The seroprevalence of Q fever and its risk factors among occupational high-risk groups in South Korea

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Q fever

- a highly infectious zoonotic disease with worldwide prevalence

- caused by the *Coxiella burnetii*, which can infect mammals, birds, reptiles and ticks.

- Human infection with *C. burnetii ;*

- about 40-50% of all cases causes acute disease: flu-like symptom, pneumonia, acute hepatitis; often diagnosed as FUO

- post Q fever fatigue syndrome: 20% of all symptomatic cases

- chronic Q fever (persistent localized infection, i.e. endocarditis, osteomyelitis, chronic hepatitis..): about1-5 % of infected case, within 2-20 years, 20-25% of case fatality rate

C. Burnetti
(Science 2007. Jul.2)

Q fever transmission

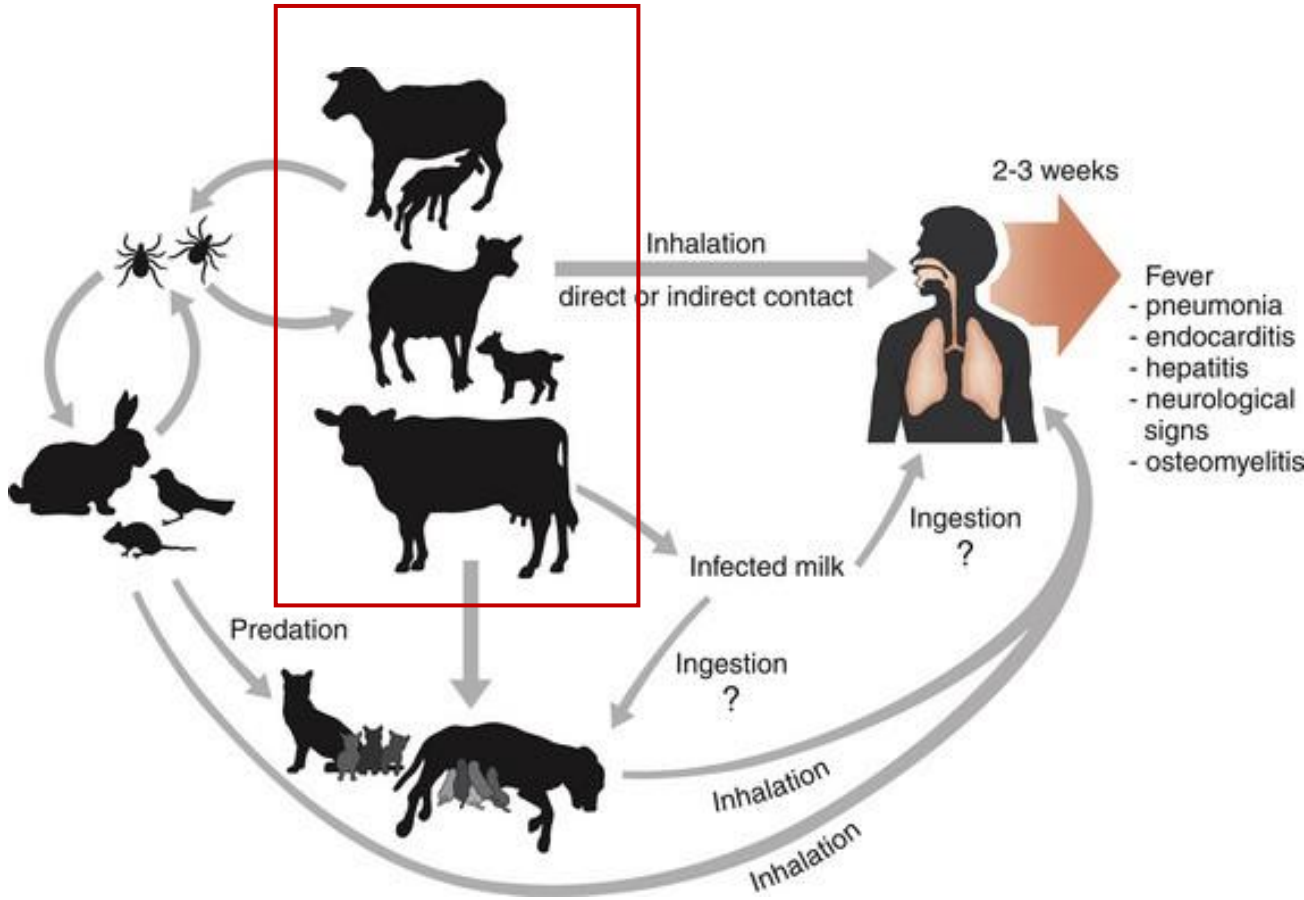
- *C. burnetii* are found in the birth products (i.e. placenta), urine, feces, and milk of infected animals.
- People get infected by breathing in dust that has been contaminated by them from infected animals, mostly cattle, goat and sheep.
- Direct contact and ingestion of contaminated milk are another route of transmission.
- High risk groups

