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Knowledge, Attitude and Adherence to Biosafety Practices among Clinicians of Tertiary Hospitals in Ghana

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ABSTRACT

Introduction: Biosafety concept in laboratory practice is of utmost importance which demands much attention always because of the daily exposure of clinical laboratory staffs to toxic hazards. Thus, there must be a continuous and cooperative effort on the part of laboratories and other departments of the health facilities to ensure that their testing procedures are safe. This study aims to assess the knowledge of clinical staffs in the four major teaching hospitals in Ghana. Methodology: The aim of the study was achieved by using a self-administered questionnaire. Results: A total of 105 participants were involved in the study (69 were males, 36 were females). About 86.7% of the participants had a bachelor's degree, 70% have had a biosafety training, Majority of the laboratory staffs agreed that following the biosafety guidelines was for their safety; 93.3% agreed that infectious materials should be decontaminated before disposed into containers, 83.3 agreed that needles should be recapped before disposing into containers. Regarding leadership qualities; 84.8% always reported accidents near miss in the laboratory, a little above half (58.1%) ensured others follow Standard Operating Procedures (SOPs), 55.2% of participants always reported new medical conditions. Concerning the safety of the facility, most of the laboratories complied with standard safety measures. However, some of the clinicians practice practiced bad laboratory behavior such as eating in the lab and mouth pippeting which can be attributed to inadequate experience. Conclusion: The majority of sample showed good laboratory practices, nevertheless, some showed bad behaviours that are not accepted and need intervention.

Keywords: Biosafety, Clinical laboratory practice,

INTRODUCTION

Clinical laboratory staffs (CLS) are exposed to several toxic hazards daily; infectious human samples, chemical reagents, centrifuge accidents, spills, injuries from broken glass, needlestick injuries, etc. (Nisii et al., 2009; Tohda, 2016). Typically, the rate of viral and bacteria acquisition for CLS is at an increased rate for Human immunodeficiency virus, hepatitis B and C, corona and mycobacterium respectively all transmitted via percutaneous damage (Auta et al., 2017; De Carli, Abiteboul, & Puro, 2014). Working with clinical samples requires good safety practices. Data from Wales and England revealed a rate of 7.5 times increased risks for laboratory technical staffs concerning the acquisition

of tuberculosis concerning the general population (Tormey & O'Hagan, 2015). A descriptive cross-sectional study conducted in Ahmedabad-India involving 154 CLS by Jitendra and Jigna showed a low level of awareness (20.8%) about universal work precautions amongst the laboratory technicians with few of the staffs (37.5%) able to state the objectives correctly (Zaveri & Karia, 2012). A recent quantitative cross-sectional study done by Sadia and colleagues in Karachi, Pakistan involving 253 public and private sector-based laboratory technicians concerning the awareness of safety laboratory practices revealed the ignorance and negligence on some part of CLS in biosafety rules and practices (Coelho & García Díez, 2015). In this study, 46.2% CLS refuse to wear any protective material (lab coat, gloves) when operating in the clinical laboratories, 39.5% recapped syringes after usage, 62.5% discard sharps into municipal dustbins, 38% practice mouth pipetting. The respondents in the study stated the unavailability of standard operating procedures (SOPs) in 75% of the laboratories with lack of records on accident records in 73.9% of the laboratories. Other several studies in different countries showed negligence and substantial standard biosafety practices (Shobowale, Adegunle, & Onyedibe, 2016; Zainol et al., 2011). In spite of the utmost importance of biosafety practices in the daily work of a laboratory technician, most of the precautions are not adhered to, exposing CLS to several hazardous agents in the laboratory environment (Haagsma, Tariq, Heederik, & Havelaar, 2012; Pedrosa & Cardoso, 2011). Biosafety standards should be given high priority in laboratory practices because it is also crucial for the certification and accreditation of medical laboratories (Masanza, Nqobile, Mukanga, & Gitta, 2010).

