



SECTION: ORIGINAL ARTICLE

Evaluation of medical professionals' knowledge about Q fever

Avaliação do conhecimento de profissionais médicos sobre a febre Q

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Abstract

Aims: evaluate the medical professionals' knowledge about Q fever, seeking integrative contributions to public health that may favor the formulation of policies and the development of strategies based on a One Health approach.

Methods: this is a cross-sectional and quantitative study with data collection through a structured questionnaire applied face-to-face to physicians from various clinical specialties working at the three levels of health care in Brazil. The questionnaire consisted of 25 questions, seven of which were specific to assessing knowledge about Q fever. Univariate and multivariate logistic regression analyses were conducted to assess whether the variables medical specialty, level of health care in which they work, age range and gender were associated with a correct answer to at least one specific question about Q fever.

Results: among the 254 physicians included, 236 (92.9%) were unaware of Q fever. Only three (16.6%) of the 18 who correctly answered at least one specific question about the disease had a score of more than 50%. The highest rates of correct answers for at least one question ($p < 0.0001$) occurred among the medical specialties most related to clinical signs and symptoms or the differential diagnosis of Q fever and among males. It is highlighted that 85.8% of physicians consider Q fever a neglected and underreported disease in Brazil. Additionally, all physicians responded that they were not aware of the One Health approach.

Conclusions: the almost total lack of knowledge among medical professionals regarding Q fever reinforces the need for greater disclosure for this zoonosis with a One Health approach in Medical Schools, in Residency Programs and for physicians in general. In addition, the inclusion of Q fever in the national list of notifiable diseases becomes relevant, allowing a better understanding of its epidemiological situation in Brazil. Finally, effective public health actions must be carried out to avoid underdiagnosis and the development of severe cases of the disease.

Keywords: *coxiella burnetii*, medical knowledge, neglected diseases, one health, Q fever..

Resumo

Objetivos: avaliar o conhecimento dos profissionais médicos sobre a febre Q, visando contribuições integrativas para saúde pública que possam favorecer a formulação de políticas e o desenvolvimento de estratégias baseadas na abordagem de Saúde Única.

Métodos: trata-se de um estudo transversal e quantitativo com coleta de dados por meio de questionário estruturado aplicado presencialmente a médicos de

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diversas especialidades clínicas que atuam nos três níveis de atenção à saúde no Brasil. O questionário foi composto por 25 questões, sendo sete específicas de avaliação de conhecimento sobre a febre Q. Foram realizadas análises de regressão logística univariada e multivariada para avaliar se as variáveis especialidade médica, nível de assistência à saúde em que atua, faixa etária e sexo estavam associadas ao acerto de pelo menos uma questão específica sobre a febre Q.

Resultados: dos 254 médicos incluídos, 236 (92,9%) desconheciam a febre Q. Apenas três (1,6%) dos 18 que acertaram pelo menos uma questão específica sobre a doença obtiveram um aproveitamento superior a 50%. As maiores taxas de acerto de pelo menos uma questão ($p < 0,0001$) ocorreram entre as especialidades médicas mais relacionadas aos sinais e sintomas clínicos ou ao diagnóstico diferencial da febre Q e entre os do sexo masculino. Destaca-se que 85,8% dos médicos consideram a febre Q uma doença negligenciada e subnotificada no Brasil. Além disso, todos os médicos responderam que não conheciam a abordagem de Saúde Única.

Conclusões: o quase total desconhecimento dos profissionais médicos sobre a febre Q reforça a necessidade de maior divulgação desta zoonose com abordagem de Saúde Única nas Faculdades de Medicina, nos Programas de Residência e para os médicos em geral. Além disso, torna-se relevante a inclusão da febre Q na lista nacional de doenças de notificação compulsória, permitindo uma melhor compreensão da sua situação epidemiológica no Brasil. Por fim, devem ser realizadas ações eficazes de saúde pública para evitar o subdiagnóstico e o desenvolvimento de casos graves da doença.

