Journal of Positive Psychology & Wellbeing
2022, Vol. 6, No. 2, 2735 – 2743
http://journalppw.com
ISSN 2587-0130

Assessment of Knowledge, Attitude, and Practice on Laboratory Occupational Safety and Health among Healthcare Workers

Rashed Abdullah Alquraini[1], Maher Mohammad Allehyani[2], Mohammed Wasl Suleman Almogati[3], Ahmed Amer Alsulami[3], Bashayer Owaid Alsulami[4], Yousef Masfer S Alotaibi[5], Fahad fahian Mohamed alotaibi[6], Mohammed Yahya Almalki[7], Ahmed bin Ali Ayed Al-Zahrani[8], Ahmed Mohammed Hamed Al-Ahmadi[9], Nadiyah Eidan Alshamrani[10], Mohamed Nashi. Alrashidi[11], Talal Awad Al-Ataibi[12], Ahmed Hassan Muhammad Al-Zahrani[13], Fahad Eid Omar Alotaibi[13], Abdulaziz Jaad Saqer Alosaimi[14], Sattam Jawaed Hilal Alotaibi[15], Salma Eidan Alshamrani[16], Nada Saad Alhazmi[17]

[1]Health Administration, prince salaman bin mohammad hospital, Saudi Arabia
[2]Health Adminstration, Executive Administration of Public Health and Preventive Medicineb, Saudi Arabia
[3]health management, king faisal hospital mecca, Saudi Arabia
[4]health management, Executive medical management, Saudi Arabia
[5]Emergency Medical Servic, Al-Rifaya Hospital in Jamsh, Saudi Arabia
[6]Laboratory Specialist, Department of Health Volunteer of Public Health of Makkah Cluster, Saudi Arabia
[7]Pharmacy technician, Department of Health Volunteering and Community Partnerships at
[8]Public Health, Makkah Al-Mukarramah Health Cluster, Saudi Arabia
[9]Social worker- Maternity and Children's Hospital in Mecca, Saudi Arabia
[10]Health information technician, King Salman Center for Kidney Diseases, Saudi Arabia
[11]Laboratory technician, King Khalid Hospital in Al Kharj, Saudi Arabia
[12]Health information technician, Al-Imamah Hospital, Saudi Arabia
[13]Nursing, (Quality management in public health in the Makkah Health Cluster) , Saudi Arabia
[14]Health management specialist, Al Quwayiyah Hospital, Saudi Arabia
[15]Medical record, Dawadmi General Hospital, Saudi Arabia
[16]Social worker, Al Yamamah Hospital The second health cluster, Saudi Arabia
[17]Nursing, Alsahnah PHCC, Saudi Arabia

Abstract

Background: The use of chemicals in laboratories exposes laboratory staff to risks arising from hazardous chemicals. Accidents related to poor management and handling of chemicals have been reported in laboratories. Good implementation of occupational safety and health (OSH) in organizations that have implemented OSH-Management System (OSH-MS) plays an important role in reducing accidents at the workplace. This study aims: to assess the level of knowledge, attitude, and practice (KAP) related to the OSH aspect in chemical handling among healthcare workers. Method: This is a cross-sectional survey involving laboratory workers. The study was conducted in two governmental hospital laboratories in Riyadh (AL Zulfi Hospital, and King Khaled Hospital) Saudi Arabia. A total of 120 laboratory staff were recruited and data on KAP was collected using self-administered questionnaires. Items in the questionnaire were adapted from previous studies and published guidelines. Data obtained were entered into statistical software for analysis. Results: approximately two-thirds of the respondents have high knowledge of OSH, 96% have a positive attitude and 84% have good practice on OSH. Moreover, the present study revealed that there was no significant difference in the knowledge level between laboratory workers. Similarly, there is no significant difference in the attitude level between laboratory workers. However, the tests show that there is a significant difference in the practice level between laboratory workers. Furthermore, the

results of this study showed evidence of the association between gender (0.049) and practice level; the association between age (0.011*) and knowledge level, and education level (p=0.003) and knowledge level. Conclusion: There were the implementation of a suitable, adequate, and effective management system that is continually improved is crucial and needs to be implemented to manage the OSH risks in the organizations.

