The Drivers of Biosafety Climate Perceptions at Public Universities in the USA

Sivarchana Mareedu-Boada, PhD[1a]; Torsten Hopp PhD[2]; and Riten Mitra PhD[2]
[1]School of Public Health and Information Sciences; [2]Department of Environmental Health and Safety; University of Louisville, Kentucky, United States
Mareedu-Boada is a current NBBTP Fellow at NIH and the research presented in this poster was conducted during her doctoral research at University of Louisville.

Introduction

Biosafety plays a key role in ensuring safety of researchers' as well as the public from unintentional exposures to infectious agents.

The need for a stronger safety culture in biological laboratories has been suggested in literature[1-3]. Occupational safety literature emphasizes safety climate as a leading (prospective) indicator of safety[3-5]. Many studies focused on evaluating safety climate in different work settings[6-8] but nothing specific to biological and biomedical laboratories.

To address this gap, we investigated biosafety climate perceptions in biological and biomedical teaching and research laboratories at public universities in the US. The main objective was to evaluate the biosafety climate perceptions and investigate the factors that influence these perceptions.

Methods

Biosafety Climate (BSCL) scale (Figure 1) developed in our previous study[9] was utilized. BSCL scale consisted of 17 items to assess biosafety climate perceptions of research professionals (RPs) and biosafety professionals (BPs) who represent two distinct roles yet share a common goal of ensuring safety in biological laboratories[9]. There are other stakeholders too such as upper management, regulators and non research staff whose perceptions contribute to biosafety climate, but our study focused on RPs and BPs as a starting point to understand biosafety perceptions.

Primary data was gathered from multiple studies to determine the drivers of biosafety climate perceptions. All the surveys utilized the BSCL scale, and the surveys were administered through REDCap. Logistic regression was conducted using R programming software.

Figure 1: Biosafety Climate Scale, developed by Mareedu-Boada, Hopp & Mitra

Biosafety Climate Scale (BSCL-17)
Items in the Scale
1. The safety of research professionals' is a priority for my institution.
2. University administration considers research professionals' safety to be as important as productivity.
3. University administration shows support for prevention of biological hazards and incidents through involvement and commitment.
4. In the laboratory *(At my institution)*, my supervisor acts quickly to correct problems/issues that affect research professionals' safety.
5. My supervisor clearly considers the safety of research professionals' to be of great importance.
6. My supervisor acts decisively when a concern of a research professionals' safety practices is raised.
7. There is good communication at my institution about biosafety issues which affect me.
8. Information about proper biosafety practices is always brought to my attention in my institution.
9. My contributions to resolving biosafety concerns in the institution are listened to.
10. Research professionals participate in developing best biosafety practices in my institution.
11. Research professionals are encouraged to become involved in biosafety matters.
12. At my institution, the promotion of best biosafety practices involves all levels of the organization.
13. Consultation in developing best biosafety practices involves researchers and biosafety professionals.
14. In the laboratory *(At my institution)*, we discuss research professionals' safety, biological hazards and incident prevention.
15. In the laboratory *(At my institution)*, we care about each other's safety awareness.
16. In the laboratory *(At my institution)*, we remind each other of the regulations and guidelines regarding research professionals' safety.
17. In the laboratory *(At my institution)*, we care about each other's safety compliance.
For Items 4 and 14 to 17, the phrase 'In the laboratory' is used in the scale for research professionals whereas for biosafety professionals the phrase, 'At my institution' is used to imply their respective work settings. BSCL-17 is a 5-point Likert scale with score ranging from 17 to 85.

REDCap

Chart 1: Biosafety Resource Awareness of RPs & BPs (National survey, 2021)
1-Not at all Aware,2- Slightly Aware,3-Moderately Aware,4-Very Aware,5-Extremely Aware

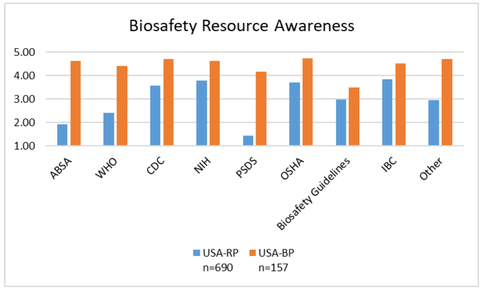


Chart 2: Biosafety Resource Utilization of RPs & BPs (National survey, 2021)
1-Never,2-Rarely,3-Sometimes,4-Often,5-Always