- Livestock (cattle, goat) and dairy farmers

- abattoir and meat workers

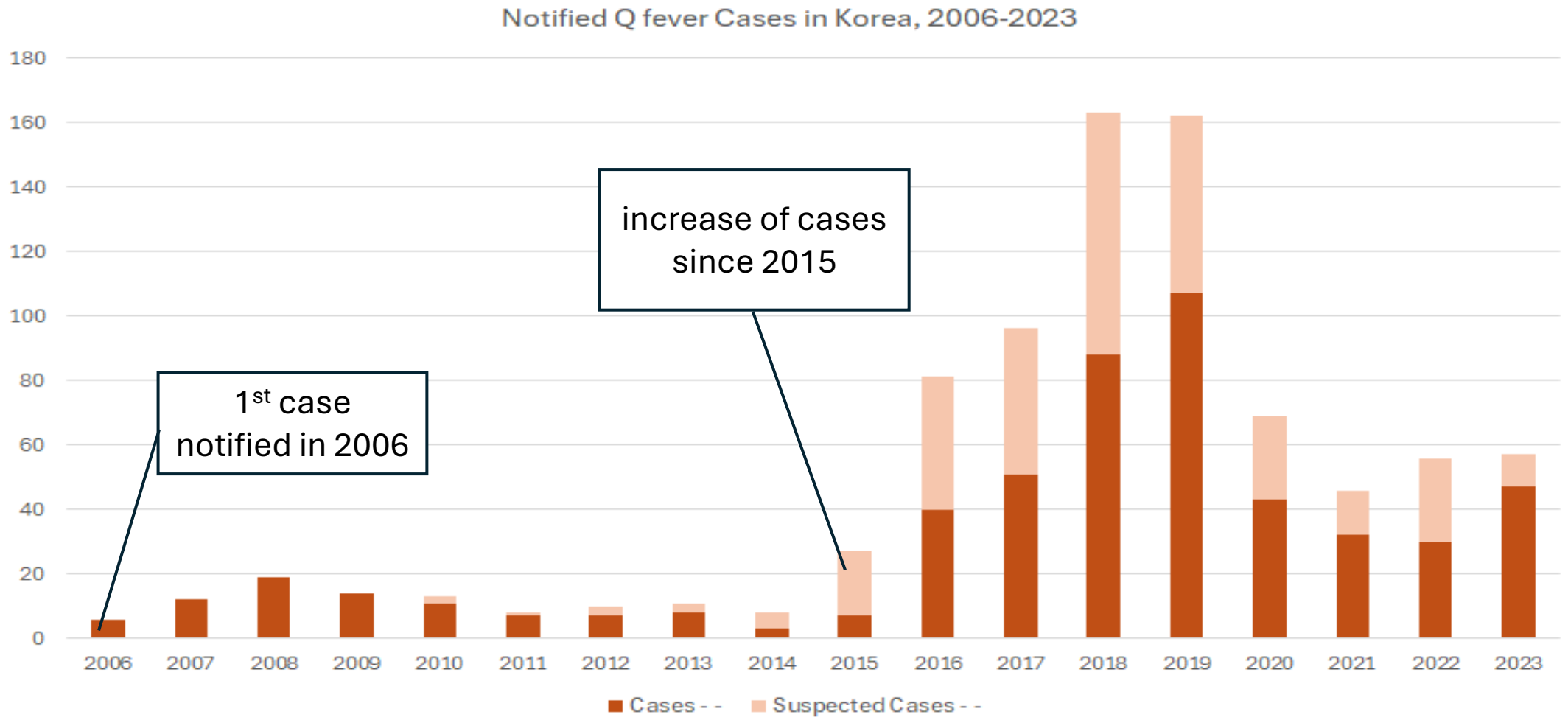
- workers and transporters of livestock, livestock products and waste

- veterinarians, veterinary assistants/nurses



(https://doi.org/10.1016/B978-0-323-50934-3.00048-3)

Q fever cases in Korea, 2006-2023



- Notified Q fever case are increasing as awareness of Q fever grows since 2015.
- However, Q fever is still a hidden disease in Korea

Aim of the study

- This study aimed
- to estimate the Q fever seroprevalence and
- to identify risk factors among workers engaged in disease control and hygiene of livestock (goat and/or cattle) in Korea (registered members of Livestock Hygiene Control Association, LHCA).

