

**ASSESSMENT PROFESSIONAL COMPETENCE AND RISK FACTORS
PERCEPTION OF *TOXOPLASMA GONDII* AT THE CUBA NATIONAL ZOO PARK
AND ZOO GARDEN OF RIO DE JANEIRO, BRAZIL**

(Avaliação da percepção de fatores de risco da transmissão de Toxoplasma gondii dos trabalhadores, em suas atividades ocupacionais, no Zoológico Nacional de Cuba e da Fundação Jardim Zoológico de Rio de Janeiro, Brasil)

ECHARTE, Ginette Villar^{1*}; FERNÁNDEZ, Yolanda Emilia Suárez²; AUGUSTO, Anderson Mendes³; SANTOS, Ana Letícia Carvalho⁴; DANTAS, Marcia Macedo Lima⁴; IRAOLA, Raymundo Cox⁴; AMENDOEIRA, Maria Regina Reis⁴

1. Programa de Pós-Graduação Stricto Sensu em Medicina Tropical, Instituto Oswaldo Cruz, Rio de Janeiro, Brasil.

2. Universidad Agraria de La Habana

3. Jardim Zoológico da Cidade do Rio de Janeiro

4. Laboratório de Toxoplasmose e outras Protozooses, Instituto Oswaldo Cruz/Fiocruz, Rio de Janeiro, Brasil.

*Autor para correspondência: ginettevillar@gmail.com

Artigo enviado em: 11/04/2018, aceito para publicação em 23/07/2018

DOI: <http://dx.doi.org/10.4025/revcivet.v6i1.42339>

ABSTRACT

The practice of veterinary medicine exposes the professional to risks, increasing to those working in zoos. The objective was to evaluate the variables: risk perception and professional competence. As well risk factors associated with the presence of anti-*Toxoplasma gondii* antibodies in workers exposed to the National Zoological Park of Cuba (PZN) and RIOZOO. Were surveyed 133 workers (79 of PZN and 54 of RIOZOO) among veterinarians, biologists, technicians and service staff. To evaluate variables, was used the questionnaire "Methodologies for the analysis of some indicators of risk associated to the territorial handling of zoonosis" developed and validated in Cuba. Was made using software Epidat 3.1 in the statistical analysis test of χ^2 . For detection of anti-*T.gondii* antibodies, were used ELISA and IFAT techniques. The samples were analyzed at the Toxoplasmosis Laboratory of the Tropical Medicine Institute in Cuba "Pedro Kourí" and at the Laboratory of Toxoplasmosis and other Protozooses of Institute Oswaldo Cruz/Fiocruz, RJ, Brazil. The analysis of replies obtained through questionnaires there were no findings of statistical differences ($p \geq 0.05$). The evaluated variables punctuatedas nominal category 'MEDIUM', predominantly. The serologic results, the technicians group have significant statistical differences $p \leq 0.05$ between the two zoological gardens. The levels of risk perception in the investigated workers were not statistically different between the two zoological gardens in relations to professional competence.

Key words: exposed workers, Toxoplasmosis, risk perception, professional competence.

RESUMO

A prática da medicina veterinária expõe o profissional a riscos, sendo que a probabilidade aumenta para os que trabalham em zoológicos. O presente estudo, aborda a infecção toxoplásmica em indivíduos com atividades laborais com animais silvestres em cativeiro. O objetivo da pesquisa foi avaliar as variáveis: percepção de risco e competência profissional, assim como os fatores de risco associado à presença de anticorpos anti-*Toxoplasma gondii* em trabalhadores com risco ocupacional no Zoológico Nacional de Cuba e no RIOZOO. Para tanto, foram pesquisados 133 trabalhadores expostos ocupacionalmente (n=79 do Zoológico Nacional de Cuba e n=54 do RIOZOO) entre médicos veterinários, biólogos, técnicos e pessoal de serviços com atividades relacionadas aos animais. Para avaliar as variáveis foi utilizado o questionário "Metodologia para a análise de alguns indicadores de risco associado ao manejo territorial das zoonoses", desenvolvido e validado em Cuba pela Dra. Suárez e colaboradores (2006), modificado (2008). Na análise estatística dos dados foi realizada a prova de X^2 utilizando o software Epidat 3.1 (2006). Para a detecção dos anticorpos anti-*T. gondii* foram utilizadas as técnicas de ELISA e RIFI. As amostras foram analisadas no Laboratório de Toxoplasmose do Instituto Medicina Tropical "Pedro Kouri" em Cuba e no Laboratório de Toxoplasmose e outras Protozooses do Instituto Oswaldo Cruz/Fiocruz, RJ, Brasil. Na análise das respostas obtidas por meio do questionário não se encontrou diferenças estatísticas ($p \geq 0.05$) entre os dois zoológicos. As variáveis, percepção de risco e competência profissional, foram pontuadas, predominantemente, como categoria nominal "MÉDIA". Nos resultados sorológicos dos trabalhadores, somente o grupo dos técnicos (Zoológico Nacional de Cuba, 43,75% e RIOZOO 75%) mostrou diferenças estatísticas significativas $p \leq 0.05$ entre os dois zoológicos. Os níveis de percepção de riscos dos trabalhadores investigados não foram estatisticamente diferentes entre os dois zoológicos com relação à competência profissional.

