Knowledge and Awareness of Routine Biosafety Measures and Proper Waste Disposal Practices Among Healthcare Workers in Karachi, Pakistan

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Abstract

This study assessed the knowledge and awareness regarding routine biosafety measures and proper waste disposal practices among healthcare workers in Karachi, Pakistan, and also highlighted areas in which training was needed. To increase knowledge of biosafety and waste disposal requirements, the Virology & Tissue Culture Laboratory, Department of Microbiology, Jinnah University for Women, Karachi, Pakistan in association with the Biosafety Association of Pakistan (BSAP) executed a collaborative project entitled “Training Workshop on Proper Waste Disposal from Hospitals & Pathological Laboratories in Karachi, Pakistan,” with financial support from the Biosecurity Engagement Program (BEP), the United States Department of State (DOS), and CRDF for health-related issues in developing countries. A 50-question pre-workshop survey was administered to better understand the current use of biosafety and biosecurity measures in place at 250 state and private-sector clinical facilities (hospital and pathological laboratories) in the city. Participants from the 250 facilities were selected on the basis of first-come, first-served, but with preference for participants without prior knowledge of biosafety and biosecurity. After the training workshop, an evaluation survey was conducted with 28 participants. Results of that survey indicate that healthcare workers (HCWs) need to be offered training and refresher courses, in Urdu, to increase their level of knowledge and awareness of biosafety and waste disposal protocols to reduce both occupational exposures and the spread of infectious diseases in the community through improper disposal of infectious waste.

Introduction

Karachi is the major city in Pakistan, with about 7% of the total national population and 22% of the country’s total urban population. Since it is relatively more developed than adjoining regions, the city attracts a sizable number of visitors and immigrants who take residence for varying time periods to benefit from the healthcare facilities, educational institutions, and diversified job market. This is why most of the public and several private-sector healthcare facilities are over-utilized, resulting in an explosive increase in the number of diagnostic laboratories, blood banks, and medical facilities in the city. Although exact numbers are not known, these facilities regularly deal with potentially infectious agents and clinical waste without using proper handling techniques based on a risk assessment. Breaches in universal precautions are common. Also, although only 10%-25% of hospital waste is infectious and requires proper treatment and disposal (WHO, 2007), there is no segregation of waste products during collection, storage, or disposal. To address these facts, the Virology & Tissue Culture Laboratory, Department of Microbiology, Jinnah University for Women, Karachi, Pakistan in association with the Biosafety Association of Pakistan (BSAP) executed a collaborative project entitled “Training Workshop on Proper Waste Disposal from Hospitals & Pathological Laboratories in Karachi, Pakistan,” with financial support from the Biosecurity Engagement Program (BEP), the U.S. Department of State (DOS), and CRDF for health-related issues in developing countries.

As a part of this project and also to complement the efforts of the Virology & Tissue Culture Laboratory, Department of Microbiology, Jinnah University for Women Karachi and BSAP’s Winning, Augmentation, and Renovation (WAR) for Biosafety in Pakistan initiative, a series of workshops to train healthcare workers and waste management personnel in Pakistan were initiated. This report is the outcome of the first Workshop/Certificate course in this series.

Methodology

This study was divided into three parts: 1) a pre-workshop clinical laboratory survey; 2) curriculum delivery; and 3) an end-of-the-workshop survey. Laboratories at which trained biosafety practitioners are already maintaining internationally accepted biosafety and waste-disposal standards were not included in the study. Instead, preference was given to those who were completely unaware of biosafety and biosecurity practices and needed education about personal safety, appropriate handling and disposal of medical waste, and community health.

1) Clinical Laboratory Survey

To make this effort a success, between January 11 and February 25, 2011, a 50-question, pre-workshop survey, designed using WHO standards, the U.S. Department of State Biosafety Engagement Program’s (BEP) guidelines, and the LOYOLA laboratory survey form, was conducted to better understand the current use of biosafety
and biosecurity measures in Karachi’s 250 state and private-sector clinical facilities (hospitals and pathological labs). The questionnaire was divided into four sections based on standard microbiological practices, special practices, safety equipment, and laboratory facilities. Results of each section are discussed separately. All of the facilities should be Biosafety Level 2 laboratories, and survey results were used to develop the curriculum.