Sampling specimen and disinfection of Livestock and farms

Control of outbreaks of Livestock disease

Sampling and hygiene works in abattoirs

Methods

- **Study participants**

- A random sample of 275 stratified by region out of 890 registered LHCA members

- **Blood sampling and Survey**

- When: June & July 2023

- What:

✓ **Blood sampling**

  - Serum for Q fever Antibody & blood for PCR test

  - 2nd sampling if any Ab > 16 after 3 week

✓**Questionnaire survey** to identify the risk factors: demographic, characteristics of works, frequency of PPE use in detail, risk behaviors, knowledge & attitude on Q fever, past medical history, presence of any symptoms & signs

Methods

- **Serological analysis**

- Ig M, Ig G Ab (both Phase I & II)
- Indirect immunofluorescent Antibody Assay (IFA) was performed (Focus Diagnostics, Inc., Cypress, CA) on serum samples according to the manufacturer's instructions.
- PCR: DNA extraction (QIAamp DNA Blood kit), Q fever Real-time PCR Kit (AttoPlex), sequencing, GenBank (NCBI)

- **Statistical analysis**

- Descriptive analysis
- Frequency analysis
- Multivariate logistic analysis (seropositive vs. seronegative group)

Diagnostic Criteria for Q fever, Korean CDC

Status	Criteria	Diagnostic test
Acute Q fever, Confirmed	• Isolation of *C. burnetii or*	Isolation
	• Specific Ag detection or	Real-time PCR
	• More than 4-fold increase in serum antibodies in the convalescent phase compared to the acute phase (Phase Ⅱ)	IFA
Acute Q fever, suspected	• Phase Ⅱ Ig G ≥1:128	IFA
Chronic Q fever, Confirmed	• Specific Ig G Ab to phase I antigen is greater than or equal to 1:800 and the titer of phase Ⅰ is higher than phase Ⅱ	IFA
Chronic Q fever, Suspected	• Phase Ⅰ Ig G is greater than or equal to 1:128 and less than 1:800	IFA

(Korean CDC. Guideline for Q fever management & Control. 2022)

Results: Seroprevalence

- Of the 275 participants, 70.1% were male and 37.3% were in their 20s and 30s.
- Seropositive rate of Q fever was 8.4%

Classification	Status	n	%
Seropositive	Acute Q fever, Confirmed*	**18**	**6.5**
	Acute Q fever, suspected	**3**	**1.1**
	Chronic Q fever, Confirmed	**0**	**0.0**
	Chronic Q fever, Suspected	2	**0.7**
	Subtotal	**23**	**8.4**
Seronegative	Undetermined (with any Ab≥ 16)	19	6.8
	Negative (all Ab < 16)	233	84.8
	Subtotal	252	91.6

*More than 4-fold increase in serum Ab in the convalescent phase compared to the acute phase (Phase Ⅱ)
*No PCR positive

Results: Risk factors

Multivariate logistic regression analysis on the risk factors of Q fever seropositivity

Variables	Classification	OR	OR 95% CI	
Age (years)	-29	Reference		
	30-39	0.50	0.09	2.92
	40-49	0.55	0.10	3.03
	50-	0.20	0.02	1.76
Sex	Female	Reference		
	Male	0.46	0.17	1.23
Working duration (years)	< 2	Reference		
	≥ 2	**5.46**	**1.60**	**18.6**
Visited known Q fever out-break farms	Yes	**15.90**	**2.04**	**124**
Work experience in abattoirs for goats	Yes	0.83	0.21	3.28
Knowledge on Q fever	Score*	**0.86**	**0.75**	**0.98**

*Number of correct answers measured by 12 questions

Discussion

- Following this survey, the Korean CDC funded additional research to test the remaining 616 registered workers for Q fever, and the seropositivity rate for all workers surveyed was 7.7%. (preliminary results)

- Acute Q fever (including suspected): 56 cases (6.3%)
- Chronic Q fever (all suspected) : 13 cases (1.5%)

- Also, this year, the Korean CDC and our laboratory began seroepidemiologic surveillance for Q fever among workers on cattle and goat farms for a pilot study.

Conclusion

- Seropositive rate for Q fever among 275 animal hygiene workers was 8.3%.
- Lack of knowledge and poor awareness of the disease was a significant risk factor for Q fever positivity.
- In South Korea, Q fever has been under-recognized, even among high-risk populations, and physicians are less likely to diagnose it.
- It is necessary to increase awareness of Q fever among healthcare providers and the general public, and to increase education on prevention and serosurveillance of Q fever for the occupational high-risk groups.


