



Building, Empowering, and Advocating for Biosafety Communities: A Gap-Analysis Approach

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- **Introduction**



Introduction

- **Introduction**
 - On behalf of the International Federation of Biosafety Associations (IFBA), the International Biological Threat Reduction program at Sandia National Labs conducted a gap-analysis globally on high-containment laboratories
- **Hypothesis:**
 - The preliminary hypothesis was to find a marked difference in access to basic utilities necessary to run and maintain a laboratory, training, and a lack of regional availability of expertise necessary to purchase and/or certify equipment.



Introduction

- **Methodology**

- IFBA utilized its network to disseminated a 23-question survey to the biosafety association professionals with whom they interact as they saw fit.
- Preliminary models of social networks indicated that there are no more than 5-7 degrees of separation between any two individuals; subsequent studies suggest that co-publication is high until individuals are sufficiently isolated (ie unreachable via traditional means, such as collaboration and co-publication).
 - **As such, social network utilization was deemed to be sufficient to generate a representative random sample.¹**

1. [The structure of scientific collaboration networks](#), M. E. J. Newman, *Proc. Natl. Acad. Sci. USA* **98**, 404-409 (2001).



Introduction

- **Basic Data:**
 - 71 individuals responded
 - 7 Incomplete surveys
 - **1-3 questions complete, the rest blank**
 - 3 Left sections blank on otherwise complete surveys
 - **Always Waste Handling**
 - **No discrepancy between IMF Economic Region; Advanced and Emerging left this section blank equally.**



Introduction

- **Weakness:**
 - Sampling Bias: No network has perfect global representation, and there was an unequal global distribution that prevented regional analysis.
- **Strength:**
 - IBTR countered sampling bias by dividing up countries based upon IMF Economic Classification (IMF Advanced Economies vs IMF Emerging and Developing Economies).
 - This proved the most effected means to account for the over-representation of developed nations



Introduction

- **Weakness:**
 - Technical Sophistication of the questions: Not necessarily every individual who answers the question may be fully versed in the architecture and engineering principals necessary to provide a complete and accurate answer to the question
- **Strength:**
 - IBTR compensated for this by comparing specific questions within the data to check for consistency of responses. Where there was inconsistency, it was likely that the technical expertise was low.



Data

- Data



Data

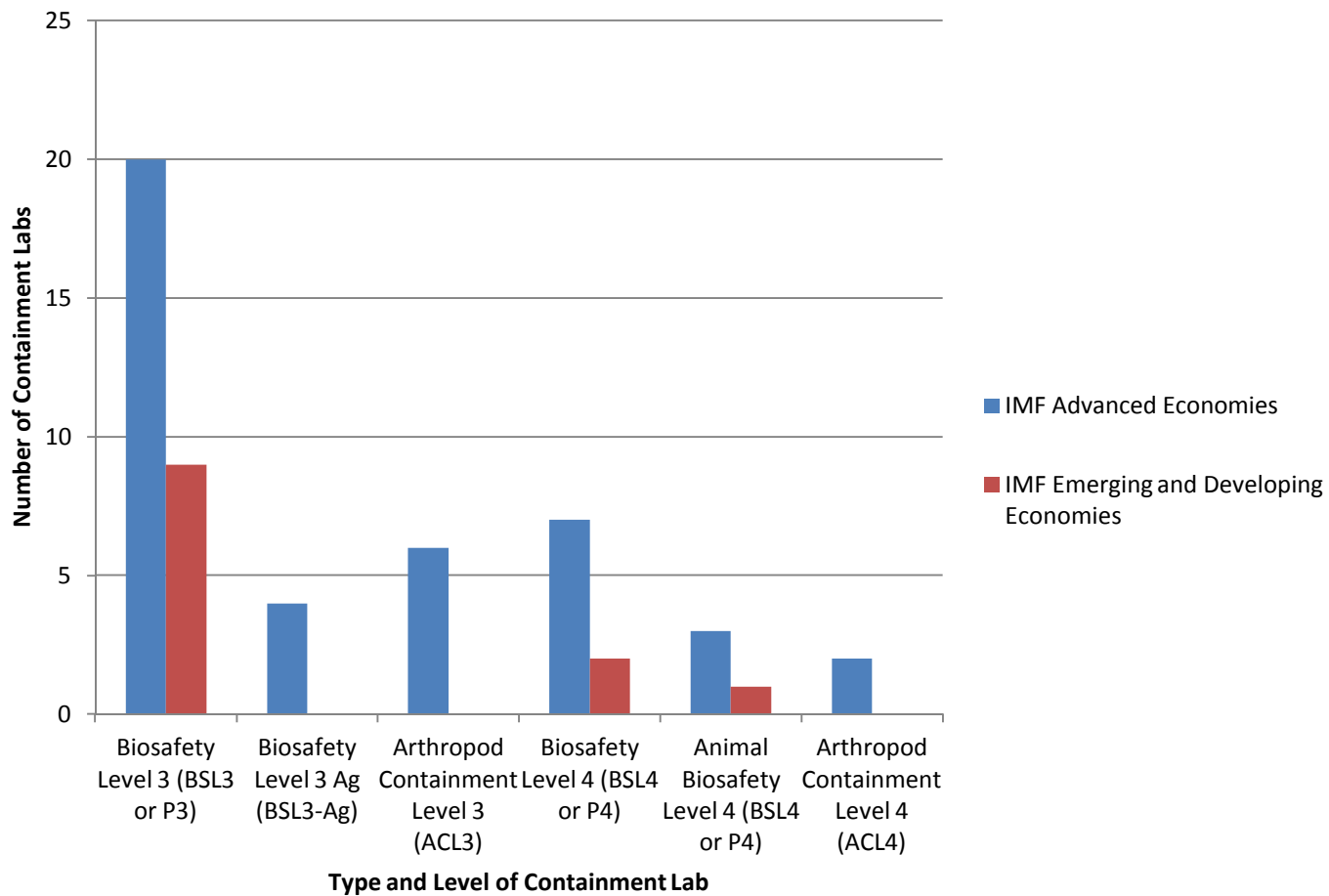
- Type, Frequency, and Containment Level of Laboratories**

	IMF Advanced Economies	IMF Emerging and Developing Economies
Biosafety Level 1 (BSL1 or P1)	14	9
Biosafety Level 2 (BSL2 or P2)	28	13
Biosafety Level 3 (BSL3 or P3)	20	9
Biosafety Level 4 (BSL4 or P4)	7	2
Vivaria for clean animals only (no infectious agents)	8	2
Animal Biosafety Level 1 (BSL1 or P1)	11	2
Animal Biosafety Level 2 (BSL2 or P2)	19	2
Animal Biosafety Level 3 (BSL3 or P3)	10	1
Biosafety Level 3 Ag (BSL3-Ag)	4	
Animal Biosafety Level 4 (BSL4 or P4)	3	1
Arthropod Containment Level 1 (ACL1)	6	1
Arthropod Containment Level 2 (ACL2)	12	0
Arthropod Containment Level 3 (ACL3)	6	0
Arthropod Containment Level 4 (ACL4)	2	0
I don't know	2	1



