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Summary of the East Africa Training Consortium Biorisk Management Practices and Training Needs Survey

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Summary of the East Africa Training Consortium Biorisk Management Practices and Training Needs Survey

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Abstract

A survey was designed to query former Biorisk management (BRM) trainees in the East Africa region about their practices post-training and their perceived future training needs. A subset of those surveyed had been trained as BRM trainers. The survey was conducted to obtain a baseline of BRM practices that can serve as a benchmark for performance monitoring, to identify priorities for future BRM training and to gauge local BRM trainers' abilities to deliver effective training. The survey revealed that less than 50% of the respondents could identify evidence of a BRM system in their institute. Coaching and mentoring by BRM experts was identified as being of highest benefit to enable success as BRM practitioners. Local trainers reached 1538 trainees in the previous year and reported that trainings positively correlated with desired BRM behavior.

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Nomenclature

BRM	Biorisk management
EATC	East Africa Training Consortium
GBRMC	Global Biorisk Management Curriculum
IBCTR	International Biological and Chemical Threat Reduction
SNL	Sandia National Laboratories

1. INTRODUCTION

A survey was designed to query prior BRM trainees in the East Africa region about their BRM practices post-training and their perceived future training needs. Those invited to complete the survey were from Kenya, Uganda, Ethiopia, Tanzania, Rwanda and Cameroon who had been trained in the past five years by members of the Sandia National Laboratories International Biological and Chemical Threat Reduction group (SNL/IBCTR) in principles of biorisk management on behalf of the Defense Threat Reduction Agency/Cooperative Biological Engagement Program (DTRA/CBEP). Those surveyed are members of ministries overseeing laboratories in their countries, management and leadership of bioscience institutes, university professors and lecturers, biosafety and biosecurity officers, veterinarians and laboratorians. Surveys were completed by BRM trainers and trainees. Participants reported on their knowledge of BRM legislation status in their countries and BRM system implementation in their institutes. The survey queried participants' perspective of their institutes' BRM training needs, their observance of (trainers) or practice of (trainees) best biosafety and biosecurity practices and their opinion on what type of support they perceived to be most effective in enabling them to be successful BRM trainers/practitioners. Trainers reported the numbers of trainees reached in the previous year, the BRM topics they presented and their adherence to the best practices they learned during their BRM trainer development programs. Participants queried were either trained under country-specific engagement (e.g. Kenya, Uganda and Tanzania) or regional engagement of the East Africa Training Consortium (EATC). Regional engagement promoted cross fertilization and networking among countries and sectors. It was designed to develop BRM awareness, local trainers, and serve as a forum in which the trainers could share BRM best practices and identify and mitigate barriers to their implementation.

Many of those surveyed have participated in both Introduction to BRM trainings as well as Trainer Development Programs, all with the full support of their leadership. Indeed, many BRM trainers are leaders in their institute (professors, middle management, biosafety/biosecurity officers, and laboratory managers). The BRM system model is one in which management and leadership, biosafety/biosecurity officers and BRM trainers are engaged in developing an organizational safety and security culture for their institute. We believe that this model has proven to be one in which the sustainability of BRM systems can occur in that the stakeholders are able to mount a concerted response to national and international requirements, potential trans-boundary disease outbreaks, and regional threats taking full advantage of a common language and platform for BRM implementation.

The goal of the survey was to gauge biorisk management (BRM) capacity in countries engaged through implementation of BRM trainings and development of local trainers.

1.1. Survey Objectives

- To obtain and document a baseline of BRM practices.
- To identify gaps in BRM performance in the workplace.
- To identify strategies and opportunities to sustain BRM capacity.
- Determine the respondents' perceived BRM competency and additional training needs, if any.

- Determine the extent to which the respondents are applying their BRM training in their place of work.
- Determine the extent to which developed BRM trainers have conducted trainings and their successes and challenges in doing so.

1.2. Desired Survey Outcomes

- Obtain a baseline of BRM practices that can serve as a benchmark for performance monitoring.
- Identify partner perceived priorities in BRM as well as their challenges and successes in conducting BRM training.
- Identify gaps in country BRM capacity including local trainers' abilities.
- Identify potential strategies to leverage and sustain BRM capacity in the region (e.g. through potential partnership with professional associations identified by the respondents).

1.3. Survey Highlighted Findings

- Overall, less than 50% of respondents indicated that their institute had evidence of a biorisk management system in place (as defined by institutional BRM policy, documented risk assessments and audits; Figure 1); stratification by country indicated that Kenyans and Ugandans are further along than other countries in BRM system implementation.
- Biosafety / biosecurity practice least observed is 'Reporting an incident (spill, needle prick, loss of sample, unauthorized access). This corresponds with the reported less than 50% reporting having an institutional BRM system.
- BRM trainings were reported in 68.9% of the trainers' institutes.
- Trainers reported that BRM trainings conducted within their institute positively correlated with desired BRM behavior (Figures 4 and 5, Table A-1).
- 37 BRM trainers reported training 1538 trainees in the previous one year period (Table 4).
- Trainers identify coaching from or co-training with expert trainers as being of the highest benefit to enable their success (Table 9).
- Non-trainers identify coaching and mentoring from BRM experts as being of greatest need to enable their success as a BRM practitioner (Table 10).
- The majority of trainers (82%) and trainees (80%) belong to a professional society where BRM training and common practices could be anchored for sustainability.

2. METHODOLOGY

2.1. Population Sampled

The population consisted of former BRM trainees and those trained as BRM trainers in Cameroon, DRC, Ethiopia, Kenya, Rwanda, Tanzania, and Uganda. The survey was sent to members of the population for which a valid email address was available on file resulting in a surveyed population of 334 individuals.

2.2. Survey Specifics

The survey was constructed in Survey Monkey and included a section which all respondents were asked to complete (19 questions), followed by separate sections for respondents who reported to have attended a trainer development event (20 additional questions) and those who did not (13 additional questions). The survey was determined to be exempt from a full ethics review by the Human Subject Research Board of Sandia National Laboratories as it did not claim generalizability of results to a larger population than those surveyed (such as, for example, “scientists in Africa”).

2.3. Data management and analysis

Data was analyzed between June – July 2016 after the survey closed. Duplicate responses from the email invitations and the weblink submissions were checked, and data were treated anonymously (the only data identifying individuals being email addresses, which were removed prior to data analysis, and institutions’ names from respondents who chose to indicate them). Responses were mainly analyzed through the analysis tools provided by the Survey Monkey services, while a smaller part of advanced analysis was performed on raw data exported from Survey Monkey using Microsoft Excel and SPSS software.

3. RESULTS

3.1. Demographics of the surveyed population

Table 1 shows the demographics for the respondents. As less than 10% of the respondents were from countries other than Uganda and Kenya, they are grouped into the “Other” category. Four respondents each from DRC and Ethiopia, three each from Rwanda and Tanzania and one from Cameroon (n = 15 total) make up the “Others” category.

Eighty-two (82) of 157 respondents (52.2%) indicated that they had completed a Trainers Development Program and were directed to answer questions related to their experience as a trainer. However, only 75 of the 82 self-identified trainers answered the questions they were directed to. Their answers which are specifically related to their experiences as trainers are discussed below in Tables 4 - 8.

Table 1: Demographics of Surveyed Population and Self-identified Sector Affiliation

	Kenya	Uganda	Others	All
Animal Health ¹	39.71% (27)	18.92% (14)	6.67% (1)	26.75% (42)
Public Health	42.65% (29)	50.00% (37)	13.33% (2)	43.31% (68)
Higher Education	1.47% (1)	8.11% (6)	53.33% (8)	9.55% (15)
Science and Technology	2.94% (2)	1.35% (1)	0.00% (0)	1.91% (3)
Ministry	8.82% (2)	14.86% (11)	26.67% (4)	13.38% (21)
Other ³	4.41% (3)	6.76% (5)	0.00% (0)	5.10% (8)
All	43.31% (68)	47.13% (74)	9.56% (15)	100% (157)

Data are shown as a percentage of totals (actual number of those responding).

¹Animal health was described as “Animal health (such as animal or livestock disease research, diagnostics, surveillance, control, or reporting)”.

²Public Health was described as “Public health (such as human disease research, diagnostics, surveillance, control or reporting).

³“Other” responses included: “Capacity building”, “Administration”, “Vaccine Production”, “University” (could be reclassified as higher education), “Kevevapi” (could be reclassified as animal health), “Both animal health and public health in higher education training institution” (could be reclassified as Higher Education), “I work at ministry of health at managerial level” (could be reclassified as Ministry) and “Blood Transfusion Service” (could be reclassified as Public Health). Upon reclassification, Animal Health increases to 27.4%, Public Health to 43.9%, Higher Education to 10.8% and Ministry to 14.0%, while Other decreases to 1.9% overall.

3.2. Evidence of BRM Systems in Region

All respondents were asked whether their country had a national bill or law in place for biosafety. Similarly, they were asked about a bill or law for biosecurity. We know that bills are in place in both Uganda and Kenya, although neither country has a law in place other than the biosafety policy or law that governs genetically modified organisms and primarily relates to agriculture. Nevertheless, a majority of Ugandans and Kenyans answered “No” or “I don’t know” (Table 2).

All respondents were asked to identify whether their institute had particular elements indicative of a biorisk management system. The results are shown in Figure 1. Considering all the respondents irrespective of nationality, less than half of those answering the survey indicated that documented biosafety or biosecurity risk assessments are in place at their institute, nor are regular audits or inspections for biorisk management performance or an institutional biorisk management policy. Those working outside of Kenya or Uganda are small in number and far fewer report that indicators of BRM systems are in place at their institutes.

Table 2: Responses to “Does your country have a national bill or law in place for biosafety/biosecurity?”

	Kenya	Uganda	Others
Laboratory Biosafety			
Yes	55.88% (38)	42.65% (29)	6.67% (1)
No	36.84% (21)	45.61% (26)	66.67% (10)
I don’t know	28.13% (9)	59.38% (19)	26.67% (4)
Laboratory Biosecurity			
Yes	55.77% (29)	44.23% (23)	0.00% (0)
No	39.34% (24)	44.26% (27)	66.66% (10)
I don’t know	34.09% (15)	54.55% (24)	33.33% (5)

Data are shown as a percentage of totals (actual number of those responding).