thank you
danke
謝謝
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teşekkür ederim
gracias
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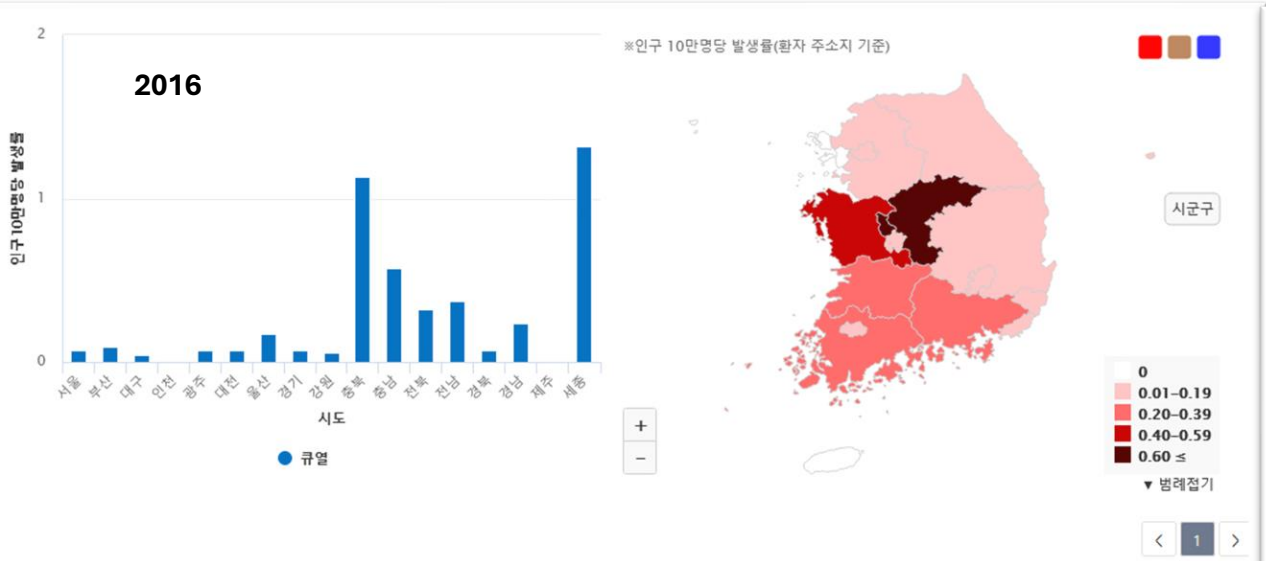
Supplementary material

Q fever antigenic phase

- C. burnetii also has two distinct antigenic phases, Phase I and Phase II.
- The primary significance of these two phases is that antibodies to phase II antigens are made during the early stages of the infection,
- but antibodies to phase I antigens predominate if the organism persists longer.
- This switch is used to distinguish acute from chronic infections in people

Annual incidence (per 100,000 population) of reported Q fever–Korea, 2016-2021



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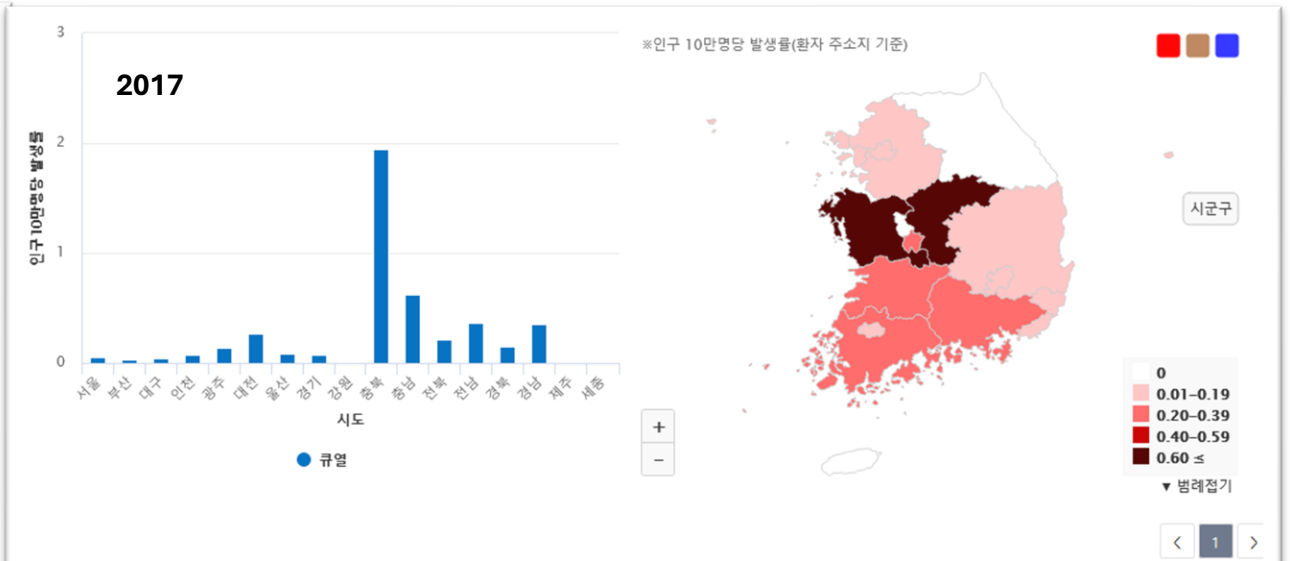
큐열	0.16	0.07	0.09	0.04	0.00	0.07	0.07	0.17	0.07	0.06	1.13	0.57	0.32	0.37	0.07	0.24	0.00	1.32



