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# Knowledge and perceptions of infectious disease physicians about epidemiology, causes, diagnosis, treatment and prevention of Q fever in the Republic of Kazakhstan: results of online survey

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**Abstract**

Q fever is a significant zoonotic infectious illness triggered by the pathogen known as Coxiella burnetii and may cause complications as pneumonia, hepatitis or myocarditis, and some patients may develop chronic Q fever due to incomplete treatment and the topical resistance of C.burnetii. Poor awareness of clinicians about the disease can be one of the reasons for delay in treatment. In view of the above, a survey has been carried out to collect information on the approach of modern Kazakhstan doctors to the problem of Q fever.

**Methods:** The electronic survey was conducted among infectious disease physicians from different cities of Kazakhstan, based on convenient sampling through social network platforms. Data were collected anonymously between November 14, 2022 and December 14, 2022 among infectious disease doctors.

**Results:** The majority of the respondents (91.7%) considered themselves to have knowledge of information; however 80.2% of physicians showed satisfactory level of knowledge.

**Conclusions:** According to the results of the study, the level of experience of infectious disease physicians about Q fever can be assessed as satisfactory. We found that the level of registration of its' diagnosis is low due to the lack of diagnostic testing systems and poor knowledge about the disease in Kazakhstan. As a consequence, we consider it advisable to enhance the level of knowledge about Q fever among young specialists by including comprehensive information in training programs, seminars, conferences in the field of infectiology, epidemiology and public health, as well as expanding diagnostic opportunities in Kazakhstan.

**Keywords:** Coxiella burnetii; Q fever; Infectious disease physicians; awareness; Kazakhstan; Surveys and questionnaires.

## Introduction

Q fever is an essential zoonotic disease having a global spread caused by Coxiella burnetii, a narrow cellular Gram-negative bacterium [1]. The primary descriptions of Q fever in humans were made in 1937 by Burnet. He investigated several cases of Australian abattoir workers who suffered from indistinguishable fever [2, 3]. The pathogen affects individuals and a widespread array of animals, both feral and domestic, including ovines, cattle, goats, pigeons and others [4]. Infected animals disseminate C.burnetii to the surrounding area through their milk, colostrum, birthing products, and urine. In

addition, C.burnetii is highly tolerant to dryness, low and high pH and ultraviolet radiation, so it can remain infectious in soil for many months [5, 6].

People are highly sensitive to C.burnetii, and infection may occur as a result of only a few hosts. The majority of cases are not symptomatic (60%), but some may induce acute flu-like symptoms and atypical pneumonia. Chronic episodes include endocarditis, chronic hepatitis and osteomyelitis with a fatality incidence of up to 11%. The disease is an occupational risk often for people working with domestic livestock who can be affected by highly contagious sprays from the birth products, contaminated particles of dust, or fur. Workers in slaughterhouses, veterinarians and ranchers are also susceptible to it [6].

Q fever has a broad spectrum of symptom that is often nonspecific. They can last from a few days to more than a year, is frequently misdiagnosed. This causes inadequate therapy, and prolonged illness can lead to severe debilitating disease and the patients may get disabled. Affected people may develop serious changes in their different organs and systems. The infection not only results in enormous economic damage to society by affecting livestock production, but also threatens physical and mental health. The prevalence of Q fever in both humans and animals cannot be estimated in most countries, remains unrecognized and there is no epidemiological surveillance of it. In Kazakhstan, there is a similar trend of under-diagnosis of Q fever and a gap in the treatment and prevention of the disease. Currently, there is limited information on knowledge and experience on Q fever among Kazakhstan doctors [7]. Therefore, this study aimed to investigate the level of Q fever awareness of in infectious disease physicians in various regions of Kazakhstan in further to address existing research questions and problems in knowledge and practice.

## Methods

*Study design*

The present descriptive questionnaire has been constructed to explore the current knowledge and perceptions of infectious disease physicians from different areas of Kazakhstan about the epidemiology, etiology, diagnostics, treatment and preventive measures of Q fever. The survey was conducted among infectious disease doctors. A pre-designed online questionnaire for self-completion in Kazakh and Russian languages, developed in Google Forms, was analyzed to collect data.

