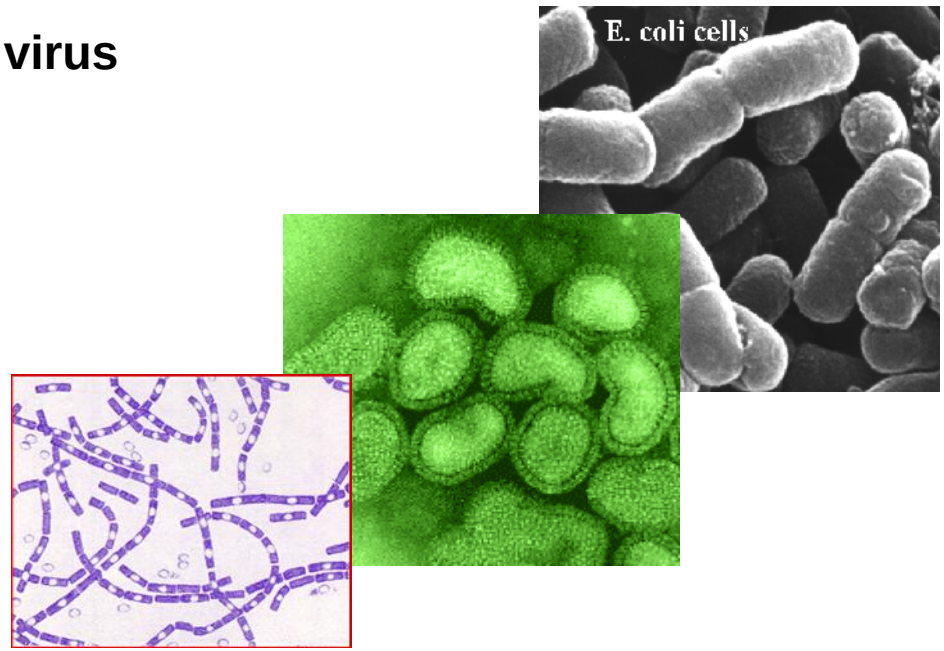
Types of Agents Studied by Respondents



Types of Agents Studied (cont.)