Palavras-chave: *coxiella burnetii*, conhecimento médico, doenças negligenciadas, saúde única, febre Q.

Introduction

Neglected tropical diseases (NTD) have a major impact on global public health and are being addressed and discussed by the World Health Organization through an ambitious plan focused on controlling and eliminating these diseases by the year 2030. This plan emphasizes the need to carry out holistic transversal interventions to combat these zoonotic diseases based on the One Health approach (1, 2).

Q fever is a zoonotic disease caused by *Coxiella burnetii*, one of the most infectious agents for humans, with resistance and environmental stability, recognized as a category B bioterrorism target by the Centers for Disease Control and Prevention of the United States (3, 4) and considered as a persistent threat to public health (5, 6, 7). Despite this, both in Brazil and in other parts of the world, Q fever is still neglected and

underreported (2, 8, 9, 10, 11).

Infection in humans has a wide spectrum of manifestations, from asymptomatic cases with spontaneous cure to severe and fatal complications. In the acute phase, the most frequent clinical manifestation is self-limiting fever combined with headache, myalgia, arthralgia and cough. In the chronic phase, patients may develop endocarditis, osteomyelitis, vascular infections, among others, with the possibility of death (6, 8, 12, 13). In addition, Q fever has been associated with chronic fatigue syndrome (3). There is still no consensus for the treatment of Q fever. The main strategies involve the use of doxycycline and hydroxychloroquine (6, 14). Regarding the vaccine, there is currently only one, marketed strictly in Australia (4).

The main form of transmission of Q fever to humans occurs through the inhalation of contaminated aerosols that can be generated from placental remains, wool, feces or other products of infected animals, mainly cattle, goats and sheep (13). In this sense, the infection is generally associated with occupational activities carried out by veterinarians, livestock farmers, workers in slaughterhouses and meat processing plants, as well as any others that facilitate contact with infected animals. The diagnosis of Q fever occurs through serological methods, mainly through Indirect Immunofluorescence, considered as reference, or through molecular methods such as Polymerase Chain Reaction (12, 13).

Studies published in recent years have demonstrated that the pathogen that causes Q fever is circulating in Brazil, follow some results: 22% seroprevalence of Q fever in quilombola communities in the state of Paraná (15); 4,8% seroprevalence of Q fever in patients suspected of dengue in the state of Minas Gerais (2); and 23,8% seroprevalence of Q fever in cattle sent to slaughterhouses in the state of São Paulo (16).

In view of the above, it is extremely important for physicians to know the clinical, epidemiological and laboratory characteristics of Q fever in order to make a correct and early diagnosis of the disease, avoiding serious and fatal cases.

Thus, the present study sought to evaluate, in an unprecedented way, the knowledge of medical professionals working in primary, secondary and tertiary Brazilian health care regarding Q fever, seeking integrative contributions to public health that may favor the formulation of policies and the development of strategies based on the One Health approach.

Methods

This is a cross-sectional study to assess the level of knowledge and associated factors among physicians from different medical specialties who work at the University Hospital of the Federal University of Juiz de Fora (HU-UFJF) and/or at the Basic Health Units (UBS) in the municipality of Juiz de Fora, Minas Gerais, Brazil. Twenty-two UBS took part in this study. A non-probabilistic convenience sampling method was used. Data were collected through a structured questionnaire prepared by the authors and applied face-to-face with physicians at their workplaces between March and August 2022.

Taking into account a finite population of 696 physicians, of which 608 (87%) worked at HU-UFJF and 88 (13%) at the 22 UBS, an expected frequency of correct answers of 50%, an absolute estimation error of 5%, the calculated sample size was 248. However, 256 physicians were included, predicting 3% losses or refusals. The sample was of convenience due to resource limitations. The questionnaires were administered over 6 months using five days of the week, which were divided proportionally, with 80% of this period for the HU-UFJF and 20% for the UBS.