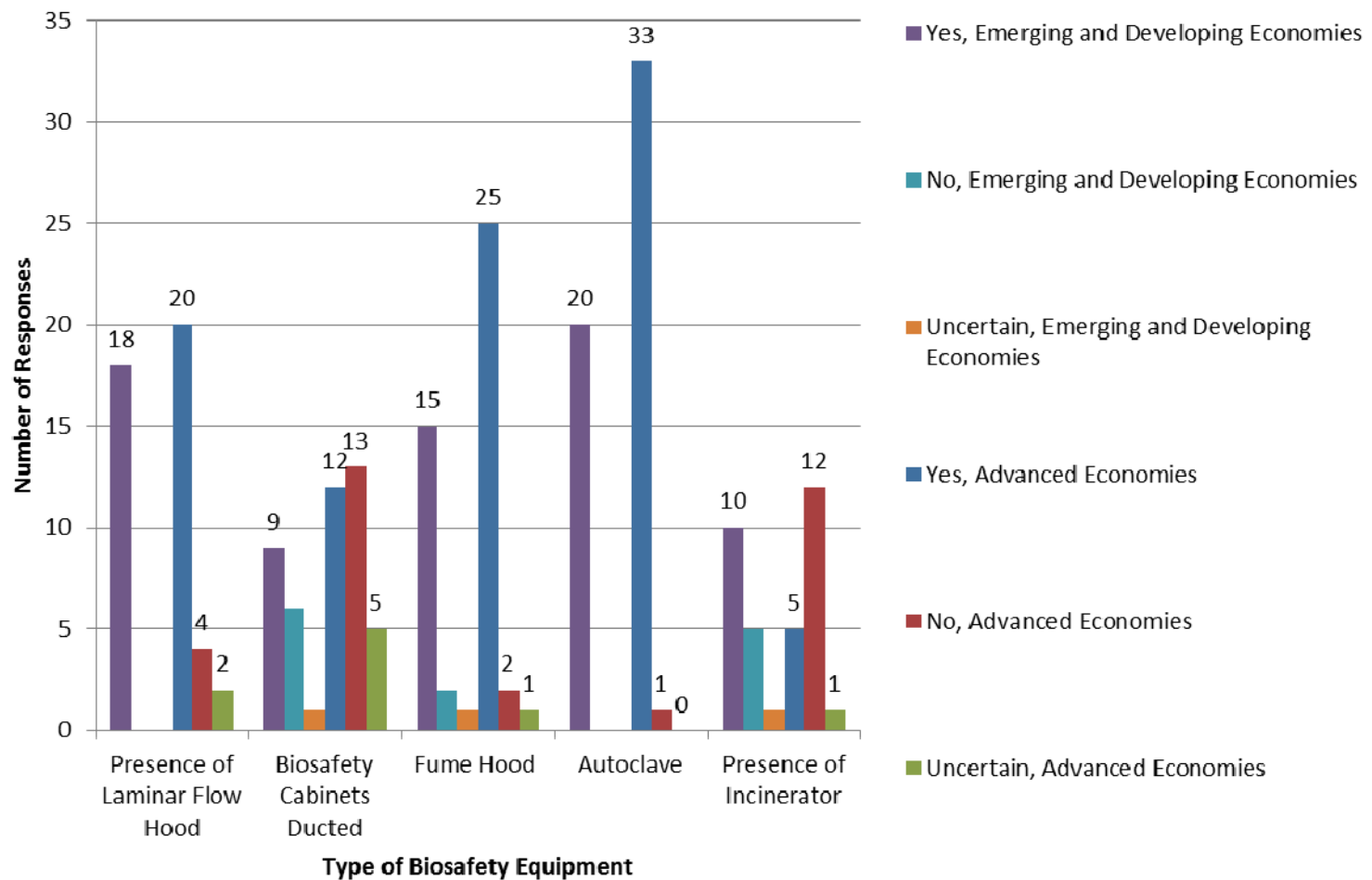
Data

Distribution of BSL3 and BSL4 Labs



Data

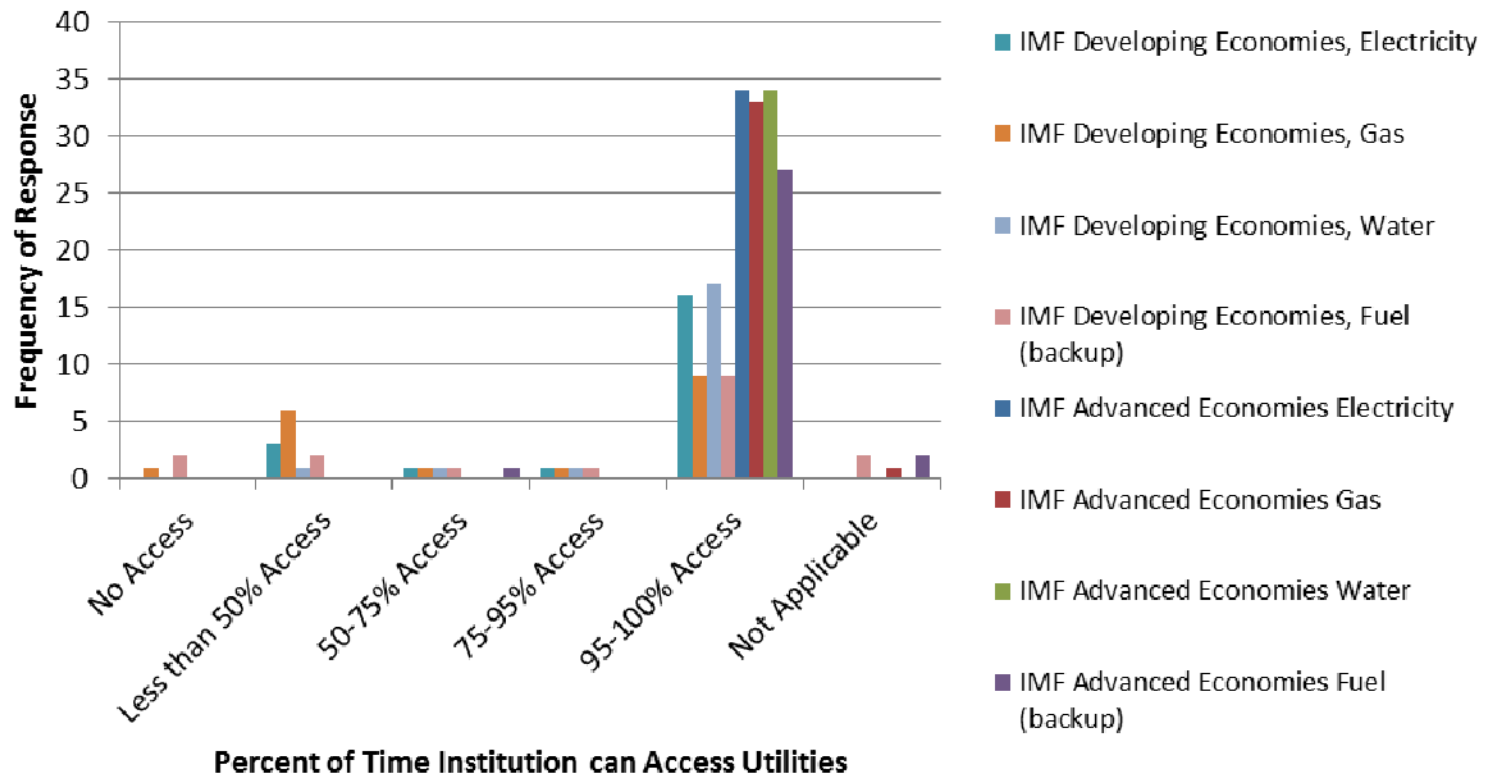
Presence of Biosafety Equipment





Data

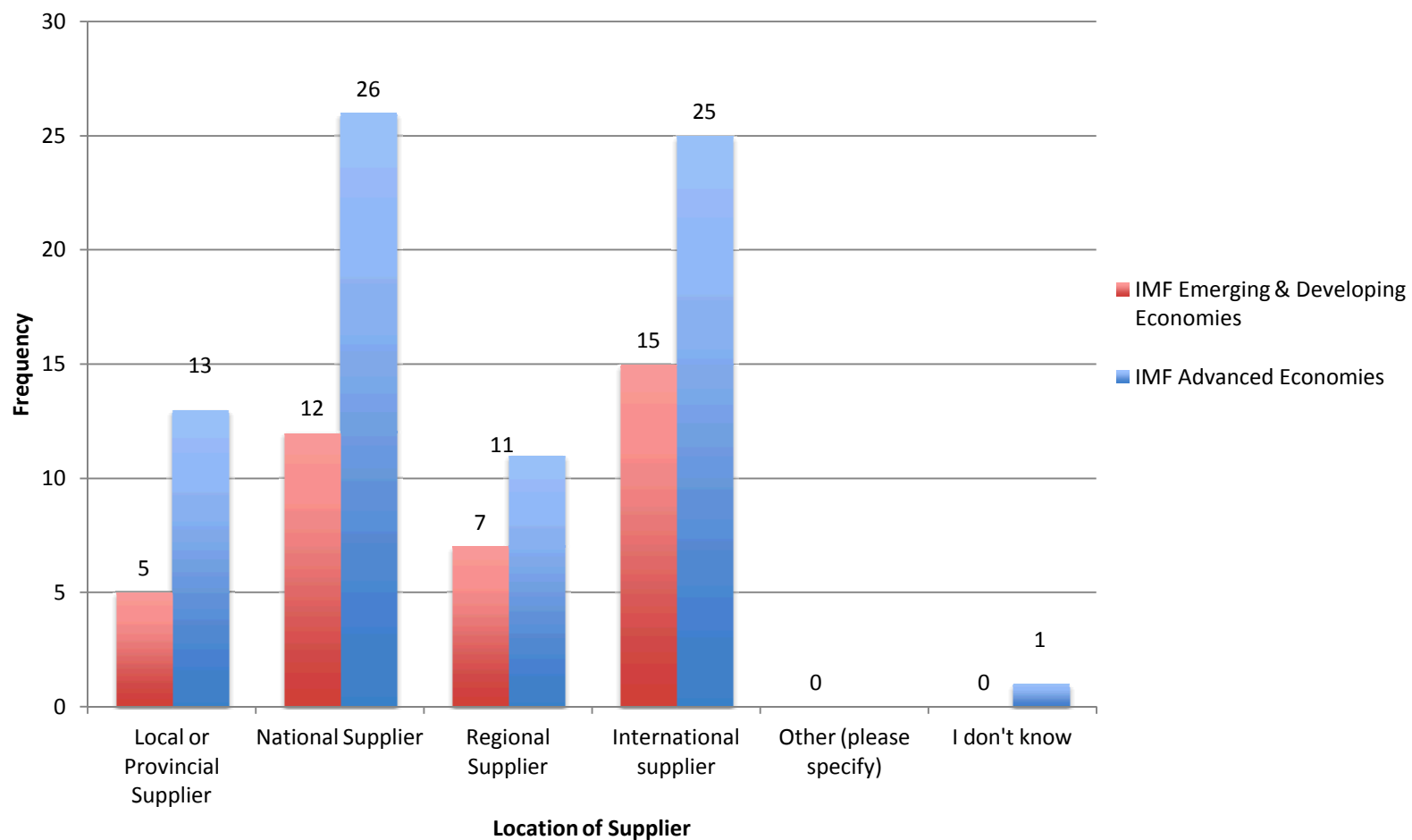
Comparison of Institutional Access to Utilities





Data

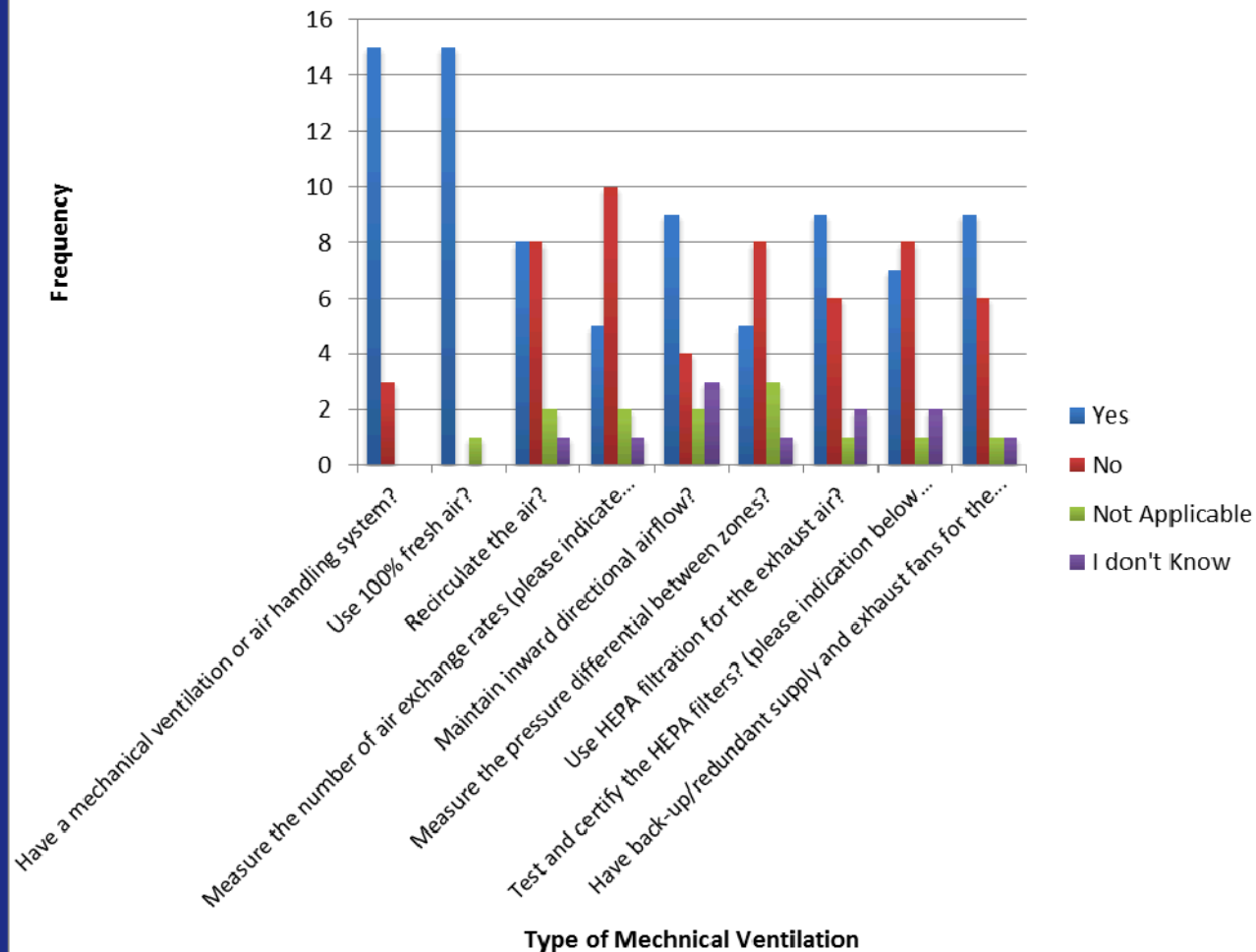
Disparity in Where Laboratories Purchase Equipment





