# Southern Queensland general practitioners' knowledge and attitudes towards Q fever and behaviours in the management of the disease

**Penny Hutchinson, Remo Ostini**

**Background and objective**
Q fever (QF) is a zoonotic disease caused by *Coxiella burnetii*, often associated with abattoir workers and farmers. Recent analysis suggests that QF might occur more frequently in urban areas. This study ascertains the knowledge of, and attitudes towards, QF and behaviours in the management of QF among general practitioners (GPs) across rural and urban areas.

**Methods**
This cross-sectional survey study targeted GPs working in regional Queensland. GPs were asked to complete a 59-item questionnaire. Logistic regression was used to compare respondent demographics with attitude ratings and knowledge scores.

**Results**
Diagnosing a patient with QF was significantly related to practitioner age, years in practice and practising in a rural area.

**Discussion**
This study shows gaps in GP QF knowledge, particularly around QF management. With increased urbanisation of rural areas potentially leading to increases in acute QF cases, GPs need to improve their knowledge of this disease.

**Q FEVER** (QF) is a disease caused by the organism, *Coxiella burnetii*. It spreads from animals to humans and has a wide range of reservoirs, including wild and domestic animals, birds and ticks.[1–5] The primary route for infection is airborne, from the inhalation of aerosolised particles from animal birthing products, urine and faeces, or the ingestion of raw milk.[6] The incubation period for QF is usually two to three weeks (ranging from four days to six weeks).[2] In Australia, this zoonotic disease has long been associated with abattoir workers and farmers, with the handling of animal birthing products or slaughtering animals considered high-risk exposures.[2]

An estimated 60% of cases of QF in adults are asymptomatic.[7] In Australia, acute QF most commonly presents as an influenza-like illness with varying degrees of pneumonia and hepatitis.[8] Fever is not always present. The case fatality rate is 1–2%.[9] Myocarditis is rare but one of the more common causes of death.[2] If untreated, the acute illness lasts two to six weeks. Despite resolution of the acute illness, return to full health might be slow in many patients. Post-Q fever fatigue syndrome (PQFFS), with systemic symptoms that fail to recover for more than 12 months after the acute illness, is the most common chronic sequela following acute infection, occurring in 10–20% of notified cases.[7,10] Chronic disease can occur months to years after acute infection and sometimes with no history of acute illness.[2,10] Endocarditis accounts for 60–70% of cases of chronic QF and nearly always occurs in patients with underlying immunosuppression or cardiovascular abnormalities.[2] Pregnant women who become infected with *C. burnetii* are also at risk of chronic disease.[11]

In children, chronic infection might present as osteomyelitis.[2] Primary infection or recrudescence in pregnancy can lead to abortion, premature birth or neonatal death.[2]

Between 2001 and 2006, the Australian Government funded a targeted screening and vaccination program called the National QF Management Program (NQFMP). There was a 20% reduction in QF cases after the end of the NQFMP,[12] although in recent years rates of QF have started to increase.[12] The reasons for this are currently unknown. The highest rates of QF are found in men aged 40–59 years who reside in Queensland or New South Wales.[12] However, the proportion of younger and female notified cases of QF have increased over time.[12] Recent analysis suggests that QF is not a disease confined to rural or remote areas and that this disease might occur more frequently in urban areas than previously thought.[13,14]

General practitioners (GPs) from rural and remote areas are familiar with QF due to traditional risk factors among their patient

population (abattoir/farm workers and contact with livestock). This might not be the case for GPs who work in more urban areas.

This study aims to ascertain the level of knowledge of QF among GPs across rural and more urban (eg Ipswich, Toowoomba) areas and how this knowledge affects their practice in the investigation and management of the patient with fever.

## Methods

This cross-sectional survey study was targeted at all GPs working within the Darling Downs and West Moreton Primary Health Network (DDWMPHN). The DDWMPHN includes both the Darling Downs (DD) and West Moreton (WM) Hospital and Health Service regions. The study used both a hard copy of the questionnaire and an online survey (Survey Monkey, Palo Alto, CA, USA).

There were 59 questions (four semiclosed, 55 closed) across four sections: (1) demographics; (2) knowledge of QF illness, testing, treatment and vaccination; (3) attitudes towards QF illness and vaccination; and (4) experience with QF and vaccination.