The questionnaire consisted of 25 questions divided into two sections: (i) general questions regarding demographic, professional and academic data, consisting of eight questions; (ii) specific and general questions about Q fever, NTD and One Health, consisting of 17 questions. Of these, seven were specifically to assess knowledge about Q fever and will be presented/described in a table with the results in the next section.

A descriptive statistical analysis of the data was performed, which were expressed in percentages,

means and standard deviations, according to the characteristics of each variable.

Univariate and multivariate logistic regression analyses were conducted to assess whether the variables medical specialty, level of health care in which they work, age range and gender were associated with a correct answer to at least one question on specific knowledge about Q fever. The medical specialty variable was categorized into two subgroups: more related to Q fever and others. For the definition of specialties possibly more related to Q fever, we used the criterion of grouping those more related to possible signs, symptoms or differential diagnosis of Q fever, namely: Infectiology, Pneumology, Otorhinolaryngology, Cardiology, Echocardiography and Hematology-Hemotherapy.

Values of $p \leq 0.05$ were considered significant. SPSS version 21 software (IBM Corporation, Armonk, NY, USA) was used for data analysis.

This study was approved by the Ethics Committee for Research with Human Beings of the University Hospital of the Federal University of Juiz de Fora (approval number: 5.277.686). The medical professionals who agreed to participate in this study signed the Free and Informed Consent Form.

Results

In all, 256 medical professionals agreed to participate in this study. Of this total, two physicians did not answer all the main questions and were therefore excluded, leaving 254 for the final analysis. **Table 1** shows the distribution of medical professionals according to age, gender, level of health care in which they work and their medical specialty, including the proportions of physicians who answered at least one specific Q fever knowledge assessment question correctly ($n = 18$). The mean age of participating physicians was 37.5 ± 10.9 years old (range, 24 to 71 years old). The mean time having been a physician was 12.0 ± 10.8 years (range 0 to 42 years).

Among the 254 physicians included in this study, 228 (89.7%) responded that they had no clinical, epidemiological and/or laboratory know-

ledge about Q fever. Of the 26 who claimed to have this knowledge, 18 correctly answered at least one specific question in assessing their knowledge about Q fever, making it possible to state that 236 (92.9%) physicians had no knowledge about Q fever. The highest rates among physicians who answered at least one question correctly were those in the 40-49 age group

(14.2%), those working in primary care (8.5%), in the medical specialties of Echocardiography and Otorhinolaryngology (50% each) and male (13%). The average age of physicians with some level of knowledge about Q fever was 41.9 ± 10.8 years old (range, 26 to 64 years old). The mean time they have been a physician was 15.9 ± 10.6 years (range one to 35 years).

TABLE 1 – Characterization of medical professionals according to age, gender, level of health care in which they work and their medical specialty, and proportions of correct answers to at least one specific question about Q fever by subgroup.

Variable	Physicians (n = 254)	Physicians with at least one correct answer (n = 18)	Percentage of physicians with at least one correct answer (%)
Age			
20 - 29	79	3	3.8
30 - 39	87	5	5.7
40 - 49	42	6	14.2
50 - 59	34	3	8.8
60 - 69	11	1	9
70 - 79	1	0	-
Gender			
Female	154	5	3.2
Male	100	13	13.0
Level of health care			
APS	47	4	8.5
ASS	129	10	7.7
ATS	187	13	6.9
APS + ASS	9	1	11.1
APS + ATS	13	0	-
ASS + ATS	93	8	8.6
APS + ASS +ATS	6	0	-
Completed medical specialty			
Anesthesiology	9	1	11.1
Cardiology	9	2	22.2
Medical Clinic	43	4	9.3
Echocardiography	2	1	50
Gynecology and Obstetrics	13	1	7.6
Hematology and Hemotherapy	4	1	25
Infectiology	5	2	40
Family and Community Medicine	21	2	9.5
Otorhinolaryngology	2	1	50

TABLE 1 – Characterization of medical professionals according to age, gender, level of health care in which they work and their medical specialty, and proportions of correct answers to at least one specific question about Q fever by subgroup. (Cont.)