Several CLS in public and private sectors in Ghana are not exempted from this global occupational health risks. Exposure to radiations, flammable chemicals, cultures etc., have been reported by shobowale et al. to have a detrimental effect on the life expectancy for CLS in Ghana (Shobowale et al., 2016). Assessing and monitoring laboratory procedures will help reduce the harmful effect of improper laboratory practices and also establish biosafety measures which will not only promote a safer working environment but also impact significantly on maintaining qualitative service delivery. In view of this, the present study seeks to assess biosafety awareness and measurement of biosafety practice especially clinical laboratories among the four prominent government teaching hospitals in Ghana. These major tertiary hospitals in Ghana receive a massive number of patients every day coming from all over the country. These hospitals also receive transferred patients, and they undertake most of the crucial laboratory and health services with a large number of CLS. This heavy-duty adds more parameters to the medical laboratory safety measures to prevent the spread of diseases to the hospital staffs. Actually, in Ghana, there is inadequate data on the level of awareness and knowledge of biosafety practices among clinical laboratory staff. Because this data is missing, there are no Biosafety trainings for clinicians in these tertiary hospitals in Ghana. It is prudent to provide adequate and frequent training on good laboratory practices as well as monitoring to ensure adherence to biosafety practices in all hospitals across the country. The findings of the study will provide a baseline data for the need to provide for researchers to conduct an extentive investigation on biosafety levels in the country and help in the implementation of biosafety practices in their respective hospitals.

METHODOLOGY

Participants and Study Design

A Cross-sectional descriptive with commodious sampling study design was deployed to assess the biosafety practice and associated factors in clinical laboratories and other diagnostic departments at Komfo Anokye Teaching Hospital (KATH), Tamale Teaching Hospital (TTH), Cape Coast Teaching Hospital (CCTH), and Korle-Bu Teaching Hospital (KBTH). The study was conducted between February and March for all health at professionals in the hospitals listed above.

A total of 105 clinicians from the various hospitals were used for the study. The number of participants was dependent on the number of clinicians who volunteered to participate in the exercise. The selection was independent on the assigned work station of the participants in the various hospitals. The total number of clinicians in the four selected hospitals were estimated to be 200 which gives a responding rate of 52.5%. The non-respondents were on leave or enrolled for long term training. 36 participants were from KATH, 27 from CCTH, 32 from KBTH and 20 from TTH. The participants worked in various stations; chemical pathology, haematology, immunology, immunohematology, histopathology and pathology department. The study was done after the University of Cape Coast has ethically approved it, College of Health and Allied Sciences, Department of Research and ethics review

of Biomedical Sciences with formal permission from the senior managers of the hospitals involved. The questionnaire was explicated to the participants and as well as the confidentiality of the information obtained.

Study Instruments

Structural questionnaires were used to collect the data between February 2018 and April 2018. The questionnaire was composed of socio-demographic factors, working information and biosafety practices. Biosafety practice questions cover biosafety policy perception among clinicians working activities, use of protective barriers, facility design, knowledge and managerial aspects. The questions were borrowed form Biosafety in Microbiological and Biomedical Laboratories (BMBL), Center for Disease Control and Prevention (CDC) and National Institutes of Health (NIH). Two data collectors were recruited to collect the information from the study sites. The collectors were oriented on the procedure for the interview with a structured questionnaire which eliminated the need for disciplinary and or knowledge gap among data collectors during the assessment. The questionnaires were filled manually, either by the participants themselves or by the collectors as they collect answers from the participants.

Statistical Analysis

Categorial and demographic variables were presented in frequency tables using SPSS software for influential descriptive analysis. Frequencies, percentages as well as the mean standard deviations were estimated.

RESULTS

The study examined the awareness of workers in the four major districts on medical laboratory practices. This was achieved by selecting 105 participants of which 85 (80.95%) being laboratory workers, and 20 (19.05%) being Nurses, Pharmacist, and Quality Control and Safety officers. Males occupy 69% of the entire study population, and 34.3% were females. Table 1 shows participants demographics. 1.9% of the total study population was less than 20 years, 46.7% were between the ages of 21-25 years, 24.8% were people within the ages of 26-30 years, 20% were between 31-35 years, 3.8% were within 36-40 years, and 2.9% were between 41-45 years. 10.8% had a diploma in laboratory education, 86.7% had a degree, and finally, 2.9% had a Master's degree. 73.3% of the participants had less than five years working experience, 20% had 6-10 years working experience, 4.8% had 11-15 years working experience, and lastly, 1,9% had more than 16 years of working experience. One participant was head of the laboratory, 70 (66.7%) were permanent staffs, 30 (28.6%) were interns (national service persons), and 3 (2.9%) subjects were nurses (in-charge). 22.9% of the entire study population worked at the Microbiology department, 13.3% worked in the Parasitology department, 28.6% worked in Haematology department, 1.9% was in the immunology department, 20.0% were in other departments; Immunohematology, Histopathology, Pathology, Pharmacy, and Nursing.