Data

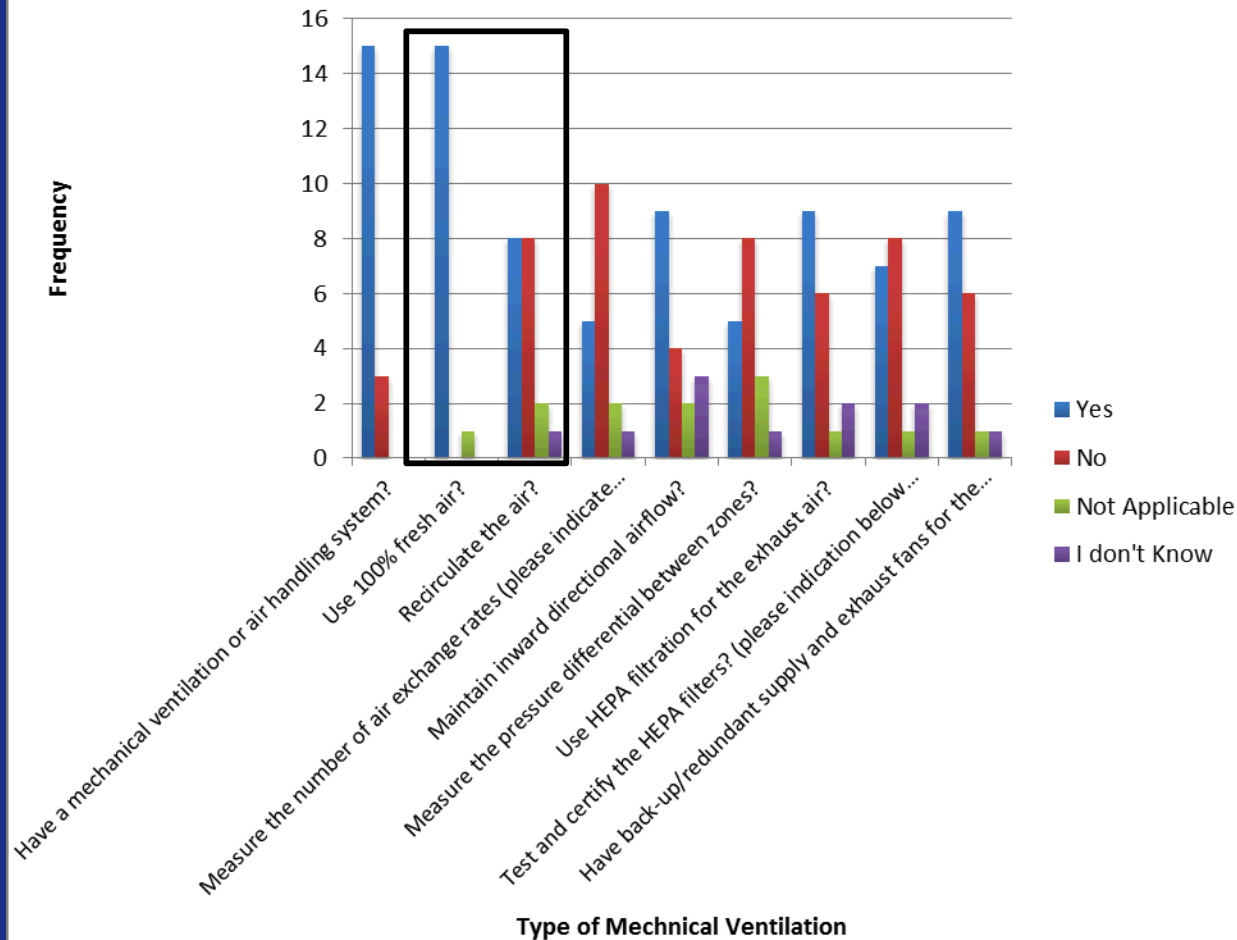
Type of Mechanical Ventilation and Air Handling System in IMF Emerging Economies





Data

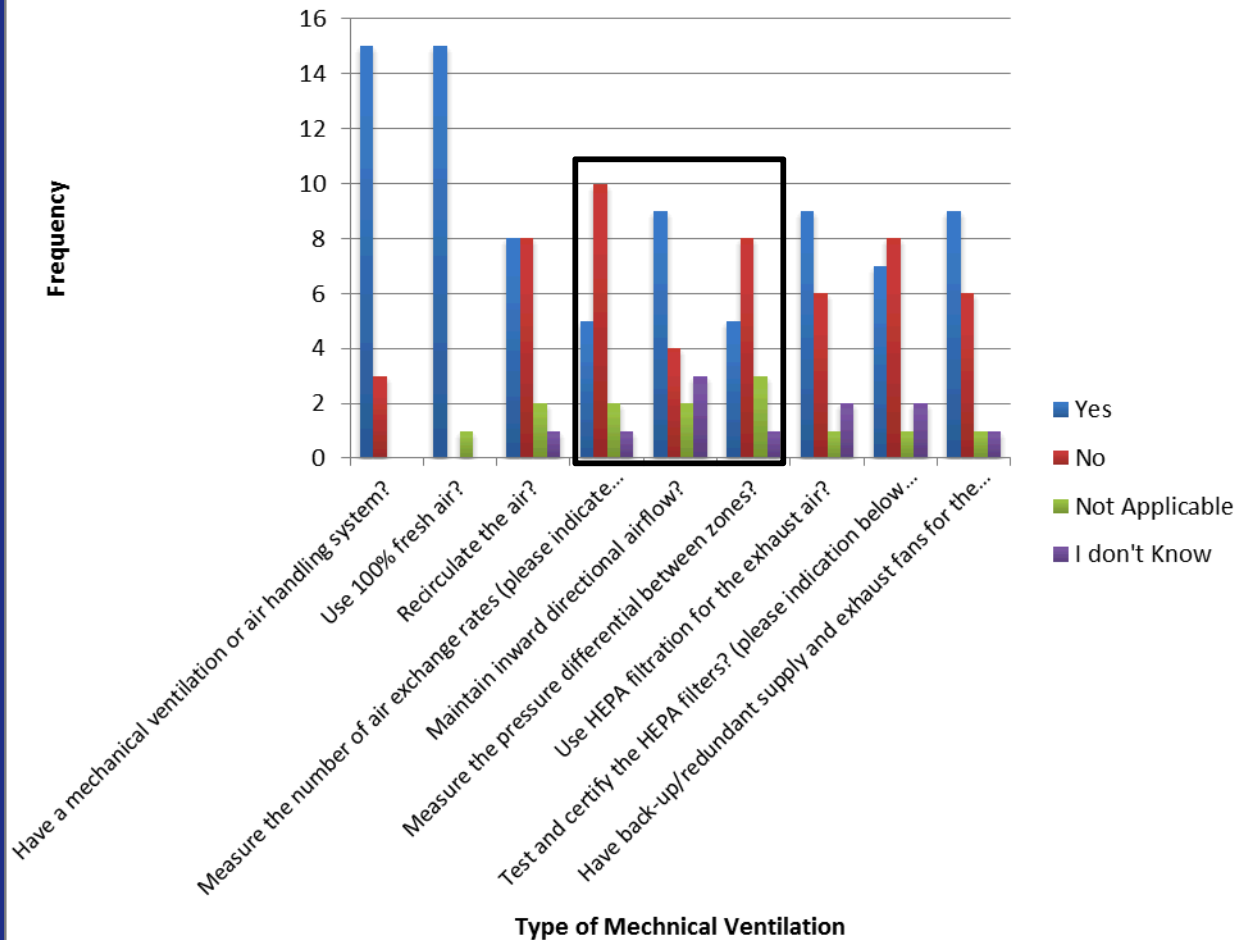
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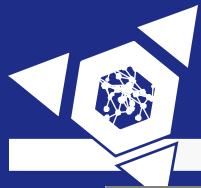




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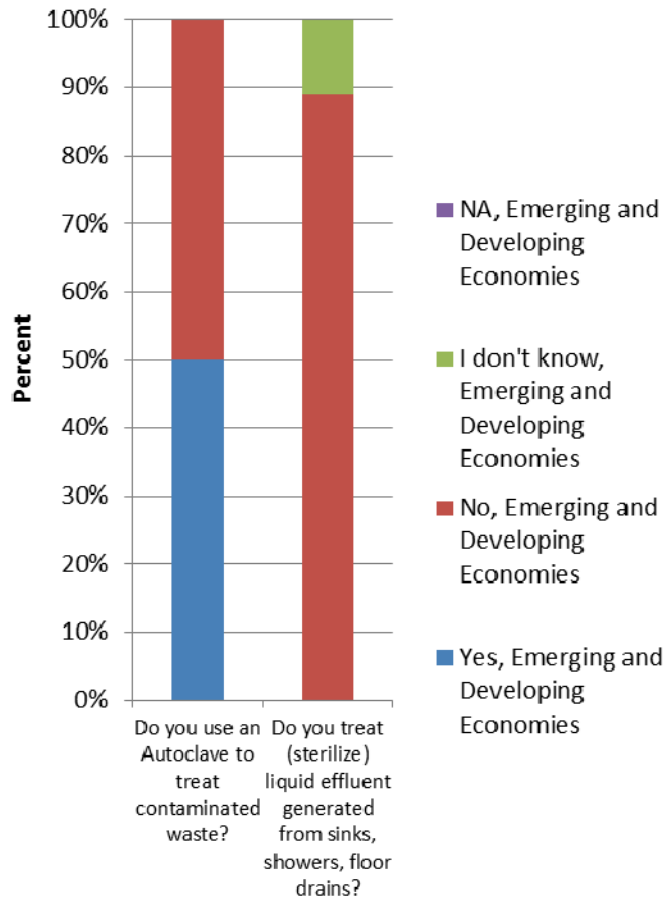
Type of Mechanical Ventilation and Air Handling System in IMF Emerging Economies