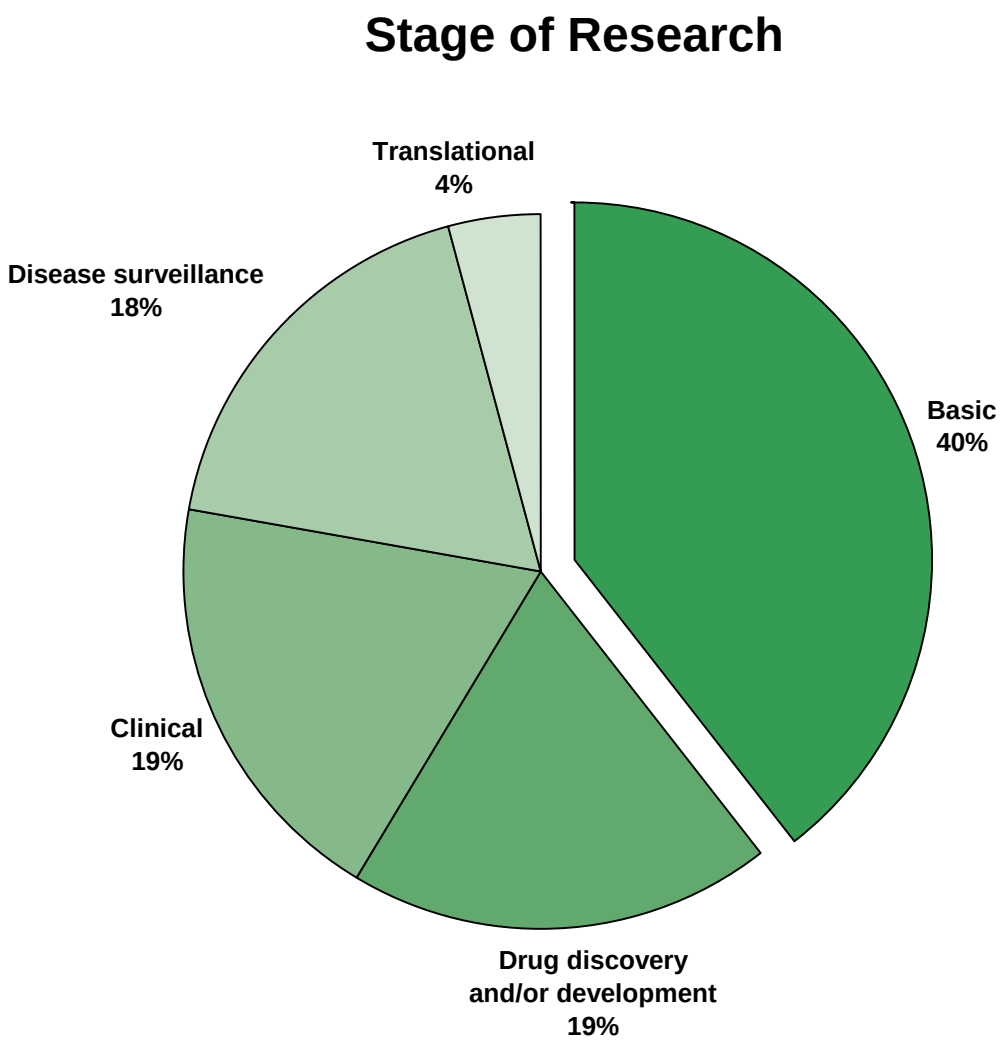
- **Bacteria (48%) more commonly studied than viruses (38%) or toxins (21%)**

- **Compared to *Advanced* and *Emerging* countries, respondents from *Developing* countries place a special emphasis on**
  - **Dengue fever virus**
  - **SARS**
  - **HPAI**