Table 2 contains data on biosafety policy perception among laboratory personnel and other clinicians at the hospitals in which the study was conducted. About 53.33% of participants all the hospitals were acquainted with biosafety rules guiding laboratory services and had received immunisation for potential infections like Hepatitis B and C, Yellow Fever, H1N1, and HPV. 66.7% and 74.3% indicated that they had had biosafety training and guidelines respectively. They provided a laboratory manual, protocol and standard operating procedures (SOPs) guiding their activities and work in the lab. 75.2% of the participants said they had been trained on how to handle spills in the lab adequately.

Table 3 shows information on safety related to building in the four major hospitals. More than half (50.5%) of participants indicated the presence of Biosafety Cabinets (BSC) in their working environments. 12.4% of participants did not recall the specific time of their BSC certification while 13.3% indicated recent certification of their biosafety cabinets. Remaining 50.5% did not know BSC installation in their respective hospitals.

Table 1: Socio-demographic characteristics of laboratory personnel and other clinicians at the four tertiary government teaching hospitals in Ghana, May 2018 (N=105)

variables	Category	Number of subjects (Percentage)
Gender	Male	69 (65.7)
	Female	36(34.3)
Age	≤20	2 (1.9)
	21-25	49 (46.7)
	26-30	26 (24.8)
	31-35	21 (20)
	36-40	4 (3.8)
	41-45	3 (2.9)
	≥45	0 (0)
Academic Degree	Diploma	11 (10.5)
	Degree	91 (86.7)
	Master+	3 (2.9)
Years of experience	≤5	77 (73.3)
	6-10	21 (20)
	11-15	5 (4.8)
	≥16	2 (1.9)
Ranks	Lab Head	1 (1)
	Department Head	1 (1)
	Staff	70 (66.7)
	NSP	30 (28.6)
	Other	3 (2.9)
Assigned work	Microbiology	24 (22.9)
	Parasitology	14 (13.3)
	Chemical Pathology	14 (13.3)
	Haematology	30 (28.6)
	Immunology	2 (1.9)
	Other	21 (20)

Table 4 shows the practices of laboratory workers in medical laboratories. A majority (95.2%) of the workers followed good lab practices in processing and handling specimen in a safe way. Most (75.2%) of them also disposed of cultures, stocks and waste after it has been decontaminated. However, 21.9% disposed chemical waste in the sink without decontamination. About 50.5% did not know how chemical waste were disposed in the hospital, but some 13.3% indicated that they knew how disposal of chemical waste were done.

Table 2: Biosafety policy among laboratory personnel and other clinicians at the four tertiary government teaching hospitals in Ghana, May 2018 (N=105)

	Yes		No		
Variables	**Frequency**	**Percentage**	**Frequency**	**Percentage**	**Total**
Immunization	56	53.3	49	46.7	105
Biosafety rule familiarity	96	91.4	9	8.6	105
Biosafety guideline	70	66.7	35	33.3	105
Biosafety training	78	74.3	27	25.7	105
Laboratory manual, protocol and SOPs	91	86.7	14	13.3	105
	Agree		Disagree		
Handling spills	79	75.2	26	24.8	105

kept in disposable containers and 14.3% provide options such as incinerating, burning, and pouring in gutters. Several participants (96.2%) sensed the need to obliterate PPE before exiting the clinical environment. Most (89.5%) of clinicians also agreed that biohazard signage placed at the entrance of laboratories signify biohazard material in the lab. 92.4% admitted to the fact that sharp

Table 3: safety-related building in laboratories of four tertiary hospitals in Ghana

	Yes		No		
Variables	**Frequency**	**Percentage**	**Frequency**	**Percentage**	**Total**
Biohazard signage at entrance	82	78.1	23	21.9	105
Decontamination of waste	79	75.2	26	24.8	105
Food storage in Lab	3	1.9	102	98.1	105

Table 4: Practices of laboratory workers in the medical laboratories

	Agree		Disagree		
Variables	Frequency	Percentage	Frequency	Percentage	Total
Eating, drinking, or applying cosmetics in the lab	100	95.5	5	4.5	105
Mouth pipetting in the absence of micropipette	16	15.2	89	84.8	105
Generation of aerosols via centrifugation	86	81.0	20	19.0	105
Recapping used needles before disposal	85	81.0	20	19.0	105
Washing hands before lab exit	103	98.1	2	1.9	105
Decontamination of infectious waste before disposal	98	93.3	7	6.7	105