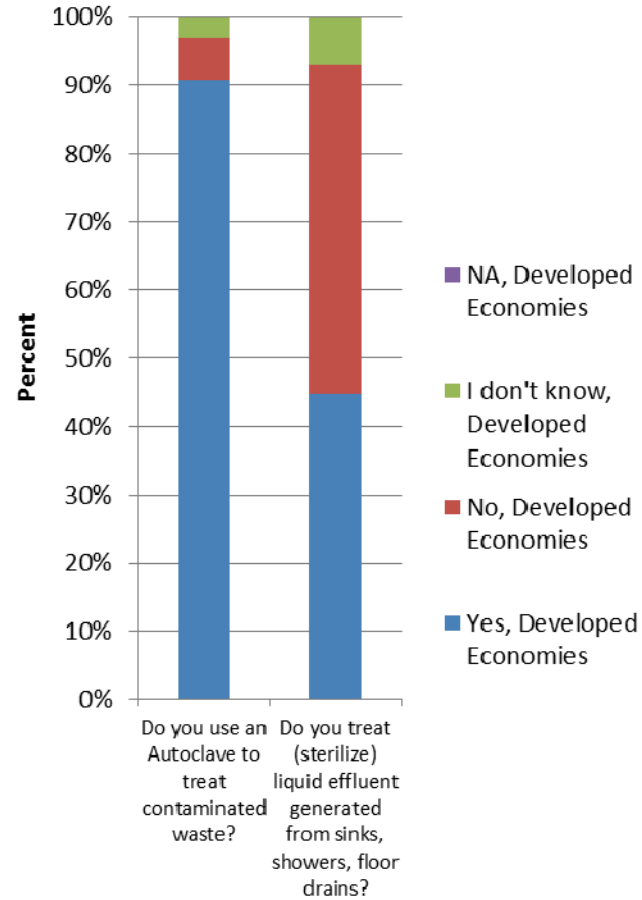
Data

Waste Treatment Practices, Emerging and Developing Economies



Waste Treatment Practice

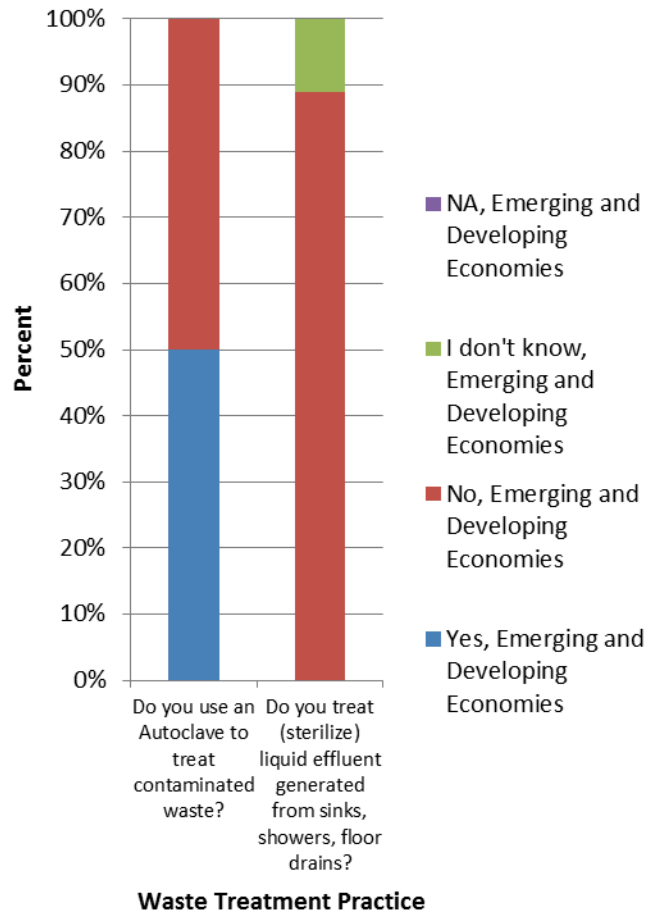
Waste Treatment Practices, Advanced Economies



