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Standardizing Hazard Signage at the Laboratory Research Division of the Research Institute for Tropical Medicine: A Step Towards Improved Safety Compliance

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ABSTRACT

Old signage faced iconography, variable layouts, visual presentations, and contents, as well as degradation issues, undermine the effectiveness of hazard communication in the laboratory. A 2016 project was initiated to standardize all hazard signages at the Laboratory Research Division of the Research Institute for Tropical Medicine, incorporating standard colors and iconography for better compliance and safety. As part of a broader initiative to enhance biorisk practices within the institute, there are plans for improvement and expansion to non-laboratory areas.

Key words: hazard, containment of biohazards, biosecurity, laboratories, communication, laboratory personnel

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BACKGROUND

Prior to 2016, various laboratory departments within the Laboratory Research Division (LRD) of the Research Institute for Tropical Medicine (RITM) displayed hazard signages to inform and remind laboratory personnel and visitors of potential risks. However, the existing signages (Figures 1 through 4) had several limitations: minimal use of iconography, excessive reliance on text, non-standardized layouts, and susceptibility to environmental damage. These deficiencies led to ineffective hazard communication, particularly in high-risk environments, such as laboratories where clear and immediate understanding of safety protocols is crucial.

Inspired by the Institute's experience with International Organization for Standardization (ISO) 9001 certification and best practices observed in other institutions (including the San Lazaro Hospital and the University of the Philippines National Institutes of Health), an initiative was launched to address these shortcomings. The goal was to implement a standardized, icon-based hazard signage system that would be easy to produce, cost-effective, and flexible enough to accommodate the specific needs of each laboratory.

STANDARDIZATION OF LABORATORY SIGNAGES

The initiative aimed to create a uniform and functional signage system for all LRD laboratories. Key objectives included:

Cost-effectiveness and ease of replacement

The new signage should be inexpensive to produce and replace, ensuring compliance and ease of revision. Some of the previous signages had comparable properties but lacked consistency and visual impact, while others were directly bought from stores (for example, the middle signage in Figure 2).

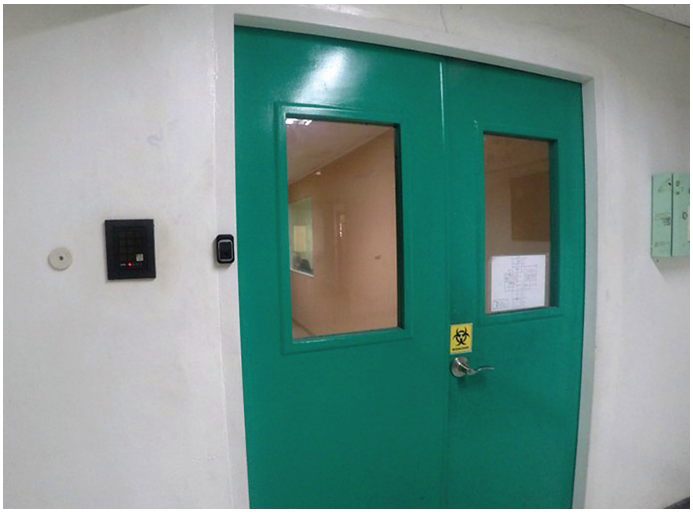

Figure 1. Old hazard signage taken 2017, from the main entrance to the P3 Laboratory established in 2008. Signage consisted of a small biohazard label on the door handle and a facility map.

Figure 2. Old hazard signage taken 2017, from the National Tuberculosis Reference Laboratory (NTRL). Signage consisted of several parts, each containing security warnings displayed almost entirely in text. A good point for this sign is the large text size (and large single icon used) and the eye-catching color scheme, even if monotonous.

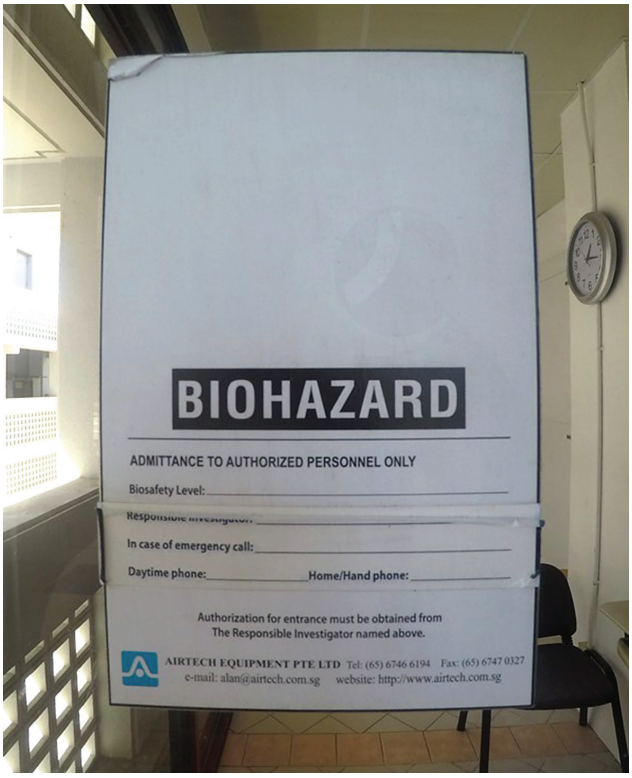

Figure 3. Old hazard signage taken 2017, from the NTRL BSL3 Laboratory established in 2012. Signage is compact and the text is small (except for "BIOHAZARD"). A biohazard symbol is the only pictograph present. But this symbol, as well as the entries in the text fields, has severely suffered from solar bleaching.