Palavras-chave: trabalhadores ocupacionalmente expostos, *Toxoplasma gondii*, percepção de risco, competência profissional.

INTRODUCTION

Currently, there are many factors that increase zoonosis occurrence like toxoplasmosis, such as: contact with wildlife and domestic animals and animal migration (URIBARREN, 2014). Migration among countries also favors the importing of infectious agents, identified or not, causing impact in the epidemiological condition of emerging and re-emerging infectious diseases in different regions Monsalve *et al.* (2009) Other factors such as the increase of human population, pollution, animal production expansion, climate change, soil usage, transportation of sick people and animals Zanella (2016), among other factors can

contribute the parasites expansion.

Workers in veterinary centers and zoological gardens are among the ones who are mostly exposed to different professional risks related to exposure to biological agents (GONZÁLEZ, 2013) through close contact with animals, secretions, excretions products or byproducts, as well as work instruments contaminated with infectious agents. These are some of the most frequent factors found in the profession that might favor the transmission of pathogens in the profession (NORWOOD *et al.* 2000; LUCAS *et al.* 2012).

Toxoplasmosis, in particular, is one of the most known parasitic zoonosis and

Assessment professional competence and risk factors perception of *Toxoplasma gondii* at the Cuba National zoo park and zoo garden of Rio de Janeiro, Brazil

is produced by protozoan *Toxoplasma gondii* Gómez (2013). This coccidium is widely distributed all over the world, with a large number of intermediate hosts, including man Artigas *et al.* (2012). It is estimated that the prevalence of toxoplasmosis varies from 20% to 90% in the global human population (SIBLET *et al.*, 2009; AMENDOEIRA e CAMILO-COURA, 2010). Some factors may impact the infection installation by *Toxoplasma gondii*, for instance: the abundance of infective forms in the environment, the non-controlled animal population and people's conduct Navarro (2015).

METHODS

The concept used for variables 'risk perception' and 'professional competence' followed the definitions preconized by Frederico Peres (2010) and Philippe Zarifian (2001).

Risk perception: ability to interpret a situation which is potentially harmful for health. One must take into account that risk perception is based on different knowledge backgrounds (PERES, 2010).

Professional competence: Knowledge combination of know-how, experiences and behaviors that executed in a precise context. Competence is 'initiative taking' by the individual before

professional situations (ZARIFIAN, 2001).

ETHICAL CONSIDERATIONS

The present study, approved by the Research Ethics Committee of Foundation Oswaldo Cruz-Fiocruz/IOC, CAAE 49773215.7.0000.5248, was developed with exposed workers, that is, those who are in direct contact with animals or its secretions at the National Zoological Park of Cuba and at the Zoological Garden Foundation of the City of Rio de Janeiro, RIOZOO. All workers that agreed to take part in this research signed a Free Informed Consent Form.

In order to determine prevalence of anti-*Toxoplasma gondii* titles, blood was collected from workers with disposable syringes. Samples were analyzed at the Toxoplasmosis Laboratory at the 'Pedro Kouri' Tropical Medicine Institute in Cuba and in the Laboratory of Toxoplasmosis and other Protozoosis at Institute Oswaldo Cruz/Fiocruz, RJ, Brazil. For antibody anti-*T.gondii* detection, the techniques ELISA (immunoenzymatic assay) and IFAT (indirect fluorescent antibody test) were used.