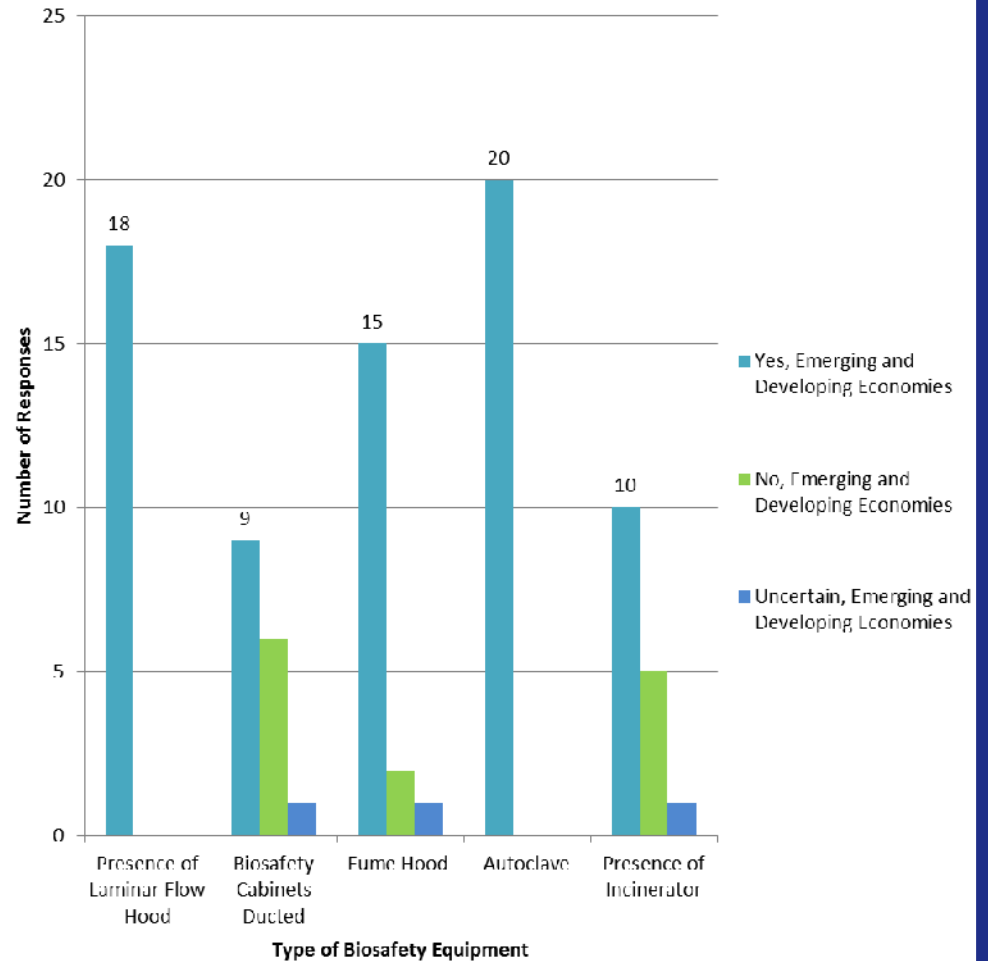
Waste Treatment Practice

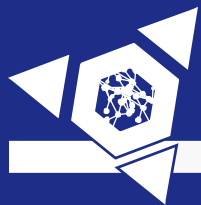
Data

Waste Treatment Practices, Emerging and Developing Economies



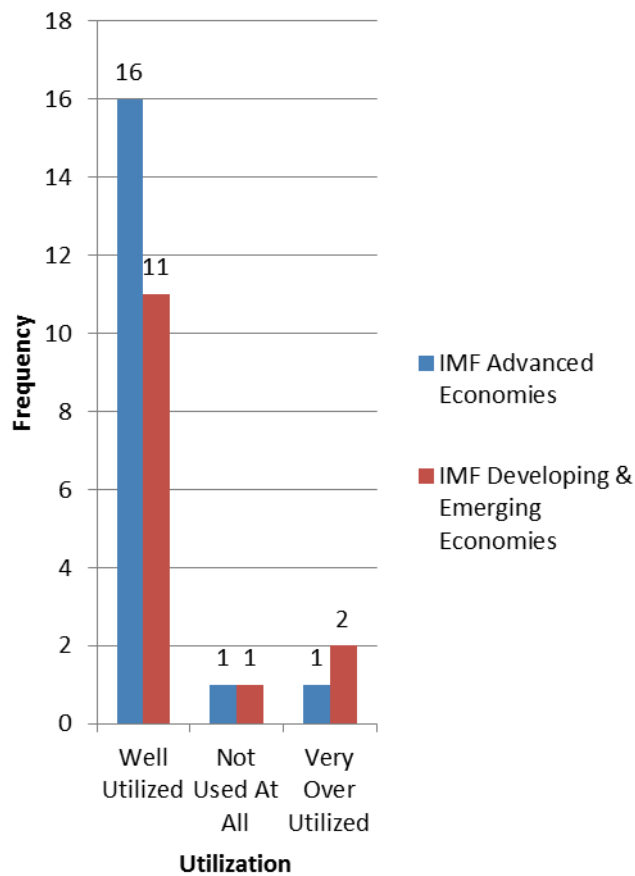
Presence of Biosafety Equipment



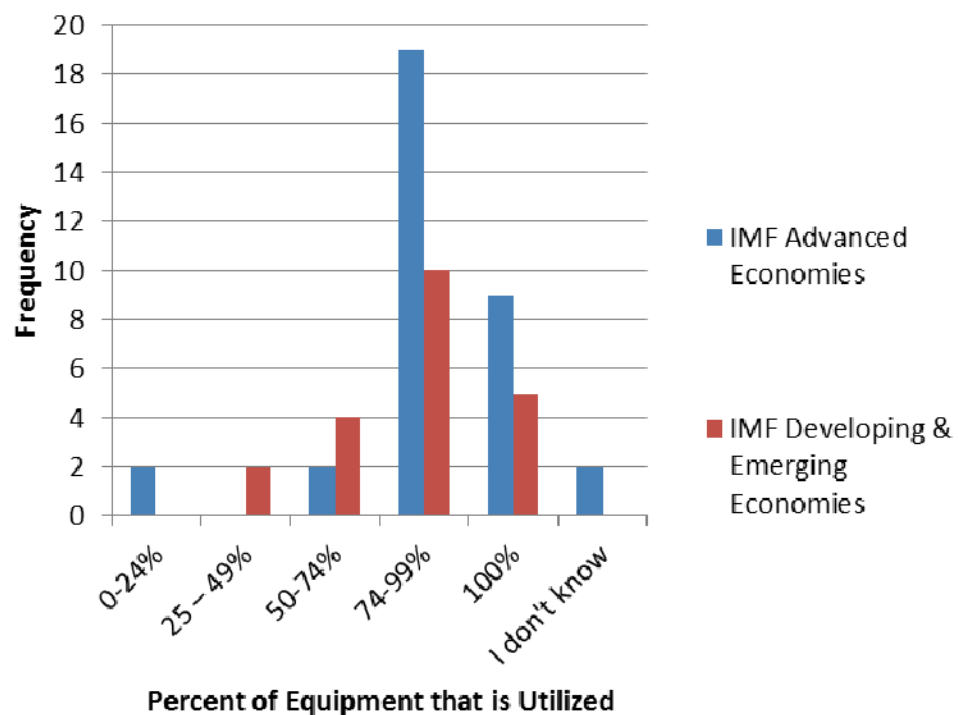


Data

Perception of How Effectively Lab Equipment is Utilized

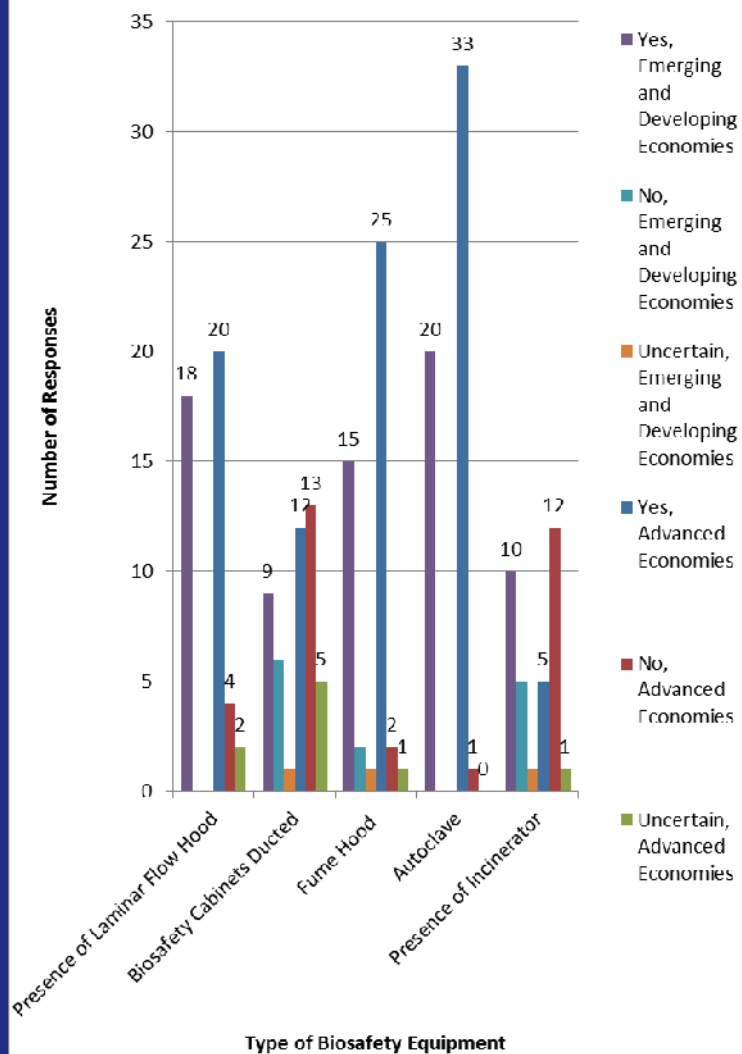


Percent of Equipment that is Utilized

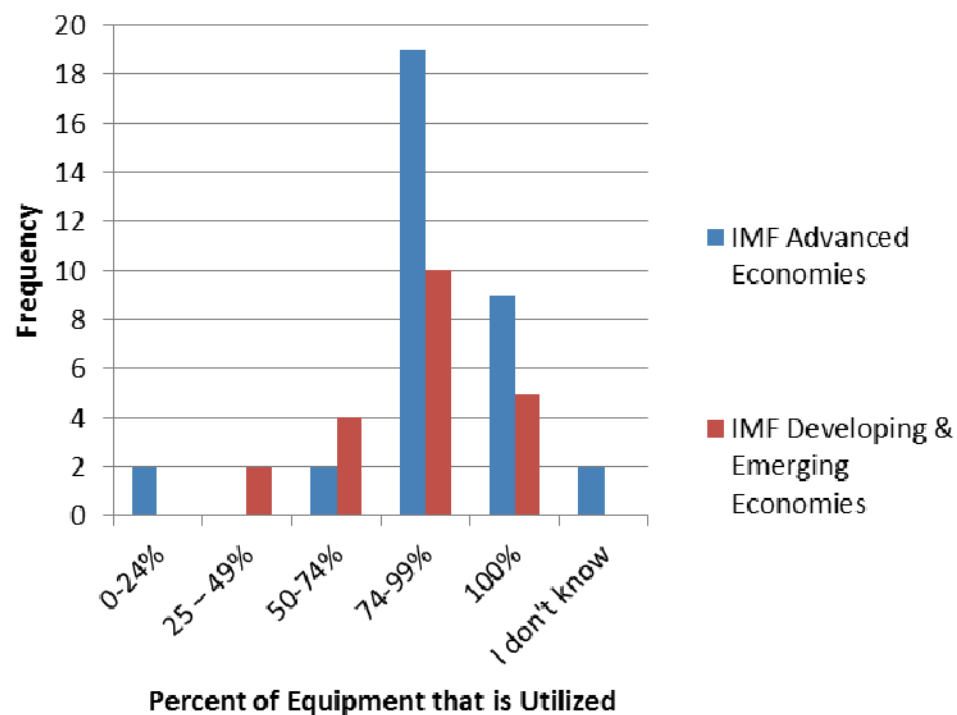


Data

Presence of Biosafety Equipment



Percent of Equipment that is Utilized





Results

- Results



Analysis

- **Major Findings:**
 - Imbalance in access to utilities
 - Distribution of high containment facilities skews towards Advanced Economic Regions
 - Lab Equipment and Space well-utilized, though financial support varies widely across economic band
 - **Implications for building new facilities vs refurbishing existing facilities**
 - Imbalance in Biosafety and Biosecurity Training
 - Complimentary grievances in “operational challenges” – what is needed is an entity to match those with means to those with needs



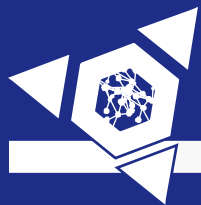
Analysis

- **Self-Reported Operational Challenges**
 - An open-ended question in which survey-takers were asked to reply with what they perceived to be their single largest operational challenge.
 - This corresponded almost exactly with the gaps the investigators found in the data.



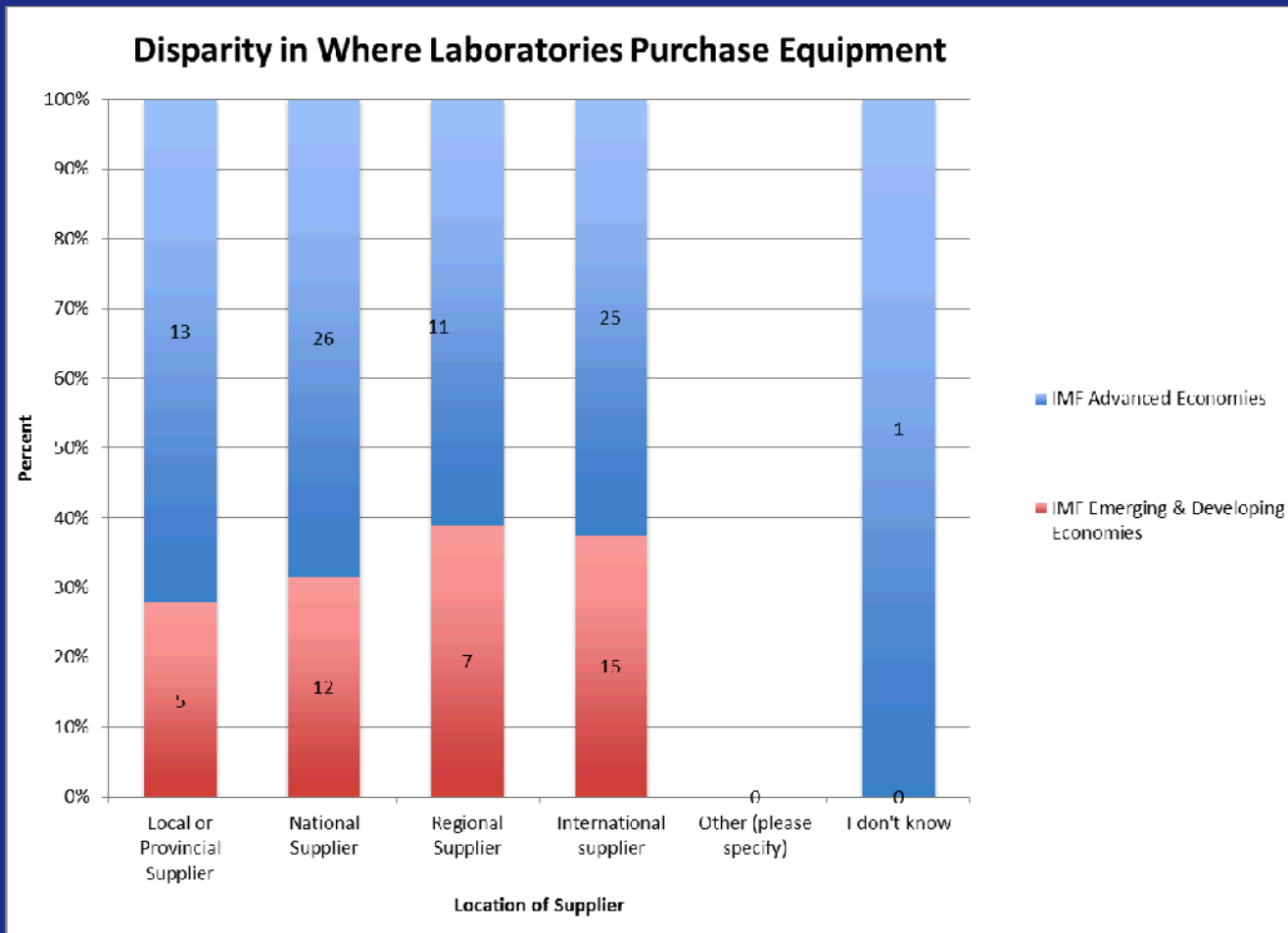
Analysis

- **Biggest Operational Challenges**
 - Similarities across Economic bands:
 - **Maintenance**
 - High Containment Facilities in particular
 - Advanced Economies: 6
 - Emerging and Developing Economies: 6



Analysis

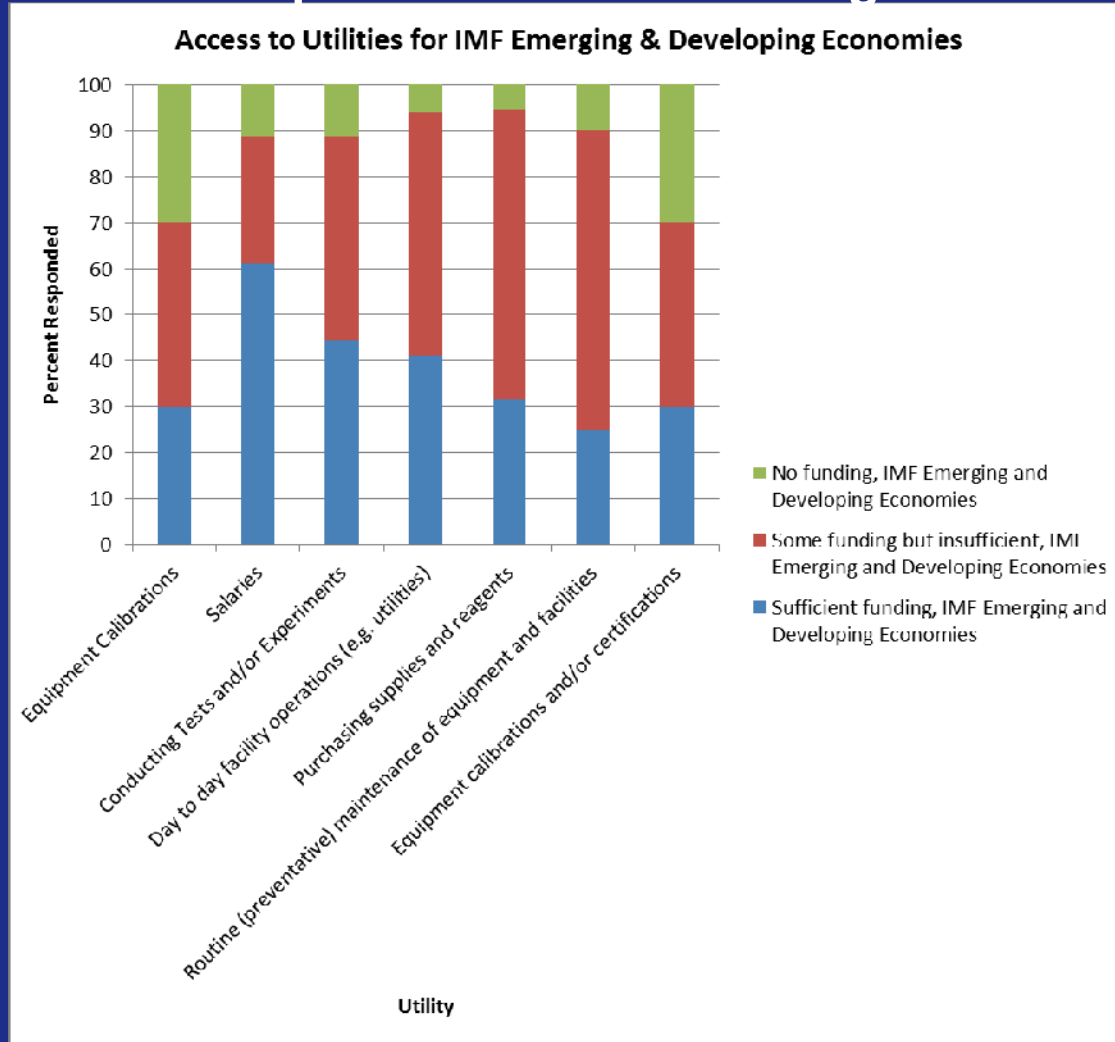
- **Maintenance: Implications and challenges.**