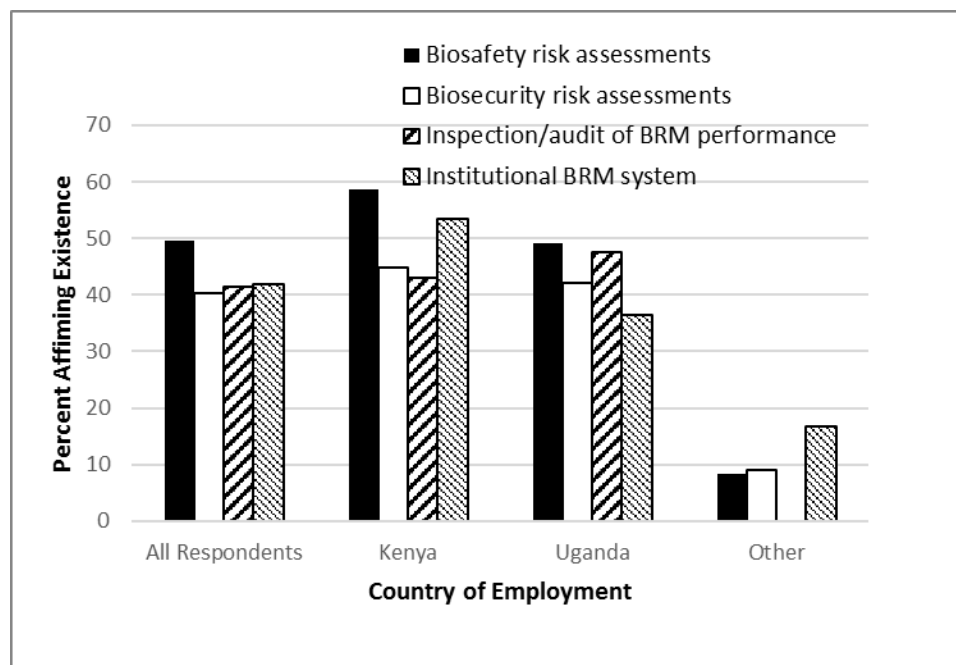


Figure 1: Percentage of Respondents Affirming that the specific BRM system indicators listed were in place in their institution.

All respondents (n = 133- 136) include those working in all countries surveyed. Those working in Kenya (n = 58), Uganda (n = 63 – 66) or Others (Cameroon, DRC, Ethiopia, Rwanda and Tanzania, n = 11 – 12) are shown separately. 0/12 from countries other than Uganda or Kenya reported that Inspection/audit of BRM performance was in place in their institute.

3.3. Risks and Associated Biosafety and Biosecurity Practices

All trainers (n = 75) and the majority (61 – 69/75) of non-trainers answered questions about the activities they undertook in the laboratory. Table 3 shows the pathogens (or toxins) that are handled in those laboratories.

In addition to identifying the types of pathogens handled (or presence of toxins) at their institutes, both the trainers and non-trainers were asked how often they practiced (non-trainers) or observed being practiced (trainers) certain biosafety and biosecurity practices. All the data is shown both as all respondents (Total), as well as stratified by certain sectors identified (Animal Health, Public health, etc.) in Table A-1 (see Appendix). Select data is shown graphically in addition in Figures 2 – 5, without stratification by sector.

Table 3: Pathogens Handled, Stored or Transported to/from the Institute

Pathogens handled, stored or transported to/from the institute	Trainers (n = 75)	Non-trainers (n = 66)
Bacteria affecting animals	44.00% (33)	36.36% (24)
Bacteria affecting humans	57.33% (43)	60.61% (40)
Bacteria affecting both animals and humans	58.67% (44)	42.42% (28)
Vaccine-preventable bacteria	46.67% (35)	33.33% (22)
Human Immunodeficiency virus (HIV)	52.00% (39)	43.94% (29)
Vaccine-preventable viruses	53.33% (40)	45.45% (30)
Viruses affecting animals	41.33% (31)	46.97% (31)
Viruses affecting humans	41.33% (31)	39.39% (26)
Viruses affecting both animals and humans	40.00% (30)	36.36% (24)
Toxins	32.00% (24)	16.67% (11)
None	1.33% (1)	0% (0)

Note that multiple selections were possible. Data are represented as percentage of trainers or non-trainers working with the indicated pathogens/toxins (actual number).

Figure 2 shows the response of both trainers and non-trainers when asked about specific biosafety practices such as “washing hands before leaving the laboratory” (panel A) and “using a sharps container” (panel B). Figure 3 shows their responses when asked about specific biosecurity practices such as “locking pathogen storage areas” (panel A) and “checking that persons are authorized to enter” (panel B).

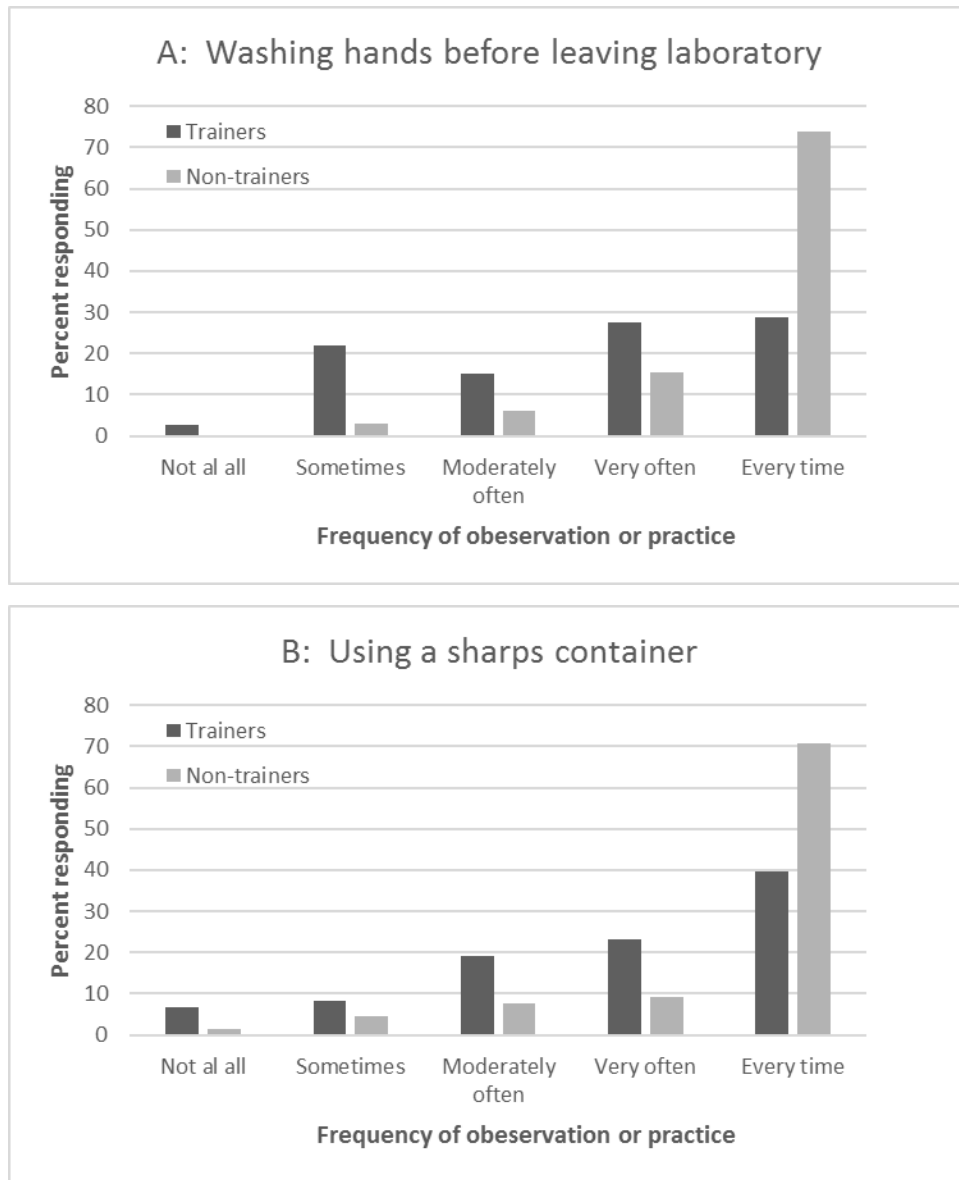


Figure 2: Frequency of Adhering to Biosafety Practices

Trainers (black bars) and non-trainers (grey bars) reported on the frequency that they observed others adhering to or adhered to, respectively, the biosafety practice specified (A: washing hands before leaving the laboratory and B: using a sharps container).