Variable	Physicians (n = 254)	Physicians with at least one correct answer (n = 18)	Percentage of physicians with at least one correct answer (%)
Pediatrics	16	1	6.2
Pneumology	3	1	33.3
Urology	6	1	16.6
Others related to surgery [†]	15	0	-
Others related to the clinic [‡]	66	0	-
Physicians with two or more completed medical specialties	31	2	6.4
Medical residency in progress			
Medical Clinic	11	1	9
Hematology and Hemotherapy	2	1	50
Neurology	10	2	20
Pneumology	3	1	33.3
Others related to surgery [†]	7	0	-
Others related to the clinic [‡]	63	0	-
Total	96	5	5.2
Physicians doing residency already having completed at least one medical specialty	19	1	5.2

APS, primary care; ASS, secondary care; ATS, tertiary care.

[†]Cardiovascular; Craniofacial; Hand; Trauma; General; Pediatric; Plastic; Vascular.

[‡]Pediatric Cardiology; Dermatology; Endocrinology; Pediatric Endocrinology; Gastroenterology; Medical Genetics; Hepatology; Immunology; Pediatric Infectiology; Mastology; Occupational Medicine; Intensive Care Medicine; Nephrology; Neonatology; Neurology; Nutrology; Ophthalmology; Clinical Oncology; Orthopedics and Traumatology; Pathology; Psychiatry; Radiology and Diagnostic Imaging; Rheumatology; Pediatric Urology.

[§]General; Plastic.

[§]Anesthesiology; Cardiology; Dermatology; Echocardiography; Endocrinology; Gastroenterology; Gynecology and Obstetrics; Infectiology; Family and Community Medicine; Intensive Care Medicine; Ophthalmology; Orthopedics; Otorhinolaryngology; Pediatrics; Psychiatry; Radiology and Diagnostic Imaging; Rheumatology; Urology.

Table 2 describes the seven specific questions that assessed medical knowledge about Q fever and presents general information regarding physicians who answered at least one of these questions correctly. Most physicians 8 (44.4%) got only one question correct and only one (5.5%) physician correctly answered all seven questions. It is noteworthy that only three (16.6%) physicians answered more than 50% of the questions

correctly. Additionally, the 1st and 4th questions were the ones with the highest number of correct answers among physicians (n = 8), while the 3rd question was the one with the lowest number of correct answers (n = 3). When asked where they acquired knowledge about Q fever, the majority 10 (55.5%) reported that it was during undergraduate studies, followed by graduate studies four (22.2%).

TABLE 2 – Description of the seven specific questions that assessed medical knowledge about Q fever and general information regarding physicians who answered at least one of these questions correctly.

Physicians	How was the knowledge about Q fever acquired	Time since graduation (years)	Medical specialty	Specific questions to assess knowledge about Q fever							Total correct answers, n(%)	
				1	2	3	4	5	6	7		
I	Event/Scientific Work	1	Neurology resident	✓	✓	✓	✓					4(57.1)
II	Undergraduate	22	Anesthesiology								✓	1(14.3)
III	Undergraduate	15	Infectiology	✓			✓		✓	✓		4(57.1)
IV	Graduate studies	19	Otorhinolaryngology				✓					1(14.3)
V	Graduate studies	32	Pneumology	✓	✓			✓				3(42.9)
VI	Undergraduate	12	Pediatrics			✓	✓					2(28.6)
VII	Graduate studies	8	MC; Cardiology; Echocardiography	✓					✓	✓		3(42.9)
VIII	Undergraduate	11	Cardiology								✓	1(14.3)
IX	Undergraduate	20	Infectiology	✓	✓	✓	✓	✓	✓	✓	✓	7(100.0)
X	Undergraduate	12	MC resident	✓								1(14.3)
XI	Undergraduate	4	Neurology resident								✓	1(14.3)
XII	Undergraduate	3	MC; Pneumology resident	✓				✓				2(28.6)
XIII	Graduate studies	2	Hematology/Hemotherapy resident							✓		1(14.6)
XIV	Undergraduate	35	Gynecology and Obstetrics				✓	✓				2(28.6)
XV	Other: Study	11	FCM		✓							1(14.3)
XVI	Other: In daily clinical practice / differential diagnosis	26	Medical Clinic; Hematology / Hemotherapy; FCM		✓		✓					2(28.6)
XVII	Undergraduate; Graduate studies	29	MC	✓			✓			✓		3(42.9)
XVIII	Undergraduate	25	Urology		✓							1(14.3)
	Total correct answers per question			8	6	3	8	4	4	7		

