

# Development of standard consensus definitions for infectious urinary tract disease in dogs and cats, a modified Delphi study

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**OBJECTIVES:** To develop consensus-based definitions for infectious urinary tract disease in dogs and cats.

**MATERIALS AND METHODS:** A modified Delphi approach was used to develop consensus on standard terminology and definitions.

**RESULTS:** Four rounds of review were performed with two different expert and stakeholder audiences.

The four rounds of review involved 19, 16, 90 and 52 participants, respectively. Consensus was reached for a collection of 29 terms and associated definitions, and one set of cut-off values.

**CLINICAL SIGNIFICANCE:** Standardisation of terminology is a foundational component of clinical communication, surveillance and guideline development. Unclear or variable definitions have commonly been present in studies of urinary tract disease in dogs and cats, causing confusion and hampering evidence assessment. Development of a set of standardised terms and definitions based on broad stakeholder consensus should assist with diagnosis, communication, surveillance and clinical research, improving the evidence base pertaining to infectious urinary tract disease and fostering improved clinical guidance.

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## INTRODUCTION

Evidence-based treatment guidelines are increasingly being developed to support veterinarians in making effective diagnostic and treatment decisions. Recommendations should ideally be underpinned with robust evidence from controlled trials, observational studies and meta-analyses. However, there can be challenges with evidence synthesis and interpretation as well as routine clinical case description, because of variability in key definitions and diagnostic criteria (Niessen et al., 2025).

Consistency in terminology is important for scientific communication, guideline development, surveillance and clinical trial design. Clinically, terminology confusion can hamper case assessment, interpretation and implementation of diagnostic

and treatment guidelines and communication with owners and colleagues. Within research studies, lack of standard definitions can also lead to bias in diagnosis and outcome measures, which impacts both internal validity and the ability to compare studies and perform meta-analysis (Bilsen et al., 2024).

In humans, heterogeneity in definitions was identified in a systematic review of urinary tract infection research (Bilsen et al., 2023), leading to development of a reference standard for definitions using a Delphi consensus approach (Bilsen et al., 2024). Such an approach has been lacking for infectious urinary tract disease in dogs and cats. A wide range of conditions may be grouped under the vague term “urinary tract infection”, which is variably used in the veterinary literature and can include infection of any part of the upper or lower urinary tract. It has

also been used to describe clinical disease, subclinical bacteriuria or undefined clinical status, thereby encompassing any situation where bacteria are identified (*e.g.* cytology) or isolated (*i.e.* bacterial culture) from the urinary tract (Lamoureux et al., 2019; Olby et al., 2010; Simpson et al., 2017). These examples represent highly disparate conditions, with different clinical impacts, pathophysiology and treatment needs, so failure to properly differentiate them can lead to confusion or suboptimal data and guidance.

Guidelines developed by the International Society for Companion Animal Infectious Diseases (ISCAID) (Weese et al., 2011, 2019) have provided some definitions, but only for a narrow range of conditions and without any formal process beyond consensus of guideline authors. The objective of this study was to use a modified Delphi approach to develop definitions for infectious urinary tract disease in dogs and cats.

## MATERIALS AND METHODS

Ethics approval for this study was obtained from the Royal College of Veterinary Surgeons Ethical Review Panel. This modified Delphi study was a mixed methods study to develop terms and definitions regarding infectious urinary tract disease in dogs and cats. Draft terms and definitions were identified and developed by members of the Methodology Team for International Society for Companion Animal Infectious Diseases (ISCAID)'s Urinary Treatment Guideline revision. This consisted of five individuals from four countries who were coordinating methodological aspects of the ISCAID guideline revision. Through an iterative process, based on review of the literature and collation of definitions in previous guidelines (Weese et al., 2011, 2019), draft disease terms and definitions were created. In total, definitions for 39 terms were developed, and quantitative cut-offs were assigned for three components of urine cytology.

Once the draft terms were prepared, they were evaluated through multiple rounds of review and feedback with different stakeholder populations. The maximum number of rounds for this process was pre-determined as four rounds.

