Authors’ response: Legionnaires’ disease following the Christchurch earthquakes

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We thank David Murdoch1 for his views on our recent research paper on Legionella in this Journal,2 although we think his criticisms are unjustified, for the reasons set out below.

First, Professor Murdoch contends that the primary reason for the observed increase in Legionnaires’ disease notifications around the time of the earthquakes was due to the change in the diagnostic testing algorithm to include the more sensitive PCR method to specifically detect Legionella DNA.3 We agree this may be correct, although at the time our study was conceived and undertaken (November 2011) this was not proven. We had no intention of implying otherwise in our paper, since the rationale for our environmentally-focused epidemiological study was to establish if there was a direct causal link between the observed increase in legionellosis cases and the widespread presence of liquefaction material in Christchurch following the earthquakes. We regret any misunderstanding this may have caused.

We made no claims about the influence of PCR testing on Legionnaires’ disease, although it is common sense that a more sensitive test should lead to an increase in case detections, other things being equal. Because the change in testing algorithm coincided with the devastating earthquakes, we considered it important to obtain microbiological evidence to ascertain if the liquefaction events were directly contributing to the increased case numbers. For reasons of cost, there was no period during which old and new testing regimes ran in parallel, rendering it impossible to determine the extent to which the increased Legionnaires’ disease notifications might be at least partly real rather than artefactual. Murdoch himself stated:

“Of particular note were the earthquake centres around Christchurch from September 2010. It is possible that the major disturbances arising from this seismic activity may have altered the local ecology of Legionella.”

Our main conclusion was that “no causal link between exposure to liquefaction-affected soils/silt and legionellosis was established since no legionellae were isolated from any environmental samples tested and Legionella was shown not to survive in the seeded silt.” Our findings support rather than detract from the observation claimed by Professor Murdoch that the change in the testing algorithm with the introduction of Legionella PCR testing was contributing to the artefactual increase in legionellosis case numbers as opposed to it being influenced directly by exposure to liquefaction material.

Second, Professor Murdoch suggests that we cannot justify any claim that “…liquefaction-affected soil does not support the growth and survival of legionellae…” Our experimental data showed exactly that, with no legionellae isolated from any of the 30 liquefaction field samples, nor the persistence of L.bozemanae in the seeded samples. While it is recognised that the majority of Legionella cases over the study period were caused by L. longbeachae, the justification for using L. bozemanae for our seeding experiments (as explained in our methodology) was because we used a Legionella species that auto-fluoresced under black light illumination. This was a deliberate decision in the experimental design to make colony counting on plate culture both easier and more accurate. In addition, L. bozemanae is a well-documented soil inhabitant that has been shown to cohabit with L. longbeachae. Unreported experimental results for a single small pilot study showed that L. longbeachae
behaved in the same way as *L. bozemanae* in the liquefaction soil with rapid die off, but proved difficult to accurately count, making the choice for using *L. bozemanae* in the seeding experiments more logical.

Finally, Professor Murdoch claims that the culture method of testing soil for *Legionella* was not sensitive. We agree and while the detection of *Legionella* from environmental sources is challenging, culture is currently the method of choice for determining the presence of viable and culturable organisms that are more likely to contribute to an infection risk. Again, it was because of these challenges that we choose *L. bozemanae* in the persistence experiment in order to improve test sensitivity by being able to more accurately determine the presence of and count the test organism on the culture medium. The use of culture-based methods at the time was justifiable since reliable PCR detection from potting mix and soils is inaccurate. It is also difficult to interpret standard PCR detection methods for any matrix, as these do not distinguish between live and dead bacteria. Because of this limitation, culture isolation is still regarded as the reference standard method for risk analysis determinations. Figure 3A of our study demonstrates that culture was sufficiently sensitive to detect *Legionella* in commercial compost.

**Competing interests:** Nil.

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