Ethics approval for the study was granted by the Darling Downs Hospital and Health Service Human Research Ethics Committee (HREC code Ref. HREC/16/QTDD/48).

### Recruitment of GPs

GPs were recruited from 1 March 2017 to 31 December 2018. Recruitment involved: approaching GPs at medical conferences and meetings to complete hard copies of the questionnaire; emailing an invitation containing electronic copies of questionnaire documents and a link to the questionnaire online; a link to the questionnaire on the DDWMPHN website; and regular promotion through the DDWMPHN online newsletter.

### Data analysis

Correct responses to knowledge questions were combined to produce knowledge scores for general QF knowledge (24 items), QF testing (three items), treatment of QF (six items) and vaccination (four items), as well as a total knowledge score from all 37 knowledge items. Mean agreement was calculated for each attitude item. Means and proportions were used to describe sample characteristics and QF experience. Group differences were tested using Fischer's exact test and t-tests. Bivariate correlations were calculated to examine variable inter-relationships, and logistic regression was used to identify variables that independently predicted QF experience.

## Results

Seventy-one complete responses were obtained. This comprised 61 GPs from the DD Public Health Unit region, four GPs from the WM Public Health Unit region and six other participants.

### Participants

Respondents had a mean age of 45.6 years (range 26–72 years), had been in practice a mean of 17.2 years (range 2–47 years) and were mostly male (59.2%; Table 1). Most respondents had rural practice experience.

### Experience with QF

Study questions about practitioner experience with QF and participant response summaries are listed in Table 2. Only 27.1% of respondents were registered QF vaccination providers, although 67.3% of the remaining respondents indicated a willingness to consider becoming a provider (Table 2). Slightly more than half the participants have provided a QF public health notification (52.9%), whereas a substantial majority of GPs in the sample have diagnosed a patient with QF (67.1%). Almost all respondents (91.4%) consider QF for patients who present with fever and feeling very unwell.

Having diagnosed a patient with QF was significantly related to older age, more years in practice, more years in current location and having practised in a rural area (all $P<0.01$).

### Knowledge of QF illness, testing, treatment and vaccination

The proportion of correct responses to QF knowledge items varied widely. All respondents correctly recognised headaches as a common presentation of QF. However, a minority of respondents correctly answered that Weil's disease is not the second phase of QF infection (30%), that nasal congestion (47.9%) and conjunctivitis (40.8%) were not common presentations of QF and that endocarditis is the most common reported presentation of chronic QF (40.8%).

Among QF testing items, most respondents (80.3%) incorrectly responded that polymerase chain reaction (PCR) testing can confirm chronic QF. Respondents had difficulty with two QF treatment questions, with only 36.6% recognising that using doxycycline in all cases was incorrect and 29.6% recognising that chronic QF can require up to four years of pharmacological treatment. All four vaccination questions were correctly answered by more than 50% of respondents, although only 53.5% recognised that acute QF rates are similar or higher than other diseases with nationally funded immunisation programs.

Overall, three participants (5.7%) answered fewer than 50% of QF knowledge items correctly and 22 (41.5%) were able to answer fewer than 66% of the knowledge items correctly.

**Table 1. Participant demographic and practice characteristics**

| | |
|---|---|
| Male sex | 42 (59.2) |
| Age (years) | 45.6±12.5 |
| Years in practice | 17.2±12.5 |
| Years in current location (range) | <1–47 |
| Ever practised rural (yes) | 63 (67.9) |
| Current practice includes farming area (yes) | 64 (91.4) |
| Abattoirs in current practice location (yes) | 49 (69.0) |
| Current practice location rural | 42 (62.7) |

Unless indicated otherwise, data are given as the mean±SD or n (%).

### Attitudes to QF

The two attitude statements with the lowest endorsement levels (four-point scale, where 1=strongly disagree) were 'Q fever does not occur in the area where I practice' (mean score 1.35) and 'Q fever is not a very serious condition' (mean score 1.55). The highest endorsements were given to 'I am convinced of the importance of the Q fever vaccine' (mean score 3.30), 'There should be a national Q fever vaccination program' (mean score 2.96) and 'I am confident that I understand how to test for Q fever' (mean score 2.83).