To evaluate 'risk perception' and 'professional competence' the questionnaire 'Methodology for analysis of

Assessment professional competence and risk factors perception of *Toxoplasma gondii* at the Cuba National zoo park and zoo garden of Rio de Janeiro, Brazil

some indicators of risk associate to territorial handling of zoonosis', developed in Cuba by Dra. Suárez and collaborators (2006) (SUÁREZ *et al.*, 2006) and modified (2007) (SUÁREZ *et al.*, 2007). For the evaluation of responses obtained through questionnaire the following criteria was used:

- To YES or NO questions, 2, 1 or 0 points were granted to correct responses, abstentions or incorrect responses, respectively;
- Multiple choice questions received 2, 1 and 0 points for responses: ALWAYS,

SOMETIMES AND NEVER, respectively;

- To the total points obtained in each questionnaire, the category amplitude was calculated divided by the total of nominal categories, giving the result nominal category HIGH, MEDIUM AND LOW for the evaluated indicators.

In order to analyze each indicator, the questions made by the methodological procedure are summed (Table 1) and punctuation intervals are established for each one of the categories.

Table 1. Qualification and analysis of questionnaires according to Suárez *et al.* (2006); (2007).

Groups to be researched	Analyzed indicator	Used questions	Nominal categories intervals		
			HIGH	MEDIUM	LOW
Members of the Veterinary Services with University degree	Risk Perception	1, 2	≥ 1	2 – 3	≤ 4
	Professional Competence	3, 4, 5, 6, 7, 8, 9, 10	≥ 12	11 – 6	≤ 5
Workers with University degree non-veterinary with oral labor risks (Biologists)	Risk Perception	1, 2, 3	≥ 5	4 – 3	≤ 2
	Professional Competence	4, 5, 6, 7, 8, 9, 10	≥ 11	10 – 6	≤ 5
Members of the Veterinary Services with Secondary School level (Technicians)	Risk perception	1, 2, 3, 4, 5	≥ 8	7 – 4	≤ 3
	Professional Competence	6, 7, 8, 9, 10	≥ 8	7 – 4	≤ 3
Service staff/Caretakers	Risk Perception	1, 2, 3, 4, 5	≥ 8	7 – 4	≤ 3
	Professional Competence	6, 7, 8, 9, 10	≥ 8	7 – 4	≤ 3

Test χ^2 was made using software Epidat 3.1 (2006) for variable correlation: 'risk perception' and 'professional competence', using the 'risk perception' as an independent variable in each group.

According the responses of the researched workers, the main risks and likelihood of the disease happening were selected, considering criteria of Organismo Internacional Regional de Sanidade

Agropecuária (OIRSA) (2006) for the risk evaluation procedure.

The frequency according to work areas was also calculated: areas in which the etiologic agent is more frequent were considered of higher risk. In these areas, one can find: the space for felines and other carnivorous species that are definite or indefinite hosts for *Toxoplasma gondii*; the laboratory, for being the area where one can find secretions and excretions of sick animals; the veterinary clinic, for being the place where sick animals stay. In these environments of larger exposure, workers can become contaminated and become spreader of the etiologic agent.

Work areas of lower risks are those environments where the ungulates and primates are found, and the area of animal food preparation. In these areas, the etiological agent presents less probability of infecting workers.

RESULTS

Participated in the research 79 workers from the Cuba National Zoological Garden and 54 workers from RIOZOO, all with occupational hazard of exposure. Were grouped according to different indicators (period of work, area of work and occupation).

Firstly, was calculated the frequency of the indicator related to period of work in both institutions (Table 2). Research participants were divided into two groups: those with more than 10 years working with zoological animals and those with less than 10 years in this kind of work. The frequency by period of work indicates that only 46% and 39% of workers at the Cuba National Zoological Park and at RIOZOO, respectively, remain executing their activities in the institutions for more than 10 years.

Table 2. Frequency of workers investigated at the National Zoological Park of Cuba and RIOZOO, according to area of work and to period (years)

Area of work	Number of workers /area of work		Relative frequency (%)		
	National Zoo. Park of Cuba	RIOZOO	National Zoo. Park of Cuba	RIOZOO	National Zoo. Park of Cuba
> risk(*)	30	29	0,38	0,54	38
< risk(**)	49	25	0,62	0,46	62
Years of work	Number of workers/years of work		Relative frequency (%)		
>10 years	36	21	0,46	0,39	46
< 10 years	43	33	0,54	0,61	54
Total	79	54	1	1	100

(*) Clinics, Laboratory, Feline area and other carnivorous animals' area.