✓, right answer. FCM, Family and Community Medicine; MC, Medical Clinic.

1 - Do you know the etiological agent of Q fever? Describe. 2 - Do you know what are the main clinical manifestations of acute Q fever? Describe. 3 - Do you know what is the most frequent and most severe clinical presentation of chronic Q fever? Describe. 4 - Do you know which are the main animals affected by Q fever? Describe. 5 - Do you know what is the main form of transmission of Q fever? Describe. 6 - Do you know what are the main methods of diagnosing Q fever? Describe. 7 - Do you know what are the main drugs used to treat Q fever? Describe.

Among medical professionals who reported working in secondary and/or tertiary health care, 37 different workplaces at the HU-UFJF were mentioned, such as private practices, institutes, clinics, emergency care units, health departments, private and public hospitals, located in

Juiz de Fora and other municipalities in the states of Minas Gerais and Rio de Janeiro.

Table 3 presents information about the area of Juiz de Fora in which the 22 UBS included in this study are located and the respective number of participating physicians.

TABLE 3 – UBS with at least one physician included in this study.

UBS	Area of Juiz de Fora	Physicians (n)
Alto Grajaú	Urban	3
Benfica	Urban	4
Borboleta	Urban	1
Centro Sul	Urban	2
Cidade do Sol	Urban	1
Dom Bosco	Urban	2
Humaitá	Rural	1
Igrejinha	Rural	1
Ipiranga	Urban	1
Jardim Natal	Urban	1
Joquei Clube I*	Urban	1
Joquei Clube II	Urban	2
Linhares	Urban	2
Nossa Senhora Aparecida*	Urban	3
Nossa Senhora de Lourdes	Urban	2
Nova Era	Urban	2
Santa Luzia*	Urban	5
Santo Antônio	Urban	5
Santos Dumont	Urban	2
São Pedro	Urban	2
Vila Ideal	Urban	2
Vila Olavo Costa	Urban	2

UBS, Basic Health Units.

*UBS with at least one physician having some level of knowledge about Q fever.

When asked if they had already requested a diagnostic test for Q fever in any patient with an acute febrile illness or endocarditis with negative blood cultures, 251 (98.8%) physicians answered no. In addition, four (1.5%) physicians reported having treated some patient with a history of Q fever, and five (1.9%) stated that some colleague had already treated a patient diagnosed with Q fever.

Regarding the question on whether they consider Q fever a neglected and underreported disease, 218 (85.8%) doctors answered yes, 35 (13.7%) no and one (0.3%) preferred not to give an opinion. On the other hand, when asked whether the inclusion of Q fever in the national list of compulsory notifiable diseases would help it to stop being neglected and underreported, 221 (87%) physicians responded that they agreed, including 21 physicians who did not consider it

a disease neglected and underreported. Finally, it was asked if the respondent had clinical, epidemiological and laboratory knowledge of the diseases present in the national list of compulsory notifiable diseases, 198 (77.9%) physicians answered in the affirmative.

