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Survey on Health and Safety Concerns of Laboratory Animal Workers in the Philippines

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Occupational health and safety are important aspects of the workplace. This study was carried out to identify the common occupational health and safety concerns of laboratory animal workers (LAWs) in the Philippines. Specifically, it aims to describe the frequency of encounters with the different health and safety concerns plus the encounters based on the workers' demographic profiles, animal contact, and the frequency of personal protective equipment (PPE) usage at work. An online survey questionnaire was developed and confidentially administered to the respondents *via* email through the Philippine Association for Laboratory Animal Science (PALAS). A total of 44 responses met the research inclusion criteria. The three most common health and safety concerns encountered by LAWs at work were animal-related injuries (34/44, 77.3%), sharp-related injuries (30/44, 68.2%), and allergy from animals (23/44, 52.3%). These were consistent regardless of the workers' age, gender, job title, years of work experience with laboratory animals, animal contact, and frequency of PPE usage at work. A high rate of experiencing animal-related injuries was observed even with the frequent use of available PPE. With this, the study revealed that LAWs in the Philippines are exposed to different health and safety concerns present at work. Moreover, the study showed the need to evaluate further the current practices and ensure implementation of additional safety measures to lessen the occurrence of these concerns and protect the health and safety of the workers.

Keywords: animals, disease, injuries, occupational health, safety

INTRODUCTION

The health and safety of the workers are both linked to the dynamics of economic globalization and should be integrated as components of social and economic development (Lucchini and London 2014). The World Health Organization (WHO) defined a healthy workplace as a setting where workers and managers collaborate to continuously improve the process of promoting and protecting the health, safety, and wellbeing of workers (WHO and Burton 2010). This is done by introducing well-implemented workforce health protection programs and health promotion services.

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The Occupational Safety and Health Standards in the Philippines were mandated and enforced by the government, specifically the Secretary of Labor and Employment, to reduce occupational safety and health hazards at the workplace (DOLE-BWC n/d). From the press release published by the Philippine Statistics Authority in 2019, the professional, scientific, and technical activities industries account for 1.2% of the total cases of occupational injuries and 0.9% for occupational diseases in the country (ISLE n/d). For instance, in the laboratory animal research industry, the workers can encounter different injuries and diseases while performing their duties that can affect their health and safety at work. To date, laboratory animal allergen (LAA) is still known

to be the most common workplace concern encountered by workers in this industry (Wood 2001; Jones 2015). However, in this kind of workplace, the workers can be exposed to different health and safety concerns related to physical, chemical, biological, and ergonomics (NRC 1997; Mobo *et al*. 2010). To our knowledge, there is no published data on occupational health and safety of LAWs in the Philippines.

The main goal of the study was to identify the common occupational health and safety concerns of LAWs in the Philippines. Specifically, it aims to describe the frequency of encounters with the different health and safety concerns, as well as the encounters based on the workers' demographic profiles (*i.e.* age, gender, job title, and years of work experience with animals), animal contact, and the frequency of PPE usage at work.

MATERIALS AND METHODS

Research Design

The study employed a quantitative, descriptive survey research design with a non-probability sampling technique. The survey was administered at a specific time point to members of PALAS to identify the common occupational health and safety concerns of LAWs in the Philippines. Since the study was strictly bounded by ethics, there was no follow-up survey conducted on the participants.

Research Instrument

The survey questionnaire was designed to minimize the subjectivity and time necessary for completing the survey. Most of the items were in multiple-choice format. Few items, however, required respondents to specify their answers if not included in the choices. The survey questionnaire was divided into three main parts. Part one was composed of questions related to personal profile, which include age and gender. Part two was related to work such as the job scope, years of work experience, type of animal exposures, and usage of PPE at work. The third and final part surveyed the frequency of encounters with the potential health and safety concerns at work (*i.e.* once a year, every 6 mo, every 3 mo, every month, every week, and every day). All questions and instructions were written in the English language, pre-tested before the actual conduct of the study, and took approximately 10 min to complete.