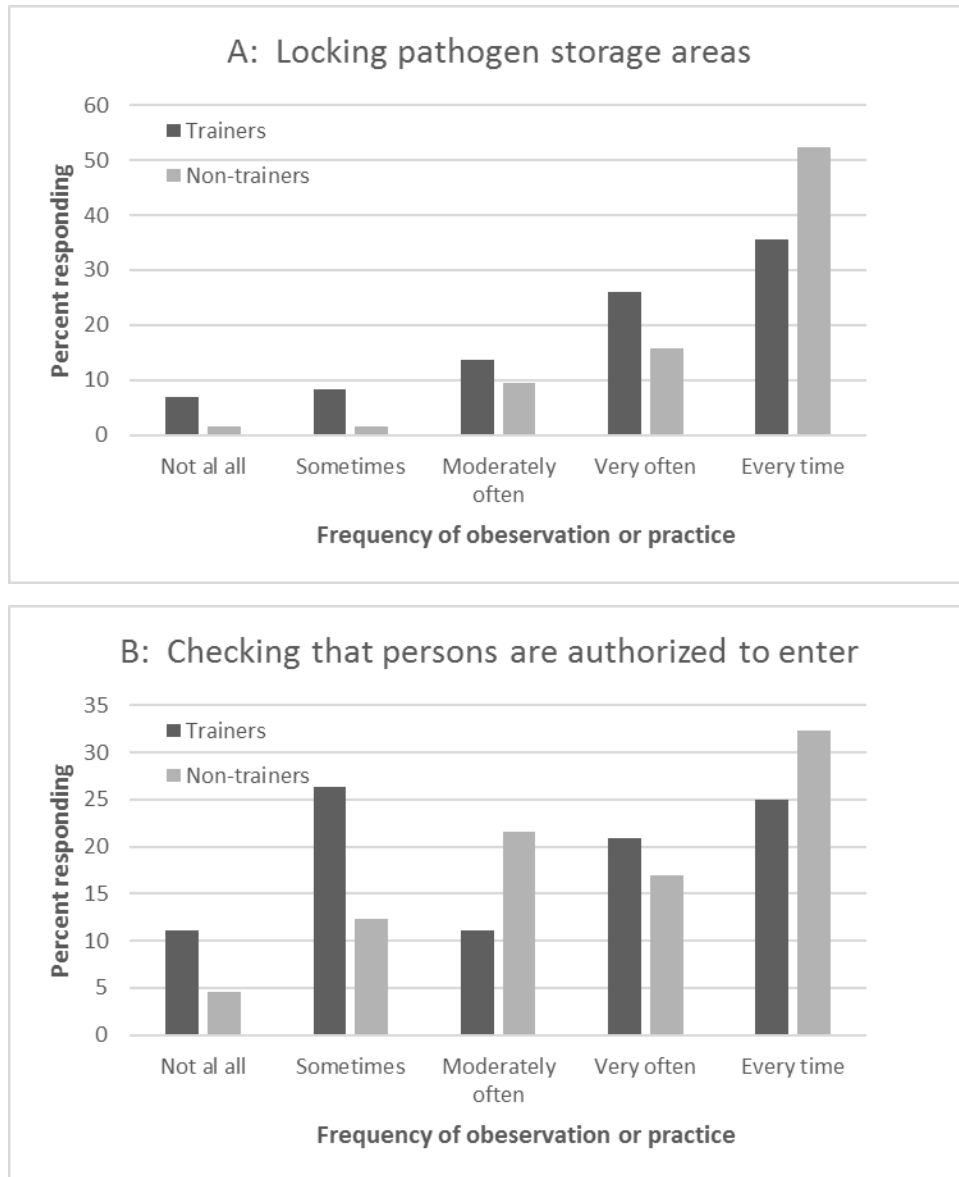


Figure 3: Frequency of Adhering to Biosecurity Practices

Trainers (black bars) and non-trainers (grey bars) reported on the frequency that they observed others adhering to or adhered to, respectively, the biosecurity practice specified (A: locking pathogen storage areas and B: checking that persons were authorized to enter).

The data in Figures 2 and 3 (and Table A-1) show that non-trainers reported adhering to the biosafety and biosecurity practices more often than the trainers reported observing them doing so (compare the higher percentage of non-trainers reporting “every time” and the lower percentage reporting “sometimes” or “not at all” to the responses of trainers). Table A-1 confirms this trend across the majority of biosafety and biosecurity practices listed, with the exception of “reporting an incident (spill, needle prick, loss of sample, unauthorized access, etc.)”.

When considering all sectors combined (Total), the most frequently practiced habit by non-trainers (followed “Every time”) was “Washing hands before leaving the laboratory” (73.85%), followed closely by “Using a sharps container” (70.77%) and “Using waste bins for segregating waste” (69.23%; see Table A-1). The least frequent habit being observed by the non-trainers was “Reporting an incident (spill, needle prick, loss of sample, unauthorized access, etc.)” with only 16.92% of respondents reporting that they did so “Every time” (see Table A-1). Similarly, trainers reported that they observed this practice being observed only 16.44% of the time, while observing most frequently “Using waste bins for segregating waste” (54.05% observing it being practiced “Every time”).

Figures 4 and 5, and Table A-1, show the observance of biosafety and biosecurity practices by both the trainers and non-trainers, stratified on whether BRM trainings are conducted at their institute.

When all the results were stratified based on whether BRM Training was conducted at the institute or not (rather than sector), trainers reported in almost every case (see Figures 4 and 5, and Table A-1) that the practices were more frequently observed in institutes where BRM trainings took place. This trend was not observed, however, when data from the non-trainers were analyzed, as they reported very similar results for the most part independent of whether BRM training took place at their institute or not.

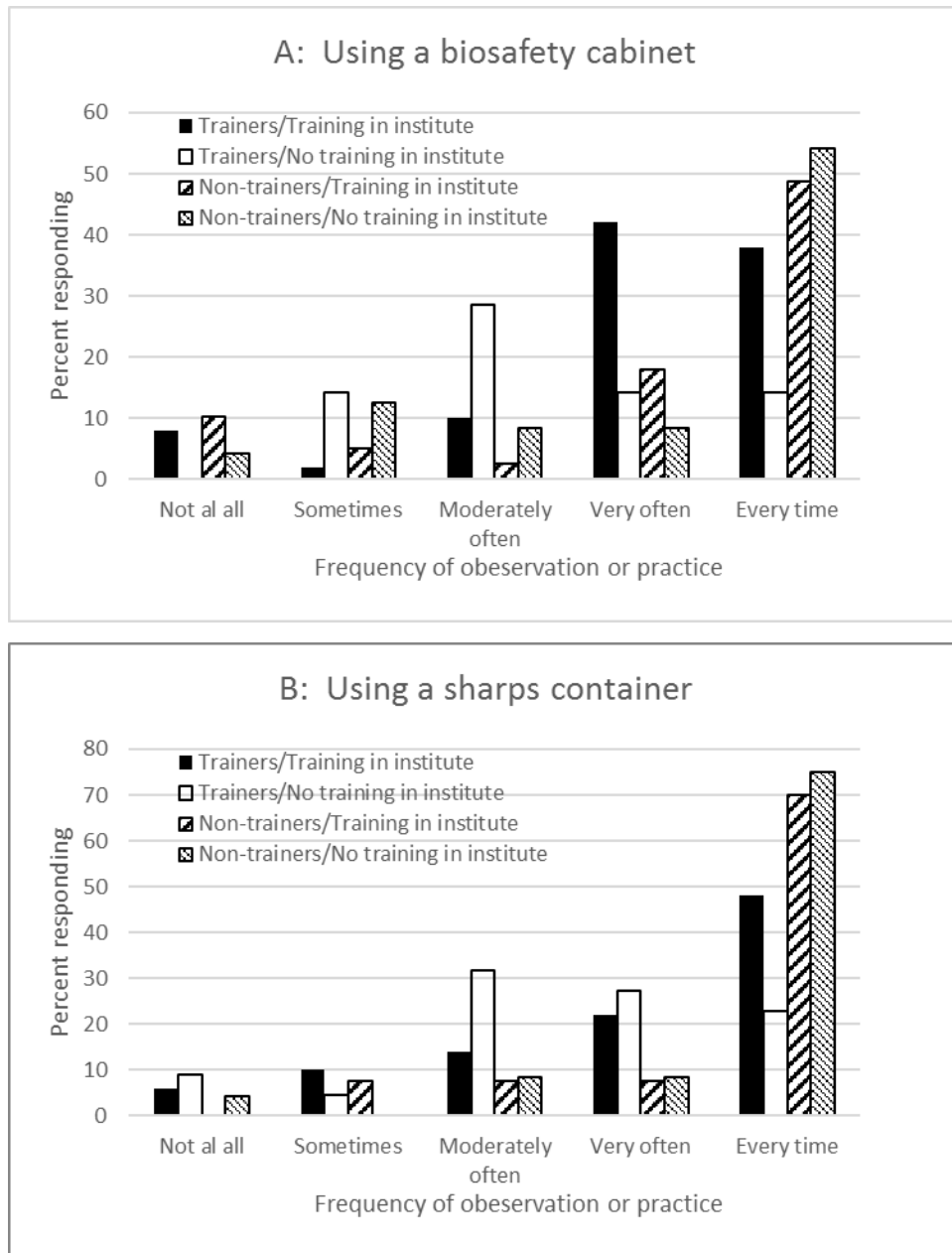


Figure 4: Adherence to Biosafety Practices Stratified by Institute BRM Training

Trainers (filled bars) and non-trainers (hatched bars) reported on the frequency that they observed others adhering to or adhered to, respectively, the biosafety practice specified (A: using a biosafety cabinet and B: using a sharps container). The data is further stratified on whether BRM trainings are conducted at their institute (black and broad diagonal) or not (white and narrow diagonal).