When asked if they were aware of the One Health approach, all physicians answered that they were not, and regarding the acronym NTD, 240 (94.4%) physicians answered that they did not know it. Of the 14 physicians who claimed to know the acronym, eight described its meaning correctly, making it possible to state that 246 (96.8%) physicians did not know the acronym NTD. In addition, those who claimed to know the acronym NTD were asked to cite three examples of NTD, with one (12.5%) physician correctly describing two diseases, four (50%) only one disease

and the remaining three (37.5%) did not describe any disease correctly.

When analyzing the responses of the 107 physicians with up to five years of training in medicine, that is, with recent passage through the undergraduate course, it is noteworthy that 103 (96.2%) had no knowledge about Q fever and 100 (93.4%) did not know the acronym NTD.

In the end, when asked if the participants would like to receive specific information about Q fever, 227 (89.3%) physicians responded in the affirmative.

In the univariate analysis, two variables, gender ($p = 0.006$) and medical specialty ($p = 0.0001$), from the four variables analyzed, were associated with at least one correct answer to questions on specific knowledge about Q fever, both having remained in the final multivariate model ($p < 0.0001$) (**Table 4**). On the other hand, the variables level of health care in which they work ($p = 0.41$) and age group ($p = 0.28$) were not associated with the score of at least one correct answer.

TABLE 4 – Variables associated with at least one correct answer on questions about specific knowledge about Q fever by univariate and multivariate logistic regression.

Variables	Total	Hits (%)	Univariate OR (95% CI)	Multivariate OR (95% CI)
Gender				
Female	154	5 (3.25)	1.00	1.00
Male	100	13 (13.00)	4.45 (1.53-12.91)	4.88 (1.59-14.90)
Medical specialties				
Others*	218	9 (4.13)	1.00	1.00
More related†	36	9 (25.00)	7.74 (2.82-21.19)	8.43 (2.93-24.23)

Summary of multivariate model: Score test = 28.70 (p -value < 0.0001); Nagelkerke R square = 0.21; Hosmer and Lemeshow test = 0.11 (p -value = 0.94).

*Medical Clinic, Family and Community Medicine, among others.

†Infectiology, Pneumology, Otorhinolaryngology, Cardiology, Echocardiography and Hematology-hemotherapy.

Discussion

The present study is a pioneer in Brazil in assessing medical professionals' knowledge about Q fever, with no similar studies being found in any other country. In Brazil, there are reports of human cases and studies that demonstrate that the pathogen that causes Q fever circulates in humans, animals and food (2, 15, 16, 17, 18). Surprisingly, in this country, Q fever is not yet on the national list of notifiable diseases in humans, unlike in other countries such as Australia, the Netherlands and the United States (19). Nationally, there are still no programs to control Q fever/coxiellosis, with cases being underreported in both humans and animals. Furthermore, there is still no systematic data available for understanding the problems of Q fever in the national public health system, which makes it difficult to impress upon authorities and

the service itself the importance of the differential diagnosis and avoiding the aggravation of many cases of Q fever (20).

The results of this study have great impact, since they demonstrated that 92.9% of the physicians did not know about Q fever. In addition, the data demonstrated that a group of more-closely-related medical specialties and male gender were independently associated with at least one correct answer on the specific knowledge questions about Q fever.

Among physicians who got at least one specific question about Q fever right, few were approved in more than half of the questions. As an aggravating factor for the low rate of knowledge about the disease among professionals, it should be noted that a group of medical specialties (Infectiology, Pneumology, Otorhinolaryngology, Cardiology,

Echocardiography and Hematology-Hemotherapy), which work less at the UBS, presented greater knowledge of Q fever than another, especially represented by two, Medical Clinic and Family and Community Medicine. These two specialties provide most of the primary health care service in Brazil, therefore, they could present greater relevance and interface in relation to the clinical aspects and diagnosis of Q fever. Thus, these specialties and graduates themselves should have more general training on this and other infectious diseases that affect our population.