Keywords*: Occupational Safety and Health, OSH-MS, Laboratory, Workers, Education.*

Introduction

Generally, workers in laboratories are faced with many occupational risks at work and their health and safety may be severely risked if adequate preventive protective measures are not applied. These hazards can be physical, chemical, and biological (1, 2). Workers usually face numerous occupational hazards and their health and safety may be severely risked if appropriate protective practices are not possessed (3-6). The clinical laboratory staff is among those workers, and, they are exposed daily to various hazards and risks from human samples, infectious aerosols, spills, broken glass, cuts from sharp objects, needle stick injuries, chemical agents, centrifuge accidents, and others (7, 8). For example, clinical laboratory staff is at increased risk of acquiring viral (e.g. hepatitis B and C, coronavirus, and HIV) and bacterial pathogens (e.g. TB), which can all be transmitted through percutaneous damage (9, 10). Laboratory-acquired tuberculosis infection was considered high among healthcare providers, including medical laboratory staff (11, 12).

Safety is defined as a method of preventing accidents or reducing personal injury or property damage that may be caused by an accident. Health and safety are key concerns in any medical laboratory because of the potential risks in handling hazardous and infectious materials (13). These risks can be eliminated or minimized by promoting good laboratory practices as well as providing proper safety equipment. Although there are legislations to govern health and safety aspects in the workplace, safety training is required to promote good safety practices and the situation varies greatly from one laboratory to another. Safety in the laboratory is the responsibility of all employees and employers (14). Occupational Safety and Health (OSH) is one of the most crucial aspects in ensuring a safe and healthy workplace. It deals with the safety and health of workers in the work setting and it mainly focuses on preventing hazards (5-7).

Several published reports provided evidence for the threat of laboratory-associated infections of emerging and re-emerging diseases among healthcare workers in a laboratory, who are potentially exposed to an increased risk of acquiring a wide range of infectious diseases including human immunodeficiency virus HIV, HBV, and HCV (15). Medical laboratories' universal precautions and good laboratory practices involve the use of protective barriers such as gloves, gowns, aprons, masks, or protective eyewear, which can reduce the risk of infection (16).

A study conducted by Nasim et al., (2012) (17) revealed a lack of awareness regarding biosafety knowledge and practices among laboratory employees as well as. Moreover, another study in Saudi Arabia conducted by Cruz et al., (2015) (18) revealed that the workers in laboratories need to improve their knowledge, it is their responsibility the adhere to biosafety policy, use biosafety manuals, personal protective equipment, biosafety containment level, and protection in their daily laboratory work.

A study conducted by Al-Zahrani, (2018) (19) revealed that laboratory workers are exposed to biological hazards during collecting or processing biological materials, disinfecting, cleaning and transporting contaminated equipment, or working in contaminated areas.

In a parallel study conducted by Sewunet et al., (2014) (20) showed that the respondents reported that there were poor safety regulations or standards in their laboratories, and higher risks of microbial, chemical, and physical/mechanical hazards. Another study conducted by Shobowale et al., (2015) (21) found that the most common type of hazards in medical laboratories include; bacteria (80%) for Biological hazards; handling un-labeled chemicals (38.2%) for chemical hazards; and laboratory equipment's not periodically maintained (49.5%) for Physical hazards, and not-wearing personal protective equipment's was statistically associated with exposure to hazards.

A study in Saudi Arabia by Khabour et al., (2018) (22) discovered that more than half of the healthcare workers were trained in laboratory safety, and the majority followed guidelines for disposing of medical wastes, decontamination of sample spills, and use of protective lab coats, and gloves. However, 24.2% of the participants used to eat, drink, or use gum. almost 18 % reported that they continued working with a finger cut, whereas only 67% reported that they used to recap needles after blood withdrawal. In other studies, Galarpe et al., (2013) (23) and Walters et al., (2017) (24) reported that the absence of safety data sheets (SDS) of chemicals and apparatuses, absence of complete personal protective equipment (PPE) absence of safety cabinets for chemicals storage were recorded respectively. So, this study aims to assess the level of knowledge, attitude, and practice (KAP) related to the OSH aspect in chemical handling among healthcare workers.

Materials and Methods:

This is a cross-sectional survey involving laboratory workers. The study was conducted in two governmental hospital laboratories in Riyadh (AL Zulfi Hospital, and King Khaled Hospital) Saudi Arabia. Data collection was performed between January to March 2022. A total of 120 laboratory staff who work with chemicals were selected through the purposive sampling method. A self-administered questionnaire on KAP related to chemical handling was developed or adapted from the published regulations and guidelines related to OSH (25, 28) and several previous studies (26, 27, 29-31). Data obtained were entered into statistical software for analysis.