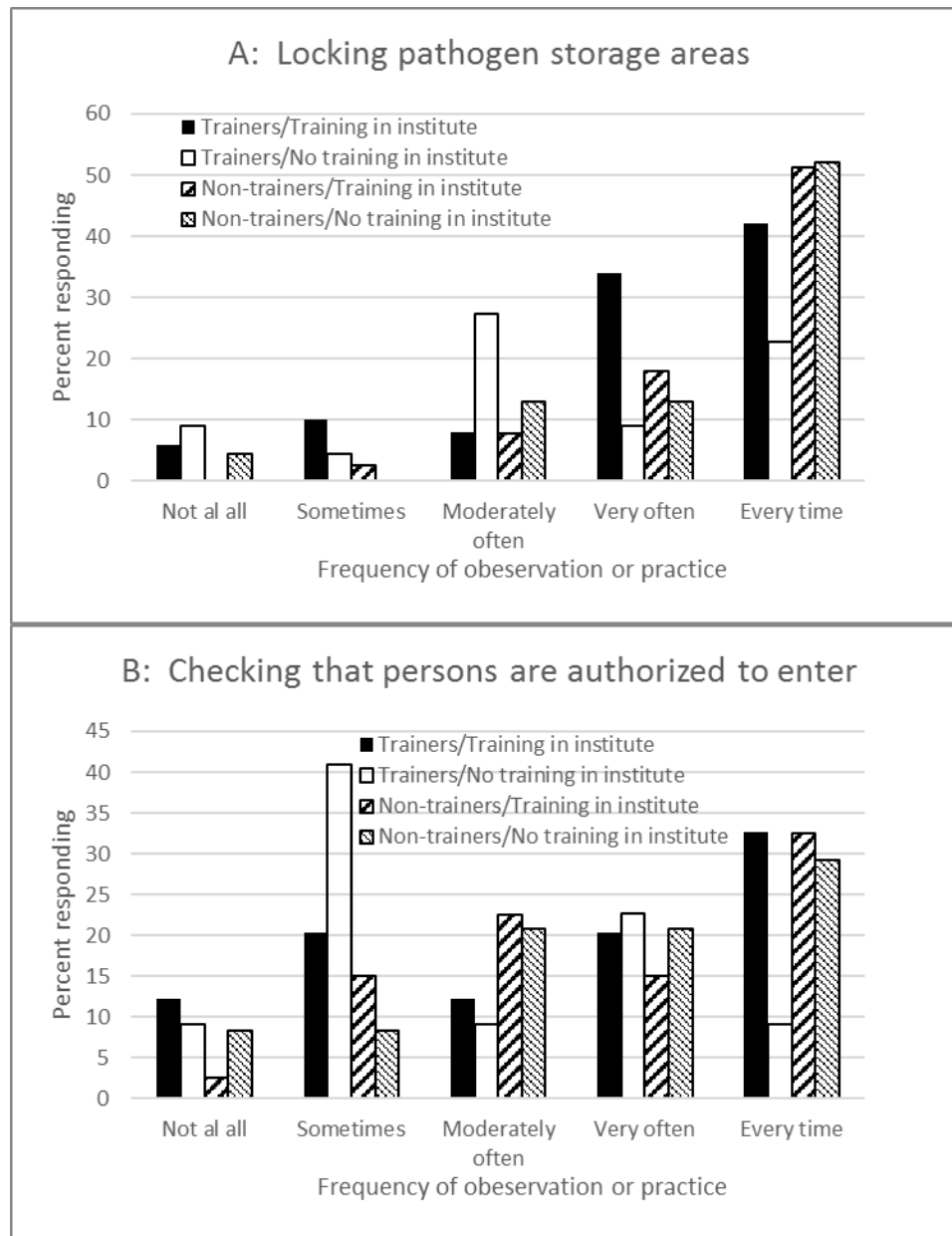


Figure 5: Adherence to Biosecurity Practices Stratified by Institute BRM Training

Trainers (filled bars) and non-trainers (hatched bars) reported on the frequency that they observed others adhering to or adhered to, respectively, the biosecurity practice specified (A: locking pathogen storage areas and B: checking that persons are authorized to enter). The data is further stratified on whether BRM trainings are conducted at their institute (black and broad diagonal) or not (white and narrow diagonal).

3.4 Reported BRM Training Needs

Both the trainers and non-trainers were presented with examples of biorisk management training topics and asked to rank either their perception of the institute's BRM training needs from highest need to lowest need amongst those topics (Trainers) or their own perceived need for the topic (Non-trainers). Topics that were ranked as highest need received a score of 5 points per number of trainers ranking it at that level, whereas those ranked as least benefit received a score

of 1 point, with the remaining responses receiving scores of 4, 3 or 2. Total scores were then divided by the number of respondents choosing to rank each statement for a weighted average. Figures 6 and 7 (and Tables A-2 and A-3 in the Appendix) show the results stratified by the respondents' self-identified sector in addition to no stratification (All respondents).

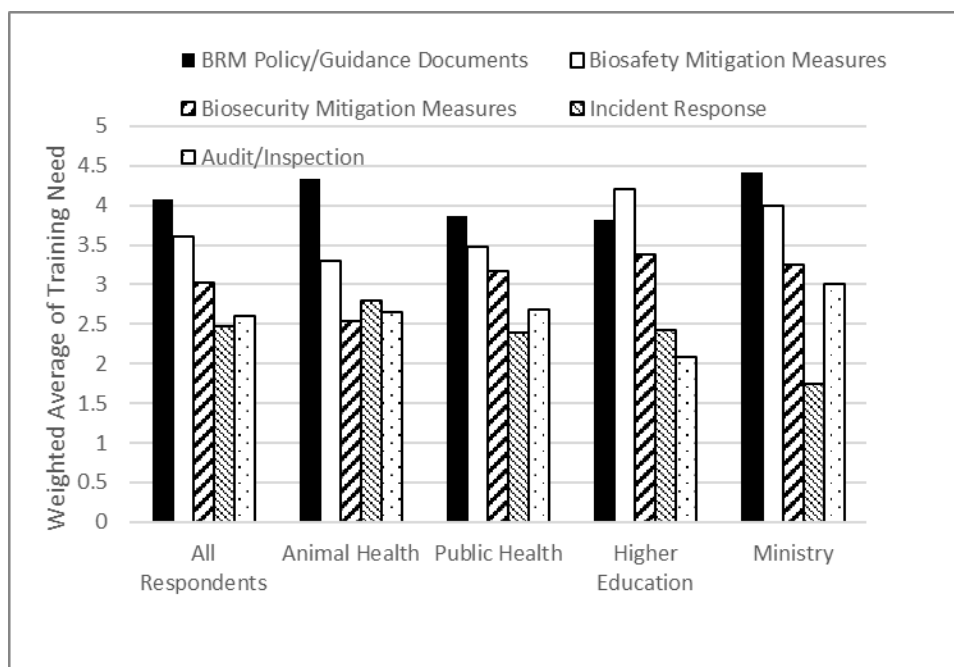


Figure 6: Ranking of BRM Training Needs by Trainers

Trainers ranked the indicated BRM training needs (see legend) from highest need (5) to lowest need (1) for their institute. A weighted average was calculated based on the percentage of respondents ranking each training topic from lowest – highest need (1 – 5). Data are shown both without (All Respondents) and with stratification by self-identified sector.

The data reveal that “Developing policy or guidance documents” was ranked as the highest training need amongst the options given for trainers in three of the four sectors, with only Higher Education trainers identifying “Advanced biosafety risk assessment methods and tools for mitigation” as the highest training need (Figure 6). When trainer sector is not considered (All respondents), “Developing policy or guidance documents” was identified as the highest training need. Trainers in the four sectors varied when ranking the BRM topic to be of “lowest need” at their institute. Trainers from the Animal Health sector ranked “Advanced biosecurity risk assessment methods and tools for mitigation” as the lowest training need, whereas those from the both the Public Health sector and Ministry viewed “Development and practice of incident recognition, response and management” as the lowest training need (resulting in a ranking of “lowest need” overall for the latter when the trainers were not stratified by sector). Higher Education trainers considered training on “Developing audit and inspection tools for biorisk management performance” to be of lowest need in their institutes.

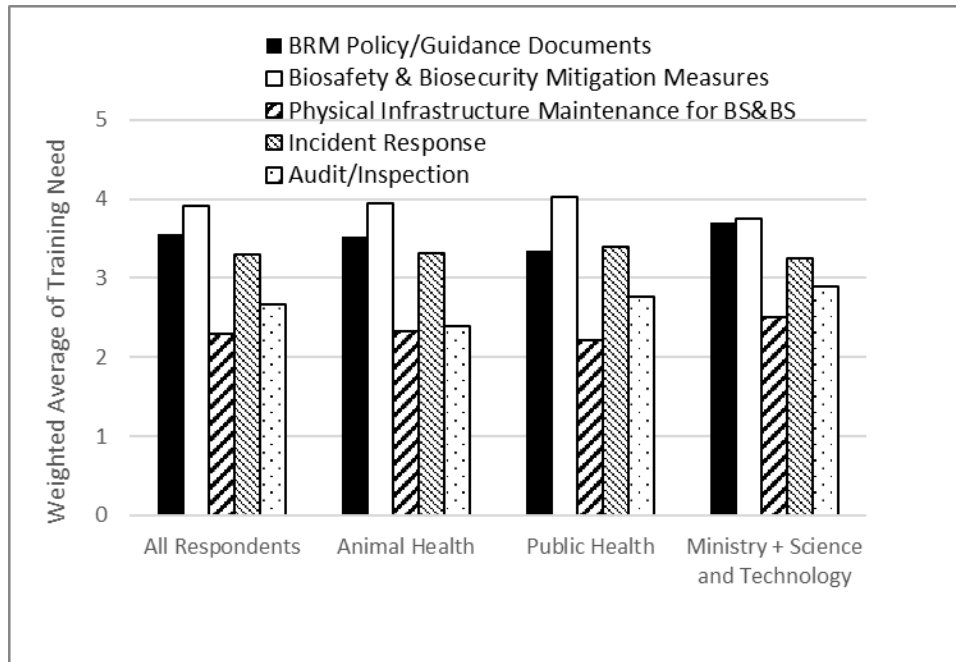


Figure 7: Ranking of BRM Training Needs by Non-trainers

Non-trainers ranked the indicated BRM training needs (see legend) from highest need (5) to lowest need (1) for their own learning. A weighted average was calculated based on the percentage of respondents ranking each training topic from lowest – highest need (1 – 5). Data are shown both without (All Respondents) and with stratification by self-identified sector. Due to the low number of respondents in the Science and Technology sector, they were combined with the Ministry sector.

When the non-trainers were asked a similar question about their own perceived training needs, and ranked the given options from “Need first” to “Need later”, the training indicated as being needed first was “Biosafety and biosecurity risk assessment methods and tools for mitigation” for all sectors (Figure 7, Table A-3).

Note that in the question presented to the non-trainers, the need for biosafety and biosecurity risk assessment methods and mitigation tools was combined into a single topic, as opposed to the two separate questions presented to the trainers. The training topic identified as being the least urgent need by the non-trainers was “Methods for maintaining physical infrastructure to support biosafety and biosecurity”.

3.5 BRM Training Metrics

As noted above, 75 of the 82 respondents who identified themselves as trainers, answered questions specific to their experience conducting trainings. 43/75 (57.3%) reported that they had conducted BRM trainings either on their own or with a co-trainer in the previous year. Of those 43, 32 (74.4%) responded that they had conducted training outside of their own institutes. Thirty-seven (37) of the trainers reported on how many trainings they conducted in the past year and how many participants they had trained. Table 4 shows the data.

Table 4: BRM Training Metrics (Over Previous Year)

	Minimum # Reported	Maximum # Reported	Sum	Mean
BRM Trainings delivered	1	22	138	3.73
Participants trained	2	500	1,538	95.62

Trainings reported were delivered by 37 BRM trainers in the previous year.