Data Collection

The data were gathered using Google Forms online survey application administered *via* email. All 130 PALAS members at the time of the survey were invited to participate. To maintain the anonymity of the respondents, a contact person was identified within PALAS. This person was the only link between the respondents and the researchers. This contact person was responsible for the dissemination of the survey link. The inclusion criteria of the study required that workers in animal research facilities must be aged 18 yr and above, and were working in direct contact with laboratory animals. Direct animal contact was defined as working in close proximity with the animals or to their environment.

Data Analysis

All survey responses were transcribed and summarized in the Microsoft Excel spreadsheet, after which a descriptive statistical analysis was performed on the data. To identify the most common occupational health and safety concerns, the count and percentage of respondents who reported experiencing the different concerns were obtained. The count and percentage based on the frequency of encounters with the concerns – based on the workers' demographic profile, animal contact, and frequency of PPE usage at work – were also calculated and presented.

Ethical Consideration

The National Ethics Committee (NEC) of the Philippines provided ethical clearance for this study. The informed consent was made available in the first part of the survey, and the participants were given an option to proceed with the survey by clicking the "Next" button signifying their consent to participate. Taking part in the study was voluntary, having no direct benefit but definitely would contribute to understanding the occupational health and safety concerns of LAWs in the Philippines. It was emphasized in the informed consent form that there were no significant risks identified during and after one's participation in the online survey. Furthermore, the compliance with the Data Privacy Act of 2012 was ensured such that no information was gathered in the survey that could be used to trace the identity of the respondents, as well as their institutional affiliations.

RESULTS

Survey Response and Demographic Profile of Workers

From a total of 130 members of PALAS at the time of the online survey, a response rate of 36.2% was calculated with 47 respondents. This was reduced to 44 since there were three respondents who declared that they had no direct animal contact at work.

Of the 44 valid respondents, 29 (65.9%) were between the ages of 18–39 yr and 15 (34.1%) were between the ages of 40–65 yr. There were also more females (38/44; 86.4%) than males (6/44; 13.6%). Majority were veterinarians (23/44; 52.3%) and researchers (18/44; 40.9%). Three respondents (6.8%) – categorized under "Others" – identified themselves as an IACUC (Institutional Animal Care and Use Committee) member, an Assistant Professor, and a Ph.D. student. Thirty (30) respondents (68.2%) had < 1 yr to 5 yr of experience working with animals. Only 14 (31.8%) respondents had experienced working with animals for 6 yr and more.

Most Common Health and Safety Concerns Encountered by Workers

Table 1 shows the count and percentage of workers who are and who are not experiencing the different health and safety concerns at work. The three most common health and safety concerns encountered were animal-related injuries such as bites, scratches, and kicks (34/44, 77.3%); sharp-related injuries (30/44, 68.2%); and allergy from animals (23/44, 52.3%). The count and percentage of workers experiencing the different health and safety concerns based on the frequency of encounters (*i.e.* once a year, every 6 mo, every 3 mo, every month, every week, and every day) are shown in Table 2. Animal-related injuries were encountered regardless of frequency. On a daily basis, LAWs encountered all the possible health and safety concerns identified in the laboratory animal environment. Animal-related injuries, electricity-related injuries, and allergy from exposure to animals, chemicals, and unknown sources (3/44; 6.8%) were commonly encountered every day. Interestingly, sharp-related injuries along with noise-related injuries (1/44; 2.3%) were the least encountered health and safety concerns on a daily basis. Sharp-related injuries, however, were encountered more commonly every 3 mo (3/44, 6.8%) and every 6 mo (6/44, 13.6%).

Table 1. Count and percentage of workers experiencing the different health and safety concerns at work.

Health and safety concerns	Not experienced n = 44	Experienced n = 44
	n (%)	n (%)
Physical		
Animal-related injuries	10 (22.7)	34 (77.3)
Sharp-related injuries	14 (31.8)	30 (68.2)
Slip, trip, and fall	33 (75.0)	11 (25.0)
Noise-related injuries	40 (90.9)	4 (9.1)
Radiation-related injuries	36 (81.8)	8 (18.2)
Electricity-related injuries	34 (77.3)	10 (22.7)
Chemical		
Toxicity	34 (77.3)	10 (22.7)
Burn	36 (81.8)	8 (18.2)
Allergy, irritation	34 (77.3)	10 (22.7)
Explosion and fire	39 (88.6)	5 (11.4)
Biological		
LAI[a]	34 (77.3)	10 (22.7)
Allergy from animals	21 (47.7)	23 (52.3)
Allergy from unknown source	27 (61.4)	17 (38.6)
Ergonomic	29 (65.9)	15 (34.1)
Others	39 (88.6)	5 (11.4)