The questionnaire consists of five (5) sections as the following: (a) socio-demographic information (10 items), (b) safety training (3 items), (c) knowledge on OSH (9 items), (d) attitude on OSH (8 items), (e) practice on OSH (8 items). There were two different types of questions namely; ‘Yes’ or ‘No’ questions for knowledge questions and ‘Likert Scale’ for attitude and practice questions. For knowledge questions, 1 point was given for correct answers and 0 points were given for wrong answers.

A total of 14 scores were given for knowledge questions. The score ranges for knowledge are categorized as the following; High Knowledge: 12 – 14 (85% -100%). Medium Knowledge: 8 – 11 (60% - 84% (. Low Knowledge: ≤7 (≤59%) For attitude questions, 0 points were given for those who answered ‘Strongly Disagree’, 1 point for ‘Disagree’, 2 points for ‘Agree’, and 3 points given for ‘Strongly Agree’. A total of 24 scores were given for attitude questions. The score ranges were categorized into; · Positive Attitude: 17 – 24 (70% - 100%) · Negative Attitude: ≤16 (≤69%) For practice questions, 0 points were given for those who answered ‘Rarely’ and ‘Never’, 1 point for ‘Occasionally’, 2 points for ‘Frequently’ and 3 points given for ‘Very Frequently’. A total of 24 answers were given for practice questions. The score ranges were categorized into; · Good Practice: 17 – 24 (70% - 100%) · Poor Practice: ≤16 (≤69%).

This questionnaire was tested on its validity and reliability to ensure that the questionnaire items were measured according to the study aim. Content validity was performed by giving the questionnaire to experts in the field to review and evaluate whether the items tested define the items of the questionnaire in terms of clarity and relevance. Next, a pilot study was

conducted among 15 laboratory workers to test reliability.

A test of reliability showed that most of the test items achieved 0.76 – 0.79. The survey was distributed in person for most of the data collection. All participants were required to answer the survey according to the format provided in the questionnaire. Data analysis was performed by using IBM SPSS version 25.

Results

Table (1) shows that socio-demographic information a total of 120 laboratory workers have participated in this study. Amongst the 120 participants, there were more males (52.5%) than females (47.5%) and most of them were from the age group of 36-45 years old (51.7%). Most of the participants have served for ≤14 years (70.8%), while the others have been in service for 15-19 years (16.7%) and ≥15 years (12.5%). The majority (94.2%) of them have attended safety training, while in terms of education background, 12.5% are certificate holders, 40.8% are Diploma holders, 44.2% are Bachelor's degree holders, and 2.5% are Master's degree holders.

Table (1): Socio-demographic information of laboratory workers (n = 120)

Socio-demographic information		**Total N (%)**
Gender	Male	63 (52.5)
	Female	57 (47.5)
Age	≤ 35	49 (40.8)
	36-45	62 (51.7)
	≥ 46	9 (7.5)
Length of Service (year)	≤14	85 (70.8)
	15-19	20 (16.7)
	≥ 20	15 (12.5)
Safety Training	Attended	113 (94.2)
	Never Attend	7 (5.8)
Types Safety Training	Chemical Handling	101 (84.2)
	First Aid	69 (57.5)
	Emergency Response	76 (63.3)
	OSH-MS	51 (42.5)
Education Level	Certificate	15 (12.5)
	Diploma	49 (40.8)
	Degree	53 (44.2)
	Master	3 (2.5)

Table (2) shows that knowledge, attitude, and practice level of laboratory workers 72.5% of the respondents scored a high level of knowledge while 26.7% of them scored medium level and another 0.8% scored a low level of knowledge. As for the attitude level, the majority (95.8%) of the laboratory workers have a positive attitude while only 4.2% of them have a negative attitude towards occupational safety and health. Meanwhile, in terms of practice on occupational safety and health, 84.2% of the laboratory workers have good practice while 15.8% of them have poor practice on occupational safety and health.

Moreover, the results of the present indicated that there was no significant difference in the knowledge level between laboratory workers, where $p>0.05$($p=0.190$). Likewise, there is also no significant difference in the attitude level between laboratory workers, where $p>0.05$ ($p=0.089$). However, the tests show that there is a significant difference in the practice level between laboratory workers, where $p>0.05$ ($p=0.022$*).