Research Focus

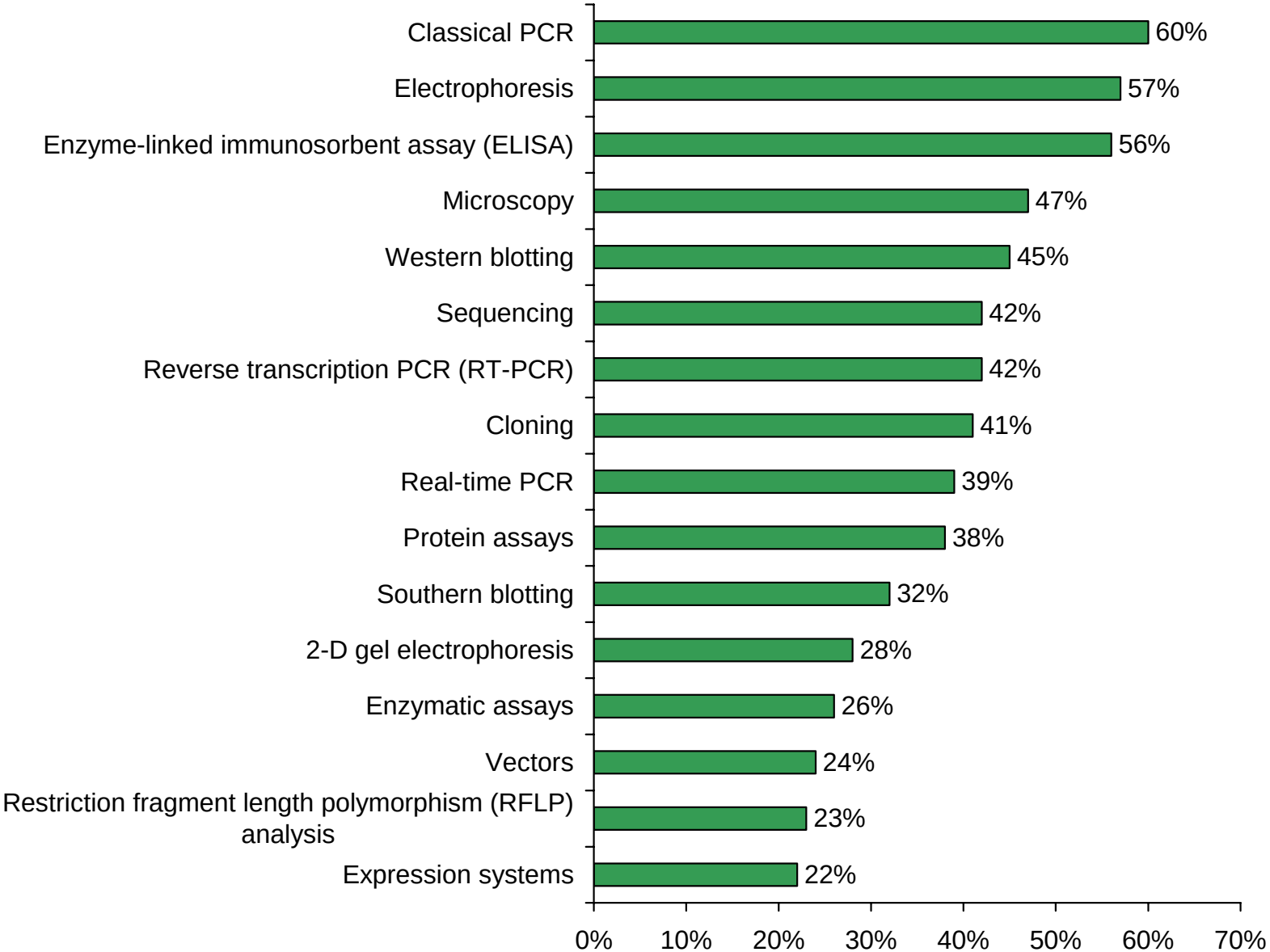
Research Focus	
Diagnostics	46%
Epidemiology	39%
Pathogenesis	33%
Infection	31%
Antibiotics	29%
Vaccines	26%
Host immune response	25%
Bacterial toxins	15%
Immune evasion and resistance	15%
Antivirals	12%
Other	10%
Vector control strategies	9%



Research Focus

- **Since more respondents study bacterial diseases, it is expected that drug research is focused on antibiotics not antivirals**
- **More *Advanced* countries emphasize diagnostics while *Developing* countries focus on epidemiology; for *Emerging* countries, the split is even**
- ***Developing* country laboratories are 1.5 times more likely to be repurposed by government to assist in an epidemic**

Most Commonly Used Research Techniques



International BIOLOGICAL THREAT REDUCTION

Regulations and Guidance for Laboratory Biosafety and Biosecurity

	Advanced	Emerging	Developing
My country's government	71%	57%	57%
World Health Organization (WHO)	44%	45%	61%
Center for Disease Control (CDC)	28%	43%	35%
Laboratory director(s)	22%	31%	22%
Our lab does not employ any specific laboratory policies	6%	8%	9%
Asia BioNet	9%	5%	4%
International Biosafety Working Group (IBWG)	7%	6%	9%
Food and Agriculture Organization of the United Nations	5%	7%	9%
Laboratory Centre for Disease Control (LCDC), Canada	4%	10%	2%
Other	4%	5%	4%
Office International des Epizooties (OIE)	4%	6%	0%

- As Biosafety Level of laboratory increases, more respondents turn to resources beyond their government:
  - WHO – Laboratory Biosafety Manual
  - CDC – Biosafety in Microbiology and Biomedical Laboratories