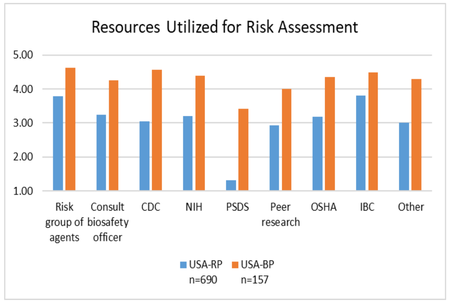


Chart 3: Biosafety Climate Score of RPs during Biosafe-1 & Biosafe-2 (Program Evaluation Study)

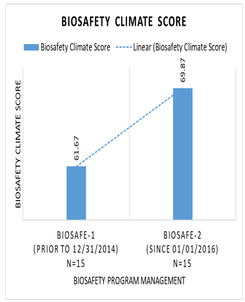
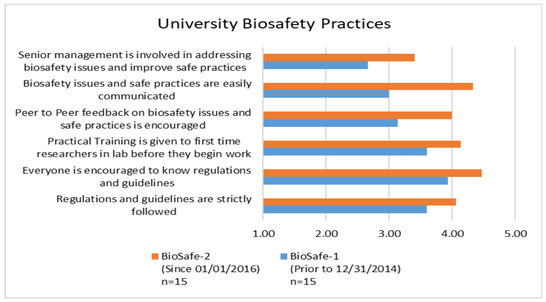


Chart 4: Comparison of University Biosafety Practices during Biosafe-1 & Biosafe-2 (Program Evaluation Study). 1 to 5: Strongly Disagree to Strongly Agree



Results

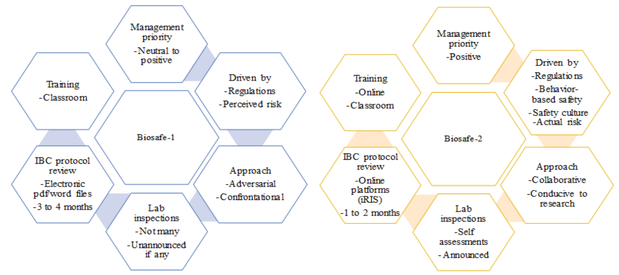
690 Research Professionals (RPs) and 157 Biosafety Professionals (BPs) responded to the national survey in 2021. Biosafety resource awareness, resources utilized for risk assessment and awareness on incidents leading to lab acquired infections was greater for BPs than RPs (Charts 1 & 2). Though overall biosafety climate scores were similar for RPs and BPs, key differences in safety climate perceptions for items on safety compliance, safety awareness, biosafety communication, contribution to biosafety practices, involvement in biosafety matters and biosafety concerns were observed for these two groups at the national level.

91 and 120 RPs participated in surveys at a public university during 2019 and 2020. No significant differences in biosafety climate perceptions were observed, highlighting the application of BSCL scale in examining changes to biosafety program periodically.

15 researchers participated in the interviews for the study on evaluation of biosafety program management over two different time periods: prior to 2014 and since 2016 to 2021. Significant differences in overall biosafety climate perceptions of researchers were found, indicating specific aspects of biosafety program to be more beneficial in eliciting positive biosafety perceptions (Figure 2 & 3, Charts 3, & 4).

15 RPs at a public university and 4 BPS from different institutions participated in the interviews in 2021 to share their perceptions on the different aspects of a biosafety program. Both RPs and BPs agreed that a biosafety program that includes hands on training, ease of IBC protocol submission & review process, trainings that are engaging, and collaborative approach between RPs and BPs will be effective in advancing safety.

Figure 2: Biosafety Program Aspects Identified During Biosafe-1 & Biosafe-2 (Program Evaluation Study)



Discussion

To cultivate a successful partnership, it is important to gain an in-depth awareness of perceptions, needs and motivation of different stakeholders in biosafety. Our study considered RPs and BPs are two key stakeholders of biosafety.

Buy-in from RPs is important in establishing an efficient biosafety program. Therefore, we investigated the drivers of BPs. As understanding the drivers of biosafety perceptions of RPs will aid in developing programs that can elicit buy-in and promote participation of RPs in biosafety practices.

Our study found that biosafety resource awareness and utilization, and awareness on lab acquired infections of RPs can be further improved at public universities. This will not only inform hazards and aid in risk assessment of RPs but also reduce the differences in perceptions of RPs and BPs.

A biosafety program that is developed based on actual risk rather than perceived risk, IBC administration that is efficient, announced inspections, safety communication and a collaborative rather than punitive approach between RPs and BPs are valuable in driving biosafety perceptions at public universities in the US.

Significance

The differences in perceptions of research and biosafety professionals which when addressed can achieve a better partnership between these two key stakeholders resulting in advancement of biosafety.

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