Analysis

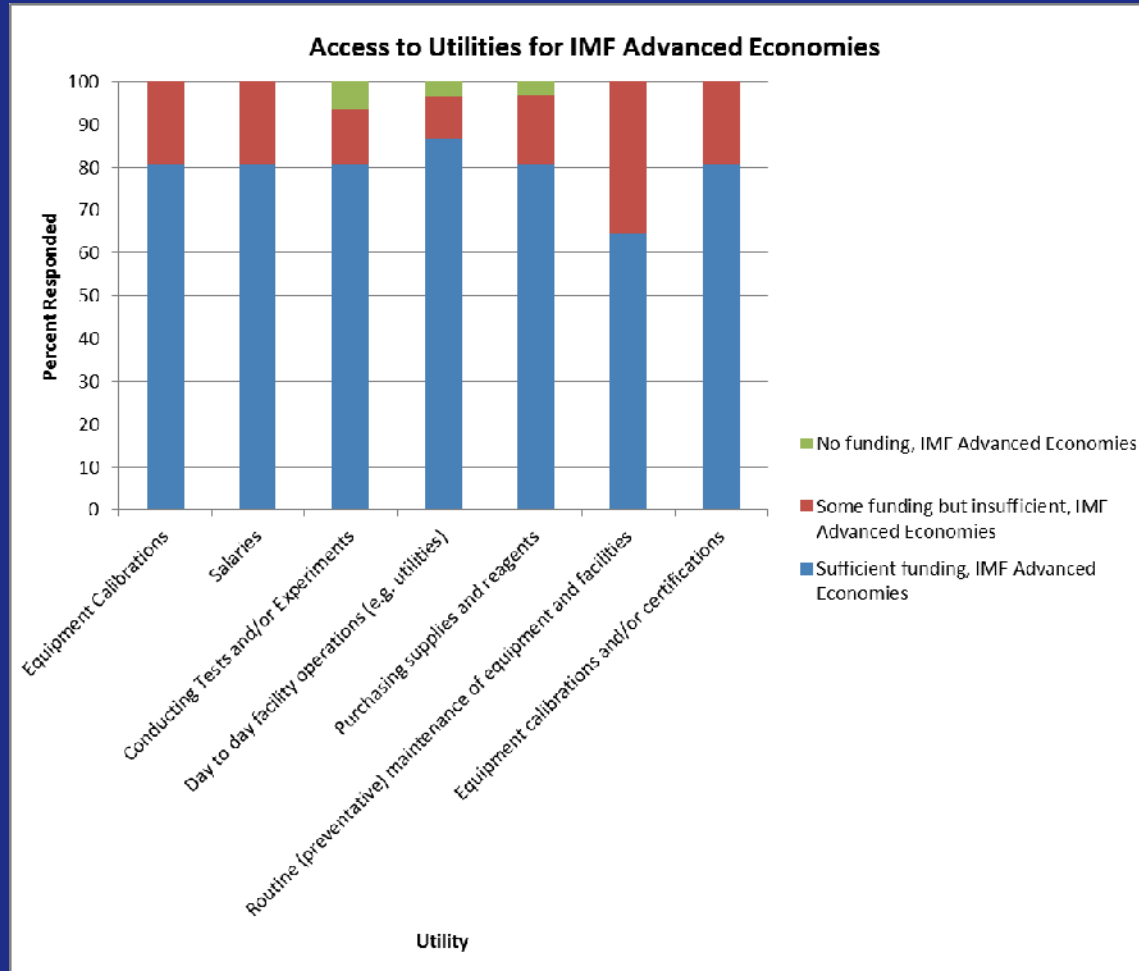
- Maintenance: Implications and challenges.**





Analysis

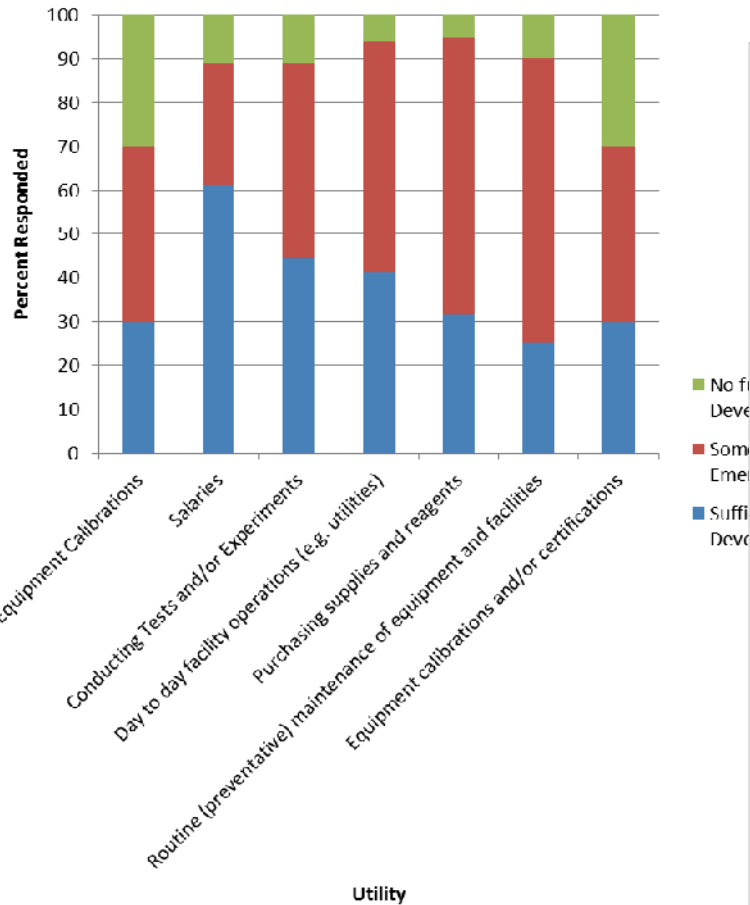
- **Maintenance: Different Implications and challenges.**



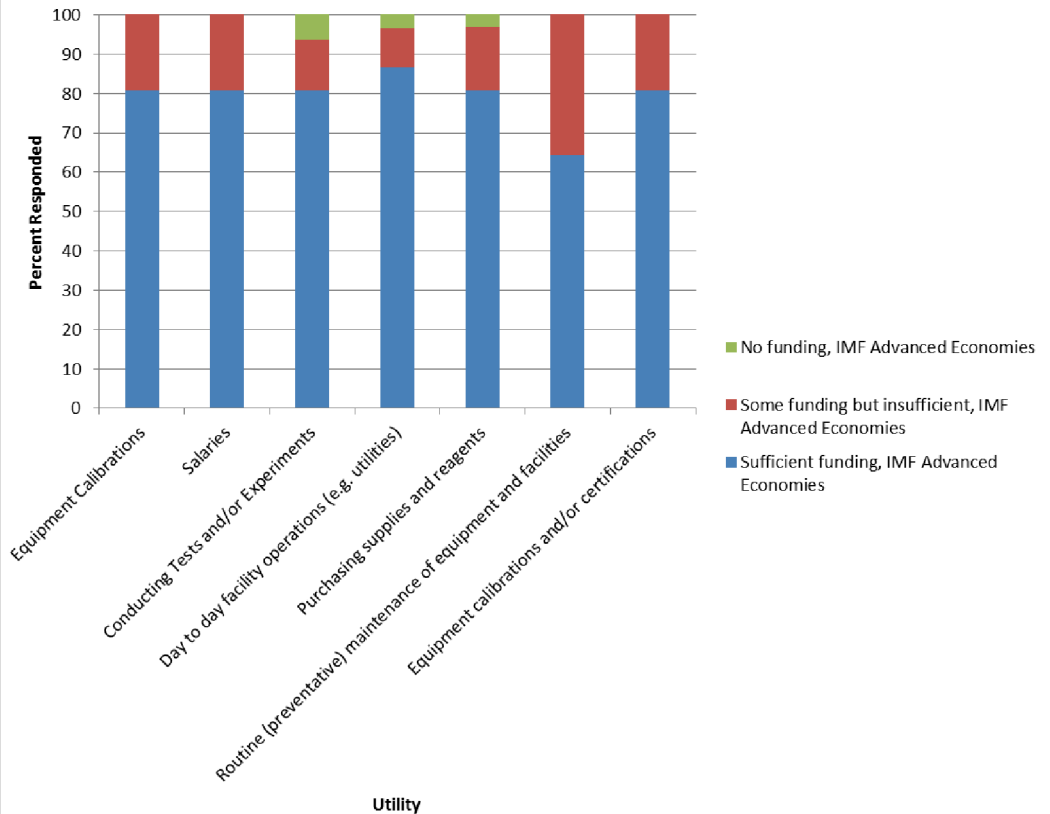


Analysis

Access to Utilities for IMF Emerging & Developing Economies



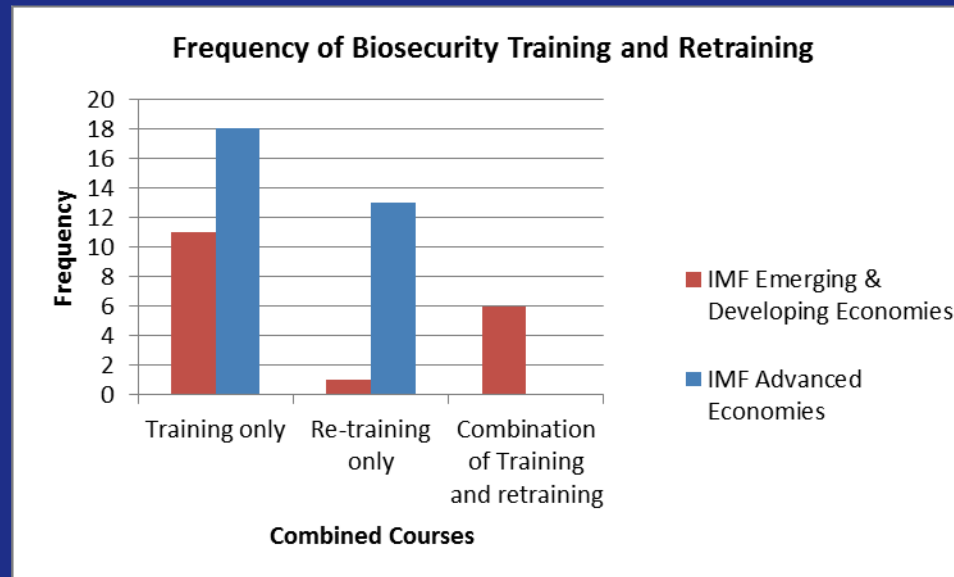
Access to Utilities for IMF Advanced Economies