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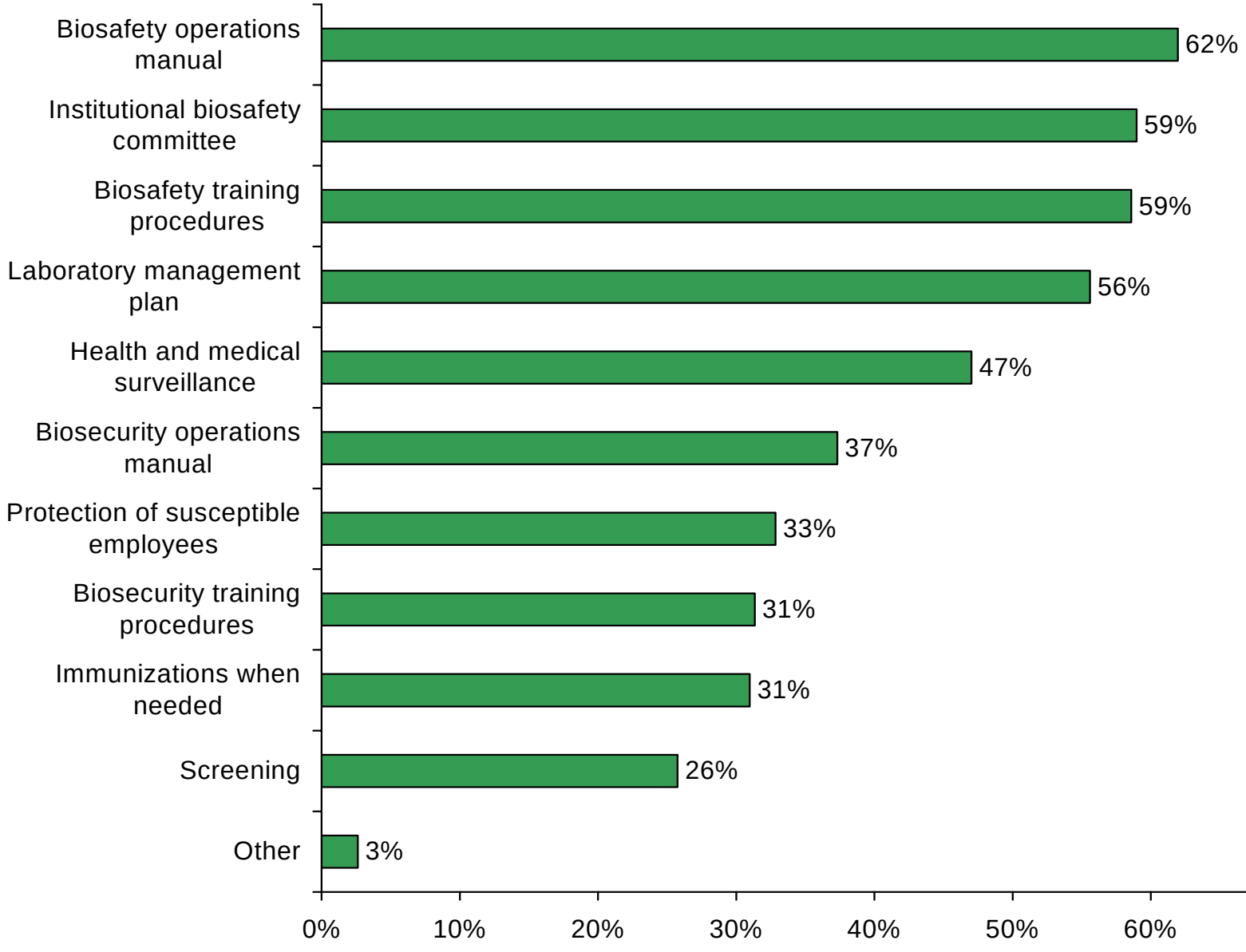