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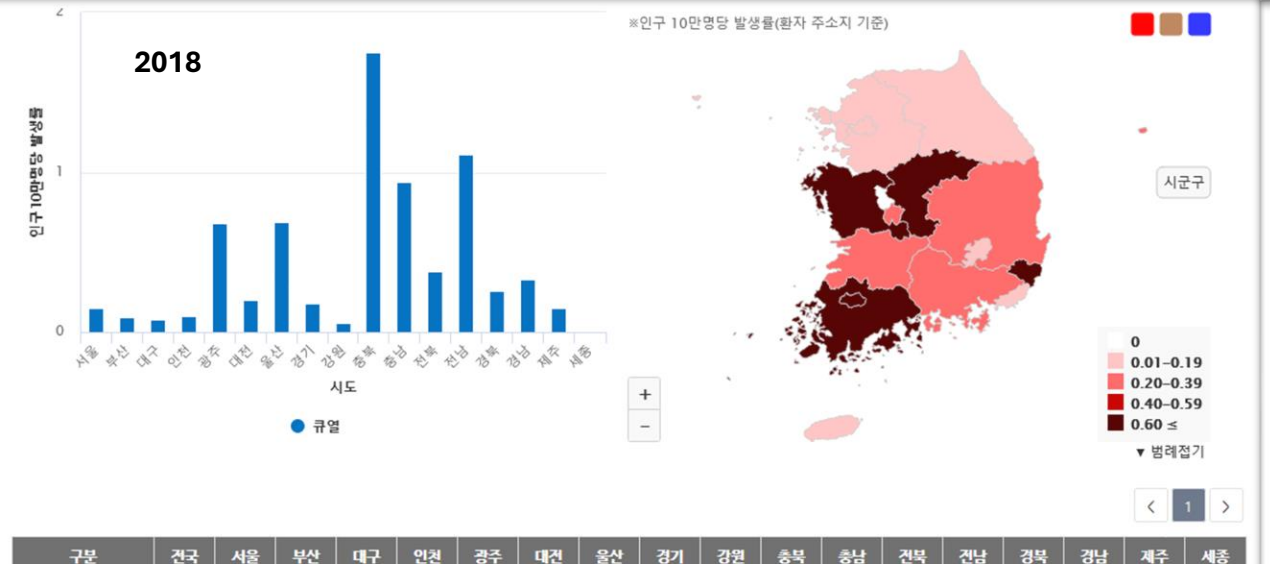
큐열	0.19	0.05	0.03	0.04	0.07	0.14	0.27	0.09	0.07	0.00	1.95	0.62	0.22	0.37	0.15	0.36	0.00	0.00



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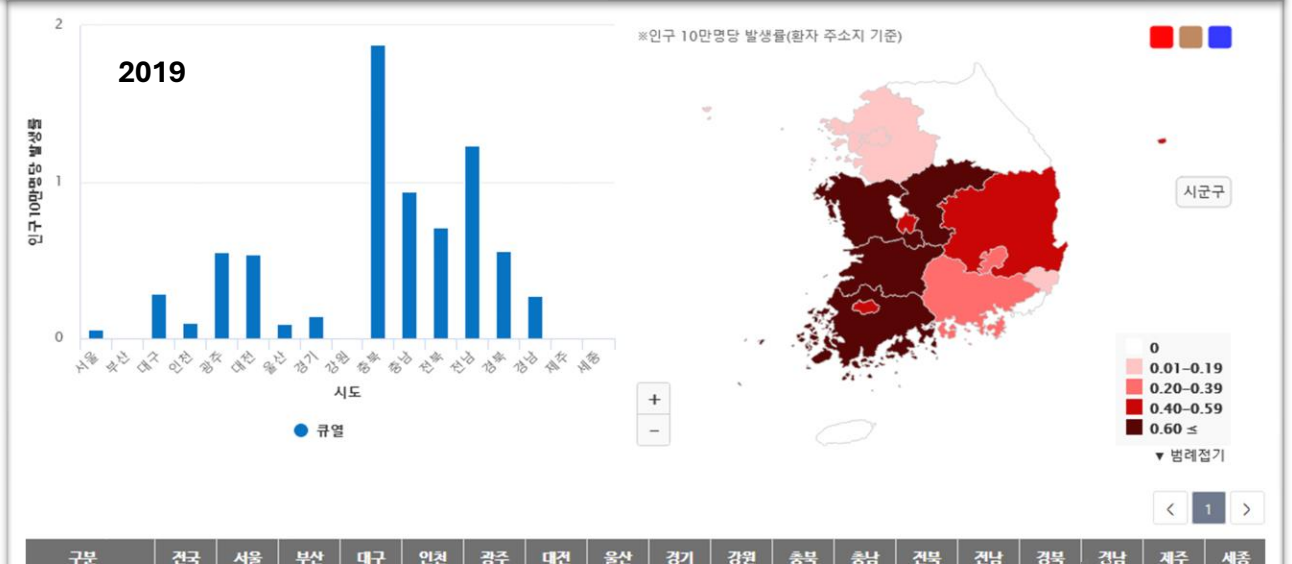
큐열	0.31	0.15	0.09	0.08	0.10	0.68	0.20	0.69	0.18	0.06	1.75	0.94	0.38	1.11	0.26	0.33	0.15	0.00