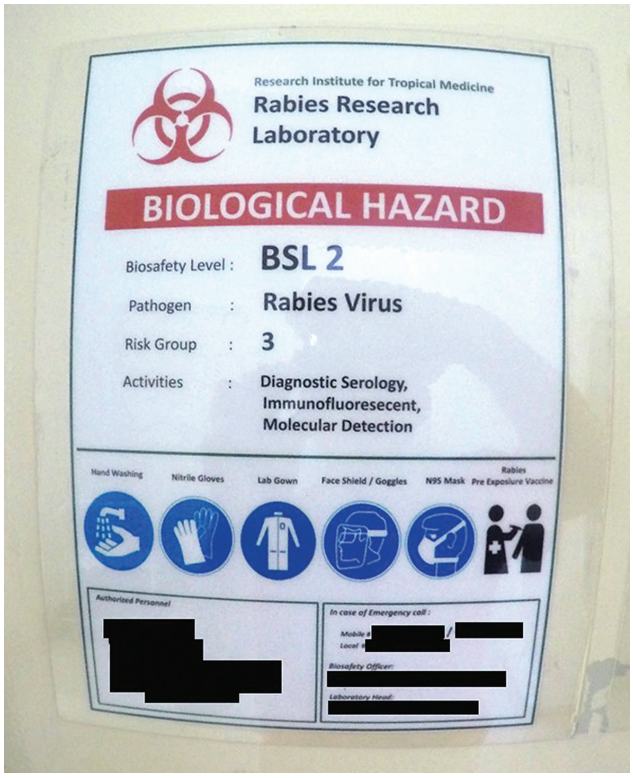

Figure 4. Old hazard signage taken 2016, from the Special Pathogens Laboratory. Usage of ISO pictographs (specifically those for mandatory action) is apparent here. There is also evidence of document control in the form of a supervisor's signature (lost to solar bleaching). Some details are redacted.

Table 1. Safety signage pictographs from ISO 3864 and ISO 7010 [1,2]

Icon Example	Color Scheme (common name and RGB)	Icon Type	Referent (Safety meaning) Example
	Blue (17, 93, 197) White (255, 255, 255)	Mandatory action	Wash your hands
	Red (255, 0, 0) Black (0, 0, 0) White (255, 255, 255)	Prohibition	Do not wear gloves
	Red (222, 0, 41) White (255, 255, 255)	Fire safety	Fire extinguisher
	Yellow (255, 238, 0) Black (0, 0, 0)	Warning	Warning; sharp element
	Green (0, 154, 59) White (255, 255, 255)	Means of escape and emergency equipment	Automated external heart defibrillator (AED)

*Only mandatory action, prohibition, and warning are currently used in the LRD uniform hazard signage.

Design standardization and flexibility

The new signage design was based on that of the RITM Advanced Molecular Technologies Laboratory (AMTL; formerly Molecular Biology Laboratory (MBL)), with a list of standard hazard icons derived from ISO 3864[1] (for pictograph shapes and color schemes) and 7010[2] (for iconography; Table 1). Laboratories were given flexibility to select icons relevant to their specific hazards, with guidelines for creating new icons if needed, as long as if they adhered to standardized shapes, color schemes, and other instructions in the aforementioned ISO documents.

Use of international signage standards

The new system (Figure 5) maximized the use of international signage standards, particularly iconography and color scheme, to communicate hazards clearly and efficiently. This was seen as essential for ensuring that warnings were immediately recognizable to all laboratory personnel, regardless of language proficiency.

Documentation and control

The signage was registered with the Institutional quality management system as a controlled document. This ensures that revisions are well-documented and based on changing laboratory activities and risks. Laboratories were also required to produce a risk assessment document to justify the content of their hazard signage, including any changes to it.

KEY DESIGN ELEMENTS

The new signage format included the following key elements:

Title	Displays the document name, control number, version, and institutional logos. This section allows department-specific branding.
Pathogens tested	Laboratories can choose how much information to disclose about the pathogens they work with, balancing biosecurity concerns with promotional and collaborative opportunities.
Hazards	A primary hazard and biosafety level are identified, with the option to list secondary hazards. The yellow triangle icon is used to signify all hazards.
Personal protective equipment (PPE)	Laboratories define mandatory and additional PPE, with blue circle icons used to indicate such equipment.
Other practices	This section addresses controlled access, prohibited activities, and required preparations before entering the laboratory. It uses prohibition and blue circle icons. Short supporting text may be used to explain some of the items.
Emergency contact information	Includes relevant contacts, such as the department head and lab manager, ensuring swift communication in case of an emergency.
Processes and workflow	Describes the laboratory's workflow, with color-coded sections indicating different rooms and activities. Each laboratory section can have its own signage displaying its unique hazard profile. This is especially important for laboratories where the flow of materials and personnel is critical for minimizing contamination (e.g., PCR or culture laboratories)

IMPLEMENTATION

The signage must be printed, signed by the department head, laminated, and displayed at the main entrance of each laboratory or laboratory section. The responsibility for producing and maintaining the signage lies with individual departments, though the institutional biorisk management office ensures compliance and quality control.