(**) Area for animal food preparation, Area of primate animals, Area of ungulates.

At the Cuba National Zoological Park, the relative frequency indicates that the larger positive cases of workers executing their functions in lower risk areas was 62 % (Table 2). However, at RIOZOO, the higher frequency was 54% in higher risk areas.

In the research, were also evaluated the seroprevalence by infection per period

of work based on diagnosis techniques ELISA and IFAT. Results demonstrate that workers with over 10 years of service present high levels of contamination on both zoological gardens. With a percentage of 52,8% for ELISA as well as IFAT at the Cuba National Zoological Park and 85,7% for ELISA and 81% for IFAT at RIOZOO (Table3).

Table 3. Seroprevalence anti-*T.gondii* in workers at National Zoo. Park of Cuba and at RIOZOO, according to period of to work and area of work used laboratory techniques

Diagnosis techniques	Seroprevalence by period of work															
	> 10 years								< 10 years							
	National Zoo. Park of Cuba				RIOZOO				National Zoo. Park of Cuba				RIOZOO			
	Investigated	+	Pp	%	Investigated	+	Pp	%	Investigated	+	Pp	%	Investigated	+	Pp	%
ELISA (***)	36	19	0,53	52,8	21	18	0,86	85,7	43	18	0,42	41,9	33	18	0,55	54,5
IFAT (****)	36	19	0,53	52,8	21	17	0,81	81	43	16	0,37	37,2	33	17	0,52	51,5
	Seroprevalence by area of work															
	> risk*								< risk**							
	National Zoo. Park of Cuba				RIOZOO				National Zoo. Park of Cuba				RIOZOO			
	Investigated	+	Pp	%	Investigated	+	Pp	%	Investigated	+	Pp	%	Investigated	+	Pp	%
ELISA	30	14	0,47	46,7	29	8	0,28	27,6	49	23	0,479	46,9	25	17	0,68	68
IFAT	30	13	0,43	43,3	29	7	0,24	24,1	49	24	0,49	49	25	17	0,68	68

(*) *Veterinary clinic, Laboratory, area of felines and other carnivorous animals' areas.*

(**) *Area of animal food preparation, area of primate animals, area of ungulates.*

+: *positive cases*

Pp: *Punctual prevalence*

(***) *ELISA (immunoenzymatic assay)*

(****) *IFAT (indirect fluorescent antibody test)*

Table 3 refers to the seroprevalence by infection to parasite *T. gondii* using techniques ELISA and IFAT per higher or lower risk area. Results point to a higher

seroprevalence in low level risk areas with a percentage of 49% at the Cuba National Zoological Park and 68% at RIOZOO. In general, the study demonstrates that labor

Assessment professional competence and risk factors perception of *Toxoplasma gondii* at the Cuba National zoo park and zoo garden of Rio de Janeiro, Brazil

practices used by workers, both at the Cuba National Zoological Park and at RIOZOO should be improved.

Table 4 shows seroprevalence results per professional occupation, where one can notice that the higher positive case numbers are among service staff (caretakers, laboratory assistants), which presented the higher number of seroreagent for infection by *T. gondii*. In this case, the technique results were of 65% for ELISA and 60% for IFAT, at the Cuba National

Zoological Park, and 76,47% for ELISA and 70,58% for IFAT at RIOZOO from seroreagent workers for infection by *T. gondii*. In the results related to veterinary technicians, there were statistically significant differences in which $p \leq 0.05$. Also when making a comparison between the professions in each one of the zoos, it is important to highlight that it was the veterinary technicians who presented a higher frequency.

Table 4. Seroprevalence of anti-*Toxoplasma gondii* in workers occupationally exposed at the National Zoo. Park of Cuba and at RIOZOO, according to professional occupation and by used laboratory techniques used.