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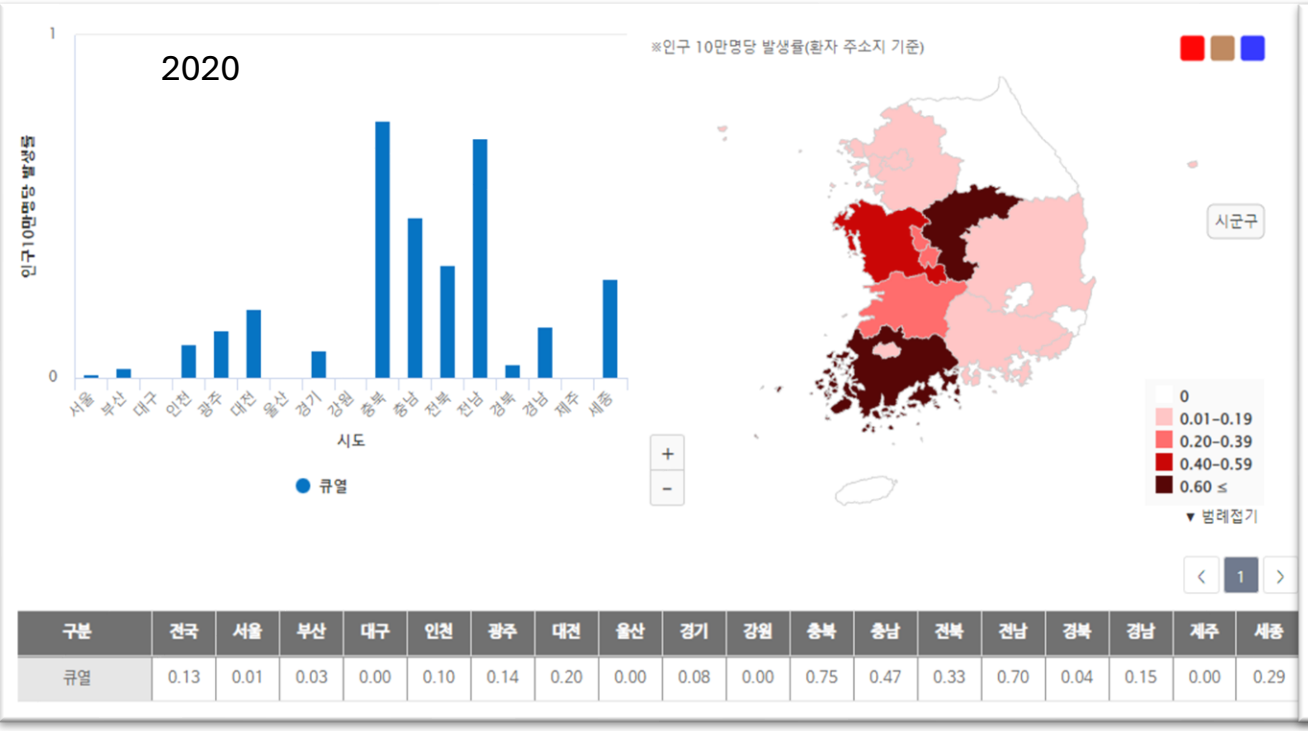
큐열	0.31	0.06	0.00	0.29	0.10	0.55	0.54	0.09	0.14	0.00	1.88	0.94	0.71	1.23	0.56	0.27	0.00	0.00