Variables	Always Frequency (Percentage)	sometimes Frequency (Percentage	never Frequency (Percentage	n/a Frequency (Percentage	Total
Following SOPs	81(77.1)	20(19.0)	2(1.9)	2 (1.9)	
Ensuring co-workers follow SOPs	61(58.1)	35(33.3)	6(5.7)	3(2.9)	3
Reporting new medical conditions	58(55.2)	39(37.1)	2(1.9)	6(5.7)	
Reporting Accidents and near misses	89(84.8)	15(14.3)	0(0.00)	1(1.0)	

	Yes		NO	
	Frequency	Percentage	Frequency	Percentage
Removal of PPE before exiting clinical environment	101	96.2	4	3.8
Biohazard signage at lab entrance indicates presence of potential toxic substances	94	89.5	11	10.5
Disposing of sharps in sharp containers	97	92.4	8	7.6
Gloves should be removed when soiled with biohazard materials	78	74.3	27	25.7
Infectious materials should be disposed of in a biohazards container	97	92.4	8	7.6

Objects including scalpels and needles should always be disposed of in sharp contains. Finally, more than half (74.3%) of the study population agreed to and disposed of soiled gloves before leaving or moving on to perform another task.

DISCUSSION

This study focuses on the awareness and adherence of laboratory workers in the four major teaching hospitals in Ghana; Komfo Anokye Teaching Hospital, Korle-Bu Teaching Hospital, and Cape Coast Teaching Hospital to biosafety practices. The majority (65.7%) of the study population were male, and most participants were between the ages of (Kahhaleh & Jurjus, 2005; Kozajda, Bródka, & Szadkowska-Stańczyk, 2013; Widjanarko, Widyastari, Martini, & Ginandjar, 2016). Most of the study population complied with international standards protocol for operation in the lab and also had good knowledge about biosafety policies with the majority indicating that they have had biosafety training or guidelines. Nevertheless, a significant number of the clinical workers practised unhealthy behaviours such as mouth pipetting in the lab which

could be attributed to poor experience and knowledge about the implications about their actions.

The study included 105 participants working in the four majority teaching hospitals in Ghana. Participants included medical laboratory staffs, laboratory technical staffs, nurses, and other clinicians in the lab. The sample represented the population which includes participants of both genders, different academic degrees, different age groups, and from every area of clinical sciences. A similar distribution of the demographics was reported in previous studies by Nasim and colleagues with respect to the age groups and gender (Nasim et al., 2012; Widjanarko et al., 2016).

This study shows that more than half (53.3%) of clinicians in the four major hospitals in Ghana have received any form of immunisation against potentially harmful pathogens. Furthermore, the provision of biosafety training was 66.7%, a little above average implying less safety awareness among clinicians particularly laboratory and support staff. Apart from that, all assessments regarding the biosafety policy perception among respondents were very encouraging.

Regarding the safety to the laboratory building, most of the buildings were in line with safety parameters. 82 (78.1%) out of the total study population reported the presence of bio-hazard warning sign in their respective hospitals and 75.2% reported a proper biohazard disposal containers for disposing of wastes. However, only 3 (1.9%) participants indicated the presence if food storage in the lab. The respondent answers from the participants were used to evaluate the study but not the physical evaluation of the places.

According to the study, 91.4% respondents reported to be familiar with the biosafety rule, 74.3% have been provided with a biosafety guideline and 86.7% with a laboratory manual, protocol and SOPs, 75.2% agreed to have been provided adequate training on how to handle spills. This is similar to the assessment conducted by Tormey et al., where 75.9% of respondents were presented with protocol, and 82.5% worked strictly according to guidelines for biosafety (Tormey & O'Hagan, 2015).