Table (2): the level of knowledge, attitude, and practice on occupational safety and health among laboratory workers (n = 120)

		Total N (%)	Z Statistics	p-value
Knowledge Levels, n (%)	High	87 (72.5)	-1.671	0.190
	Medium	32 (26.7)		
	Low	1 (0.8)		
Attitude Levels, n (%)	Positive	115(95.8)	-0.126	0.089
	Negative	5 (4.2)		
Practice Levels, n (%)	Good	101 (84.2)	-3.780	0.022*
	Poor	19 (15.8)		

*p-value is significant at 0.05 level

Table (3) presents the results of bivariate analysis between knowledge, attitude, and practice level with independent variables. Bivariate analysis between practice and sociodemographic and occupational factors was conducted and the results of the test showed evidence of the association between gender (0.049) and practice level as $p<0.05$. Whereas, other independent variables such as age (p=0.680), work experience (p=0.065), safety training (p=0.306), and education level (p=0.185) do not show any evidence of association.

Moreover, the association between age (0.011*) and knowledge level, and education level (p=0.003) and knowledge level is $p<0.05$. Whereas, other independent variables such as gender (p=0.680), work experience (p=0.121), and safety training (p=1.000), do not show any evidence of association. Furthermore, all independent variables such as age (p=0.584), gender (p=0.368), work experience (p=0.615), safety training (p=0.263), and education level (p=0.855) do not show any evidence of association with attitude.

Table (3): Association between knowledge level and independent variables (n = 120)

Variables, n=120	Knowledge			Attitude			Practice		
	High n= 87	**Medium/Low n= 33**	***p*-value**	**Positive n=115**	**Negative n=5**	***p*-value**	**Good ,n= 101**	**Poor, n= 19**	***p*-value**
Gender			0.680			0.368			**0.049***
Male	47(54.0)	16 (48.5)		59 (51.3	4 (80.0)		49 (48.5)	14 (73.7)	
Female	40(46.0)	17 (51.5)		56 (48.7)	1 (20.0)		52 (51.5)	5 (26.3)	
Age			**0.011***			0.584			0.680
≤35	34(39.1)	15 (45.5)		48 (41.7)	1(20.0)		43 (42.6)	6 (31.6)	
36-45	50(57.5)	12 (36.4)		58 (50.4)	4(80.0)		50 (49.5)	12 (63.2)	
≥46	3 (3.4)	6 (18.2)		9 (7.8)	0		8 (7.9)	1 (5.3)	
Length of Service(year)			0.121			0.615			0.065
≤14	62(71.3)	23 (69.7)		81 (70.4)	4(80.0)		68 (59.1)	17(89.5)	
15-19	17(19.5)	3 (9.1)		20 (17.4)	0		20 (19.8)	0	
≥20	8 (9.2)	7 (21.2)		14 (12.2)	1(20.0)		13 (12.9)	2 (10.5)	
Safety Training			1.000			0.263			0.306
Attended	82(94.3)	31 (94.0)		109(94.8)	4(80.0)		96 (95.0)	17(89.5)	
Never	5 (5.7)	2 (6.0)		6 (5.2)	1 (20.0)		5 (5.0)	2 (10.5)	

Attend						
Education Level		**0.003***		0.855		0.185
Certificate	6 (6.9)	9 (27.2)	15 (13.0)	0	(10.9)	4 (21.1)
Diploma	42(48.3)	7 (21.2)	46 (40.0)	3(60.0)	40	9 (47.4)
Degree	36(41.4)	17 (51.6)	51 (44.4)	2(40.0)	(39.6)	5 (26.3)
Master	3 (3.44)	0	3 (2.6)	0	48	1 (5.2)
					(47.5)	
					2 (2.0)	

Discussion

Medical laboratories are considered potentially hazardous workplaces, workers in labs are exposed to a wide range of biologic hazards in addition to physical incidents (3). There is general agreement about adequate preparation of the workers in terms of training to improve their knowledge and skills in addition to providing them with proper personal protective equipment (4, 5). Almost all measures and guidelines are listed in manuals that are distributed to lab workers, but adherence to such measures, and acquired knowledge about biosafety, is another issue, that needs to be investigated, especially since faulty practices could cause serious health problems (6, 7). This study assessed the knowledge, attitude, and practice concerning occupational safety and health among laboratory workers.