[a]Laboratory acquired infections

Health and Safety Concerns Based on Workers' Demographic Profiles

Table 3 shows the count and percentage of workers experiencing the different health and safety concerns based on their age, gender, job title, and years of work experience with animals. The age groups were collapsed into two categories: younger workers are those between 18–39 yr of age and older workers were those between 40–65 yr old. The three most common health and safety concerns identified were consistent regardless of age. Animal-related injuries were the most common (22/29, 75.9%; 12/15, 80%; younger *vs.* older), followed by sharp-related injuries (21/29, 72.4%; 9/15, 60%) and allergies from animals (16/29, 55.2%; 7/15, 46.7%). Younger workers encountered all possible concerns identified in the laboratory animal environment.

The three most common concerns identified in this study were also consistent regardless of gender. Animal-related injuries were the most common (6/6, 100%; 28/38, 73.7%, male *vs.* female), followed by sharp-related injuries (5/6, 83.3%; 25/38, 65.8%) and allergy from animals (4/6, 66.7%; 19/38, 50%). For male workers, allergy from unknown sources was also common (4/6, 66.7%). Overall, the rate of experiencing the three most common health and safety concerns was noted to be higher in male than in female workers.

Both veterinarians and researchers were commonly exposed to animal-related injuries (18/23, 78.3% and 14/18, 77.8% respectively), sharp-related injuries (16/23, 69.6%; 11/18, 61.1%), and allergies from animals (14/23, 60.9%; 7/18, 38.9%). Between these two jobs, the rate of experiencing the three common concerns identified in this study was reported higher for veterinarians. Sharp-related injuries (3/3, 100%) were common to those respondents under the category "Others."

LAWs with shorter work experience tended to have higher rates of experiencing the different health and safety

Table 2. Count and percentage of workers experiencing the different health and safety concerns based on the frequency of encounters.

Health and safety concerns	Frequency of encounter (n = 44)					
	Once a year	Every 6 mo	Every 3 mo	Every mo	Every week	Every day
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Physical						
Animal-related injuries	21 (47.7)	4 (9.1)	2 (4.5)	2 (4.5)	2 (4.5)	3 (6.8)
Sharp-related injuries	19 (43.2)	6 (13.6)	3 (6.8)	0 (0.0)	1 (2.3)	1 (2.3)
Slip, trip, and fall	4 (9.1)	3 (6.8)	1 (2.3)	0 (0.0)	1 (2.3)	2 (4.5)
Noise-related injuries	0 (0.0)	0 (0.0)	1 (2.3)	2 (4.5)	0 (0.0)	1 (2.3)
Radiation-related injuries	3 (6.8)	0 (0.0)	0 (0.0)	2 (4.5)	1 (2.3)	2 (4.5)
Electricity-related injuries	3 (6.8)	4 (9.1)	0 (0.0)	0 (0.0)	0 (0.0)	3 (6.8)
Chemical						
Toxicity	2 (4.5)	3 (6.8)	0 (0.0)	2 (4.5)	1 (2.3)	2 (4.5)
Burn	3 (6.8)	3 (6.8)	0 (0.0)	0 (0.0)	0 (0.0)	2 (4.5)
Allergy, irritation	5 (11.4)	0 (0.0)	1 (2.3)	1 (2.3)	0 (0.0)	3 (6.8)
Explosion and fire	2 (4.5)	1 (2.3)	0 (0.0)	0 (0.0)	0 (0.0)	2 (4.5)
Biological						
LAI[a]	7 (15.9)	0 (0.0)	1 (2.3)	0 (0.0)	0 (0.0)	2 (4.5)
Allergy from animals	14 (31.8)	4 (9.1)	1 (2.3)	0 (0.0)	1 (2.3)	3 (6.8)
Allergy from unknown source	11 (25.0)	2 (4.5)	1 (2.3)	0 (0.0)	0 (0.0)	3 (6.8)
Ergonomic	7 (15.9)	4 (9.1)	2 (4.5)	0 (0.0)	0 (0.0)	2 (4.5)
Others	4 (9.1)	1 (2.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

[a]Laboratory acquired infections

Table 3. Count and percentage of workers experiencing the different health and safety concerns based on their demographic profiles.