*Survey items*

Three experts reviewed the questions to finalize the wording and ensure content validity. Once finished, the survey included 24 questions. The first part of the survey (Q1-Q6) was used to collect demographic characteristics (age, gender) one response had to be selected, it also included background characteristics of respondents (degree, duration of experience and type of institution working at) only a numeric value had to be entered. The second part of the survey (Q6-Q14) focused on general knowledge and epidemiology of the disease. Finally, the third and last part of the questionnaire (Q15-Q24) converged on symptoms, diagnosis, differential diagnosis, treatment, complications and prevention of Q fever, the questions were multiple choice. Respondents could change answers before submission but not afterward. All questions were made mandatory so that partial answers were automatically discarded by the Google Forms platform.

*Sampling strategy and confidentiality*

We used convenient sampling strategy and distributed questionnaire on social network, through Whats up chats, between November 14, 2022 and December 14, 2022. Respondents were anonymous and only one response from each participant was accepted. The survey link was open from the moment it was distributed to the professional social network.

*Statistical analysis*

The normality of the data was checked by means of the Shapiro-Wilk test. Mostly descriptive statistics are presented. Microsoft Excel was used to construct graphical representations.

After the data were extracted, they were translated, edited, coded, entered into statistical software and analyzed with help of SPSS version 26. Categorical variables were presented as frequencies and percentages. Continuous variables were expressed as mean and standard deviation. The Kraskal-Wallis, Mann-Whitney U criterion was used to assess the statistical relationship between categorical variables. A value of $P \leq 0.05$ was considered statistically significant.

Table 1 Base line demographics

| Variables | Response |
|---|---|
| **Education** | |
| Higher education 4-5 years | 47(38.8) |
| Postgraduate education (master's / residency) 1-2 years | 42(34.7) |
| Postgraduate education (PhD) from 3 years | 6(4.9) |
| Other | 26(21.4) |
| **Experience (years)** | |
| 0–10 | 49(40.4) |
| 11–20 | 19(15.7) |
| 21–30 | 35(28.9) |
| 31–40 | 17(14) |
| >40 | 1(0.8) |
| **Type Of Workplace** | |
| Outpatient type (outpatient clinics, polyclinics, consultations, dispensaries, medical-sanitary units and ambulance stations) | 57(47.1) |
| Inpatient type (hospitals, clinics, hospitals, maternity hospitals) | 60(49.5) |
| Other | 4(3.3) |
| **Location** | |
| City | 90(74.3) |
| Rural location | 31(25.6) |
| **Age** | |
| 18–23 | 1(0.8) |
| 24–29 | 32(26.4) |
| 30–35 | 13(10.7) |
| 36–40 | 11(9.1) |
| 41–45 | 14(11.5) |
| 46–49 | 7(5.7) |
| 50–55 | 26(21.4) |
| >55 | 17(14.1) |
| **Gender** | |
| Female | 105(86.7) |
| Male | 16(13.2) |

Values are presented as number (%).

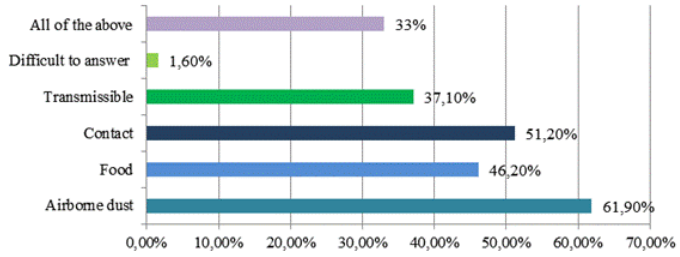


**Figure 1** – Answer results about the main routes of transmission of Q fever

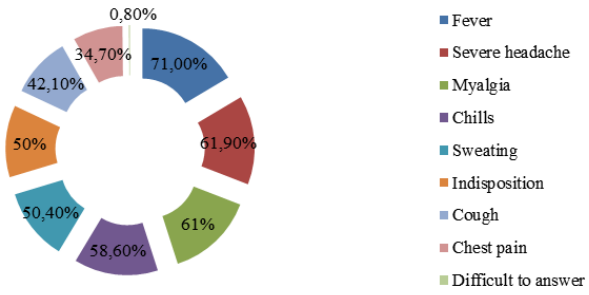


**Figure 2** – Results of responses about the clinical symptoms of Q fever

## Results

Out of total 121 respondents, majority (86.7%) were female infectious disease specialists, age group 24-29 years (26.4%). More than half of the respondents resided in the city (74.3%), almost half of the participants (49.5%) were working in hospital, with an experience of 1-10 years (40.4%). The detailed demographics of the respondents are presented in Table 1.