According to Awang et al. (2019) (29), the implementation of OSH-MS in an organization can lead to the development of a good safety culture. In the present study, approximately two-thirds of the respondents have high knowledge of OSH, 96% have a positive attitude and 84% have good practice on OSH. Moreover, the present study revealed that there was no significant difference in the knowledge level between laboratory workers. Similarly, there is no significant difference in the attitude level between laboratory workers. However, the tests show that there is a significant difference in the practice level between laboratory workers. Furthermore, the results of this study showed evidence of the association between gender (0.049) and practice level; the association between age (0.011*) and knowledge level, and education level (p=0.003) and knowledge level.

This study found no association between knowledge level and independent variables such as gender, work experience, and safety training. However, younger age and higher education level were significantly associated with the level of knowledge of OSH. The result is different from the findings in one study by Odu et al. (2018) (30) where no evidence of association was found between knowledge of safety culture and socio-demographic characteristics. Similarly, in another study conducted by Rosliza et al. (2015) (31), job title, employment status, and work experience have proven to have an association with the knowledge level of work safety culture. However, the current result is similar to a study conducted by Nasab et al., (2009) (32) in Iran where an association between education level and knowledge level on OSH was proven to be significant.

The current study demonstrates that all independent variables do not show any evidence of association with attitude. This result is inconsistent with the study conducted by Hamouda (2013) (33) the study on attitude towards safety culture among employees at the intensive care unit by revealed the association between attitude level and work experience. In another study by Nasab et al., (2009) (32) an association between attitude on OSH and age was proven significant, where older workers were found to have more positive attitudes as compared to younger workers. Similar findings were proven by Hurst et al., (1996) (34) and Heidari et al. (2004) (35), showing a positive relation between attitude toward safety and age.

The present study is inconsistent with a previous study from Jeddah, Saudi Arabia, which reported that training on occupational

health and safety was a significant predictor of knowledge of the health workers in the labs, as well as the need to organize a national training program to increase awareness of the Laboratories health workers about proper laboratory techniques and self-hygienic principles (20). Another study from Al Madinah, Saudi Arabia, showed that a fraction of medical laboratory staff who participated in the study had no previous training on lab safety, which is almost similar to ours, and this was associated with inappropriate behaviors like the use of cosmetics, eating/drinking in the labs, and continue working with torn gloves and injured fingers (22). The percentage of those who did not receive training is considered low when compared to equivalent regional studies. For example, previous studies from Sudan and Pakistan reported that about 60-84.2% of the respondents did not have any training in biosafety (36). In a study from Yemen, of the private and public laboratory staff, 67% and 32% had training in biosafety (27).

Conclusion

In summary, this study found the implementation of a suitable, adequate, and effective management system that is continually improved is crucial and needs to be implemented to manage the OSH risks in organizations. Good OSH implementation will develop a good image, and morale, and increase the productivity of workers. Since laboratory workers will need to convey safety and health information, they need to have good knowledge, attitude, and practice on OSH first. Therefore, continuous safety training is necessary for laboratory workers to maintain, at the same time, to improve their knowledge of OSH, particularly on laboratory safety which is a dynamic field due to the advancement of technology. A stricter system will influence the workers to be more compliant with the safety and health rules while working, thus preventing accidents from happening.

