Evaluation of Biological Risks at the Microbiological Laboratory

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Introduction

All procedures performed in a microbiological laboratory have intrinsic biological risks. Laboratory personnel who handle samples infected with pathogenic bacteria are subject to high biological risk exposure.

As part of the microbiological analyses conducted in the Microbiological Laboratory of the National Center for Disease Control and Prevention, pathogenic and conditionally pathogenic bacteria are routinely isolated. These bacteria include *Salmonella* spp., *Shigella* spp., *Vibrio cholerae*, *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella* spp., *Enterobacter* spp., *Pseudomonas aeruginosa*, and *Acinetobacter* spp.

We hypothesized that the disinfection procedures currently used in our laboratory are sufficient to decontaminate the working surfaces and air.

To test this hypothesis, we analyzed the efficacy of existing disinfection procedures against intestinal bacteria and *S. aureus*.

Table 1: The number and type of samples collected to determine the efficiency of decontamination.

Type of samples	Number of samples	Number of positive results before disinfection		Number of positive results after disinfection
		E. coli	*S. Aureus*	
Lab bench	80	16	0	0
Lab door handle	36	6	0	0
Thermostat surface	72	10	0	0
Lab air	24	0	8	0

Methods

After completing routine microbiological analyses of human fecal and throat swab samples, we collected samples from the surrounding air using the sedimentation method and from laboratory surfaces using washouts.

After wiping work surfaces with 70% ethanol and operating the bactericidal ultraviolet lamp for one hour, we collected additional samples.

To detect and identify viable organisms, we cultured samples in/on MacConkey broth (*E. coli* and coliforms), Salmonella-Shigella agar (Enterobacteriaceae), Endo agar (coliforms), triple sugar iron agar (Enterobacteriaceae), Simmons citrate agar (Enterobacteriaceae), motility test media (Enterobacteriaceae), mannitol salt agar (*Staphylococcus*), and blood agar (hemolytic bacteria).

We also used oxidase, catalase, and antibiotic susceptibility tests to further characterize isolates.

To confirm that the bacteria isolated from the environment originated from patient samples, we compared the morphological, biochemical, and fermentative features, and zones of inhibition of each isolate.

Results

In 2016 and 2017, we collected 80 samples from laboratory bench surfaces, 36 samples from laboratory door handles, 72 samples from thermostat surfaces, and 24 laboratory air samples (Table 1).

Before decontamination, 32 of the surface samples (17%) were positive for *E. coli* (16 from lab benches, 6 from lab door handles, and 10 from thermostat surfaces), and 8 of the air samples (33%) were positive for *S. aureus* (Figure 1).

The biochemical and antibiotic resistance characteristics of these isolates matched those of the patient samples, indicating that the environmental samples originated from the patient samples.

Only *E. coli* and *S. aureus* were isolated from samples. No other pathogenic or conditional pathogens were identified as surface contaminants.

All samples collected after disinfection were negative.

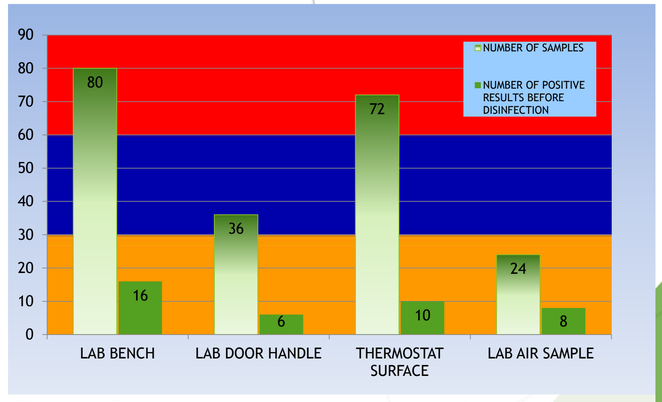

Figure 1: The number of positive samples isolated prior to decontamination.

Conclusions

The surface contaminants that were detected were *E. coli* and *S. aureus.*

Current disinfection procedures are sufficient to kill *E. coli* and *S. aureus*.

It is critical to adhere to all biosafety, disinfection, and decontamination guidelines to protect the laboratory, the staff, and the environment from exposure to pathogenic bacteria.

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