2) Workshop Curricula

The curricula of the workshop was divided into presentations to cover biosafety in the clinical setting, the importance of waste segregation—what it is and why do it?, understanding universal precautions and blood-borne pathogen safety, emergency response, spill response measures, occupational safety and health, biological safety cabinets (classes, types, safety use, certification), and operational laboratory biosafety practices. Three practical demonstration sessions on biological safety cabinets, personal protective equipment (PPE), and spill response were also provided to give hands-on training to the participants. In addition, all participants received a complete set of PPE along with samples of biohazard-labeled, autoclavable bags and hand sanitizers to help them introduce the materials and explain their importance to their organizations. The speakers addressed the topics in a clear and precise manner and were complimented by the participants during and after the workshop.

3) Participant Survey

The end-of-the-workshop survey was designed by BEP coordinators and was administered after completion of the training on waste disposal. It was divided into three sections: 1) satisfaction with the training program; 2) results and future plans; and 3) recommendations.

### Results of Clinical Laboratory Survey

#### A) Standard Microbiological Practices

Sixty-five and one-fifth percent (65.2%) (n=163) of the surveyed labs enforce restricted access when experiments are being conducted in the laboratory; 30% (n=75) use gloves when working in the laboratory both for personal protection and to prevent the spread of infectious microorganisms; 85.2% (n=213) of lab workers have a habit of washing hands during lab procedures; approximately 10% (n=25) of the labs do not permit eating, drinking, and applying cosmetics; 45.2% (n=113) do not use mouth pipetting techniques; 32.2% (n=83) have policies for the safe handling of sharps; and 6% (n=15) have instituted precautions to prevent the creation of aerosols. Seventy percent (70%) (n=175) of the labs decontaminate work surfaces daily, while 22% (n=55) decontaminate cultures, stocks, and other laboratory wastes before disposal. Insect or rodent control programs are in effect in 70% (n=175) of the labs in the city.

#### B) Special Practices

Of the 250 laboratories, 85.2% follow required BSL-2 precautions such as: 1) closing lab doors during experiments; 2) having access to the laboratory controlled by the lab director; and 3) restricting persons who are at increased risk of infections from entering the labs. Out of 250 laboratories, 87.2% (n=218) of lab directors establish policies and procedures for handling potential biohazards, 53% (n=133) have a hazard warning sign posted; and 10% (n=25) regularly immunize the laboratory professionals against agents handled in the labs. Serum samples are collected and stored for all laboratory staff or persons at-risk in approximately 1% (n=3) of the labs. About 5% (n=13) have an approved biosafety manual including preparations and standard pro-

### Table 1

Example of Pre-workshop Survey on Standard Microbiological Practices in the Laboratories in Karachi (Section A).

<table>
<thead>
<tr>
<th>Question No.</th>
<th>Question</th>
<th>Positive Answers (N=250)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Is access to the laboratory limited or restricted?</td>
<td>163 (65.2%)</td>
</tr>
<tr>
<td>2</td>
<td>Are gloves worn during routine laboratory work?</td>
<td>75 (30%)</td>
</tr>
<tr>
<td>3</td>
<td>Do laboratory procedures include washing of hands?</td>
<td>213 (85.2%)</td>
</tr>
<tr>
<td>4</td>
<td>Are eating, drinking, smoking, handling contact lenses, and applying cosmetics prohibited?</td>
<td>25 (10%)</td>
</tr>
<tr>
<td>5</td>
<td>Is mouth pipetting prohibited?</td>
<td>113 (45.2%)</td>
</tr>
<tr>
<td>6</td>
<td>Are policies for safe handling of sharps in place?</td>
<td>83 (32.2%)</td>
</tr>
<tr>
<td>7</td>
<td>Are careful procedures in place to minimize the creation of aerosols?</td>
<td>15 (6%)</td>
</tr>
<tr>
<td>8</td>
<td>Are work surfaces decontaminated at least once a day or after a spill?</td>
<td>175 (70%)</td>
</tr>
<tr>
<td>9</td>
<td>Are regulated wastes decontaminated before disposal by an approved method?</td>
<td>55 (22%)</td>
</tr>
<tr>
<td>10</td>
<td>Is an effective insect and rodent control program in place?</td>
<td>175 (70%)</td>
</tr>
</tbody>
</table>
nated. Eighty-nine percent (89%) (n=224) of all labs have covered with non-fabric material that is easily decontaminable and are accessible for cleaning; chairs and furniture are approximately 83.2% (n=208) of labs have lab furniture capable of labs have impervious bench tops that are resistant to liquids, and resistant to chemicals and disinfectants, contain a hand-washing sink near the door. Interior surfaces of walls, floors, and ceilings are washable, smooth, impermeable to liquids, and resistant to chemicals and disinfectants, and any spaces between doors and frames are sealed in 72% (n=180) of labs. Ninety-eight percent (98%) (n=245) of labs have impervious bench tops that are resistant to moderate heat, organic solvents, acid, and alkalies. Approximately 83.2% (n=208) of labs have lab furniture capable of supporting the anticipated load of equipment on them and are accessible for cleaning; chairs and furniture are covered with non-fabric material that is easily decontaminated. Eighty-nine percent (89%) (n=224) of all labs have closed or sealed windows. Biosafety cabinets are present in 4% (n=10) of labs. Three percent (3%) (n=8) of labs have an eye-wash station and 76% (n=190) have adequate illumination for all activities.