The standardized hazard signage system has significantly improved the clarity and consistency of safety communications across the laboratories. By incorporating internationally recognized symbols, the new signage allowed for immediate recognition of hazards, reducing the reliance on text-heavy signage that may be overlooked. Additionally, the flexibility of the system ensures that each laboratory (and each laboratory section) can tailor the signage to its specific needs, while maintaining overall standardization.

Furthermore, the use of controlled documentation for both the signage and the accompanying risk assessment ensures that safety information remains up to date and aligns with institutional quality management procedures and evolving laboratory practices. This structured approach is expected to facilitate ongoing improvements in laboratory safety and compliance.

CONTINUOUS IMPROVEMENT

Future modifications for the signage system include:

- **Expansion to larger paper sizes**
  To accommodate more detailed information and improve visibility, signage may be printed on larger paper sizes such as A3.

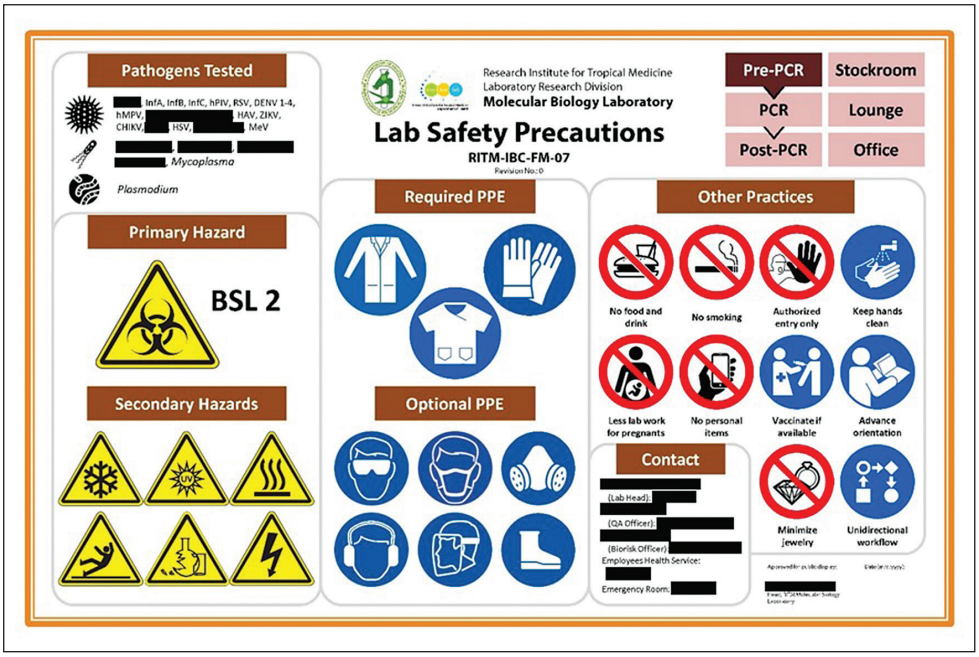

Figure 5. Working version of the uniform hazard signage used by all LRD laboratories today, example above from the Molecular Biology Laboratory (currently Advanced Molecular Technologies Laboratory) Pre-PCR Area. Take note of the document control number (RITM-IBC-FM-07) at the top. Some details are redacted.

- **Incorporation of additional safety standards**
  Efforts are underway to include other signage standards, such as NFPA 704 (fire diamond) and updates to ISO 3864 and 7010.[1,2]

- **Increased compliance with viewing and illumination standards**
  Stricter compliance with viewing distances, angles, and illumination standards is planned to enhance the effectiveness of the signage.

- **Extension to Non-laboratory Areas**
  Similar signages may be extended to non-laboratory areas to further promote occupational safety.

CONCLUSION

The standardization of hazard signage within the Laboratory Research Division at the Research Institute for Tropical Medicine represents a significant step toward improving laboratory safety and compliance. By adopting a flexible yet standardized signage system based on internationally recognized icons and color schemes, the Institute has created a clear, consistent, and cost-effective method for communicating hazards in high-risk laboratory environments. This initiative not only enhances biosafety but also lays the foundation for broader institutional and inter-institutional improvements in occupational safety. The signage system may be adopted by other facilities that wish to adopt the standardized format.

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STATEMENT OF AUTHORSHIP

The author certified fulfillment of ICMJE authorship criteria.

AUTHOR DISCLOSURE

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