OCCUPATION PROFISSIONAL	TOTAL		ELISA seroreagents ^a			IFAT seroreagents ^b		
	National Zoo. Park of Cuba	RIOZOO	Number (%) positives National Zoo. Park of Cuba	Number (%) Positives RIOZOO	P- value	Number (%) Positives National Zoo. Park of Cuba	Number (%) Positives RIOZOO	P- value
Veterinary Doctor	5	7	2 (40)	3 (42,85)	0,19	2 (40)	2 (28,57)	0.18
Other Professionals	6	6	2 (33,33)	2 (33,33)	0,19	2 (33,33)	2 (33,33)	0,19
Veterinary Technicians	48	24	21 (43,7)	18 (75)	0,01	20 (41,67)	19 (79,16)	0,03
Service de Staff	20	17	12 (60)	13 (76,47)	0,10	13 (65)	12 (70,58)	0,11

^a Positives test ELISA

^b Positives test IFAT

The other professional groups maintained a similar behavior. In general, one can affirm that on both institutions there is a high frequency of seropositivity for anti-*T. gondii* in exposed professionals.

Risk factors related to infectious or parasitary zoonosis in environments where

wildlife animals stay increase the likelihood that the contamination risk is higher. Among them, one can state hygiene and handling practices, as well as the veterinary attention that allows even more increase of likelihood of disease manifestation.

The main risk factors related to the presence of titles anti-*T. gondii* in occupationally exposed workers at the Cuba National Zoological Garden and RIOZOO are: 1-Manipulation of animals and their products, secretions, excretions, etc., without the use of gloves; 2-Bad hygiene habits after handling of animals; 3-Accidents with contaminated instruments and materials; 4-Improper use of installations destined to animals or to maintaining personal or work belongings; 5-Animal handling in non-appropriate places; 6-Not wearing gloves or other ways of protection; 7-Improper use of animals installations, used to store personal or work; 8-Incorrect control of vectors; 9-Feline presence at food storage place; 10-Contaminated drinkable water; 11-Consumption of raw meat and improper cleaning of fruits and vegetables; 12-Animal handling in non-appropriate places.

Table 5 shows the variable evaluation of "risk perception" and "professional competence" of workers with occupational hazard in both zoological gardens. There one can observe a **HIGH**(100%) risk perception in the group of veterinary doctors at the Cuba National Zoological Park and among veterinary

doctors at RIOZOO it was between **HIGH** and **MEDIUM** (66,66 % and 33,33 %). In relation to the professional competence the tax obtained was between **HIGH** and **MEDIUM**, (60% and 40%), at the Cuba National Zoological Park. At RIOZOO, these percentage number were: **MEDIUM** (50%), **LOW** (33,33%) and **HIGH** (16,67%). These numbers show a lack of worry on behalf of veterinary doctors, only 16,67% wore the individual protection equipment for working with animals, and these professionals also did not have good hygiene habits after work. In the case of other University level professionals, risk perception stayed between **HIGH** and **MEDIUM** (50%), at the Cuba National Zoological Park. At RIOZOO, this perception was **HIGH** (66,66%) and **MEDIUM** (33,33%). Other University level professionals had, in relation to professional competence, a rate among **HIGH** (50%), **MEDIUM** (33,33%) and **LOW** (16,67%) in this group at the Cuba National Zoological Park. At RIOZOO, it varied among **MEDIUM** (66,6%) and **HIGH** (33,33%). Therefore, statistics show that there were no significant difference among professional occupations.

Assessment professional competence and risk factors perception of *Toxoplasma gondii* at the Cuba National zoo park and zoo garden of Rio de Janeiro, Brazil

Table 5. Risk perception behavior and professional competence of workers occupationally exposed per professional occupation professional.

PROFESSIONAL OCCUPATION	RISK PERCEPTION		PROFESSIONAL COMPETENCE	
	National Zoo. Park of Cuba	RIOZOO	National Zoo. Park of Cuba	RIOZOO
Veterinary	High → 100%	High → 66,66%	High → 60%	High → 16,67%
Doctor		Medium → 33,33%	Medium → 40%	Medium → 50% Low → 33,33%
Other	High → 50%	High → 50%	High → 66,66%	High → 33,33%
Professionals	Medium → 50%	Medium → 33,33%	Medium → 33,33%	Medium → 6,66%
		Low → 16,37%		
Veterinary	High → 58,33%	High → 50%	High → 64,58%	High → 20%
Technicians	Medium → 53,33%	Medium → 33,33%	Medium → 22,92%	Medium → 72%
	Low → 8,33%	Low → 8%		Low → 8%
Service staff	High → 30%	Medium → 66,66%	High → 20%	Medium → 86,67%
	Medium → 60%	Low → 33,33%	Medium → 45%	Low → 13,33%
	Low → 10%		Low → 13,33%	

DISCUSSION

The study presents the main risk factors for exposure and the behavior for risk perception and professional competence. It is important to highlight that workers at veterinary centers and zoological gardens are among the group of people who are mostly exposed to several risks associated to biological agents exposure (GONZÁLEZ, 2013).