Annual incidence (per 100,000 population) of reported Q fever–Korea, 2016-2021



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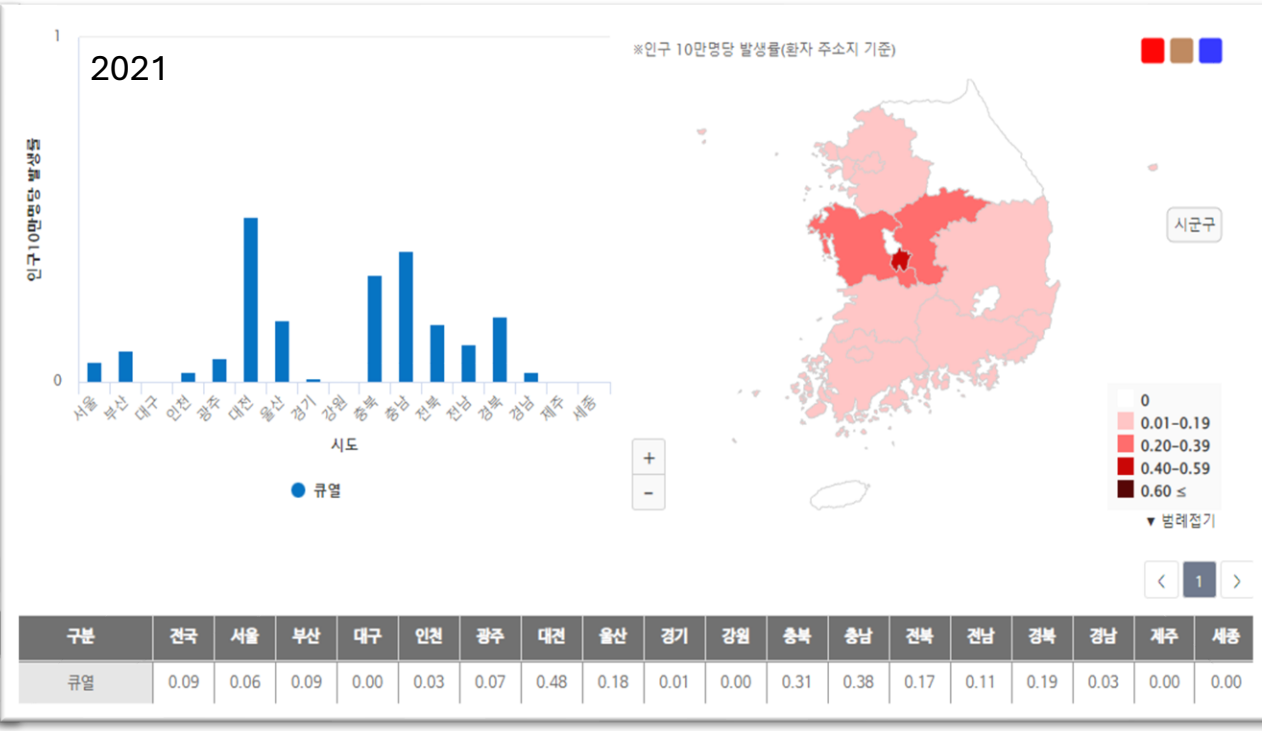
큐열	0.13	0.01	0.03	0.00	0.10	0.14	0.20	0.00	0.08	0.00	0.75	0.47	0.33	0.70	0.04	0.15	0.00	0.29