Round 1 was a survey of members of Working Groups of the ISCAID Urinary Treatment Guideline Group. This was a group of 26 individuals from ten countries and five continents (North America, South America, Europe, Africa and Australia) with expertise in infectious diseases, urology, microbiology and pharmacology that were participating in one or more Working Groups (*e.g.* bacterial cystitis, fungal cystitis, pyelonephritis, subclinical bacteriuria, urolithiasis, urinary tract procedures or devices) for ISCAID Urinary Treatment Guideline revision. Working Group members were invited to participate by email. Participants completed an anonymous survey to provide their opinion on the proposed terms and definitions, both whether they agreed or disagreed with each term and definition, and if they had any comments. The Methodology Team reviewed the results. Terms and definition that received 100% agreement were provisionally accepted and retained for Round 3. When

there was 80% to 99% agreement, the methodology team reviewed the dissenting comment(s) and determined whether an alternative definition should be proposed. If revision was deemed unnecessary by 100% consensus of the methodology team, the definition was provisionally accepted for Round 3. Otherwise, the term and/or definition was revised for review in Round 2. If there was <80% agreement, the term or definition was revised based on comments and presented for review in Round 2.

In Round 2, the revised definitions were again presented to the Working Group members. Participants were provided with a summary of results from Round 1, an explanation of terms that had been provisionally accepted, a description of terms that were abandoned based on participant feedback, and an updated survey regarding the revised terms. Participants were asked to agree or disagree with the revised terms and definitions with an opportunity to provide comments. Results of Round 2 were evaluated by the Methodology Team members to accept or edit terms for Round 3. All terms that received 100% agreement were accepted. Those that received <100% agreement were discussed by the Methodology Team, who determined whether to edit or remove the term and definition.

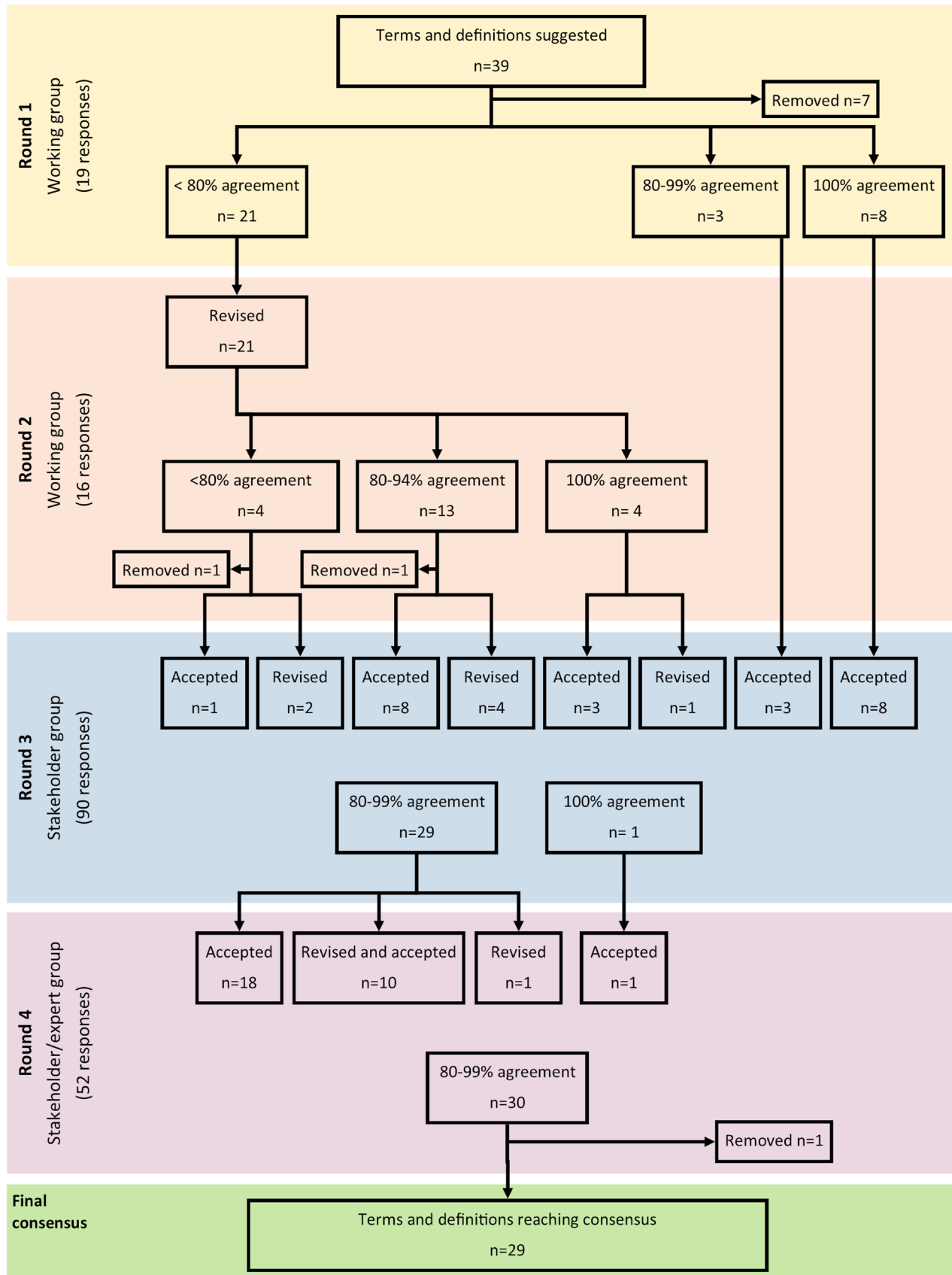
Round 3 presented the full list of terms that had been provisionally accepted in Rounds 1 and 2. An expanded target audience consisting of members of the American College of Veterinary Nephrology and Urology (ACVNU), European College of Veterinary Nephrology and Urology (ECVNU) or ISCAID were invited to participate through their respective listserves or mailing lists. Selected individuals with experience in urinary tract disease and/or veterinary guidelines who had expressed interest in participating were also invited by email. Participants were asked to agree or disagree with the proposed terms and definitions and invited to provide comments. Respondents were asked to indicate whether they wished to participate in Round 4, and if so, they were asked to provide an email address that was not linked to their survey results. Round 3 results were reviewed using the same approach as in Round 1.