After calculating the workers frequency, according to the years of work, it was observed that the smallest frequency is among those with less than 10 years of

work, which was to be expected, because the longer the time exposed to risk factors, the higher the change of getting in contact with the protozoan due to its diverse transmission mechanisms. However, it must be highlighted that in one's personal life, the person may, at some point, have contact with one of the infection mechanisms. This fact indicates that, because they are people with work experience, they should have more consciousness at work about animal safety protection measures Alonso *et al.* (2015).

According to the existence of a

higher frequency of positive workers in areas of lower risk, we can affirm that in these areas, there are sufficient risk factors associated with toxoplasmosis and that poor management practices and work hygiene could increase the risk of presentation of the disease.

Among the professional occupation mostly exposed to zoonosis are the veterinary doctors and technicians (LECAROS *et al.*, 2010). Observed that service staff and caretaker were the ones more exposed, that is, they presented a higher frequency of positive serologic results. Because they are the most exposed to contracting zoonotic diseases through direct contact with animals. In addition to the possibility of not using adequate means of protection

It is the first step towards initiating a program for fighting and controlling these diseases Miller *et al.* (2000), besides highlighting that the demands of any action to the prevention and control of these diseases is vigilance Alonso *et al.* (2015).

OIE (2015, 2017) designates as basic competences for veterinarians the knowledge, skills and attitudes required so that a state veterinary organization enables the practice of the profession. This group must have the theoretical knowledge and capacitation for avoiding the risk of

zoonotic diseases (HANISCH–KIRKBRID *et al.*, 2013).

Besides that, veterinary doctors, on account of their professional activities, are constantly exposed to risk (ALONSO *et al.*, 2015). This is explained due to the fact that in some activities inherent to the profession, such as veterinary assistance, there is risk of contamination by some zoonosis, which is a condition assumed as 'inevitable' by the professional during the labor period (GARCÍA, 2013; OIE, 2017).

Nevertheless, veterinary doctors and technicians also have their part in complying with OIE's (OIE, 2009, 2017) mandate and, therefore, their professional competence cannot be of low level, in case they come from a country which is part of member of this intergovernmental organization.

FINAL CONSIDERATIONS

The present study is pioneer for making an analysis of variables 'risk perception' and 'professional competence' in two zoological gardens (Cuba National Zoological Park and RIOZOO), demonstrating that there is a lack of knowledge related to zoonosis. This result confirmed by the presence of antibodyanti-*T. gondii*, which have higher frequencies among technical professionals that mainly

work in lower risk areas. This is related to the perceived risk levels of occupationally exposed workers. This fact is an institutional challenge in the differential education to reduce health risks to workers.

ACKNOWLEDGMENT

The authors would thank the workers at the Cuba National Zoological Park and at RIOZOO, who took part in this research and the staff at the Toxoplasmosis Laboratory at the "Pedro Kouri" Tropical Medicine Institute in Cuba and at the Toxoplasmosis and other Protozoosis Laboratory at Institute Oswaldo Cruz/Fiocruz, Rio de Janeiro in Brazil, where the samples of workers were processed.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest.

FINANCIAL SUPPORT

The authors gratefully acknowledge the Brazilian research funding agency: Coordination of Improvement of Higher Level Personnel [Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES)] for their financial support of this research.