Health and safety concerns	Age (yr)		Gender		Job			Work experience	
	18–39 n = 29	40–65 n = 15	M[a] n = 6	F[b] n = 38	Vet[c] n = 23	Res[d] n = 18	Othrs[e] n = 3	Less[f] n = 30	More[g] n = 14
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Physical									
Animal-related injuries	22 (75.9)	12 (80.0)	6 (100.0)	28 (73.7)	18 (78.3)	14 (77.8)	2 (66.7)	22 (73.3)	12 (85.7)
Sharp-related injuries	21 (72.4)	9 (60.0)	5 (83.3)	25 (65.8)	16 (69.6)	11 (61.1)	3 (100.0)	21 (70.0)	9 (64.3)
Slip, trip, and fall	9 (31.0)	2 (13.3)	3 (50.0)	8 (21.1)	6 (26.1)	4 (22.2)	1 (33.3)	8 (26.7)	3 (21.4)
Noise-related injuries	5 (17.2)	0 (0.0)	1 (16.7)	4 (10.5)	3 (13.0)	1 (5.6)	1 (33.3)	4 (13.3)	1 (7.1)
Radiation-related injuries	8 (27.6)	0 (0.0)	1 (16.7)	7 (18.4)	5 (21.7)	2 (11.1)	1 (33.3)	8 (26.7)	0 (0.0)
Electricity-related injuries	9 (31.0)	1 (6.7)	2 (33.3)	8 (21.1)	6 (26.1)	3 (16.7)	1 (33.3)	9 (30.0)	1 (7.1)
Chemical									
Toxicity	9 (31.0)	1 (6.7)	2 (33.3)	8 (21.1)	4 (17.4)	3 (16.7)	2 (66.7)	8 (26.7)	2 (14.3)
Burn	8 (27.6)	0 (0.0)	2 (33.3)	6 (15.8)	2 (8.7)	3 (16.7)	2 (66.7)	5 (16.7)	3 (21.4)

Table 3 continuation

Allergy, irritation	8 (27.6)	2 (13.3)	2 (33.3)	8 (21.1)	5 (21.7)	3 (16.7)	2 (66.7)	7 (23.3)	3 (21.4)
Explosion and fire	5 (17.2)	0 (0.0)	1 (16.7)	4 (10.5)	2 (8.7)	2 (11.1)	1 (33.3)	5 (16.7)	0 (0.0)
Biological									
LAI[h]	7 (24.1)	3 (20.0)	1 (16.7)	9 (23.7)	5 (21.7)	3 (16.7)	2 (66.7)	7 (23.3)	3 (21.4)
Allergy from animals	16 (55.2)	7 (46.7)	4 (66.7)	19 (50.0)	14 (60.9)	7 (38.9)	2 (66.7)	17 (56.7)	6 (42.9)
Allergy from unknown source	12 (41.4)	3 (20.0)	4 (66.7)	13 (34.2)	10 (43.5)	5 (27.8)	2 (66.7)	13 (43.3)	4 (28.6)
Ergonomic	13 (44.8)	2 (13.3)	3 (50.0)	12 (31.6)	7 (30.4)	7 (38.9)	1 (33.3)	12 40.0)	3 (21.4)
Others	5 (17.2)	0 (0.0)	1 (16.7)	4 (10.5)	4 (17.4)	1 (5.6)	0 (0.0)	4 (13.3)	1 (7.1)

Legends: [a]male; [b]female; [c]veterinarian; [d]researcher, [e]others (IACUC member, Assistant Professor, Ph.D. student); [f]< 1–5 yr; [g]6 yr and above; [h]laboratory acquired infections

concerns. Moreover, this group of workers encountered all the health and safety concerns identified in the laboratory animal environment. Regardless of the length of work experience, the three common concerns were consistent. Interestingly, workers with longer experience had higher rates of experiencing animal-related injuries (22/30, 73.3%; 12/14, 85.7%, shorter *vs.* longer work experience). Most of these workers were veterinarians (data not shown). On the contrary, workers with shorter work experience had higher rates of experiencing sharp-related injuries (21/30, 70%; 9/14, 64.3%) and allergy from animals (17/30, 56.7%; 6/14, 42.9%).