Round 4 involved Round 3 participants that had agreed to participate in Round 4. Participants were provided with a document that described terms that were accepted, and a questionnaire for definitions that were modified in Round 3 and for which re-review was needed. They were also provided with the ability to provide final comments on any of the accepted terms.

For all rounds, feedback was aggregated among all participants, not by area of specialty or other subgrouping. Specific dissenting comments were not provided back to participants in each round, but the overall agreement rate for each term and definition was listed. For Round 4, a brief narrative description of the remaining issues and previous responses was provided.

Quantitative data were described. Open-ended comments were reviewed individually by all members of the Methodology Team.

The DELPHISTAR (Niederberger et al., 2024) reporting checklist is presented in Online Appendix 1.



**FIG 1.** Flow chart summarising the responses and results from each round of a modified Delphi study to establish terms and definitions for infectious urinary tract disease in dogs and cats.

**Table 1. Countries of stakeholder participants in a modified Delphi process to develop standard terms and definitions for infectious urinary tract disease in dogs and cats**

| Country        | n/89 (%) |
|----------------|----------|
| USA            | 32 (36%) |
| Canada         | 9 (10%)  |
| Spain          | 6 (6.7%) |
| United Kingdom | 5 (5.6%) |
| Australia      | 4 (4.5%) |
| Sweden         | 3 (3.4%) |
| Greece         | 3 (3.4%) |
| Italy          | 3 (3.4%) |
| France         | 2 (2.2%) |
| Japan          | 2 (2.2%) |
| Norway         | 2 (2.2%) |
| Switzerland    | 2 (2.2%) |
| Argentina      | 2 (2.2%) |
| Germany        | 1 (1.1%) |
| Israel         | 1 (1.1%) |
| Poland         | 1 (1.1%) |
| Romania        | 1 (1.1%) |
| Finland        | 1 (1.1%) |
| Czechia        | 1 (1.1%) |

**Table 2. Society membership of stakeholder participants in a modified process to develop standard terms and definitions for infectious urinary tract disease in dogs and cats**

| Group membership                                               | n  |
|----------------------------------------------------------------|----|
| International Society for Companion Animal Infectious Diseases | 50 |
| American College of Veterinary Internal Medicine               | 32 |
| European College of Veterinary Nephrology and Urology          | 22 |
| European College of Veterinary Internal Medicine               | 12 |
| American College of Veterinary Nephrology and Urology          | 8  |
| American Board of Veterinary Practitioners                     | 1  |

## RESULTS

### Round 1

Nineteen of 26 (73%) Working Group members responded to the survey (Fig 1). Eight terms and definitions were provisionally accepted as written and three were provisionally accepted with minor wording changes that the methodology team determined did not require re-review. These 11 terms were advanced directly to Round 3. Seven proposed terms were removed. Twenty-one terms or definitions was revised. These revisions were then presented to participants during the Round 2 survey.