*Presentation of the features of Q fever*

Majority (91.7%) of the respondents answered that they are familiar with Q fever. Based on the respondents' answers, the main routes of transmission of Q fever showed (61.9%) airborne, (51.2%) contact and (46.2%) alimentary routes (Figure 1). More than two thirds reported that animals (71.9%) were the main source of C.burnetti, this followed by mosquitoes (14.8%), humans (4.9%) and others. Just over ½ (52%) reported that ticks are the main vectors of the disease, while 17% of respondents thought humans and mosquitoes as the main vectors. The most common way to contract Q fever is in spring and summer (65.2%). Also 14, 8% answers of respondents were summer time, 9% answered fall and winter, and 7% of the doctors could not answer this question. More than ¾ of the infectious disease specialists think that the main risk factor for Q fever is (77.6%) a contact with infected animals, 64.4% of respondents think that traveling and living in endemic areas affect the risk of the disease. 55.3% selected occupational risk. Above ½ of the respondents (63.6%) answered that the risk of contracting Q fever for all contingents is the same, the same number of answers were for pregnant, about 20% for elderly people, about ¼ of the respondents (23.1%) selected male contingents, a small proportion (7.4%) thought that women are more likely to get infected with Q fever. The specific signs of Q fever reported were fever in 71% of answers, severe headache and myalgia in 61.9%. They were followed by chills (58.6%), sweating and malaise (50.4%), and cough (42.1%) (Figure 2).

*The level of awareness of specialists about diagnosis of Q fever*

Among the tests used to examine patients with Q fever for diagnosis, serologic testing methods were most commonly used (75.2%), followed by bacteriologic testing methods (15.7%), microscopic testing methods (3.3%) and others. The majority of respondents (76.8%) chose blood as the material to confirm the diagnosis of Q fever, followed by sputum (33.8%), urine (31.4%), liquor (24.7%), bronchial lavage (21.4%), and feces (19%), only (1.6%) found it difficult to answer. However, more than 1/3 (46.2%) reported that due to the lack of special tests for confirming Q fever, the diagnosis is not made in Kazakhstan. Almost all respondents believe that the differential diagnosis of Q fever should be made with all listed diseases, such as influenza, brucellosis, tuberculosis and others.

*The level of awareness of specialists about treatment of Q fever*

Doxycycline, an antibiotic of tetracycline group, was the most commonly (76.8%) selected as a drug for treatment of Q fever, then it was followed by Ceftriaxone (8.2%), Interferon (7.4%), Metronidazole (2.4%), Chloramphenicol (0.8%). 4.1% of participants found it difficult to answer.

*The level of awareness of specialists about complications and prevention of Q fever*

The majority of interviewees considered veterinary sanitary control (84.2%) as the main preventive measure against Q fever, followed by other measures such as consumption of milk after thorough boiling (63.6%), vaccination (57.8%), the need to treat fields and places (47.9%), only (1.6%) doctors found it difficult to answer. The majority of participants (71.9%) think that pneumonia is the main complication of the disease. More than ½ of respondents (59,5%) think endocarditis, almost half of participants answered hepatitis (47,9%), a small part of participants think that complications of this disease are peritonitis (14%) and bleeding (19,8%).

## Discussion

We conducted this survey due to the high risk of Q fever infection in our country, as a large number of residents are engaged in animal production, which increases the risk of Q fever in the communities.

According to Hamad G. and et al. [8] investigations a total of 15 articles were analyzed. These articles published on surveys and interviews conducted with farmers, veterinary practitioners and nurses, medical practitioners, policy makers, researchers, industry representatives, animal science students, cat breeders, wildlife rehabilitators, and agriculture show attendees. Two investigations [9, 10] that involved practicing physicians revealed a low level of awareness of Q fever. In our survey involved only infectious disease physicians, the majority of the surveyed interviewees (91.7%) felt that they had good knowledge of information, with 80.2% demonstrating a satisfactory level of knowledge. In study Lindsay P. J. et al. investigated 43 hospital and community-based doctors, 72% accurately identified that Q fever is caused by a bacteria; less than half (47%) of clinicians were aware of long-term complications of Q fever, with few clinicians being aware of the variable clinical presentations and suggesting underestimation of disease burden [9]. According to Rahaman M. R. et al. study that included general practitioner as one of many stakeholders recognized the important role general practitioners have in diagnosing, reporting and treating