Complementarily, another study in the same region showed that residing in a rural area increases the chances of exposure to the pathogen that causes Q fever (2). However, it is important to highlight that in this study, all physicians working at UBS located in rural areas did not know about Q fever, which may compromise the detection of those affected by this disease.

There were no significant differences in the rates of correct answers for at least one specific question among physicians who work in primary, secondary and tertiary health care, suggesting the possibility of underdiagnosis in both the acute and chronic phases of the disease in symptomatic patients, regardless of the level of health care provided. This zoonosis, because it presents a clinical picture similar to that of other acute febrile diseases, combined with a lack of knowledge among medical professionals, may not be getting diagnosed and therefore is possibly being treated wrongly. This fact, combined with the risk of chronic Q fever, and consequently death, may contribute to increased costs in the public health system.

Comparing the results of the present study with others that assessed the knowledge of health professionals/doctors about other neglected tropical diseases, such as Chagas disease (21), dengue, rickettsiosis (22), rabies (23) and leprosy (24), it was possible to find similarity in relation to low knowledge on the part of these professionals. The results of these studies emphasize the importance of permanent education to overcome the lack of knowledge among health professionals about NTD.

The largest outbreak of human Q fever recorded in the world occurred in the Netherlands between 2007 and 2010, with 4,026 cases reported, with an estimate of more than 40,000 individuals infected with *C. burnetii*. Although that outbreak was controlled, the post-epidemic period raised concerns due to the possibility of future cases of chronic Q fever (25).

Nowadays, it is essential that the strategies for monitoring, controlling and preventing Q fever are based on the One Health approach, that is, in a comprehensive and holistic way, integrating human, animal and environmental health actions. In this study, the One Health approach was unknown to all physicians interviewed, indicating the need to disseminate its concept to these professionals so that it can be used in favor of public health. Fernandes and Lemos (26) describe that understanding the dynamics of infection caused by *C. burnetii* in the human and animal population in Latin American countries depends on multidisciplinary actions developed based on the One Health approach, which is essential for implementing strategies for control and prevention of Q fever. This fact reinforces the importance of the professionals involved having knowledge about the One Health approach.

In summary, this study found that most physicians consider Q fever a neglected and underreported disease in Brazil and that its inclusion in the national list of notifiable national diseases will contribute to its being observed and controlled in Brazil. The almost total lack of knowledge among medical professionals regarding this zoonosis as revealed by this study reinforces the need for greater dissemination and awareness of the occurrence of Q fever in this country, in addition to its inclusion in the exercise of the differential diagnosis of acute febrile illnesses and cases of endocarditis with negative blood culture, thus avoiding possible diagnostic errors and, consequently, unnecessary health-related public resource expenditures.

This study had the limitation of convenience sampling, which may introduce some bias into the study. However, we believe that the proportional

use of the questionnaire application period at the HU-UFJF and UBS, in addition to the inclusion in the study of the majority of medical professionals who were working on the days the questionnaires were applied, may have contributed to avoid possible biases in this study.

Finally, it is expected that the results of this study will raise awareness among the competent authorities in Brazil so that effective actions are carried out. On the one hand, more generalist undergraduate training for physicians on NTD, including Q fever, should be prioritized. On the other hand, the implementation of systematic actions for the diagnosis and notification of human cases would allow a better knowledge of the epidemiological situation in the country regarding Q fever.

Notes

Based on the results of this study, two abstracts were presented at the *XXIII Congresso Brasileiro de Infectologia*, which took place between the 19th and 22nd of September 2023, in Salvador, Bahia, Brazil.

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Conflicts of interest disclosure

The authors declare no competing interests relevant to the content of this study.

Authors' contributions

All the authors declare to have made substantial contributions to the conception, or design, or acquisition, or analysis, or interpretation of data; and drafting the work or revising it critically for important intellectual content; and to approve the version to be published.

Availability of data and responsibility for the results

All the authors declare to have had full access to the available data and they assume full responsibility for the integrity of these results.

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