When queried about which instructional resource material the trainers used, 65% reported that they used the Global Biorisk Management Curriculum (GBRMC), developed for DTRA and curated by SNL/IBCTR. Table 5 shows the data. BRM trainers (n = 41) reported training on topics such as laboratory biosafety (78%), laboratory biosecurity (56%) and basic BRM terminology and skills (51%). They reported training a diverse group of trainees ranging from management, staff, and students (Table 6).

Table 5: Use of BRM Curricula

Instructional Resource	Number of respondents	Percent
Global Biorisk Management Curriculum (GBRMC/SNL)	28	65%
Biorisk Management Laboratory Biosecurity Guidance (WHO)	17	40%
World Animal Organisation (OIE)	7	16%
Biosafety in Microbiological and Biomedical Laboratories (BMBL/CDC)	6	14%
Other	6	14%

43 trainers responded and could check more than one answer.

Table 6: BRM Trainee Job Classifications

Classification of Trainee	Number of respondents	Percent
Management staff	14	33%
Laboratory staff	35	83%
Laboratory support staff (such as cleaners, drivers, facility engineers)	14	33%
Administrative staff	5	12%
Field Veterinarians	6	14%
Undergraduate students	11	26%
Graduate students	10	24%

42 trainers responded and could check more than one answer.

Trainers were next asked how frequently they used several good practices that were emphasized during their Training Development Program. Table 7 shows the results. Other than documenting participant satisfaction with the training at the conclusion of the training, the other practices are being observed “every time” by less than 30% of the trainers.

Table 7: Trainers' Use of Good Training Practices

Factor	Rarely	Infrequently	Some of the time	Most of the time	Every time
Document participant satisfaction at conclusion of training	18.92% (7)	5.41% (2)	10.81% (4)	32.43% (12)	32.43% (12)
Document participant BRM behavior after training	10.81% (4)	24.32% (9)	21.62% (8)	27.03% (10)	16.22% (6)
Discuss training needs prior to the training with management	10.81% (4)	5.41% (2)	27.03% (10)	29.73% (11)	27.03% (10)
Discuss training outcomes with management	22.22% (8)	13.89% (5)	22.22% (8)	22.22% (8)	19.44% (7)

Data are presented as percentage responding (total number responding).

Overall, 68.9% of trainers report that BRM trainings are conducted at their institute, while only 57.5% of non-trainers queried report such.

3.6 Identification of Desired BRM Support by Trainees

Trainers were asked to rank various types of support from highest to lowest benefit when considering how each would enable their success as a BRM trainer (Table 8; “Please rank the following from highest to lowest benefit to you to enable your success as a biorisk management trainer.”) Responses that were ranked as highest benefit received a score of 4 points per number of trainers ranking it at that level, whereas those ranked as least benefit received a score of 1 point, with the remaining responses receiving scores of 3 or 2. Total scores were then divided by the number of respondents choosing to rank each statement for a weighted average. “Coaching from or co-training with an expert trainer” received the highest score with 29 of the 75 respondents ranking it as the support identified as providing the highest benefit. The other three options (see Table 8) were identified as providing slightly less benefit.

Table 8: Types of Support Identified as Providing the Highest benefit to BRM Trainers

Support type	Weighted Average (scale of 1 – 4)	Number of respondents
Coaching from or co-training with an expert trainer	3.09	54
Guidance in conducting training needs assessment and curriculum development	2.73	52
Institutional management support and authorization to train	2.51	63
Certification as a biorisk management trainer	2.40	67

Non-trainers were also asked to rank various statements as describing their highest to lowest need in enabling their success as BRM practitioners. Table 9 shows the results. Similar to the BRM trainers' identification of coaching from and co-training with BRM experts as being of highest benefit to them, the non-trainers identified coaching and mentoring from BRM experts to be of greatest need.

Table 9: Needs Identified by Non-Trainers as Providing the Highest Benefit

Support Type	Weighted Average (scale of 1 – 6)	Number of respondents
Coaching and Mentoring from BRM experts	4.74	57
Guidance in conducting training needs assessment and curriculum development	4.43	58
Institutional requirement for biorisk management	3.88	58
National requirement for biorisk management	3.42	62
Certification as a biorisk management practitioner	3.18	60
Networking with others with similar biorisk management needs	2.58	65

Both BRM trainers and non-trainers were asked what factors were important to them when considering attending a BRM training course. Table 10 shows the results. Respondents favored BRM training delivered as part of a professional conference, and nearly half indicated that it was either extremely or very important that their fellow trainees would be from their own sector. Conversely, respondents did not believe that having trainers or fellow trainees from their own country was of significant importance.

The great majority of both trainers (82.4%) and non-trainers (79.7%) noted that they belonged to a professional society when queried, and reported membership to such organizations as the African Biological Safety Association, American Society for Microbiology, the East and South African Laboratory Managers' Association, veterinary associations and allied health associations. Ninety-nine percent of survey respondents indicated that they were either extremely likely (83%) or very likely (16%) to recommend BRM training to a colleague.

Table 10: Factors Influencing Attendance at BRM Courses

Factor	Extremely important	Very important	Moderately important	Slightly important	Not at all important
Participants are from my own sector	28% (40)	21% (30)	21% (30)	15% (22)	15% (22)
Participants are from my own institution	21% (30)	21% (30)	19% (27)	14% (20)	26% (37)
Participants from my own country regardless of sector	18% (26)	23% (33)	15% (21)	13% (19)	31% (44)
Trainers from my own country	12% (17)	16% (23)	14% (20)	10% (14)	48% (68)
As part of a professional conference	34% (48)	31% (44)	15% (22)	10% (14)	10% (15)

Data are presented as percentage responding (total number responding).

4. DISCUSSION

This is the first BRM practices and training needs survey done by CBEP/SNL in the region. The average percentage of a population responding to an unsolicited online survey has been estimated to be 10 – 15%¹. In contrast, this survey received a relatively high response rate of 47% suggesting that many BRM trainees recognized the value of their BRM training and were motivated to provide input and feedback regarding their current BRM practices and future BRM training needs.

4.1. Evidence of BRM System Implementation

Key Message: Less than 50% of survey respondents report that their institute has evidence of a biorisk management system in place.

Over 90% of the survey respondents were from Kenya and Uganda, reflecting the fact that these two countries in East Africa have been engaged for the longest period of time by DTRA/CBEP and SNL. Both Kenya and Uganda currently have biosafety and/or biosecurity bills moving through their respective parliament committees, a fact that approximately half of Kenyan and Ugandan survey respondents failed to recognize when asked whether this was the case (“Does your country have a national bill or law in place for biosafety/biosecurity?”; see Table 2). Similarly, slightly less than half of survey respondents reported that their institute had documented biosafety or biosecurity risk assessments, regular inspections or audits for BRM performance or an institutional BRM policy (Figure 1). When respondents working outside of Kenya and Uganda are considered, the percentage of respondents reporting that they have documented biosafety and biosecurity risk assessments, or regular inspection or audits for BRM performance at their institutes decreases greatly by comparison to those in Kenya or Uganda.

¹ <https://www.surveygizmo.com/survey-blog/survey-response-rates/>

This likely reflects the relative dearth of engagement by CBEP/SNL in these countries (Cameroon, DRC, Ethiopia, Rwanda, Tanzania) compared to Kenya and Uganda.

4.2. Adherence to BRM Best Practices

Key Message: A majority of survey respondents are practicing the desired biosafety and biosecurity behaviors, though no single behavior was either observed or reported to be practiced by more than 75% of the individuals “every time.”

Given that human and animal pathogens are routinely handled by the survey respondents (see Table 3), it was important to assess whether the respondents were adhering to common biosafety and biosecurity procedures. The survey asked BRM trainers to report on how often they observed their co-workers adhering to such procedures as “washing hands before leaving the laboratory” and “locking pathogen freezers, refrigerators and rooms” while non-trainers self-reported on such (see Figures 2 – 5, and Tables A-1 – A-2 in the appendix).

Not unexpectedly, non-trainer respondents reported adhering to the biosafety and biosecurity practices more often than the BRM trainers reported observing them to do so. Furthermore, when the data are stratified by whether BRM trainings are conducted within the institute at which the trainers work, the trainers report observing the desired behaviors more often in almost every case (Figures 4 and 5, Table A-1). By contrast, the frequency of adherence to biosafety and biosecurity practices reported by non-trainers is not affected by whether BRM trainings are conducted in their institute or not.

The biosafety/biosecurity practice least observed by trainers or practiced by non-trainers was “Reporting an incident (spill, needle prick, loss of sample, unauthorized access, etc.)”. This is an area of concern and adherence to these practices should be emphasized in future trainings. The reluctance to report incidents, however, is not surprising in a culture dominated by strict lines of authority and may be in part due to fear of reprisal upon reporting.

4.3. BRM Trainer Metrics

Key Message: 37 trainers report training 1538 trainees in the previous one-year period, with the majority of them using the Global Biorisk Management Curriculum (GBRMC) as a resource.

Although only 57.3% of all self-reported trainers were actively training (as defined by delivering training independently or as a co-trainer within 1 year of survey delivery), a highly encouraging finding of the survey was that 37 BRM trainers reported training over 1500 trainees in that time frame, with 74% of them reporting training outside of their own institute. This finding supports our contention that BRM capacity is best built by training local trainers. As SNL only held one event in the region in the year previous to the survey which involved regional co-trainers, it can be assumed that the vast majority of the trainees were trained in the absence of SNL trainers. The exact number of trainees is difficult to assess due to the fact that some trainers reported numbers such as “>400” or “I do not remember”. Finally, we do not know that the >1500 trainees are unique. Some trainers may have trained the same individuals in different subjects. In addition, in the case of co-trainers, if each co-trainer counted their trainees and reported them individually, there may be an inflation of trainee number. Nevertheless, these uncertainties do not significantly reduce the impact of 37 BRM trainers training so many individuals in the region.

The majority (65%) of trainers reported using GBRMC as a resource for their training. They also report training management, staff and students on both biosafety and biosecurity topics. One concern is that <30% report discussing the training needs or outcomes with management, a practice which they have been trained to do for best results. This should be an area of emphasis in future Trainer Development Programs in the region, and should also be emphasized in remote mentoring sessions with current trainers.

4.4. Reported Needs for Additional Mentoring and Training

Key Message: Trainers report that coaching from or co-training with expert trainers will best enable their success, while trainees identify coaching and mentoring from BRM experts as their greatest need.