### Group differences

The only significant QF knowledge group difference was for QF treatment knowledge, where doctors who had not ever practiced in a rural area had lower scores (mean score 0.33; range 0–1) than doctors who had (mean score 0.57; $P$=0.028).

Regarding attitudes, doctors who had never practised in a rural area gave higher mean ratings (mean score 2.00 vs 1.33) to the statement 'Q fever does not occur in the area where I practice' ($P$<0.001) and lower mean ratings to the statement 'I am convinced of the importance of the Q fever vaccine' (mean score 3.00 vs 3.33; $P$=0.005) compared with those who had practised in a rural area. Doctors currently practising in urban areas gave a lower mean rating to the statement 'Q fever is not a very serious condition' than those practising in rural areas (mean score 1.24 vs 1.76; $P$<0.001). The only attitude statement that distinguished DD and WM doctors was 'Q fever epidemiology may be changing', which DD doctors gave a lower mean endorsement (mean score 2.81 vs 3.00; $P$=0.007).

### Multiple regression analysis

Logistic regression analyses were conducted to determine whether respondent demographic characteristics, attitude ratings or knowledge scores could predict responses on any of the seven QF experience questions.

Total knowledge score was the sole independent predictor for five of the QF experiences, excluding only the experiences of 'vaccinating (or advising vaccination)' and 'being a registered Q fever vaccination provider'. As indicated in Table 3, the results are more complex at the level of knowledge subtests. In those analyses, general knowledge predicts responses on four experience questions and vaccination knowledge predicts two experience question responses. Two attitude statements are also independently predictive of QF experience responses. Confidence in vaccination ability predicts responses on two experience questions, whereas confidence in testing ability predicts one. For two experiences ('having diagnosed Q fever' and 'vaccinating, or advising vaccination'), both knowledge subtest scores and attitude statements are independently predictive. Being a registered QF vaccination provider was the only experience question that was not independently predicted by any knowledge subtest scores and only independently predicted by an attitude statement.

**Table 2. Participant experience with Q fever**

| Experience | n (%) |
|---|---|
| Have you ever diagnosed a patient with Q fever? | Yes: 47 (67.1) |
| Have you ever provided medical care for a patient with chronic or acute Q fever? | Yes: 51 (76.1) |
| Have you ever notified public health of a case of Q fever? | Yes: 37 (52.9) |
| Do you vaccinate (or advise vaccination for) patients who are at increased risk for Q fever? | Yes: 46 (65.7) |
| Do you have experience ordering and interpreting laboratory tests for Q fever? | Yes: 56 (80.0) |
| Do you consider Q fever for patients presenting with fever who feel very unwell? | Yes: 64 (91.4) |
| Are you a registered Q fever vaccination provider? | Yes: 19 (27.1) |
| If not: would you consider becoming a registered Q fever vaccination provider? | Yes: 33 (67.3) |

## Discussion

No previous studies have been performed looking at GP knowledge and attitudes towards QF and behaviours related to the management of QF. However, a recent study examined the knowledge of, and attitudes and behaviours towards, QF by veterinarians and vet nurses.[15] In that study, almost half the respondents had low levels of QF knowledge in areas such as common presentations of the disease, diagnoses and treatment, raising the potential issue of a lack of knowledge among GPs about the QF vaccine.

In the present study, respondents did poorly on questions related to chronic QF, particularly around diagnosis and duration of disease. This might be because the diagnosis and management of chronic QF are more likely to occur in the specialist setting. Similarly, pregnant women infected with QF are often asymptomatic and might not be commonly seen in general practice.[16]

Less than 40% of respondents correctly answered two QF treatment questions. One-third of respondents incorrectly stated doxycycline can treat all cases of QF (it is contraindicated in pregnant women).[17]

Specialised prescreening training is required to become proficient in QF vaccination. Obtaining this training has become increasingly difficult as it appears that the number of QF vaccinators has declined following the cessation of the NQFMP (personal observation). Currently, there is an online training course, which is managed by the Australian College of Rural and Remote Medicine.[18] Seqirus, the producer of the QF vaccine, also has an online training module.[19] These factors might have contributed to the low numbers of registered vaccine providers identified in this study.