**Discussion**

Although the Lab Director establishes policies and procedures for potential biohazards and biosafety measures, this study revealed that those policies were not comprehensive or implemented consistently in Karachi, Pakistan. Eating, drinking, and applying cosmetics in the laboratory are very common, but these practices were prohibited in only 25 (10%) of the labs (Table 1). Although gloves are worn in 30% of the laboratories, frequent changing of gloves is practiced in only 13%-15% of laboratories, while safe sharps practices are employed in only 32% of the facilities. An eye-wash station, biological safety cabinets, and some of the PPEs are used in only 3%, 4%, and 8% of the facilities, respectively.

Procurement of proper PPE for laboratory staff is difficult in Pakistan because there is an insufficient number of distributors from whom the products can be purchased. This is because stakeholders do not sufficiently understand the significance of PPE, professional input is absent, and facility managers often exhibit a general work slackness and inability to deal with these issues. Although two major hospitals, both in the private sector and both following biosecurity measures regarding waste management, are importing PPE from international markets on their own, the rest of the hospitals and laboratories are dependent on the limited PPE supply of the local markets.

Seventeen (17) questions were asked in the end-of-the-workshop survey conducted by BEP coordinators, and the response rate was 100% (that is, all 28 selected participants gave their response willingly). Training topics such as waste segregation, blood-borne pathogen safety, spill response, and operational biosafety practices were welcomed. Participants stated that the training provided opportunities to exchange ideas and that the logistics of the training workshop and its overall organization were very good. More than 90% of the participants responded that their overall knowledge was increased after completing the course. Almost 95% of the participants said that they will share the information and knowledge gained at the workshop with their staff and colleagues, and will also initiate joint projects to implement new strategies for proper waste disposal. Overall satisfaction with the training program and the competence of the coordination team were rated very well by a majority of those surveyed.

**Emphasis on Segregation and Proper Treatment of Hospital Waste**

Not all healthcare waste is biohazardous; infectious waste and sharps constitute approximately 10%-25% of the healthcare waste. (El-Sharkway, 2009; Yanez et al.,...
However, if this infectious waste is not disposed of properly, it could contaminate the normal waste, rendering it biohazardous material too (International Healthcare Waste Network, www.who.int/water_sanitation_health/medicalwaste/002to019.pdf). In 2007, the Pakistan Medical Research Council (PMRC) conducted a cross-sectional, hospital-based survey (Fazil, 2009) with 137 personnel involved in hospital waste management at 68 randomly selected healthcare facilities in urban areas in Karachi. Data from 137 sanitary workers at 9 hospitals, 11 maternity homes, and 29 dispensaries revealed that knowledge about hospital waste management was inadequate in 100% of the workers. Additionally, the study further showed that 25.5% of the healthcare facilities disposed of infectious and non-infectious waste, without any treatment, into public dustbins, and 73.7% of the sanitary workers carried waste in open buckets for final disposal. None of the sanitary workers had undergone routine medical check-ups except when ill and 67.9% were not provided any protective equipment. It was also reported that 96.4% of participants were not interested in health education about the safe disposal of healthcare facility waste; rather, they were just doing their jobs for the salary.