REFERENCE

- ALONSO, R.; SOLANS, X.; CONSTANS, A. Centros veterinarios: exposición laboral a agentes biológicos. Notas técnicas de prevención. Instituto Nacional de Seguridad e Higiene del Trabajo. Chile. 2015.
- AMENDOEIRA, M.R.R.; CAMILO-COURA, L.F. Uma breve revisão sobre a toxoplasmose na gestação. *Scientia Medica*, Porto Alegre 2010; 20(1): 113-119.
- ARTIGAS, R.; GÓNGORA, W.; COBOS, D.; GOYA, Y.; MIRANDA, A. Aspectos básicos sobre la patogenicidad, respuesta inmune y bioseguridad en el trabajo con el *Toxoplasma gondii*. Centro de Inmunología y Biopreparados. Holguín. Cuba. Correo Científico Médico. 2012;16(1).
- EPIDAT 3.1. Software recomendado pela OPS/OMS para o processamento de dados nos análises epidemiológicas. 2006.
- GARCÍA, I. Los riesgos laborales y la profesión veterinaria. 2013. Available from: <http://www.seguridad-laboral.es/prl-por-sectores/agroalimentario/los-riesgos-laborales-y-la-profesion-veterinaria>. (Accessed on 23 November 2017).
- GONZÁLEZ, B. Riesgos de zoonosis en zoológicos y centros veterinarios. 2013.

Assessment professional competence and risk factors perception of *Toxoplasma gondii* at the Cuba National zoo park and zoo garden of Rio de Janeiro, Brazil

- Available from: <http://www.preving.com/index.php/actualidad/los-expertos-de-preving/item/414-riesgos-de-zoonosis-en-zool%C3%B3gicos-y-centros-veterinarios.html>. (Accessed on 1 December 2017).
- GÓMEZ, R.A. La vigilancia epidemiológica de las enfermedades zoonóticas en la coordinación de zoonosis del estado Táchira – Venezuela. *Revista de Investigación en administración e ingeniería*. 2013;1:24–34. Available from: <http://service.udes.edu.co/revistas/index.php/aibi>. (Accessed on 3 March 2017).
- HANISCH-KIRKBRID, S.; RILEY, S.; GORE, M. Wildlife disease and risk perception. *J Wildlife Diseases*. 2013;49(4):84–849.
- LECAROS, A.; FALCÓN, C.; ELÍAS, R. Accidentes ocupacionales y zoonosis en profesionales que laboran en zoológicos y zocriaderos de Lima, Perú. *Revista Sapuvet de Salud Pública* 2010; 2:27–42.
- LUCAS, M.; DAY, L.; FRITSCHI, L. Serious injuries to Australian veterinarians working with cattle. *Austr Vet J*. 2012;91(1-2):57–60.
- MILLER, D.S.; MITCHEL, G.F.; BIGGS, B.; MCCRAKEN, H.; MYRONIUK, P.; HEWISH, M. Agglutinating antibodies to *Toxoplasma gondii* insert from captive eastern barred bandicoots in Australia. *J. Wildlife Disease* 2000;36(2):8–32.
- MONSALVE, S.B.; MATTAR, S.V.; GONZÁLEZ, M.T. Zoonosis transmitidas por animales silvestres y su impacto en las enfermedades emergentes y reemergentes. Universidad de Córdoba. Facultad de Medicina Veterinaria. Departamento de Ciencias Pecuarias. Instituto de Investigaciones Biológicas del Trópico. Montería, Córdoba, Colombia. *Rev MVZ, Córdoba*. 2009; 14(2):1762–1773.
- NAVARRO, D.M.; CHÁVEZ, A.V.; PINEDO, R.V.; MUÑOZ, K.D. Factores de Riesgo Asociados a la Seroprevalencia de *Toxoplasma gondii* en Mamíferos del Orden Carnívora y Primates Mantenidos en Cautiverio. *Rev Inv Vet Perú* 2015; 26(3):497-508.
- NORWOOD, S.; MCAULEY, C.; VALLINA, V.L.; FERNÁNDEZ, L.G.; MCLARTY, J.W.; GOODFRIED, G. Mechanisms of patterns of injuries related to large animals. *J. Trauma*. 2000;(48):740–744.
- ORGANISMO INTERNACIONAL REGIONAL DE SANIDADE AGROPECUÁRIA (OIRSA); OIE para as Américas. *Análises de Risco. Guia Prática*. 2006.
- Organização Mundial de Sanidade Animal (OIE). *Proyecto de recomendaciones. Una*

Assessment professional competence and risk factors perception of *Toxoplasma gondii* at the Cuba National zoo park and zoo garden of Rio de Janeiro, Brazil

formación veterinaria en evolución para un mundo más seguro. 12–14 de octubre. París, Francia 2009. Available from: <http://www.oie.int/es/para-los-periodistas/comunicados-de-prensa/detalle/article/evolving-veterinary-education-for-a-safer-world/>. (Accessed on 2 April 2017)

ORGANIZACIÓN MUNDIAL DE SANIDAD ANIMAL (OIE). Informe de la reunión del grupo de trabajo sobre las enfermedades de los animales salvajes. 2015. Available from: http://www.oie.int/fileadmin/Home/esp/Media_Center/docs/pdf/Fact_sheets/WD_ES.pdf. (Accessed on 5 September 2017).