This study has demonstrated an association between experienced GPs working in rural areas with greater experience in QF and greater knowledge

and more proactive behaviours in disease detection (considering QF as part of a differential diagnosis in a febrile patient), appropriate testing and willingness to train as vaccine providers for QF.

### Limitations

A limitation of this study is the low number of GPs (71) participating in the study. A large proportion of respondents were currently working or had previously worked in a rural area, with 67.9% having ever practised in a rural area and 91.4% currently practising in a farming area. Unfortunately, there was a poor response rate (5.6%) from the WM Public Health Unit region, which includes a major urban centre. Repeating the study in a predominantly urban area would be useful.

## Conclusion

It is very important for GPs to be aware of the changing epidemiology of QF and to consider QF as a diagnosis. Increased urbanisation of previously rural areas has the potential to lead to increasing numbers of acute QF cases and subsequent increases in PQFFS and chronic QF, with their associated morbidity and mortality. The increase in prevalence of the disease in people not associated with traditional occupations with no known risks[12,13] (eg professional dog and cat breeders, wildlife and zoo workers) highlights the need for increased awareness of both the disease and opportunities for vaccination.

**Table 3. Multivariate logistic regression analysis predicting participant Q fever experiences from Q fever demographic, attitude and knowledge items**

| Q fever experiences | Independent predictors | Overall model and independent predictor test results |
|---|---|---|
| Has ever diagnosed a patient with Q fever | High general knowledge | *P*=0.019 |
| | I am confident that I understand how to test for Q fever | *P*=0.029 |
| | Overall model | chi-square (4) =35.966, *P*<0.001 |
| Has ever provided medical care for a patient with chronic or acute Q fever | High level of vaccination knowledge | *P*=0.027 |
| | Overall model | chi-square (2) =14.193, *P*=0.001 |
| Has ever notified public health of a case of Q fever | High general knowledge | *P*=0.015 |
| | Overall model | chi-square (2) =12.298, *P*=0.002 |
| Vaccinates (or advises vaccination for) patients who are at increased risk for Q fever | High vaccination knowledge | *P*=0.016 |
| | I am confident in my ability to vaccinate for Q fever | *P*=0.005 |
| | Overall model | chi-square (2) =22.222, *P*<0.001 |
| Has experience ordering and interpreting laboratory tests for Q fever | High general knowledge | *P*=0.010 |
| | Overall model | chi-square (2) =14.703, *P*=0.001 |
| Considers Q fever for patients presenting with fever who feel very unwell | High general knowledge | *P*=0.005 |
| | Overall model | chi-square (1) =16.342, *P*<0.001 |
| Is a registered Q fever vaccination provider | I am confident in my ability to vaccinate for Q fever | *P*=0.002 |
| | Overall model | chi-square (2) =26.722, *P*<0.001 |

**Authors**

Penny Hutchinson BMed, FRACGP, MPH&TM, FAFPHM, FNZCPHM, Public Health Physician, West Moreton Public Health Unit, Ipswich, Qld

Remo Ostini PhD, Adjunct Senior Research Fellow, Rural Clinical School Research Centre, The University of Queensland, Canberra, ACT

Competing interests: None.

Funding: None.

Provenance and peer review: Not commissioned, externally peer reviewed.

**Correspondence to:**
Penny.Hutchinson@health.qld.gov.au

**Acknowledgements**

The authors thank Bridget Appleyard, Epidemiologist and Principal Research Officer, Office of the Chief dental officer, for her assistance with preparing this manuscript. The authors also thank Catherine Quagliotto, Public Health Physician, West Moreton Public Health Unit, for her assistance with the recruitment of general practitioners to the study, and Sarah Ayles and Marcella Kwan for assistance in developing the questionnaire.