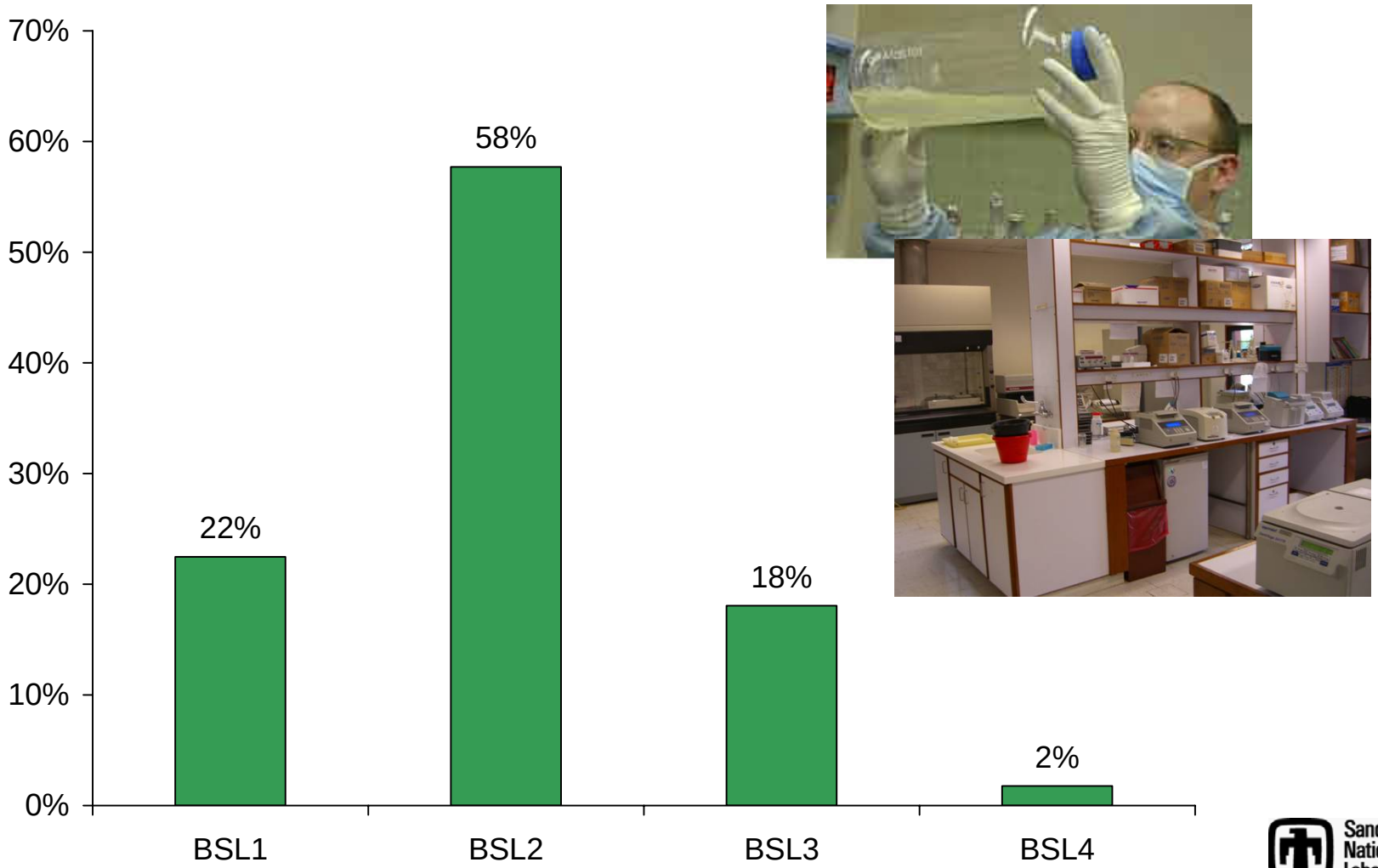
Laboratory Management of Biosafety and Biosecurity