Reference

1. RHill, R. H. (2007). The emergence of laboratory safety. Journal of Chemical Health and Safety, 14(3), 14-19.
2. A study on knowledge, attitude and practice of laboratory safety measures among paramedical staff of laboratory services. 2019. Available from: http://connection.ebscohost.com/c/articles/83290491/study-knowledge-attitude-practice-laboratory-safety-measures-among-paramedical-staff-laboratory-services
3. Chauhan, A., Anand, T., Kishore, J., Danielsen, T. E., & Ingle, G. K. (2014). Occupational hazard exposure and general health profile of welders in rural Delhi. Indian Journal of Occupational and Environmental Medicine, 18(1), 21. https://doi.org/10.4103/0019-5278.134953
4. Hofmann, D. A., Burke, M. J., & Zohar, D. (2017). 100 years of occupational safety research: From basic protections and work analysis to a multilevel view of workplace safety and risk. J Appl Psychol, 102(3), 375-388. https://doi.org/10.1037/apl0000114
5. Tompa, E., Kalcevich, C., Foley, M., McLeod, C., Hogg-Johnson, S., Cullen, K., et al. (2016). A systematic literature review of the effectiveness of occupational health and safety regulatory enforcement. Am J Ind Med., 59(11), 919-933. https://doi.org/10.1002/ajim.22605
6. Valenti, A., Gagliardi, D., Fortuna, G., & Iavicoli, S. (2016). Towards a greener labour market: occupational health and safety implications. Ann Ist Super Sanita, 52(3), 415-423. https://doi.org/10.4415/ANN_16_03_13.
7. Nisii, C., Castilletti, C., Di Caro, A., Capobianchi, M. R., Brown, D., Lloyd, G., et al. (2009). The European network of Biosafety-Level-4 laboratories: Enhancing European preparedness for new health threats. ClinMicrobiol Infect, 15(8), 720-26. https://doi.org/10.1111/j.1469-0691.2009.02946.x.

8. Tohda, S. (2016). Infection Control from the Viewpoint of Medical Safety by Our Clinical Laboratory in TMDU Hospital. RinshoByori, 64(3), 334-337.

9. Auta, A., Adewuyi, E. O., Tor-Anyiin, A., Aziz, D., Ogbole, E., Ogbonna, B. O., et al. (2017). Health-care workers' occupational exposures to body fluids in 21 countries in Africa: systematic review and meta-analysis. Bull World Health Organ, 95(12), 831-841. https://doi.org/10.2471/BLT.17.195735

10. De Carli, G., Abiteboul, D., & Puro, V. (2014). The importance of implementing safe sharps practices in the laboratory setting in Europe. Biochem Med (Zagreb), 24(1), 45-56. https://doi.org/10.11613/BM.2014.007.

11. Baussano, I., Nunn, P., Williams, B., Pivetta, E., Bugiani, M., & Scano, F. (2011). Tuberculosis among Health Care Workers. Emerg Infect Dis, 17(3), 488-494. https://doi.org/10.3201/eid1703.100947.

12. Nasreen, S., Shokoohi, M., Malvankar-Mehta, M. S. (2016). Prevalence of Latent Tuberculosis among Health Care Workers in High Burden Countries: A Systematic Review and Meta-Analysis. PLoS ONE, 11(10), e0164034. https://doi.org/10.1371/journal.pone.0164034

13. Balkhiour, M. A. (2011). Evaluation of the Safety Status in Some University Laboratories. Journal of King Abdulaziz University: Meteorology, Environment & Arid Land Agriculture Sciences, 22(1).

14. Shnawa, Z. K. (2017). Chemical Safety in Chemistry Departments Laboratories at Iraqi Universities. Iraqi National Journal of Chemistry, 17(2), 149-156.

15. Reddy, S., Sadhan, D., Doshi, D., Kulkarni, S., Srikanth Reddy, B., & Padma Reddy, M. (2017). Occupational Hazards in Dentistry, 6, 110.

16. Manyele, S. V., Ngonyani, H. a. M., & Eliakimu, E. (2008). The status of occupational safety among health service providers in hospitals in Tanzania. Tanzan J Health Res., 10(3), 159-165.

17. Nasim, S., Shahid, A., Mustufa, M. A., Arain, G. M., Ali, G., Taseer, I.-H. et al. (2012). Biosafety perspective of clinical laboratory workers: a profile of Pakistan. J Infect DevCtries, 6(8), 611-619. https://doi.org/10.3855/jidc.2236.

18. Cruz, C. P., Cruz, J. P., Abu Bakr, S. A., & Thazha, S. K. (2015). Biosafety knowledge and perceptions of clinical laboratory science educators in Shaqra University. J Infect Public Health, 8(4), 398.

19. Al-Zahrani, K. (2018). Assessment of Biosafety and associated Occupational Hazards among Laboratories Health Workers in Governmental Moderate and High Complexity Medical Labs. Journal of Medical Science and Clinical Research, 2(6).

20. Sewunet, T., Kebede, W., Wondafrash, B., Workalemau, B., & Abebe, G. (2014). Survey of Safety Practices Among Hospital Laboratories in Oromia Regional State, Ethiopia. Ethiop J Health Sci., 24(4), 307-310.