**References**

1. Hartzell JD, Marrie TJ, Raoult D. *Coxiella burnetii* (Q fever). In: Bennett JE, Dolin R, Blaser MJ, editors. Mandell, Douglas, and Bennett's principles and practice of infectious diseases. Elsevier, 2015, p. 2208–16.
2. Parker NR, Barralet JH, Bell AM. Q fever. Lancet 2006;367(9511):679–88. doi: 10.1016/S0140-6736(06)68266-4.
3. Kopecny L, Bosward KL, Shapiro A, Norris JM. Investigating *Coxiella burnetii* infection in a breeding cattery at the centre of a Q fever outbreak. J Feline Med Surg 2013;15(12):1037–45. doi: 10.1177/1098612X13487360.
4. Shapiro AJ, Norris JM, Heller J, Brown G, Malik R, Bosward KL. Seroprevalence of *Coxiella burnetii* in Australian dogs. Zoonoses Public Health 2016;63(6):458–66. doi: 10.1111/zph.12250.
5. Wildlife Health Australia. Q Fever in Australian wildlife fact sheet. Wildlife Health Australia, 2013. Available at https://wildlifehealthaustralia.com.au/Portals/0/ResourceCentre/FactSheets/PublicHealth/Q_Fever_in_Australian_Wildlife.pdf [Accessed 28 September 2023].
6. Communicable Diseases Network Australia (CDNA). Q fever: CDNA national guidelines for public health units. CDNA, 2018. Available at www.health.gov.au/sites/default/files/documents/2020/02/q-fever-cdna-national-guidelines-for-public-health-units.pdf [Accessed 28 September 2023].
7. Marmion B. A guide to Q fever and Q fever vaccination. CSL Biotherapies, 2009. Available at www.amieuqld.asn.au/wp-content/uploads/2013/12/Q_Fever_booklet.pdf [Accessed 28 September 2023].

8. Maurin M, Raoult D. Q fever. Clin Microbiol Rev 1999;12(4):518–53. doi: 10.1128/CMR.12.4.518.
9. Heymann DL, editor. Control of communicable diseases manual. 20th edn. American Public Health Association, 2015.
10. Eastwood K, Graves SR, Massey PD, Bosward K, van den Berg D, Hutchinson P. Q fever: A rural disease with potential urban consequences. Aust J Gen Pract 2018;47(3):5555. doi: 10.31128/AFP-08-17-4299.
11. Angelakis E, Million M, D'Amato F, et al. Q fever and pregnancy: Disease, prevention, and strain specificity. Eur J Clin Microbiol Infect Dis 2013;32(3):361–68. doi: 10.1007/s10096-012-1750-3.
12. Sloan-Gardner TS, Massey PD, Hutchinson P, Knope K, Fearnley E. Trends and risk factors for human Q fever in Australia, 1991–2014. Epidemiol Infect 2017;145(4):787–95. doi: 10.1017/S0950268816002843.
13. Tozer SJ, Lambert SB, Sloots TP, Nissen MD. Q fever seroprevalence in metropolitan samples is similar to rural/remote samples in Queensland, Australia. Eur J Clin Microbiol Infect Dis 2011;30(10):1287–93. doi: 10.1007/s10096-011-1225-y.
14. Gidding HF, Faddy HM, Durrheim DN, et al. Seroprevalence of Q fever among metropolitan and non-metropolitan blood donors in New South Wales and Queensland, 2014–2015. Med J Aust 2019;210(7):309–15. doi: 10.5694/mja2.13004.
15. Sellens E, Norris JM, Dhand NK, et al. Q fever knowledge, attitudes and vaccination status of Australia's veterinary workforce in 2014. PLoS One 2016;11(1):e0146819. doi: 10.1371/journal.pone.0146819.
16. Denman J, Woods M. Acute Q fever in pregnancy: Report and literature review. Intern Med J 2009;39(7):479–81. doi: 10.1111/j.1445-5994.2009.01933.x.
17. Kelly H, Buising K, Burke A, et al. 'Q fever', Therapeutic guidelines, Antibiotic volume, version 16(2). Therapeutic Guidelines, 2019. Available at https://tgldcdp.tg.org.au/index [Accessed 10 September 2023].
18. Australian College of Rural and Remote Medicine. Q Fever - Early diagnosis and vaccination (online course). ACCRM, 2023. Available at https://mycollege.acrrm.org.au/search/find-online-learning/details?id=11347&title=Q+Fever+-+Early+Diagnosis+and+Vaccination [Accessed 8 December 2023].
19. Australian Government, Department of Health. Q fever facts. Seqirus Pty Ltd., [date unknown]. Available at www.qfeverfacts.com.au/ [Accessed 8 December 2023].

correspondence **ajgp@racgp.org.au**