Health and Safety Concerns Based on Workers' Animal Contact at Work

Most of the LAWs were exposed to more than one species of animals at work (32/44, 72.7%; data not shown). The most common laboratory animals the workers handled were mice (37/44, 84.1%), rats (26/44, 59.1%), and rabbits (16/44, 36.4%). Table 4 shows the count and percentage of workers experiencing the different health and safety concerns based on the species of animals that they came into contact with at work. The least common animals such as hamsters, guinea pigs, monkeys, birds, ruminants, invertebrates, dogs, cats, and reptiles were combined into one and categorized as "Others." Regardless of animal species, LAWs commonly encountered animal and sharp-related injuries. The incidence of animal-related injuries was reported to be highest in workers exposed to rabbits (14/16, 87.5%) and rats (22/26, 84.6%). Sharp-related injuries, on the other hand, were recorded high in those exposed to pigs (9/10, 90%). Allergy from animals was most common in those exposed to rabbits (10/16, 62.5%). Furthermore, those working with aquatics such as fish and frogs were commonly exposed to electricity-related injuries (8/13, 61.5%), along with animal-related injuries (10/13, 76.9%) and sharp-related injuries (9/13, 69.2%). In general, the rate of experiencing all health and safety concerns identified in the laboratory animal environment (*i.e.* physical, chemical, biological, ergonomics) was consistently high for workers exposed to aquatic animals.

Health and Safety Concerns Based on the Frequency of the LAWs' PPE Usage at Work

Gloves, facemasks, and laboratory gowns were the most commonly used PPE by LAWs in the Philippines. These three PPE were often used together or in combination with other PPEs. Table 5 shows that the majority of the workers wore PPE when they were handling animals, chemical agents, or equipment inside the facility (21/44, 47.7%). A percentage of workers wearing PPEs every time they entered the facility, regardless of whether or not they perform animal procedures or handle chemicals, was also reported high (20/44, 45.5%). Three of the respondents (6.8%) only used PPEs when handling hazardous compounds. These three respondents represented the three categories under job in Table 3 (*i.e.* veterinarian, researcher, and those belonging to the category "others"). Allergies from animals and unknown sources were common in workers who used PPEs less frequently (2/3, 66.7 %). The rate of experiencing animal-related injuries, sharp-related injuries, and allergy from animals remained high regardless of whether PPEs were worn every time when entering the facility (16/20, 80%; 13/20, 65% and 10/20, 50% respectively) or only when handling animals, chemicals, and equipment (17/21, 81%; 16/21, 76.2%; and 11/21, 52.4% respectively).

Table 4. Count and percentage of workers experiencing the different health and safety concerns based on their animal contact at work.