ORGANIZACIÓN MUNDIAL DE SANIDAD ANIMAL (OIE). Plan de Estudios Básico de Formación Veterinaria Directrices de la OIE. Available from: http://www.oie.int/Plan_de_Estudios_Basico_de_Formacion_Veterinaria.pdf. (Accessed on 27 March 2017).

ORGANIZAÇÃO MUNDIAL DE SANIDADE ANIMAL (OIE). Recomendaciones de la OIE sobre las competencias mínimas que se esperan de los veterinarios recién licenciados para garantizar Servicios Veterinarios Nacionales de calidad. Available from: [http://www.oie.int/fileadmin/Home/esp/Support_to_OIE_Members/Edu_Vet](http://www.oie.int/fileadmin/Home/esp/Support_to_OIE_Members/Edu_Vet_AHG/day_1/DAYONE-B-esp-VC.pdf)

[_AHG/day_1/DAYONE-B-esp-VC.pdf](http://www.oie.int/fileadmin/Home/esp/Support_to_OIE_Members/Edu_Vet_AHG/day_1/DAYONE-B-esp-VC.pdf).

(Accessed on 27 March 2017).

ORGANIZAÇÃO MUNDIAL DE SANIDADE ANIMAL (OIE). Recomendaciones de la OIE sobre las competencias mínimas que se esperan de los veterinarios recién licenciados para garantizar Servicios Veterinarios Nacionales de calidad. Available from: http://www.oie.int/fileadmin/Home/esp/Support_to_OIE_Members/Edu_Vet_AHG/day_1/DAYONE-B-esp-VC.pdf.

(Accessed on 27 March 2017).

PERES, F. Onde Mora o Perigo? Percepção de riscos, ambiente e saúde. In: de Souza, MCM & Carvalho, A. Saúde e ambiente sustentável: estreitando nós. Parte II.3. Ed. Fiocruz. 2010.135–138.

SIBLEY, D.; KHAN, A.; AJIOKA, W.; ROSENTHAL, B. Genetic diversity of *Toxoplasma gondii* in animals and humans. Philosophic Transact Royal Society. 2009;364:2749–61.

SUÁREZ, Y.; FABRÉ, Y.; SOCA, M.; FUENTES, M.; CABRERA, C.; ÁLVAREZ, J. Metodología para el análisis de algunos indicadores de riesgo asociado al manejo territorial de las zoonosis. Rev Elect. de Vet. 2006;7(9). Available at: <http://www.veterinaria.org/revistas/redvet/n090906/090615.pdf>. (Accessed on 3 March 2017).

Assessment professional competence and risk factors perception of *Toxoplasma gondii* at the Cuba National zoo park and zoo garden of Rio de Janeiro, Brazil

SUÁREZ, Y.; FABRÉ, Y.; SOCA, M.; FUENTES, M. Propuesta de acciones de reducción de riesgos de servicios veterinarios –servicios de salud pública– intersectoriales. Resultado Terminado base Técnica para el análisis, .Manejo y reducción de Riesgos de presentación de enfermedades zoonósicas y transmitida por alimentos (ETA) asociados o no a la ocurrencia de desastres naturales hidrometeorológico. La Habana, Cuba: informe de Proyecto. Proyecto Territorial CITMA/Habana. 2007; 7(8). Available at: <http://www.redalyc.org/pdf/636/63612734006.pdf>. (Accessed on 3 March 2017).
ca. Cap 3. 2001.68–78.

URIBARREN, T. Zoonosis y parasitosis emergentes. Departamento de Microbiología y Parasitología, Facultad de Medicina, UNAM. 2014. Available from: <http://www.facmed.unam.mx/deptos/microbiologia/parasitologia/zoonosis-y-emergentes.html>. (Accessed on 9 November 2017).

ZANELLA, J.R. Zoonoses emergentes e reemergentes e sua importância para saúde e produção animal. *Pesq. Agropec. Bras.* Brasília. 2016; 51(5): 510– 519.

ZARIFIAN, P. Objetivos competência: por uma nova lógi