Biosafety Levels of Respondents' Laboratories

- **21% of respondents did not know their biosafety level**



Laboratory Biosafety

- CDC recommends BSL 3 for research with 5 of the top 9 infectious agents in this survey
- BSL 2 is most common:
  - ~2/3 of respondents studying Japanese encephalitis, avian influenza, and SARS use BSL 2
  - 54% of those who work with HIV and 62% of those who work with *E. coli* O157:H7 use BSL 2
  - Unclear if this is because of type of work (i.e. clinical specimens) or inability to meet higher biosafety standards
- If respondents do not have a particular item of safety equipment, nearly 50% will do the experiment anyway

Biosafety Practices and Equipment

- 83% of respondents use personal protective equipment (PPE)
  - Gloves, gowns, lab coats
- 67% decontaminate waste prior to disposal
  - 51% have autoclave on-site
  - 47% have autoclave in laboratory
  - 16% have pass-thru autoclave
  - 33% treat effluent
- Ventilation
  - 35% have a “controlled ventilation system”
  - 31% have directional airflow
- 62% have Biosafety Cabinets

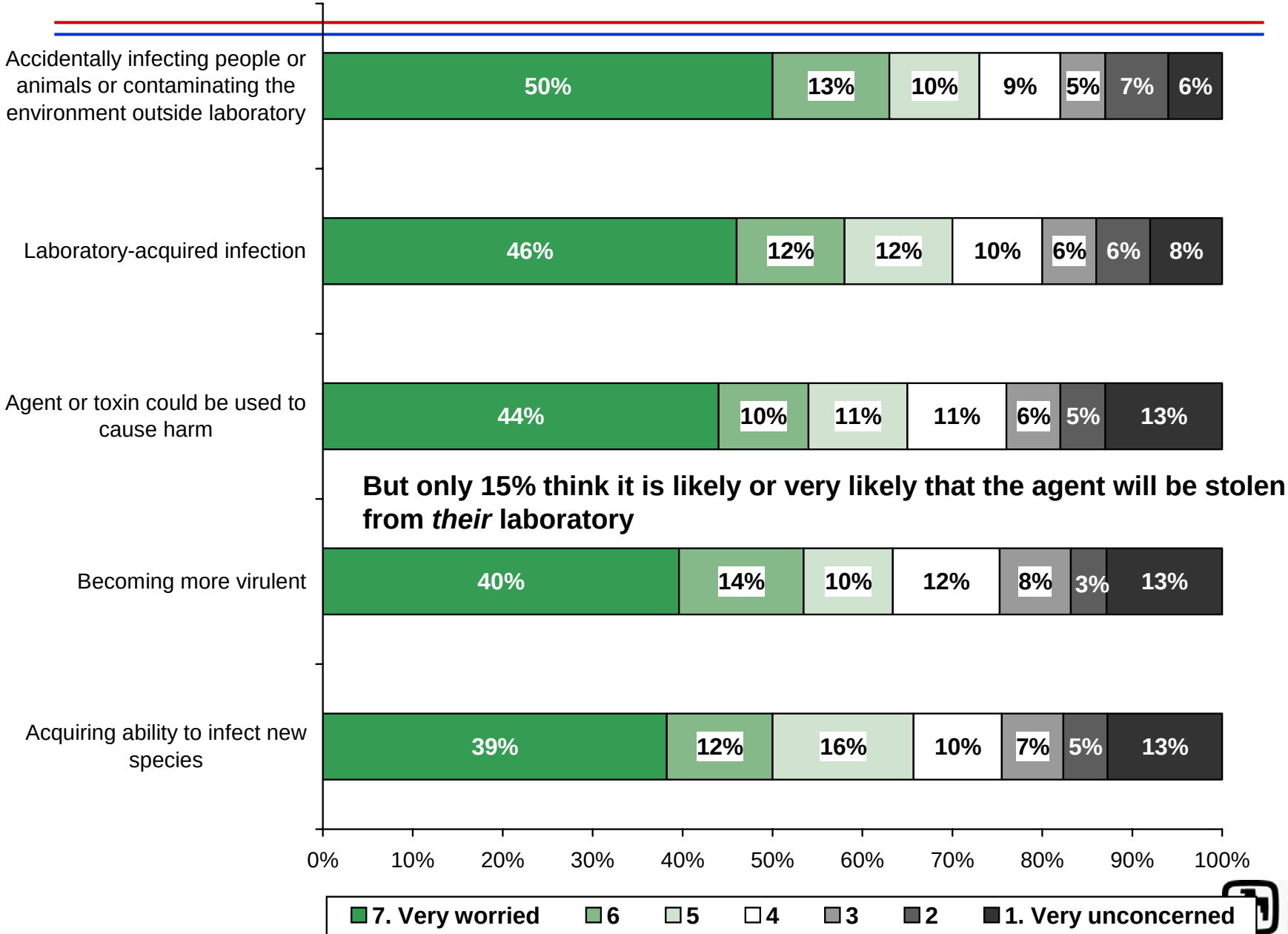
Laboratory Biosecurity

- **Physical security**
  - **50% of respondents always have a guard at the building entrance, lighted buildings at night, and locked cabinets**
  - **At least 1/3 of respondents have access controls, locked doors and refrigerators, and security patrols**
  - **Compared to *Advanced* and *Emerging* countries, laboratories in *Developing* countries tend to have personnel intensive security measures**
- **Information security**
  - **Most common measure is use of computer passwords**
  - **> 50% have network security measures**
  - **Slightly more than 50% destroy sensitive documents prior to disposal**

Laboratory Biosecurity (cont.)

- **Personnel security**
  - **Slightly more than 40% of respondents keep lists of employees with access or use photo badges to know who has access to restricted areas**
  - **34% conduct background checks on potential employees**
    - **Most common in *Developing* rather than *Advanced* or *Emerging***