Health and safety concerns	Animal contact					
	Mouse n = 37	Rat n = 26	Rabbit n = 16	Pig n = 10	Aquatics n = 13	Others[a] n = 22
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Physical						
Animal-related injuries	29 (78.4)	22 (84.6)	14 (87.5)	7 (70.0)	10 (76.9)	18 (81.8)
Sharp-related injuries	24 (64.9)	15 (57.7)	12 (75.0)	9 (90.0)	9 (69.2)	19 (86.4)
Slip, trip, and fall	8 (21.6)	4 (15.4)	4 (25.0)	4 (40.0)	6 (46.2)	5 (22.7)
Noise-related injuries	4 (10.8)	3 (11.5)	2 (12.5)	1 (10.0)	6 (46.2)	6 (27.3)
Radiation-related injuries	5 (13.5)	3 (11.5)	2 (12.5)	2 (20.0)	4 (30.8)	1 (4.5)
Electricity-related injuries	7 (18.9)	5 (19.2)	4 (25.0)	4 (40.0)	8 (61.5)	7 (31.8)
Chemical						
Toxicity	8 (21.6)	3 (11.5)	2 (12.5)	3 (30.0)	6 (46.2)	1 (4.5)
Burn	7 (18.9)	5 (19.2)	2 (12.5)	1 (10.0)	6 (46.2)	1 (4.5)
Allergy, irritation	8 (21.6)	4 (15.4)	3 (18.8)	4 (40.0)	6 (46.2)	3 (13.6)
Explosion and fire	4 (10.8)	3 (11.5)	1 (6.3)	1 (10.0)	4 (30.8)	0 (0.0)
Biological						
LAI[b]	7 (18.9)	4 (15.4)	4 (25.0)	5 (50.0)	4 (30.8)	5 (22.7)
Allergy from animals	20 (54.1)	12 (46.2)	10 (62.5)	6 (60.0)	6 (46.2)	6 (27.3)
Allergy from unknown source	12 (32.4)	7 (26.9)	6 (37.5)	3 (30.0)	7 (53.8)	9 (40.9)
Ergonomic	12 (32.4)	7 (26.9)	5 (31.3)	4 (40.0)	6 (46.2)	6 (27.3)
Others	12 (32.4)	4 (15.4)	2 (12.5)	2 (20.0)	4 (30.8)	4 (18.2)

Legends:
[a]Hamster, guinea pig, monkeys, birds, ruminants, invertebrates, dogs, cats, and reptiles
[b]Laboratory acquired infections

DISCUSSION

The study revealed that the three most common health and safety concerns at work encountered by LAWs in the Philippines were animal-related injuries, sharp-related injuries, and allergy from animals. These were encountered regardless of the workers' age, gender, job, years of work experience with animals, and animal contact at work. These health and safety concerns were also consistent, even with the frequent use of available PPEs at work.

According to Schmitt *et al*. (2018), animal-related injuries are always present in the laboratory animal environment. LAWs in the Philippines commonly encounter physical injuries caused by animals such as bites, scratches, and kicks. This can be attributed to the direct contact of the workers to the animals during various procedures in the laboratory. The most common sources of animal-related occupational injuries and diseases are obtained during animal handling such as feeding, restraint, and medical interventions. On the other hand, sharp objects like needles, lancets, scalpels, pipettes, and sharp equipment are present in the laboratory and are essential components of the facility (Schmitt *et al*. 2018). Hence, injuries caused by the use of these objects are more likely to occur.

The vulnerability of younger workers towards experiencing different health and safety concerns is similar to that of other occupations. From the data published by the Centers for Disease Control and Prevention–The National Institute for Occupational Safety and Health (CDC-NIOSH 2020), younger workers are more vulnerable to experience workplace health and safety concerns compared to older workers. This can be due to their lack of experience in performing tasks and inadequate training on their job. However, the three common health and safety concerns identified in this study are consistent regardless of age. This is also true with gender. The higher rate of experiencing animal allergies on younger workers compared to those of older workers concurred with the findings of Elliott *et al*. (2005). The study further revealed that this concern is more common in females than in male workers. In a literature review conducted by Nicholson *et al*. (2010)

Table 5. Count and percentage of workers experiencing the different health and safety concerns based on the frequency of their PPE usage at work.

Health and safety concerns	Frequency of PPE usage		
	Very frequent[a] n = 20	Frequent[b] n = 21	Not so frequent[c] n = 3
	n (%)	n (%)	n (%)
Physical			
Animal-related injuries	16 (80.0)	17 (81.0)	1 (33.3)
Sharp-related injuries	13 (65.0)	16 (76.2)	1 (33.3)
Slip, trip, and fall	5 (25.0)	5 (23.8)	1 (33.3)
Noise-related injuries	0 (0.0)	4 (19.0)	1 (33.3)
Radiation-related injuries	4 (20.0)	3 (14.3)	1 (33.3)
Electricity-related injuries	3 (15.0)	6 (28.6)	1 (33.3)
Chemical			
Toxicity	5 (25.0)	4 (19.0)	1 (33.3)
Burn	2 (10.0)	5 (23.8)	1 (33.3)
Allergy, irritation	3 (15.0)	6 (28.6)	1 (33.3)
Explosion and fire	2 (10.0)	2 (9.5)	1 (33.3)
Biological			
LAI[d]	5 (25.0)	4 (19.0)	1 (33.3)
Allergy from animals	10 (50.0)	11 (52.4)	2 (66.7)
Allergy from unknown source	5 (25.0)	10 (47.6)	2 (66.7)
Ergonomic	6 (30.0)	7 (33.3)	2 (66.7)
Others	1 (5.0)	3 (14.3)	1 (33.3)