Trainers identified “Coaching from or co-training with an expert trainer” as being of the highest benefit to enable their success as a BRM trainer. Non-trainers similarly identified “Coaching and mentoring from BRM experts” as their greatest need. These data confirm that mentoring should be a key objective of BRM capacity building. Mentoring of biosafety officers, biosecurity officers and BRM trainers through networks such as biological safety associations, medical laboratory technician associations, and veterinarian associations is a mechanism by which sustainable professional development can be achieved.

When asked to identify the highest BRM training needs for their institutions, most trainers selected “Developing policy or guidance documents”. This is understandable as trainers would benefit in the hierarchical structure of their institutes if their roles were delineated and required by policy. Ironically, “Development and practice of incident recognition, response and management” was identified as the lowest training need by the trainers, despite their failure to observe frequent incident reporting. It cannot be discounted, however, that a failure to observe incident reporting by the trainers may relate to a low number of reportable incidents and if so, they may not view training on the topic to be of need.

By contrast, most non-trainers identified “Biosafety and biosecurity risk assessment methods and tools for mitigation” as their most urgent training need. This too is understandable given that they are working primarily in the laboratories where risks are greatest as opposed to spending at least part of their time in training arenas.

Key Message: The great majority of trainers (82%) and trainees (80%) belong to a professional society where anchoring training and expectations on BRM could be made more sustainable.

Survey respondents indicated that they would favor receiving training within their own sector, and as part of a professional conference, regardless of whether their fellow trainees or trainers were from their own country or not.

5. SUMMARY

In summary, the Biorisk Management Practices and Training Needs Survey provided a snapshot of the current status of BRM practices and perceived needs from respondents in Kenya, Uganda, Ethiopia, Tanzania, Rwanda and Cameroon. The majority of respondents were from Kenya and

Uganda, the two countries which have had the longest history of CBEP/SNL engagement in the region.

Some trainers surveyed were successful at delivering BRM trainings to large numbers of trainees from diverse sectors. Mentoring and professional development are integral methods to sustain BRM capacity. Professional societies are potential mechanisms to leverage for mentorship and professional development.

Regular administration of a BRM practices and training needs survey would allow for monitoring of performance, adjustment of engagement strategies, and provision of data for end state goals. It will be interesting to monitor the effect of eventual passage of biosecurity legislation in Kenya and Uganda, as well as the impact of Global Health Security Initiatives in East Africa, by surveying the same population periodically.

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APPENDIX A

Table A-1: Biosafety and Biosecurity Practices Observed/Practiced							
Washing hands before leaving the laboratory		Not at all	Sometimes	Moderately often	Very often	Every time	N/A
Animal Health	Trainers	5.00% (1)	25.00% (5)	15.00% (3)	25.00% (5)	30.00% (6)	0.00% (0)
	Non-Trainers	0.00% (0)	0.00% (0)	5.26% (1)	15.79% (3)	73.68% (14)	5.26% (1)
Public Health	Trainers	3.33% (1)	16.67% (5)	16.67% (5)	23.33% (7)	33.33% (10)	6.67% (2)
	Non-Trainers	0.00% (0)	3.03% (1)	3.03% (1)	6.06% (2)	87.88% (29)	0.00% (0)
Higher Education	Trainers	0.00% (0)	30.77% (4)	7.69% (1)	30.77% (4)	23.08% (3)	7.69% (1)
	Non-Trainers	0.00% (0)	0.00% (0)	100.0% (1)	0.00% (0)	0.00% (0)	0.00% (0)
Ministry	Trainers	0.00% (0)	22.22% (2)	22.22% (2)	33.33% (3)	22.22% (2)	0.00% (0)
	Non-Trainers	0.00% (0)	16.67% (1)	0.00% (0)	66.67% (4)	16.67% (1)	0.00% (0)
Total	Trainers	2.74% (2)	21.92% (16)	15.07% (11)	27.40% (20)	28.77% (21)	4.11% (3)
	Non-Trainers	0.00% (0)	3.08% (2)	6.15% (4)	15.38% (10)	73.85% (48)	1.54% (1)
BRM trainings are conducted in the institute	Trainers	4.00% (2)	24.00% (12)	14.00% (7)	28.00% (14)	30.00% (15)	0.00% (0)
	Non-Trainers	0.00% (0)	5.00% (2)	5.00% (2)	20.00% (8)	67.50% (27)	2.50% (1)
BRM trainings are not conducted in my institute	Trainers	0.00% (0)	18.18% (4)	18.18% (4)	27.27% (6)	27.27% (6)	9.09% (2)
	Non-Trainers	0.00% (0)	0.00% (0)	8.33% (2)	8.33% (2)	83.33% (20)	0.00% (0)
Locking pathogen storage building, rooms, or freezers		Not at all	Sometimes	Moderately often	Very often	Every time	N/A
Animal Health	Trainers	5.00% (1)	5.00% (1)	20.00% (4)	30.00% (6)	40.00% (8)	0.00% (0)
	Non-Trainers	0.00% (0)	0.00% (0)	5.26% (1)	10.53% (2)	63.16% (12)	21.05% (4)
Public Health	Trainers	10.00% (3)	6.67% (2)	6.67% (2)	30.00% (9)	40.00% (12)	6.67% (2)
	Non-Trainers	0.00% (0)	0.00% (0)	9.68% (3)	22.58% (7)	48.39% (15)	19.35% (6)
Higher Education	Trainers	7.69% (1)	15.38% (2)	15.38% (2)	7.69% (1)	23.08% (3)	30.77% (4)
	Non-Trainers	0.00% (0)	0.00% (0)	100.0% (1)	0.00% (0)	0.00% (0)	0.00% (0)
Ministry	Trainers	0.00% (0)	11.11% (1)	22.22% (2)	22.22% (2)	33.33% (3)	11.11% (1)
	Non-Trainers	0.00% (0)	16.67% (1)	0.00% (0)	16.67% (1)	50.00% (3)	16.67% (1)
Total	Trainers	6.85% (5)	8.22% (6)	13.70% (10)	26.03% (19)	35.62% (26)	9.59% (7)
	Non-Trainers	1.59% (1)	1.59% (1)	9.52% (6)	15.87% (10)	52.38% (33)	19.05% (12)
BRM trainings are conducted in the institute	Trainers	6.00% (3)	10.00% (5)	8.00% (4)	34.00% (17)	42.00% (21)	0.00% (0)
	Non-Trainers	0.00% (0)	2.56% (1)	7.69% (3)	17.95% (7)	51.28% (20)	20.51% (8)

BRM trainings are not conducted in my institute	Trainers	9.09% (2)	4.55% (1)	27.27% (6)	9.09% (2)	22.73% (5)	27.27% (6)
	Non-Trainers	4.35% (1)	0.00% (0)	13.04% (3)	13.04% (3)	52.17% (12)	17.39% (4)
Checking for all authorization before entry into facility		Not at all	Sometimes	Moderately often	Very often	Every time	N/A
Animal Health	Trainers	20.00% (4)	15.00% (3)	15.00% (3)	25.00% (5)	25.00% (5)	0.00% (0)
	Non-Trainers	5.26% (1)	10.53% (2)	15.79% (3)	15.79% (3)	36.84% (7)	15.79% (3)
Public Health	Trainers	3.33% (1)	36.67% (11)	10.00% (3)	13.33% (4)	30.00% (9)	6.67% (2)
	Non-Trainers	3.03% (1)	9.09% (3)	27.27% (9)	21.21% (7)	33.33% (11)	6.06% (2)
Higher Education	Trainers	23.08% (3)	15.38% (2)	7.69% (1)	30.77% (4)	7.69% (1)	15.38% (2)
	Non-Trainers	0.00% (0)	100.00% (1)	0.00% (0)	0.00% (0)	0.00% (0)	0.00% (0)
Ministry	Trainers	0.00% (0)	37.50% (3)	12.50% (1)	12.50% (1)	37.50% (3)	0.00% (0)
	Non-Trainers	0.00% (0)	16.67% (1)	16.67% (1)	16.67% (1)	16.67% (1)	33.33% (2)
Total	Trainers	11.11% (8)	26.39% (19)	11.11% (8)	20.83% (15)	25.00% (18)	5.56% (4)
	Non-Trainers	4.62% (3)	12.31% (8)	21.54% (14)	16.92% (11)	32.31% (21)	12.31% (8)
BRM trainings are conducted in the institute	Trainers	12.24% (6)	20.41% (10)	12.24% (6)	20.41% (10)	32.65% (16)	2.04% (1)
	Non-Trainers	2.50% (1)	15.00% (6)	22.50% (9)	15.00% (6)	32.50% (13)	12.50% (5)
BRM trainings are not conducted in my institute	Trainers	9.09% (2)	40.91% (9)	9.09% (2)	22.73% (5)	9.09% (2)	9.09% (2)
	Non-Trainers	8.33% (2)	8.33% (2)	20.83% (5)	20.83% (5)	29.17% (7)	12.50% (3)
Recording sample inventory		Not at all	Sometimes	Moderately often	Very often	Every time	N/A
Animal Health	Trainers	5.00% (1)	5.00% (1)	15.00% (3)	15.00% (3)	60.00% (12)	0.00% (0)
	Non-Trainers	0.00% (0)	5.26% (1)	5.26% (1)	21.05% (4)	47.37% (9)	21.05% (4)
Public Health	Trainers	6.67% (2)	10.00% (3)	16.67% (5)	13.33% (4)	46.67% (14)	6.67% (2)
	Non-Trainers	0.00% (0)	3.13% (1)	18.75% (6)	3.13% (1)	68.75% (22)	6.25% (2)
Higher Education	Trainers	15.38% (2)	38.46% (5)	0.00% (0)	7.69% (1)	15.38% (2)	23.08% (3)
	Non-Trainers	0.00% (0)	100.00% (1)	0.00% (0)	0.00% (0)	0.00% (0)	0.00% (0)
Ministry	Trainers	0.00% (0)	0.00% (0)	11.11% (1)	44.44% (4)	33.33% (3)	11.11% (1)
	Non-Trainers	0.00% (0)	16.67% (1)	16.67% (1)	0.00% (0)	50.00% (3)	16.67% (1)
Total	Trainers	6.85% (5)	12.33% (9)	12.33% (9)	17.81% (13)	42.47% (31)	8.22% (6)
	Non-Trainers	1.56% (1)	6.25% (4)	14.06% (9)	9.38% (6)	57.81% (37)	10.94% (7)
BRM trainings are conducted in the institute	Trainers	8.00% (4)	10.00% (5)	12.00% (6)	20.00% (10)	50.00% (25)	0.00% (0)
	Non-Trainers	0.00% (0)	5.00% (2)	12.50% (5)	10.00% (4)	60.00% (24)	12.50% (5)
BRM trainings are not conducted in my institute	Trainers	4.55% (1)	18.18% (4)	13.64% (3)	13.64% (3)	27.27% (6)	22.73% (5)
	Non-Trainers	4.35% (1)	8.70% (2)	17.39% (4)	8.70% (2)	52.17% (12)	8.70% (2)