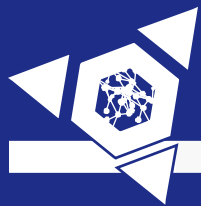




Analysis

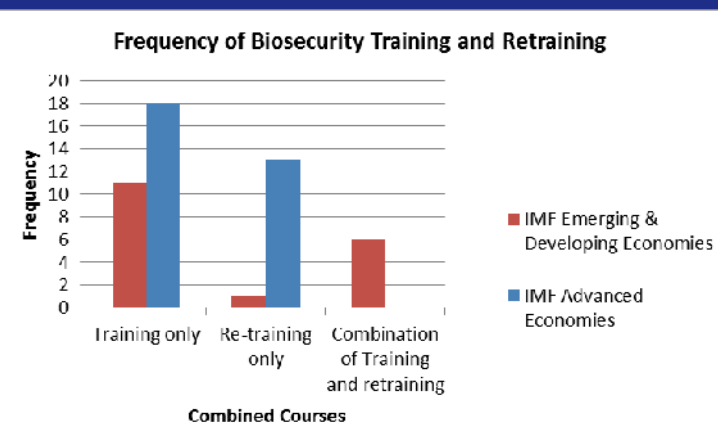
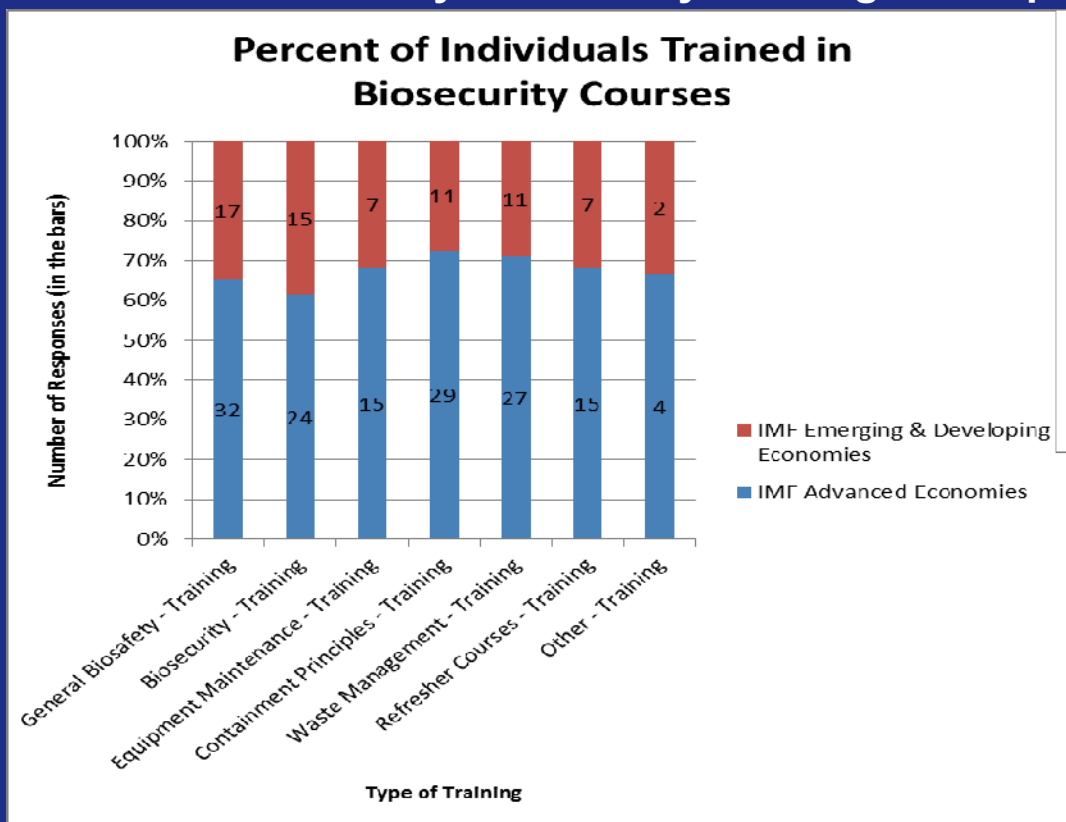
- **Operational Challenges**
 - Similarities across Economic bands:
 - **Biosafety Biosecurity Training**
 - High Containment Facilities in particular
 - Advanced Economies: 7
 - Emerging and Developing Economies: 6





Analysis

- **Operational Challenges**
 - Similarities across Economic bands:
 - **Biosafety Biosecurity Training – in depth look**





Analysis

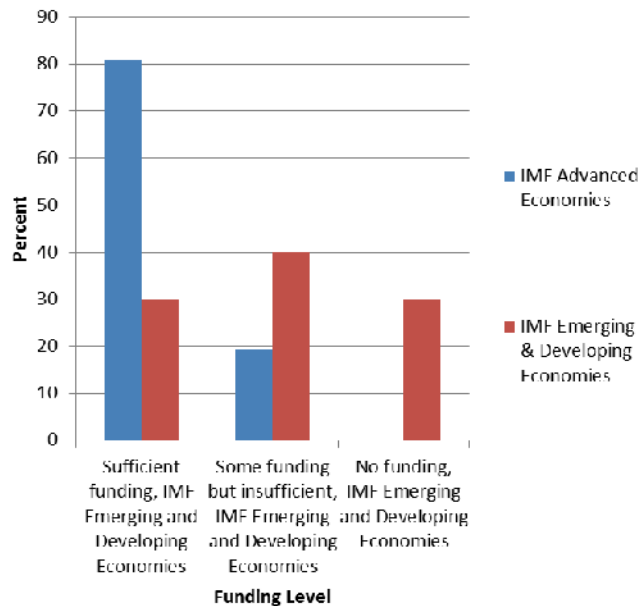
- **Operational Challenges**
 - Differences across Economic bands:
 - **Advanced Economies**
 - Regulatory Compliance (6)
 - **Emerging and Developing Economies**
 - Failing Physical Infrastructure (3)
 - Lack of Basic Materials and/or Utilities (7)