Legends:
[a]Every time when entering the facility
[b]When handling animals, chemicals, and equipment
[c]Only when handling hazardous compounds
[d]Laboratory acquired infections

on LAWs exposed to LAA, workers' age, and gender – in general – were not independent risk factors for the development of allergies from animals.

Interestingly, the rate of experiencing animal-related injuries was noted to be higher in LAWs with longer years of experience. This can be attributed to their having more responsibility at work and more exposure to animals. However, in general, the rate of experiencing all possible health and safety concerns was higher for workers with shorter experience. The higher rates of occupational injuries for less-experienced workers are common not only in the laboratory animal environment but also in other jobs (Alali *et al*. 2016). For animal allergies, a higher rate of encounters was noted in workers with fewer years of work experience with animals. This concurred with the results of previous studies with LAWs. Allergy symptoms mostly developed within the first four years of starting work with animals (Nicholson *et al*. 2010).

Veterinarians and researchers dominated the manpower of laboratory animal research facilities in the Philippines. In a study conducted in India, it was reported that animal kicks and needlestick injuries were the most frequent physical hazards encountered by veterinarians (Mishra and Palkhade 2020). Veterinarians, regardless of the industry to which they belong, were prone to acquiring animal-related injuries due to their frequent contact with animals. In a study on work-related accidents and occupational diseases in veterinarians, it was reported that most of the work-related accidents were due to animal injuries such as animal bites, scratches, and kicks (Nienhaus *et al*. 2005). In an animal research setting, veterinarians play multiple roles from advisory, oversight, and even technical support. It is the main responsibility of the veterinarians to ensure both the health and well-being of animals used in research, as well as the testing and teaching by doing preventive medicine, disease surveillance, diagnosis, and treatment (NRC 2011b). These key responsibilities

require them to be in close contact with animals, hence making them predisposed to different forms of animal-related injuries and to allergens from animals. In this line of work, sharp-related injuries can be acquired during the dispensing of medications using needles and syringes or even when opening ampoules of drugs. For veterinarians, sharp-related injuries such as needlestick were acquired mostly from recapping needles (Fowler *et al*. 2016; Mishra and Palkhade 2020).

The trend of using different animals in research has expanded to multiple species utilization for different kinds of experiments. Hence, researchers are becoming more exposed to various forms of animal-related injuries. As for sharp-related injuries, the collection of tissues and injection of compounds are tasks, which involve the use of sharp instruments. In general, LAWs, regardless of their jobs, have higher chances of acquiring allergy from animals. In a study conducted in Iran, more than half of the animal workers (*i.e.* veterinarians, veterinary students, veterinary technicians, animal caretakers, other animal workers) had reported allergy symptoms from animals (Moghtaderi *et al*. 2014).

Regardless of animal exposures, the three most common health and safety concerns identified in this study were consistent. In a large epidemiological study of LAWs in Japan, the incidence of allergies from animals was common in workers exposed to rabbits. The incidence rate of LAA in workers exposed to mice and rats was also recorded high (Aoyama *et al*. 1992). Elliott *et al*. (2005) also reported a high incidence rate of LAA in workers exposed to these three animals. Mice, rats, and rabbits were the common animals handled by workers; hence, there were higher chances of contact with the sources of allergens. The different sources of animal allergens are urine, dander, fur, epithelium, and saliva (Phipatanakul *et al*. 2012). The incidence of animal and sharp-related injuries in relation to animal exposure is not well-studied in laboratory animal settings and, to our knowledge, there is no published data available. However, the higher rates of animal-related injuries from rabbits can be accounted for by the animal's behavior and characteristics. Laboratory rabbits are known to easily get nervous. If not properly restrained, they can inflict scratches with their powerful kicks. Rabbits can also inflict severe bites, especially if the handlers are unfamiliar to them (Mapara *et al*. 2012).