21. Shobowale, E., Elikwu, C. J., Coker, A. O., Mutiu, P. B., Nwadike, V. et al. (2015) A Survey of Biosafety Practices of Clinical LaboratoryPersonnel in Four Selected Clinical Laboratories. Med Safe Glo Heal, 4, 123. https://doi.org/10.4172/2574-0407/1000123

22. Khabour, O. F., Ali, K. H. A., Aljuhani, J. N., Alrashedi, M. A., Alharbe, F. H., & Sanyowr, A. (2018). Assessment of biosafety measures in clinical laboratories of Al-Madinah city, Saudi Arabia. 12(9), 755-761. https://doi.org/10.3855/jidc.10081

23. Galarpe, V. R. K., C. Lamela, N., & Alcantara, R. (2013). Preliminary evaluation of laboratory practices in Cebu Doctors' University, Philippines, 20, 25-30.

24. Walters, A. U. C., Lawrence, W., & Jalsa, N. K. (2017). Chemical laboratory safety

awareness, attitudes and practices of tertiary students. Safety Science, 1(96), 161-171. https://doi.org/10.1016/j.ssci.2017.03.017

25. Malaysia. Occupational Safety and Health Act 1994: Use and standards of exposure of chemicals hazardous to health regulations. 2018. Available from: https://www.dosh.gov.my/index.php/legislation/eregulations/regulations-under-occupational-safety-and-health-act-1994-act-514/522-pua-131-2000-1/file

26. Goswami, H.M., Soni, S.T., Patel, S.M., Patel, M.K. (2011). A study on knowledge, attitude, and practice of laboratory safety measures among paramedical staff of laboratory services. National Journal of Community Medicine; 2(3):470–73.

27. Narayanan, S. (2013). Knowledge, attitude, and practice on occupational safety and health among medical laboratory personnel in Hospital Raja Permaisuri Bainun Ipoh: Impact of intervention. University Tun Abdul Razak.

28. Department of Occupational Safety and Health. Guidelines on storage of hazardous chemicals: A guide for safe warehousing of packaged hazardous chemicals. Putrajaya: Ministry of Human Resources Malaysia; 2005.

29. Walters, A.U.C., Lawrence, W., Jalsa, N.K. (2017). Chemical laboratory safety awareness, attitudes and practices of tertiary students. Safety Science; 96(161– 171). doi:10.1016/j.ssci.2017.03.017

30. Odu, J.O., Hamedon, T.R., Juliana, J. (2018). Safety culture among the staff at a public university in Malaysia. International Journal of Public Health and Clinical Sciences; 5(4);191-74.

31. Rosliza, A.M., Rahmawati, H.T., Syukran, M. (2015). Knowledge, attitude and practice regarding work safety culture among staffs in the faculty of medicine and health sciences, Universiti Putra Malaysia. International Journal of Public Health and Clinical Sciences; 2(5); 33–44.

32. Nasab, H.S., Tavakoli, R., Ghofranipour, F., Kazemnejad, A., Khavanin, A. (2009). Evaluation of knowledge, attitude and behavior of workers towards occupational health and safety. Iranian Journal of Public Health, 38(2);125–29.

33. Hamouda, A.S. (2013). Attitude towards safety culture among employees at the intensive care unit in the government hospital of Gaza city. [Master Thesis]. Islamic University, Gaza.

34. Hurst, N.W., Young, S., Donald, I., Gibson, H., Muyselaar A. (1996). Measures of safety management performance and attitudes to safety at major hazard sites. Journal of Loss Prevention in the Process Industries, 9(2):161–72. doi:10.1016/0950-4230(96)00005-8

35. Heidari, M., Farshad, A.A., Arghami, S. (2004). Relation between safety climate and safety behaviors among workers Arak metal industries. Iranian Journal of Occupational Health, 1(1):30–32.

36. Elduma, A. H., & Saeed, N. S. (2011) Hepatitis B virus infection among staff in three hospitals in Khartoum, Sudan, 2006-07. East Mediterr Health J., 17, 474-478.

37. Al-Abhar, N., Al-Gunaid, E., Mogram, G., Al-Habibi, A. A., Alserouri, A., & Khader, Y. (2017). Knowledge and practice of biosafety among laboratory staff working in clinical laboratories in Yemen. ApplBiosaf, 22, 168-71. https://doi.org/10.1177/1535676017733451