  - **Escorting visitors is highly variable but is most common in laboratories in *Advanced* countries**
- **Material Control & Accountability**
  - **Most common measure is awareness of all agents studied in lab by laboratory head (76%) or direct supervisor (69%)**
  - **54% maintain an inventory**
  - **59% obtain permission prior to sharing infectious agents**
  - **64% ship infectious agents in accordance with IATA regulations**

Perceptions of Risk



International
BIOLOGICAL THREAT REDUCTION

Collaborations

	Advanced	Emerging	Developing
My organization	60%	62%	59%
My country, not including my organization	55%	71%	59%
United States	32%	26%	57%
Other countries within Asia	23%	25%	39%
United Kingdom	13%	21%	15%
Other	8%	13%	33%
Australia	7%	12%	33%
France	4%	8%	24%
My laboratory does not collaborate.	9%	6%	7%
Germany	7%	6%	11%
Canada	5%	4%	9%

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Challenges for Researchers in Asia

- **Expense, lack of equipment, delayed shipments are top problems**
- **Cost of research**
  - **Top complaint for researchers in *Advanced* countries**
  - **Also a concern for respondents in *Emerging* and *Developing* countries but is overshadowed by other problems**
- ***Emerging* and *Developing* countries top concerns:**
  - **Limited access to necessary equipment**
  - **Difficulty in shipping infectious substances**
  - **Lack of qualified staff**
  - **Delayed shipments of lab supplies (*Developing*)**

Conclusions

- Respondents seem to have a greater awareness about biosafety risks than biosecurity risks
- 86% indicate they conduct detailed risk assessments for biosafety and biosecurity yet implementation is lacking
- This study indicates possible avenues for providing education on biosafety and biosecurity:
  - Collaborations, including a strong reliance on American scientists
  - For higher risk agents, respondents turn to WHO and CDC for guidance
- Cost is a major concern
  - Lower cost / lower technology solutions to managing biosafety and biosecurity risks must be made available