Another interesting finding in this study is the high incidence of electricity-related injuries in workers exposed to fish and frogs. This can be accounted to the overall environment of the aquatic rooms. Wet surfaces are common in holding rooms for fish and frogs. Additionally, the environmental moisture is high due to the system of caging and the requirement of animals (NRC 2011a). Hence, electricity-related injuries such as electrocutions, burns, and shock can occur. These are considered serious occupational safety concerns in aquatic facilities (O'Rourke *et al*. 2018).

The concept of risk assessment (RA) is important to safeguard the health and safety of the workers in the laboratory animal environment. According to the Guide for the Care and Use of Laboratory Animals (NRC 2011a), it is important to identify the risks associated with the experimental use of animals and to reduce its occurrence to acceptable levels. The three most common occupational health and safety concerns identified in this study are more likely to occur in the animal research environment. However, they can be mitigated or prevented (Schmitt *et al*. 2018). Assessing risk, however, is a continuous process. It is because the identified risk may change over time or during the course of the study. As a part of mitigating risks in the laboratory animal environment, the implementation of the proper use of PPEs is essential, especially when handling animals or dealing with infectious agents, carcinogens, and chemical substances. The lower rate of experiencing allergy caused by animals in workers who wore PPEs more frequently is in agreement with previous studies on animal handlers, proving PPEs can lessen the allergen exposure from animals (Ferraz *et al*. 2013). However, even with the more frequent use of PPEs (*i.e.* every time when entering the facility), cases of physical, chemical, biological, and ergonomic issues tended to occur. As stated by Villano *et al*. (2017), the use of PPEs alone cannot guarantee full protection from possible hazards present in the laboratory animal environment. Furthermore, the use of PPEs should be selected based on the nature of work to be done, substances handled, and possible risks involved. For instance, in preventing animal-related injuries, the use of specialized gloves must be considered to reduce cases of punctures due to animal bites or scratches. In addition to donning proper PPEs, training on appropriate restraint techniques is also helpful. The same is true in handling sharp objects; the proper training on handling and the correct disposal of sharps are imperative (Schmitt *et al*. 2018).

The study recognizes various limitations that can be improved for future studies. The survey questionnaire does not categorize whether the reported encounters with the different health and safety concerns were actual or self-reported. This can yield different forms of biases such as respondents' interpretation and honesty of reply. The latter is addressed by taking anonymous responses. The study is also strictly bounded by ethics, hence susceptible to non-response bias resulting in a lower response rate. The result can be more meaningful if more responses are obtained. In terms of sampling, the study does not utilize a random sampling technique. Therefore, a correlation analysis between variables is not performed. The exposure

of LAWs to psychosocial stressors is also important to explore. Some tasks in the animal research environment can affect the workers' mental well-being such as the euthanasia of animals. It is also imperative to include the RA practice of the different facilities. This can provide ideas on whether the encounters with the different health and safety concerns are due to gaps in RA implementation or the lack of it.

CONCLUSION

Based on the findings of the study, it can be inferred that LAWs in the Philippines are exposed to various health and safety concerns at work. The three most common concerns identified in descending order are animal-related injuries, sharp-related injuries, and allergies from animals. These concerns are consistently encountered regardless of the workers' demographic profile and animal contact. Additionally, these concerns are encountered even with the frequent use of PPEs at work. It is important to have a well-implemented risk assessment program to evaluate current experiences. This program can also provide additional safety measures, such as readily available free PPEs, in order to lessen the occurrence and severity of workplace health and safety concerns. It must be emphasized that the use of sharp and bite-resistant gloves can also be considered. Furthermore, the periodic conduct of training on animal handling and procedures substantiated by information dissemination, particularly with regard to proper disposal of sharps, can be recommended. On the other hand, to address the high incidence of animal allergies, the provision of biosafety cabinets and proper cage changing stations should be considered.

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STATEMENT ON CONFLICT OF INTEREST

The authors declare no conflict of interest.

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