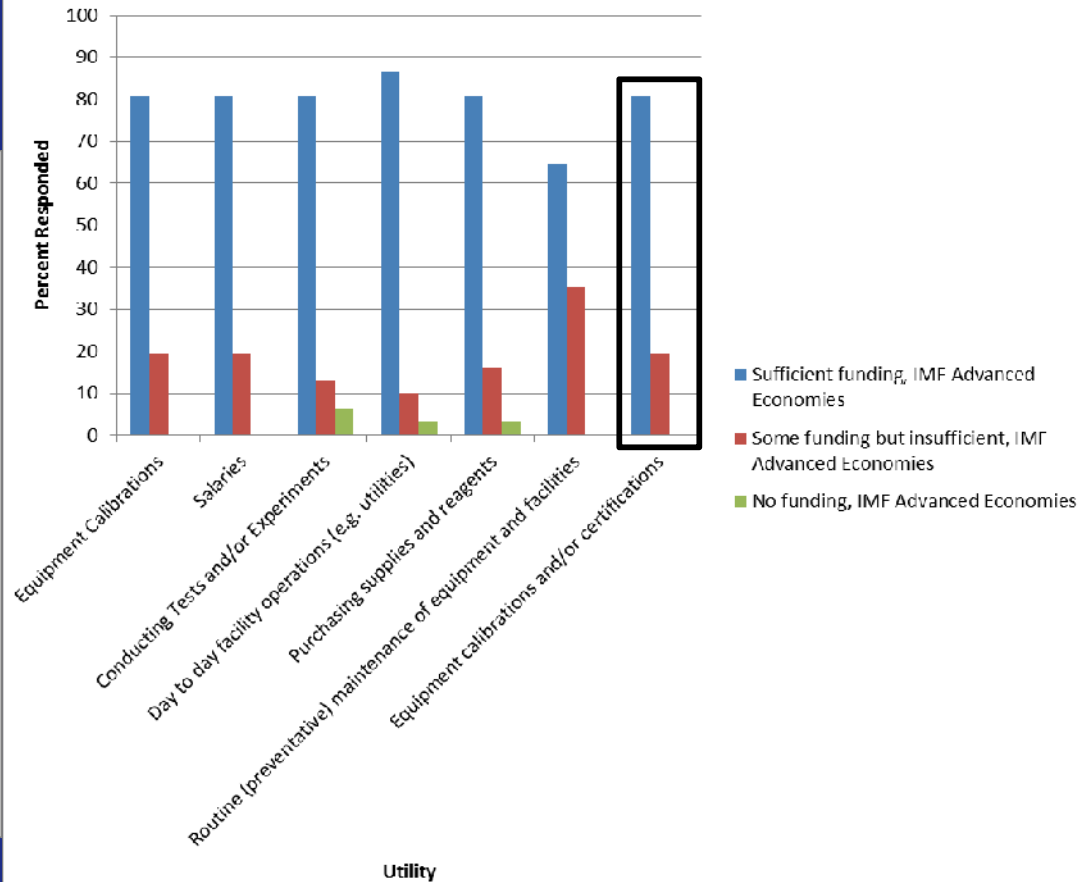
Analysis

- Operational Challenges
 - Advanced Economies-Regulatory Compliance

Equipment Calibration and/or Certification



Access to Utilities for IMF Advanced Economies

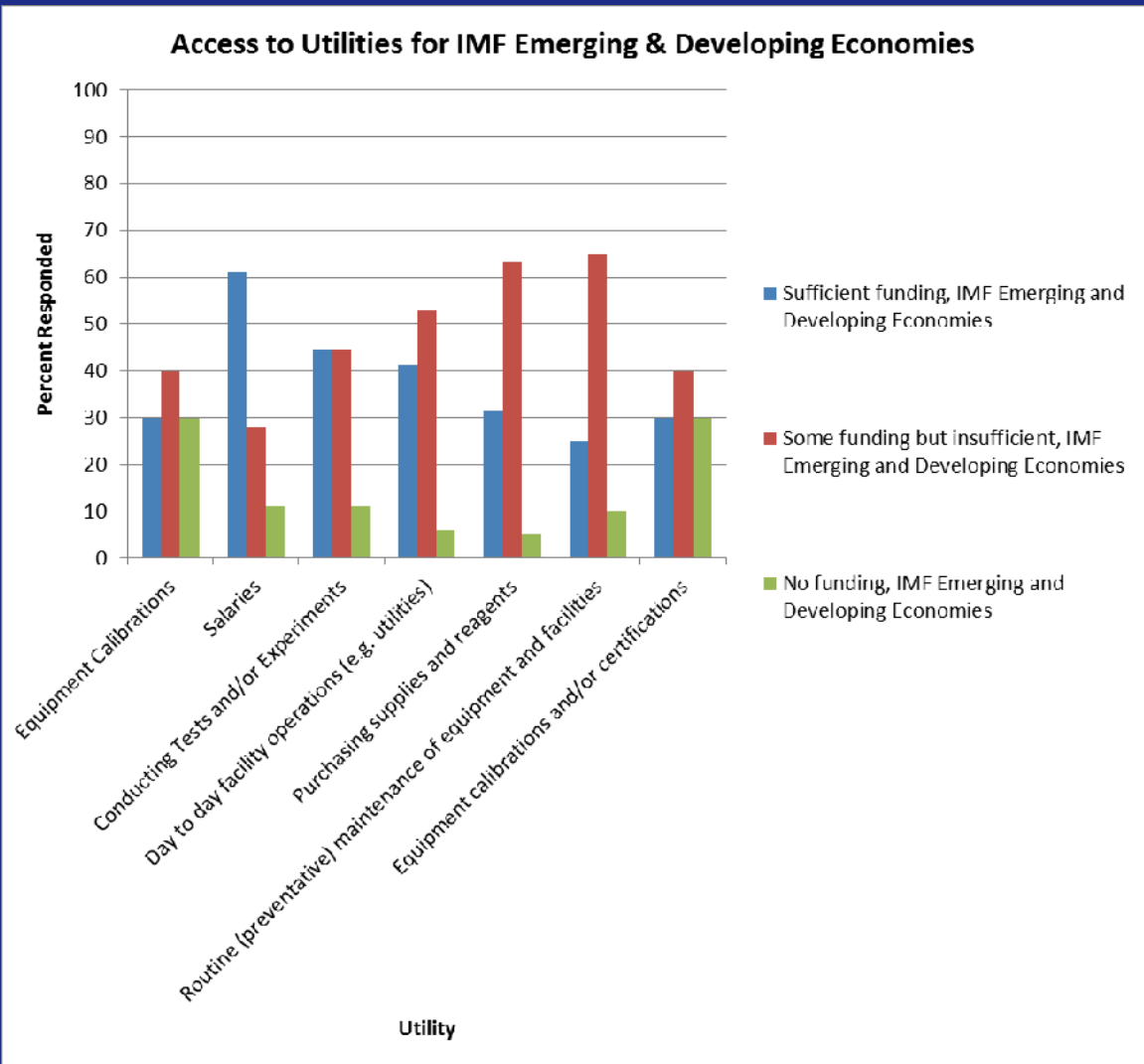




Analysis

- **Operational Challenges: Emerging and Developing Economies**

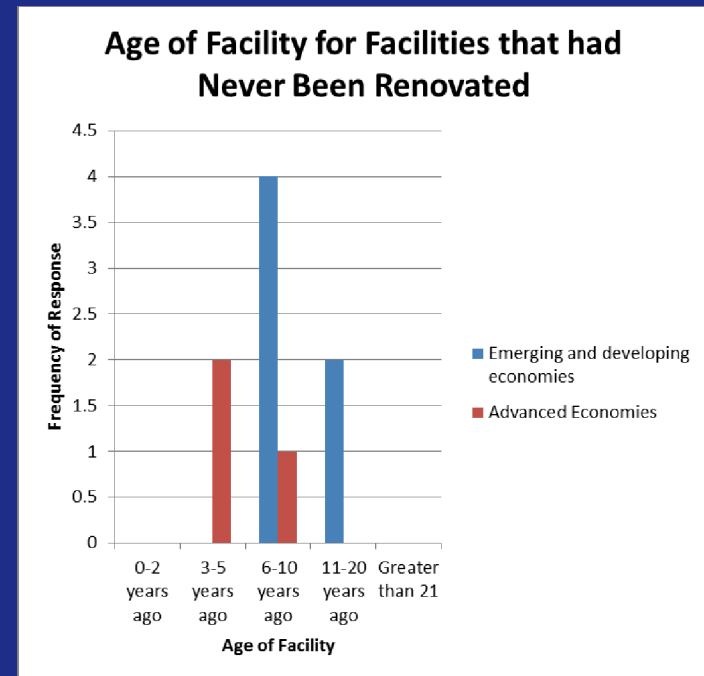
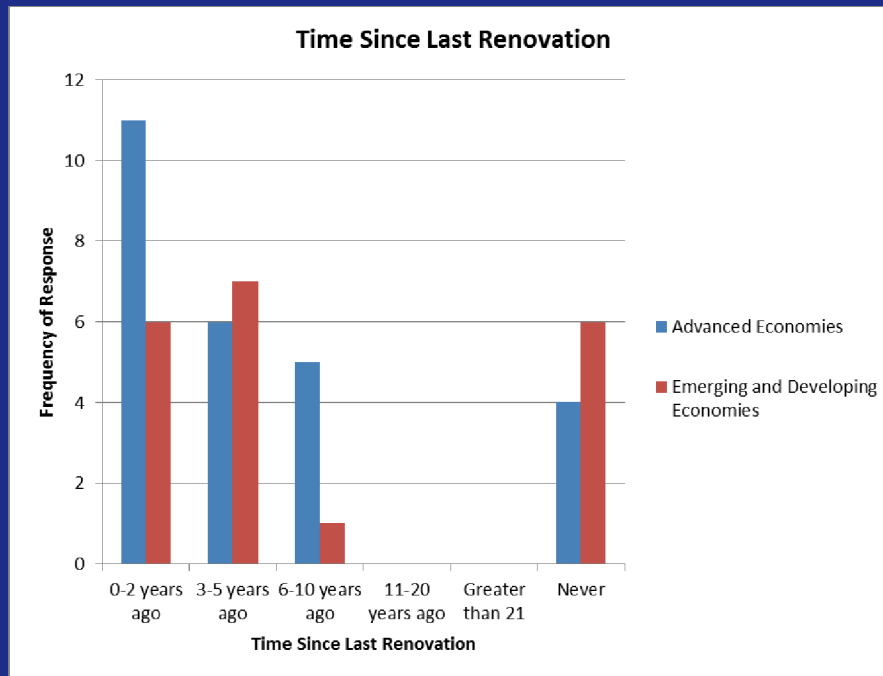
- Failing Physical Infrastructure
- Lack of Basic Materials and/or Utilities





Analysis

- **Operational Challenges – Explaining the differences**
 - Emerging and Developing Economies
 - Failing Physical Infrastructure





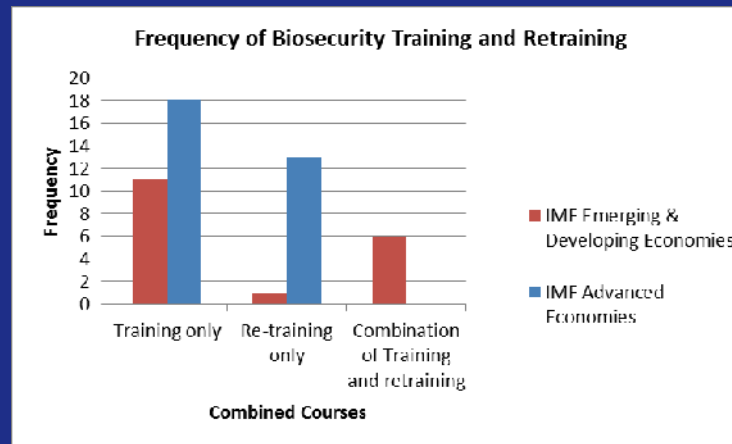
Recommendations

- **Recommendations**



Recommendations

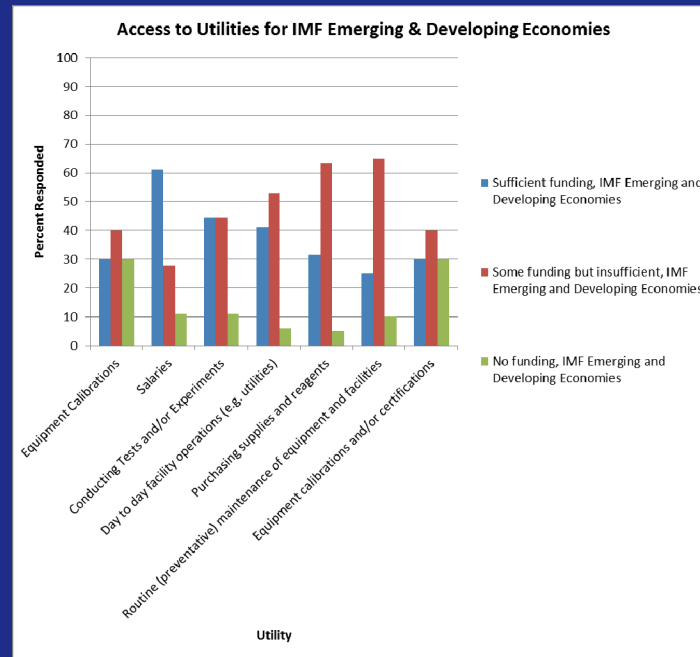
- **An international entity needs to fill the gap between the highly trained Developed Economies and the inconsistently trained Developing and Emerging Economies.**
 - Coordinating training and outreach by trained and certified Biosafety professionals with those whom seek training and/or certification





Recommendations

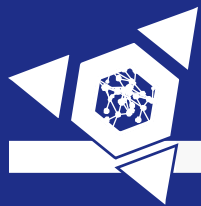
- **There is a critical gap that an international entity such as IFBA could fill and more effectively match the needs of those in developing economies**
 - Improving the condition of existing facilities through sustainable, monetarily small efforts that improve conditions at a facility





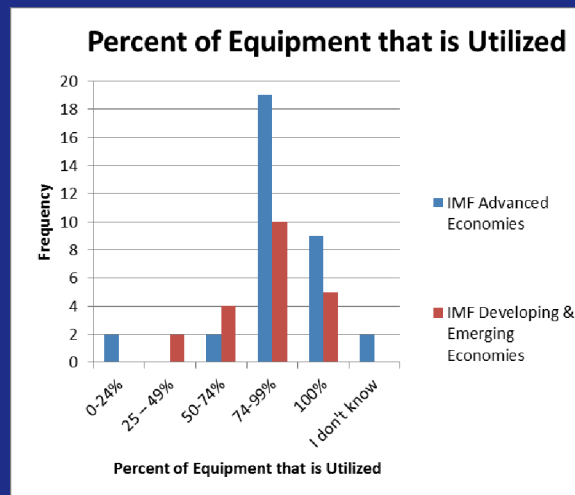
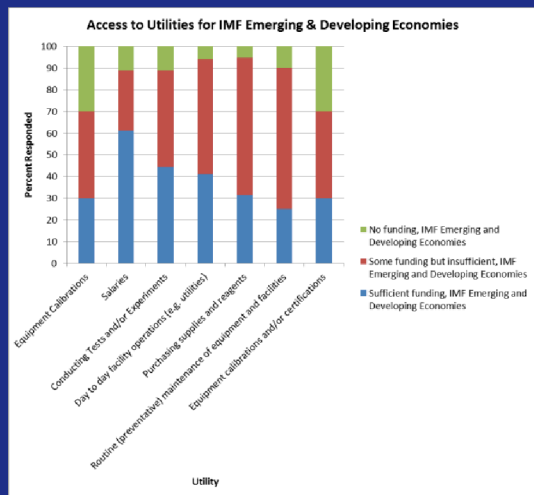
Recommendations

- **Synthesize current biosafety and biosecurity guidelines for effective international implementation of biosafety and biosecurity**
 - Developing economies are faced with myriad of guidelines each implemented differently, each regionally focused.
 - The current regulatory burden on research facilities is tremendous; there is a need to synthesize regional guidelines in the context of an international framework rather than continue to create new ones.
 - **Example: Synthesizing regional guidelines with the CWA to allow labs to demonstrate ISO-compliance and facilitate international collaborations – possibly improving developing nations access to funds, utilities, and biosafety equipment.**
 - **This would create a complementary - rather than competitive - relationship between regional biosecurity and biosafety guidelines**



Recommendations

- The Developing and Emerging economies are not in drastically over-utilized facilities – they do not need new facilities that their economy, infrastructure, access, and human resources cannot support
 - Instead:
 - Training
 - Refurbishing
 - Equipment
 - Sustainable physical upgrades that facilitate access to basic utilities such as water, gas, and electricity





Conclusions

- **Conclusions**



Conclusions

- **Primary Discrepancies**

- Training Gaps Across Economic Sectors
- Equipment Spread unequally
- Unequal access to basic utilities
- The burden of existing lab maintenance on developing economies suggests that new facilities are not needed
- Distribution of high containment facilities skews towards Advanced Economic Regions

- **Recommendations**

- There is a gap that needs to be filled by an international entity capable of matching those with needs to those with means.
- There is a significant regulatory burden by synthesizing existing regional regulations that respect regional preferences yet bow to international collaborative needs



- Thank you.