Using a biosafety cabinet		Not at all	Sometimes	Moderately often	Very often	Every time	N/A
Animal Health	Trainers	5.00% (1)	10.00% (2)	15.00% (3)	50.00% (10)	20.00% (4)	0.00% (0)
	Non-Trainers	10.53% (2)	15.79% (3)	5.26% (1)	10.53% (2)	47.37% (9)	10.53% (2)
Public Health	Trainers	6.90% (2)	3.45% (1)	13.79% (4)	27.59% (8)	44.83% (13)	3.45% (1)
	Non-Trainers	3.03% (1)	3.03% (1)	6.06% (2)	18.18% (6)	57.58% (19)	12.12% (4)
Higher Education	Trainers	7.69% (1)	7.69% (1)	23.08% (3)	15.38% (2)	15.38% (2)	30.77% (4)
	Non-Trainers	100.00% (1)	0.00% (0)	0.00% (0)	0.00% (0)	0.00% (0)	0.00% (0)
Ministry	Trainers	0.00% (0)	0.00% (0)	11.11% (1)	33.33% (3)	33.33% (3)	22.22% (2)
	Non-Trainers	0.00% (0)	16.67% (1)	0.00% (0)	16.67% (1)	33.33% (2)	33.33% (2)
Total	Trainers	5.56% (4)	5.56% (4)	15.28% (11)	33.33% (24)	30.56% (22)	9.72% (7)
	Non-Trainers	7.81% (5)	7.81% (5)	4.69% (3)	14.06% (9)	51.56% (33)	14.06% (9)
BRM trainings are conducted in the institute	Trainers	8.00% (4)	2.00% (1)	10.00% (5)	42.00% (21)	38.00% (19)	0.00% (0)
	Non-Trainers	10.26% (4)	5.13% (2)	2.56% (1)	17.95% (7)	48.72% (19)	15.38% (6)
BRM trainings are not conducted in my institute	Trainers	0.00% (0)	14.29% (3)	28.57% (6)	14.29% (3)	14.29% (3)	28.57% (6)
	Non-Trainers	4.17% (1)	12.50% (3)	8.33% (2)	8.33% (2)	54.17% (13)	12.50% (3)
Using a sharps container		Not at all	Sometimes	Moderately often	Very often	Every time	N/A
Animal Health	Trainers	5.00% (1)	10.00% (2)	25.00% (5)	30.00% (6)	30.00% (6)	0.00% (0)
	Non-Trainers	0.00% (0)	0.00% (0)	15.79% (3)	21.05% (4)	52.63% (10)	10.53% (2)
Public Health	Trainers	3.33% (1)	10.00% (3)	10.00% (3)	23.33% (7)	53.33% (16)	0.00% (0)
	Non-Trainers	0.00% (0)	3.03% (1)	6.06% (2)	3.03% (1)	84.85% (28)	3.03% (1)
Higher Education	Trainers	23.08% (3)	0.00% (0)	38.46% (5)	15.38% (2)	7.69% (1)	15.38% (2)
	Non-Trainers	100.00% (1)	0.00% (0)	0.00% (0)	0.00% (0)	0.00% (0)	0.00% (0)
Ministry	Trainers	0.00% (0)	11.11% (1)	11.11% (1)	11.11% (1)	66.67% (6)	0.00% (0)
	Non-Trainers	0.00% (0)	16.67% (1)	0.00% (0)	0.00% (0)	66.67% (4)	16.67% (1)
Total	Trainers	6.85% (5)	8.22% (6)	19.18% (14)	23.29% (17)	39.73% (29)	2.74% (2)
	Non-Trainers	1.54% (1)	4.62% (3)	7.69% (5)	9.23% (6)	70.77% (46)	6.15% (4)
BRM trainings are conducted in the institute	Trainers	6.00% (3)	10.00% (5)	14.00% (7)	22.00% (11)	48.00% (24)	0.00% (0)
	Non-Trainers	0.00% (0)	7.50% (3)	7.50% (3)	7.50% (3)	70.00% (28)	7.50% (3)
BRM trainings are not conducted in my institute	Trainers	9.09% (2)	4.55% (1)	31.82% (7)	27.27% (6)	22.73% (5)	4.55% (1)
	Non-Trainers	4.17% (1)	0.00% (0)	8.33% (2)	8.33% (2)	75.00% (18)	4.17% (1)
Using an autoclave for decontamination of waste		Not at all	Sometimes	Moderately often	Very often	Every time	N/A
Animal Health	Trainers	14.29% (3)	4.76% (1)	14.29% (3)	19.05% (4)	47.62% (10)	0.00% (0)

	Non-Trainers	10.53% (2)	5.26% (1)	10.53% (2)	21.05% (4)	36.84% (7)	15.79% (3)
Public Health	Trainers	10.00% (3)	6.67% (2)	13.33% (4)	16.67% (5)	46.67% (14)	6.67% (2)
	Non-Trainers	9.68% (3)	0.00% (0)	6.45% (2)	19.35% (6)	61.29% (19)	3.23% (1)
Higher Education	Trainers	23.08% (3)	23.08% (3)	0.00% (0)	30.77% (4)	0.00% (0)	23.08% (3)
	Non-Trainers	0.00% (0)	0.00% (0)	0.00% (0)	100.00% (1)	0.00% (0)	0.00% (0)
Ministry	Trainers	11.11% (1)	0.00% (0)	11.11% (1)	33.33% (3)	44.44% (4)	0.00% (0)
	Non-Trainers	16.67% (1)	16.67% (1)	0.00% (0)	16.67% (1)	33.33% (2)	16.67% (1)
Total	Trainers	13.51% (10)	8.11% (6)	10.81% (8)	22.97% (17)	37.84% (28)	6.76% (5)
	Non-Trainers	9.52% (6)	3.17% (2)	7.94% (5)	19.05% (12)	50.79% (32)	9.52% (6)
BRM trainings are conducted in the institute	Trainers	11.76% (6)	7.84% (4)	9.80% (5)	19.61% (10)	49.02% (25)	1.96% (1)
	Non-Trainers	12.82% (5)	5.13% (2)	7.69% (3)	20.51% (8)	43.59% (17)	10.26% (4)
BRM trainings are not conducted in my institute	Trainers	18.18% (4)	9.09% (2)	13.64% (3)	31.82% (7)	13.64% (3)	13.64% (3)
	Non-Trainers	4.35% (1)	0.00% (0)	8.70% (2)	17.39% (4)	60.87% (14)	8.70% (2)
Using waste bins for segregating waste		Not at all	Sometimes	Moderately often	Very often	Every time	N/A
Animal Health	Trainers	14.29% (3)	4.76% (1)	14.29% (3)	19.05% (4)	47.62% (10)	0.00% (0)
	Non-Trainers	5.26% (1)	0.00% (0)	5.26% (1)	31.58% (6)	52.63% (10)	5.26% (1)
Public Health	Trainers	0.00% (0)	10.00% (3)	10.00% (3)	13.33% (4)	66.67% (20)	0.00% (0)
	Non-Trainers	0.00% (0)	0.00% (0)	3.03% (1)	9.09% (3)	84.85% (28)	3.03% (1)
Higher Education	Trainers	0.00% (0)	23.08% (3)	15.38% (2)	23.08% (3)	23.08% (3)	15.38% (2)
	Non-Trainers	0.00% (0)	0.00% (0)	100.00% (1)	0.00% (0)	0.00% (0)	0.00% (0)
Ministry	Trainers	0.00% (0)	0.00% (0)	11.11% (1)	11.11% (1)	77.78% (7)	0.00% (0)
	Non-Trainers	0.00% (0)	16.67% (1)	16.67% (1)	0.00% (0)	50.00% (3)	16.67% (1)
Total	Trainers	4.05% (3)	9.46% (7)	12.16% (9)	17.57% (13)	54.05% (40)	2.70% (2)
	Non-Trainers	3.08% (2)	1.54% (1)	6.15% (4)	15.38% (10)	69.23% (45)	4.62% (3)
BRM trainings are conducted in the institute	Trainers	5.88% (3)	11.76% (6)	3.92% (2)	15.69% (8)	62.75% (32)	0.00% (0)
	Non-Trainers	5.00% (2)	2.50% (1)	7.50% (3)	12.50% (5)	67.50% (27)	5.00% (2)
BRM trainings are not conducted in my institute	Trainers	0.00% (0)	4.55% (1)	31.82% (7)	22.73% (5)	36.36% (8)	4.55% (1)
	Non-Trainers	0.00% (0)	0.00% (0)	4.17% (1)	16.67% (4)	75.00% (18)	4.17% (1)
Preparing samples for transport		Not at all	Sometimes	Moderately often	Very often	Every time	N/A
Animal Health	Trainers	9.52% (2)	0.00% (0)	14.29% (3)	33.33% (7)	42.86% (9)	0.00% (0)
	Non-Trainers	5.26% (1)	10.53% (2)	31.58% (6)	21.05% (4)	15.79% (3)	15.79% (3)
Public Health	Trainers	3.33% (1)	16.67% (5)	16.67% (5)	23.33% (7)	33.33% (10)	6.67% (2)