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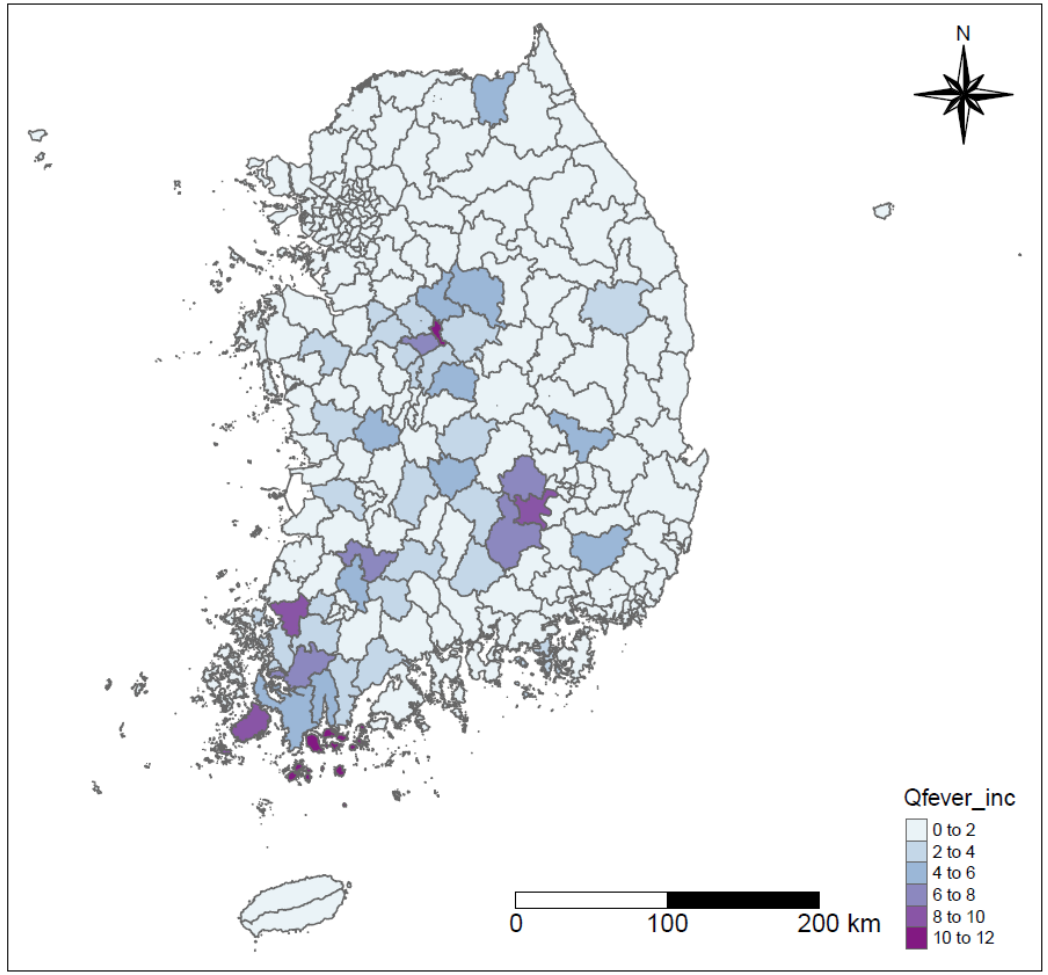
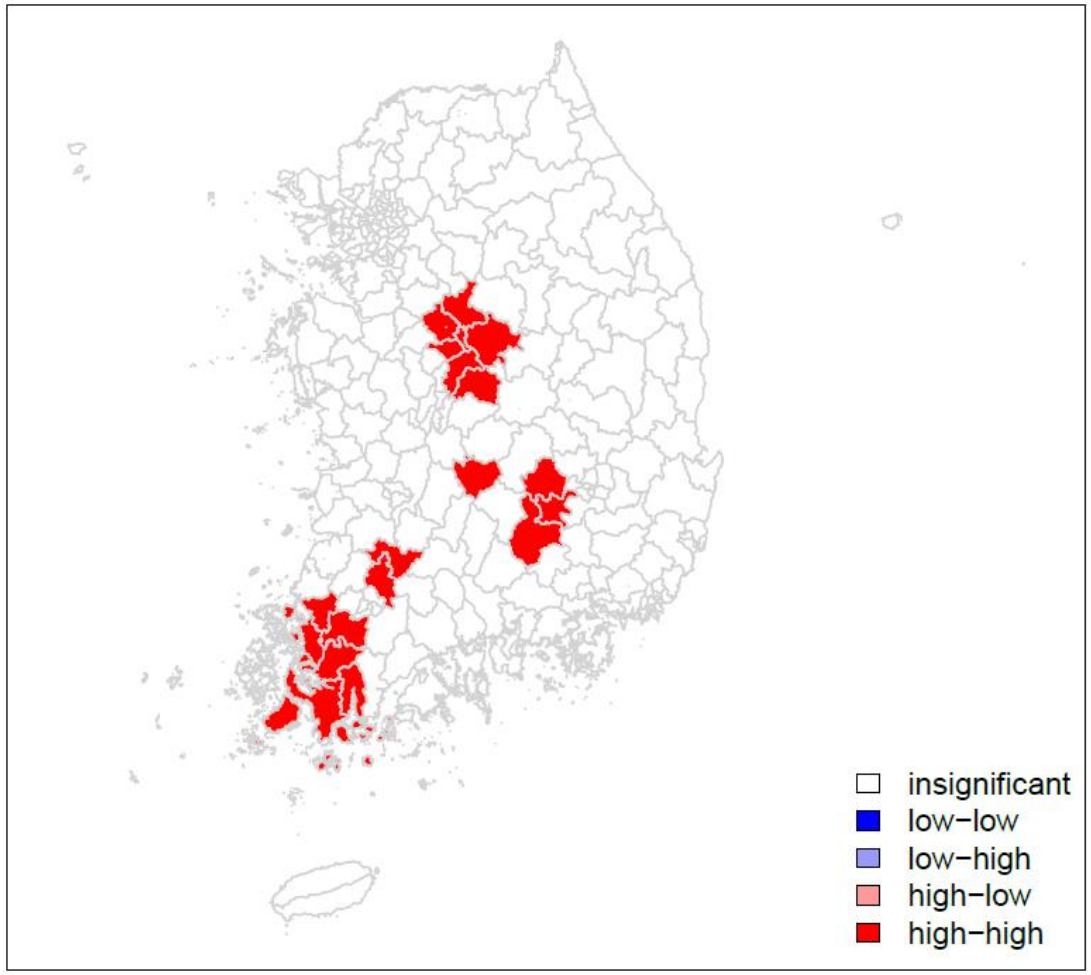
큐열	0.09	0.06	0.09	0.00	0.03	0.07	0.48	0.18	0.01	0.00	0.31	0.38	0.17	0.11	0.19	0.03	0.00	0.00

Spatial clustering of Q fever, 2018-2019



Q fever incidence (/100,000), 2018-2019



LISA clustering of Q fever, 2018-2019