The results show that there was a good observance of biosafety practice because 95.5% agreed that eating, drinking and applying cosmetics is prohibited at working areas. 84.8% insisted that practising mouth pipetting in the absence of mechanical or micropipette should not be encouraged, 81.9% agreed centrifugation generate aerosols whilst 81.0% agreed that used needles should be recapped before disposal, 98.1% said they wash their hands before exiting the laboratory, 93.3% agreed that infectious waste should be decontaminated before removal, 95.2% practiced hand washing after discharge of gloves. However, participants did not follow the standard protocol for disposing of chemicals; 50.5% of participants had no idea about how chemical waste should be disposed. Unlike a study conducted by Nasim and colleagues in which eating and drinking were frequent (70.3%) in laboratories, mouth pipetting reported by 28.3% technicians and 73.3% of technicians covered centrifuge during centrifugation. Another study conducted by Jitendra and Jigna showed that45.6% of the participants eat in the laboratory, 47.0% of them store foods and water in the refrigerators, 31.5% of them put on cosmetics in the laboratory, 12.6% smoke in the laboratory, 10.0% cut their fingernails with teeth in the laboratory ((Nasim et al., 2012; Zaveri & Karia, 2012). About half (49.5%) of the participants declared the absence of a biosafety cabinet and 50.5% had no idea on certification of BSCs even though they had BSCs in their working environments. A similar study by Nasim et al. reported the. 91.4% respondents declared they regularly wore PPE during working hours contrast to the study conducted by Nasim et al. which indicated that 28.4% laboratory technicians from Punjab, 35.7% from Sindh, 32% from Balochistan and 38.4% from Khyber Pakhtoon Khawa (KPK) did not use any PPE during working hours. A similar study conducted by Khan S et al. found indicated that about 40% of the participants indicated proper maintenance of the biosafety cabinet as a result of regular maintenance cultures carried out in the laboratories. Proper disinfection and decontamination of biosafety cabinets were carried out in 70% of the cases. The safety cabinets were kept uncluttered in 50% of the labs whereas 50% of the participants agreed that theirs were usually cluttered their workplaces with only 38.10% of them providing information about its checkup based on daily, weekly, monthly and yearly basis compared to a study conducted by Khan S (Khan et al., 2014) had 10% of laboratories providing eyewash station. 82.9% of participants declared the existence of fire extinguishers at their working areas out of which 54.3% have been trained to use them. A cross-sectional study carried out to study the safety measures in clinical laboratories of India showed that 73.9% of laboratories are equipped with fire extinguishers (Of et al., n.d.).

Regarding the managerial aspects of biosafety practice in this study, 77.1% of participants indicated

that they always follow SOPs whereas 19.0% stated they sometimes follow. 58.1% of participants declared they always ensured others followed SOPs whereas 33.3% indicated they sometimes ensured others followed SOPs. 55.2% often reported all incidents, accidents and near misses that occurred during working hours and 84.8% frequently reported new medical conditions. Similarly, a study conducted by Nasim (Nasim et al., 2012) showed that on average, 73.9% of labs (75.9% private and71.7% public) were operating without written standard operating procedures and, on average 83.4% of laboratories(85.7% private and 80.8% public) did not maintain any accident records (12). Also 46.7% of respondents reported incidents or accidents to the in charge, 20.0 % said to the immediate supervisor on duty that period and the remaining 33.3% recorded them into the incident log books. A study conducted by Khan S showed that logbook for incident reporting is not maintained in 40% of the cases, 30% were unaware of it and 30% filled it accordingly (Selvakumar, Panneerselvam, & Ganeshamurthy, 2014).

The results revealed some inappropriate behaviors in the participants such as mouth pipetting which can be attributed to inexperience. The relevance of experience on the part of laboratory workers contributes to the reduction in risk in diagnostic laboratories (Peacock et al., 2008; Plebani, 2009; Rusnak et al., 2004). With respect to clinicians involved in the study, they are most usually assigned similar tasks to that of diagnostic medical laboratory technicians and thus are at the same risk level.

Finally, this study a modest scale investigation which provides baseline information on biosafety practices; managerial skills, work activities, the safety of facilities, and demographic design of the four major teaching hospitals in Ghana. The sample of this study is relatively small but can provide baseline information for large scale studies needed at a national level incorporating other minor hospitals to identify possible widespread health hazards to laboratory workers.

CONCLUSION

Majority of the laboratories in the various hospitals fit the safety measures concerning buildings and equipment. Regarding personnel working in the labs, most of them complied with safety guidelines related to disposing of sharp objects, removing soiled gloves, dealing with sample spills etc. Nevertheless, there were some improper practices in part of some clinicians such as mouth-pipetting, and almost half of the population size were not immunised against infectious pathogens in the laboratory; these practices are not accepted and need interventions. We recommend a detailed routine biosafety training for all clinicians in all hospitals in Ghana.

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