CRD summary
This review concluded that *Legionella* urinary antigen for serotype 1 appeared to have excellent specificity and modest sensitivity for the diagnosis of clinical pneumonia, but that limitations of the available evidence meant that test performance may have been overestimated. Despite several limitations of the review and the poor quality of the available data, the overall conclusion seems appropriate.

Authors' objectives
To assess the test characteristics of *Legionella* urinary antigen for the diagnosis of pneumonia.

Searching
MEDLINE and EMBASE were searched from inception to August 2008 for studies in published in English; search terms were reported. Bibliographies of retrieved articles were also searched.

Study selection
Diagnostic accuracy studies that compared urine antigen tests against "gold standard" tests were eligible for inclusion. Eligible studies were required to clearly report the criteria for diagnosis and provide sufficient data to produce 2x2 tables of test performance.

The most common methods for *Legionella* urinary antigen used in the included studies were enzyme immunoassays, enzyme-linked immunosorbent assays, radioimmunoassays, and immunochromatographic tests. Most studies used culture and indirect immunofluorescence as the reference standard, with or without direct fluorescent antibody. Where reported, the duration of illness ranged from less than one day to 63 days. The legionellosis serogroup was *Legionella pneumophila* or *L. pneumophila* serogroup 1 in most patients.

The authors did not state how many reviewers performed the study selection.

Assessment of study quality
Study quality was assessed by more than one reviewer (but not independently) using the 14-criteria QUADAS (Quality Assessment of Diagnostic Accuracy Studies) tool; disagreements were resolved by consensus.

Data extraction
Data were extracted or calculated on a per patient basis in order to produce 2x2 tables of test performance, from which sensitivity, specificity and positive and negative likelihood ratios (LR+ and LR-) were calculated. Authors were contacted where duplicate publications were suspected, or where clarification was not received, or only the latest publication or largest sample was used.

The authors did not state how many reviewers performed data extraction.

Methods of synthesis
Sensitivity and specificity were pooled using a random-effects model. Pooled likelihood ratios were calculated from the pooled estimates of sensitivity and specificity. Spearman's rank correlation was used to test for a correlation between sensitivity and specificity; as no correlation was identified, pooling using summary receiver operating characteristic curves was not undertaken.

Heterogeneity was assessed using the Cochran Q and I² tests. Heterogeneity due to the type of assay used and study quality was investigated using stratified analyses and meta-regression.

Publication bias was assessed using the Egger test and the methods described by Deeks et al and Song et al.
Results of the review

Thirty studies met the inclusion criteria (n=7,333 patients; range 39 to 704). Most of the studies were of case-control (two-gate) design. Out of a maximum quality score of 14, one study scored 9, one scored 8, one scored 7, five score 6, and the remainder scored 5 or under. Only three studies recruited a representative population; two studies avoided partial verification bias; three studies avoided differential verification bias; and only one study reported any blinding (blinded interpretation of the index test).

Overall, the pooled results for *Legionella* urinary antigen assays were: sensitivity 74% (95% CI 68% to 80%); specificity 99% (95% CI 98% to 99.7%), positive likelihood 82, and negative likelihood was 0.26. There was substantial heterogeneity for the analyses of sensitivity (I$^2$=93.9%) and specificity (I$^2$=77.4%). Heterogeneity in sensitivity across studies was partially explained by study quality and the assay method used, but heterogeneity remained significant (I$^2$=86.8%). The exclusion of a single study that used the test L-Clone eliminated heterogeneity in the analysis of specificity (I$^2$=0%).

Evidence for publication bias was observed.

Authors’ conclusions

*Legionella* urinary antigen for serotype 1 appeared to have excellent specificity, and modest sensitivity, for the diagnosis of clinical pneumonia. However, limitations of the available evidence meant that test performance may have been overestimated.

CRD commentary

The review addressed a clear question supported by well-defined inclusion criteria. Two relevant sources were searched, but unpublished studies were not sought and only studies published in English were included; therefore studies may have been missed. Study quality was performed by two reviewers, but it was not clear whether similar methods were employed to reduce error and bias during study selection and data extraction.

Study quality was investigated using appropriate criteria, results given for each criterion for each study, and the impact of study quality on the analyses investigated. Most of the included studies were of poor quality. Sensitivity and specificity were pooled separately. Given the substantial heterogeneity in sensitivity across the studies, the reliability and generalisability of the pooled result is uncertain. This impacts further on the reliability and generalisability of the likelihood ratios derived from the pooled estimates of sensitivity and specificity.

Despite the limitations of the review and the available data, the overall conclusion seems appropriate.

Implications of the review for practice and research

**Practice:** The authors stated that the 26% false negative rate means the clinician should be cautious about deciding to withdraw therapy with anti-*Legionella* antibiotics.

**Research:** The authors stated that well-designed prospective studies are needed, and studies that include serogroup and species other than *L. pneumophila* serogroup 1 would be of value.

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This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.