Another study conducted on the same issue in 2005 in eight teaching hospitals (>200 beds) in Karachi highlighted the routine hospital waste management practices including segregation approaches, storage arrangements, and collection and disposal systems (Rasheed et al., 2005). This study revealed that out of eight hospitals visited, two (25%) were segregating sharps, pathological waste, chemicals, infectious, pharmaceuticals, and pressurized containers at the source. For handling potentially dangerous waste, two (25%) hospitals provided essential protective gear to their waste handlers. Only one (12.5%) hospital regularly offered training sessions to its waste handling staff. Five (62.5%) hospitals had storage areas, but they were generally not protected from access by scavengers. Five (62.5%) hospitals disposed of their hazardous waste by burning it in incinerators, two (25%) disposed of their hazardous waste at municipal landfills, and one (12.5%) was burning waste in the open air without any specific treatment. No record of waste quantities and disposal method was generally maintained. Only two (25%) hospitals had well documented guidelines for waste management or a proper waste management team (Rasheed et al., 2005). Today, in 2012, the scenario has not improved much. Local municipal vehicles collect medical waste on a daily or weekly basis, depending upon their contract with the hospital/laboratory administration, and most dispose of it without adhering to acceptable guidelines. Hospital and laboratory staffs (e.g., nurses, paramedics, and janitorial staff) still do not appear very much interested in health education regarding the safe disposal of healthcare facility waste.

On the whole, the knowledge and awareness of biosafety and biosecurity issues around waste disposal by HCWs in Karachi are far below a desirable level due to inadequately trained staff. This is a major impediment to the creation of a proper system, which was found lacking in almost all public and most of the private hospitals and laboratories. Healthcare waste from hospitals and laboratories located in slum areas or the low socio-economical areas of the city is either dumped at community waste sites “kuchra kundis” or sold directly to junk dealers—“kabarisi.” Scavengers, driven by extreme poverty and ignorant of risks, are involved in sorting and handling the contaminated materials at community waste sites; their favorite items for resale include syringes, infusion sets, empty bottles, and blood bags. Scavenger boys and sweepers at healthcare facilities also sell these goods to junk dealers. Unfortunately, a market for healthcare waste exists in the recycling business. Moreover, the plasticware industry remains the biggest buyer of used syringes, infusion sets, and blood bags (Altif & Mujeeb, 2002). Most of the used syringes are recycled into plastic items, but some are washed and simply packaged for resale. Unfortunately, the public cannot differentiate between new sterilized syringes and recycled unsterilized syringes (Ahmad, 2004). It is important to note that the Ministry of Environment in consultation with the Environmental Health Unit of the Ministry of Health, Pakistan has designed guidelines for hospital waste management in Pakistan; these guidelines are incorporated into the Hospital Waste Management Rules 2005 and the National Sanitation Policy 2006 which cover all aspects of safe hospital waste management, including the risks associated with the specific types of waste; forming waste management teams and their responsibilities; collection, segregation, transportation, storage, and disposal methods for various waste categories; and, above all, supervision, monitoring, and evaluation of the entire process. Additionally, the National Program for Prevention and Control of Hepatitis is also in the process of developing national guidelines. This program has also developed Trainer and Trainee Manuals for various categories of healthcare workers including health managers, professionals, and waste management staff (Fazli, 2009).

**Conclusion**

This study was an attempt to re-examine the current status of the biosafety programs for clinical laboratory staff and the medical waste issues in Pakistan. On the whole, the situation is not very promising. The end-of-the-workshop survey questions related to level of awareness before, and after, introduction to PPE, concepts of biosafety and biosecurity, use of basic biosafety measures, etc. The participants, who were selected employees from the hospitals and laboratories, were found more aware about personal safety, waste segregation, and safe sharps practices after the workshop. It was also noted that many of the participants had not even seen the different kinds of face masks or labeled/unlabeled autoclavable biohazard bags and were not able to distinguish between simple polyethylene disposable gloves.
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References