	Non-Trainers	3.03% (1)	15.15% (5)	15.15% (5)	27.27% (9)	33.33% (11)	6.06% (2)
Higher Education	Trainers	15.38% (2)	30.77% (4)	7.69% (1)	15.38% (2)	0.00% (0)	30.77% (4)
	Non-Trainers	0.00% (0)	100.00% (1)	0.00% (0)	0.00% (0)	0.00% (0)	0.00% (0)
Ministry	Trainers	0.00% (0)	11.11% (1)	0.00% (0)	33.33% (3)	44.44% (4)	11.11% (1)
	Non-Trainers	16.67% (1)	0.00% (0)	0.00% (0)	50.00% (3)	0.00% (0)	33.33% (2)
Total	Trainers	6.76% (5)	13.51% (10)	12.16% (9)	27.03% (20)	31.08% (23)	9.46% (7)
	Non-Trainers	6.15% (4)	12.31% (8)	16.92% (11)	24.62% (16)	26.15% (17)	13.85% (9)
BRM trainings are conducted in the institute	Trainers	7.84 % (4)	3.92% (2)	13.73% (7)	31.37% (16)	39.22% (20)	3.92% (2)
	Non-Trainers	7.50% (3)	7.50% (3)	17.50% (7)	27.50% (11)	27.50% (11)	12.50% (5)
BRM trainings are not conducted in my institute	Trainers	4.55% (1)	36.36% (8)	9.09% (2)	18.18% (4)	13.64% (3)	18.18% (4)
	Non-Trainers	4.17% (1)	20.83% (5)	16.67% (4)	20.83% (5)	20.83% (5)	16.67% (4)
Reporting an incident (spill, needle prick, loss of sample, unauthorized access etc.)		Not at all	Sometimes	Moderately often	Very often	Every time	N/A
Animal Health	Trainers	10.00% (2)	10.00% (2)	30.00% (6)	30.00% (6)	20.00% (4)	0.00% (0)
	Non-Trainers	26.32% (5)	26.32% (5)	5.26% (1)	21.05% (4)	5.26% (1)	15.79% (3)
Public Health	Trainers	16.67% (5)	36.67% (11)	13.33% (4)	13.33% (4)	16.67% (5)	3.33% (1)
	Non-Trainers	21.21% (7)	9.09% (3)	12.12% (4)	27.27% (9)	27.27% (9)	3.03% (1)
Higher Education	Trainers	30.77% (4)	23.08% (3)	7.69% (1)	7.69% (1)	7.69% (1)	23.08% (3)
	Non-Trainers	0.00% (0)	100.00% (1)	0.00% (0)	0.00% (0)	0.00% (0)	0.00% (0)
Ministry	Trainers	0.00% (0)	22.22% (2)	11.11% (1)	44.44% (4)	22.22% (2)	0.00% (0)
	Non-Trainers	16.67% (1)	50.00% (3)	0.00% (0)	16.67% (1)	0.00% (0)	16.67% (1)
Total	Trainers	15.07% (11)	24.66% (18)	16.44% (12)	21.92% (16)	16.44% (12)	5.48% (4)
	Non-Trainers	21.54% (14)	21.54% (14)	7.69% (5)	23.08% (15)	16.92% (11)	9.23% (6)
BRM trainings are conducted in the institute	Trainers	12.00% (6)	26.00% (13)	16.00% (8)	28.00% (14)	16.00% (8)	2.00% (1)
	Non-Trainers	22.50% (9)	12.50% (5)	7.50% (3)	22.50% (9)	22.50% (9)	12.50% (5)
BRM trainings are not conducted in my institute	Trainers	22.73% (5)	22.73% (5)	18.18% (4)	9.09% (2)	18.18% (4)	9.09% (2)
	Non-Trainers	20.83% (5)	37.50% (9)	8.33% (2)	20.83% (5)	8.33% (2)	4.17% (1)

Data is presented as the percentage of the respondents replying in each category, as well the total number responding in that category (in parentheses).

Table A-2: Trainers' identification of their institute's BRM training needs						
	5 Highest need	4	3	2	1 Lowest need	Weighted Average (scale of 1 – 5)
Developing policy or guidance documents						
Animal Health	72.22% (13)	11.11% (2)	0.00% (0)	11.11% (2)	5.56% (1)	4.33
Public Health	52.17% (12)	21.74% (5)	4.35% (1)	4.35% (1)	17.39% (4)	3.87
Higher Education	54.55% (6)	9.09% (1)	18.18% (2)	0.00% (0)	18.18% (2)	3.81
Ministry	54.14% (4)	28.57% (2)	14.29% (1)	0.00% (0)	0.00% (0)	4.42
All respondents	60.00% (36)	16.67% (10)	6.67% (4)	5.00% (3)	11.67% (7)	4.08
Advanced biosafety risk assessment methods and tools for mitigation						
Animal Health	17.65% (3)	35.29% (6)	17.65% (3)	17.65% (3)	11.76% (2)	3.29
Public Health	17.39% (4)	43.48% (10)	17.39% (4)	13.04% (3)	8.80% (2)	3.48
Higher Education	60.00% (6)	10.00% (1)	20.00% (2)	10.00% (1)	0.00% (0)	4.20
Ministry	20.00% (1)	60.00% (3)	20.00% (1)	0.00% (0)	0.00% (0)	4.00
All respondents	25.45% (14)	36.36% (20)	18.18% (10)	12.73% (7)	7.27% (4)	3.60
Advanced biosecurity risk assessment methods and tools for mitigation						
Animal Health	5.88% (1)	0.00% (0)	47.06% (8)	35.29% (6)	11.76% (2)	2.53
Public Health	4.17% (1)	33.33% (8)	45.83% (11)	8.33% (2)	8.33% (2)	3.17
Higher Education	15.38% (2)	38.46% (5)	23.08% (3)	15.38% (2)	7.69% (1)	3.38
Ministry	25.00% (1)	25.00% (1)	25.00% (1)	0.00% (0)	25.00% (1)	3.25
All respondents	8.62% (5)	24.14% (14)	39.66% (23)	17.24% (10)	10.34% (6)	3.03
Development and practice of incident recognition, response and management						
Animal Health	5.26% (1)	31.58% (6)	21.05% (4)	21.05% (4)	21.05% (4)	2.79
Public Health	8.70% (2)	8.70% (2)	13.04% (3)	52.17% (12)	17.39% (4)	2.39
Higher Education	0.00% (0)	8.33% (1)	33.33% (4)	50.00% (6)	8.33% (1)	2.42
Ministry	0.00% (0)	0.00% (0)	25.00% (1)	25.00% (1)	50.00% (2)	1.75
All respondents	5.17% (3)	15.52% (9)	20.69% (12)	39.66% (23)	18.97% (11)	2.48
Developing audit and inspection tools for biorisk management performance						
Animal Health	10.00% (2)	30.00% (6)	15.00% (3)	5.00% (1)	40.00% (8)	2.65
Public Health	28.57% (8)	3.57% (1)	14.29% (4)	14.29% (4)	39.29% (11)	2.68
Higher Education	0.00% (0)	27.27% (3)	0.00% (0)	27.27% (3)	45.45% (5)	2.09
Ministry	28.57% (2)	14.29% (1)	0.00% (0)	42.86% (3)	14.29% (1)	3.00
All respondents	18.18% (12)	16.67% (11)	10.61% (7)	16.67% (11)	37.88% (25)	2.61

Table A-3: Trainees' identification of their own BRM training needs						
	5 Need first	4	3	2	1 Need later	Weighted Average (scale of 1 – 5)
Developing policy or guidance documents						
Animal Health	41.18% (7)	17.65% (3)	17.65% (3)	0.00% (0)	23.53% (4)	3.53
Public Health	48.28% (14)	0.00% (0)	10.34% (3)	20.69% (6)	20.69% (6)	3.34
Ministry + Science and Technology	40.00% (4)	33.33% (3)	0.00% (0)	20.00% (2)	10.00% (1)	3.70
All respondents*	46.67% (28)	11.67% (7)	10.00% (6)	13.33% (8)	18.33% (11)	3.55
Biosafety and biosecurity risk assessment methods and tools for mitigation						
Animal Health	44.44% (8)	33.33% (6)	0.00% (0)	16.67% (3)	5.56% (1)	3.94
Public Health	36.67% (11)	36.67% (11)	23.33% (7)	0.00% (0)	3.33% (1)	4.03
Ministry + Science and Technology	25.00% (2)	37.50% (3)	25.00% (2)	12.50% (1)	0.00% (0)	3.75
All respondents	35.00% (21)	38.33% (23)	15.00% (9)	6.67% (4)	5.00% (3)	3.92
Methods for maintaining physical infrastructure to support biosafety and biosecurity						
Animal Health	21.05% (4)	0.00% (0)	10.53% (2)	26.32% (5)	42.11% (8)	2.32
Public Health	9.38% (3)	12.50% (4)	6.25% (2)	34.38% (11)	37.50% (12)	2.22

Ministry + Science and Technology	20.00% (2)	10.00% (1)	10.00% (1)	20.00% (2)	40.00% (4)	2.50
All respondents	15.15% (10)	7.58% (5)	7.58% (5)	30.30% (20)	30.39% (26)	2.29
Development and practice of incident recognition, response and management						
Animal Health	0.00% (0)	43.75% (7)	43.75% (7)	12.50% (2)	0.00% (0)	3.31
Public Health	14.29% (4)	35.71% (10)	28.57% (8)	17.86% (5)	3.57% (1)	3.39
Ministry + Science and Technology	25.00% (2)	12.50% (1)	37.50% (3)	12.50% (1)	12.50% (1)	3.25
All respondents	10.53% (6)	31.58% (18)	38.60% (22)	15.79% (9)	3.51% (2)	3.30
Developing audit and inspection tools for biorisk management performance						
Animal Health	0.00% (0)	16.67% (3)	27.78% (5)	33.33% (6)	22.22% (4)	2.39
Public Health	12.90% (4)	16.13% (5)	29.03% (9)	19.35% (6)	22.58% (7)	2.77
Ministry + Science and Technology	10.00% (1)	20.00% (2)	40.00% (4)	10.00% (1)	20.00% (2)	2.90
All respondents	7.81% (5)	17.19% (11)	29.69% (19)	23.44% (15)	21.88% (14)	2.66

*All respondents may include trainees who self-identified as categories other than those shown, e.g. Higher Education (n = 1) and Other (n = 6, see footnote to Table 1).

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