Q fever; however limited knowledge and awareness among general practitioner was acknowledged [10]. Participants from four additional studies [11-14] raised concern about general practitioners in certain locations. This included: identifying at risk populations, symptoms, and vaccination provision of Q fever [11]; lack of awareness including vaccination administration and advocation to higher-risk populations [12]; failure to recommend vaccination and lack of knowledge around Q fever [14]; and general practitioners expressing low levels of awareness [13]. In our study, the lowest level of knowledge in the categories is the knowledge of transmission routes (32.2%), risk factors of the disease (19.8%), materials used for diagnosis (27.3%), prevention (43.8%), outcomes and complications (27.3%) of the disease. In consequence, awareness in these domains of knowledge needs to be increased. In the categories of knowledge possession, the highest knowledge levels were knowledge about sources of infection (71.9%), vector (52.1%), seasonality of the disease (65.3%), symptoms (52.1%), differential diagnosis (60.3%), diagnostic methods (75.2%), and treatment (76.9%).

We also, assessed the relationship of knowledge level with different socio-demographic characteristics of the respondents. A statistically significant difference was found for work experience (*P<0.05) and for age (*P<0.05). Namely, the higher is the work experience, the more is knowledge about the disease (Figure 3). When comparing the level of knowledge in different age groups, it was found that age groups 50-55, over 55 years demonstrated significantly more "good" knowledge than other age groups (Figure 4). There were no statistically significant differences in the knowledge level of participants according to education level, gender, place of residence and type of institution (P> 0.05). That is, the distribution of knowledge level was the same for these categories, indicating that the knowledge level of participants on Q fever is independent of gender, education, place of residence, and type of institution.

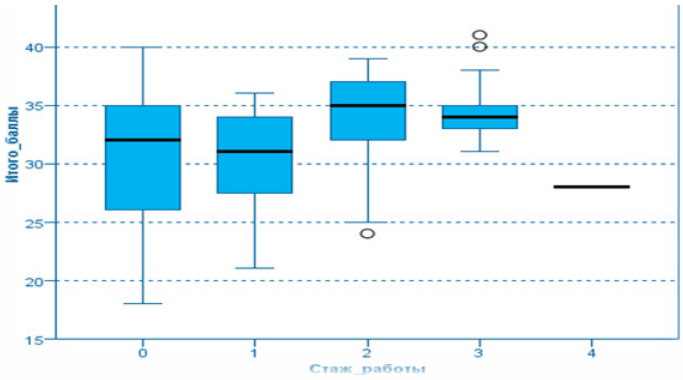


**Figure 3** – Level of knowledge by Work experience

(Kraskal-Wallis criterion for independent samples. The horizontal line shows the work experience, the vertical line shows the total score)

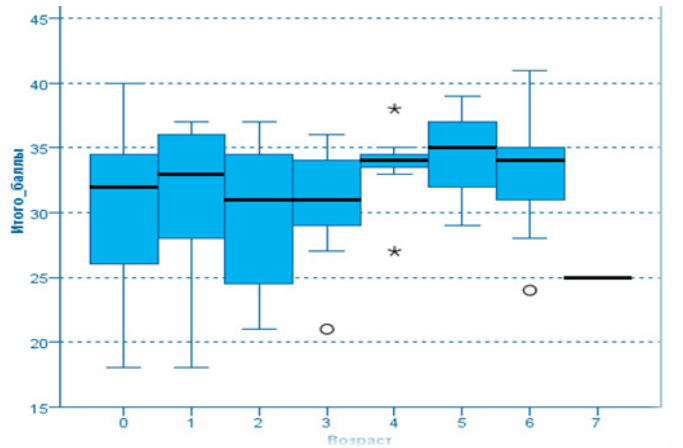


**Figure 4** – Level of knowledge by age

(Kraskel-Wallis criterion for independent samples. The horizontal line shows the age, the vertical line shows the total score)

## Conclusion

In our study, most of the respondents in the sample were aware of Q fever; the level of knowledge about the pathology was satisfactory. However, among specialists in the age groups of 24-45 years old there was a lack of knowledge about transmission, risk factors, diagnosis, prevention, outcomes and complications of Q fever; therefore, we recommend to increase the level of knowledge about Q fever in these sections for this age group. Consequently, we consider it advisable to include comprehensive information on the previously mentioned categories in training programs, seminars, conferences in the field of infectiology, epidemiology and public health, to create online video courses on available platforms, educational videos, publications in the media to attract attention and talk about the discussed disease among young professionals and the population.

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