### Round 2

There were 16 (62%) responses from Working Group members. Four definitions received 100% agreement. One of these was slightly revised to cover both bacterial and fungal diseases (recurrent bacterial cystitis → recurrent bacterial/fungal cystitis). The remaining three were accepted unchanged. Thirteen received 80% to 94% agreement. Eight of these were accepted unchanged based on the nature of the comments following review by the Methodology Group. Four of 13 definitions were

revised and one was removed based on provided comments. Four terms received <80% agreement (64% to 75%). Two were revised. One was removed. One was accepted as written because while it only received a score of 73%, all comments provided by dissenters were general comments and questions, not overt disagreement. The definition was included unchanged for review by the broader group in Round 3.

### Round 3

There were 90 responses from individuals from 19 countries (Table 1) with different specialty certification and organisation membership (Table 2). Thirty terms and definitions were queried, along with cytology cut-offs, all of which received >80% agreement (range 83% to 100%, median 95%). One definition received 100% agreement and was accepted. Eighteen definitions were accepted after review of the scores and comments. Ten definitions were slightly modified and accepted as changes were to wording only with no impact on content. Many of these changes were to ensure consistency in terminology across the definitions. One definition was modified and the proposed definition was presented for review in Round 4.

Comments varied and included statements of support, suggestions of alternative wording, dissenting opinions and general commentary about experiences and cases. In some situations, there were directly opposing comments for a term or definition. For example, for “bacteriuria of uncertain significance”, 92% of respondents agreed with the term, with comments including “This seems like not a helpful term...”, “Is this a necessary definition?” and “This term is very confusing” but also “I like this!” and “I like adding this term! So common clinically”!

### Round 4

Sixty-eight participants from Round 3 provided email addresses and consented to be invited to participate in Round 4. There were 52 (76%) responses. Round 4 included review of one revised definition (culture-negative suspected pyelonephritis), comments on proposed removal of a term and associated definition (bacterial pyelitis) and an opportunity to provide comments on any of the other terms and definitions.

Fifty of 52 (96%) respondents agreed with including a term and definition for “culture-negative suspected pyelonephritis”. Several variants of this term were proposed. Culture-negative suspected pyelonephritis was preferred by 26 (52%) of the 50 respondents that agreed a term was needed, compared to 17 (34%) that preferred “suspected culture-negative pyelonephritis” and seven (14%) that preferred “culture-negative pyelonephritis”. Forty-eight of 50 (96%) agreed with the definition. One person commented that they did not think the term was required and indicated that it should be a histopathological, rather than a clinical, term.

Removal of fungal/bacterial pyelitis was supported by 47/49 (96%) of respondents.

Three (5.8%) participants provided comments about the list of provisionally accepted terms and definitions. One participant questioned the 1000 CFU/mL cut-off for cystocentesis. Another

**Table 3. Final terms and definitions for infectious urinary tract disease in dogs and cats**

| Term                                                    | Definition                                                                                                                                                                                                                                                                                                                                           | Footnote |
|---------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| Cystitis                                                | Inflammation of the urinary bladder, manifested clinically by the presence of lower urinary tract signs (e.g. stranguria/dysuria, periuria, haematuria, pollakiuria)                                                                                                                                                                                 | 1        |
| Bacterial cystitis                                      | Cystitis attributable to bacterial origin                                                                                                                                                                                                                                                                                                            | 2        |
| Presumptive bacterial cystitis, canine                  | Cystitis with concurrent cytological evidence of inflammation (pyuria, haematuria) and bacteriuria but without submission of a urine culture                                                                                                                                                                                                         | 3, 4     |
| Positive urine culture (bacterial growth)               | Isolation of a potentially pathogenic species at pure growth or with no more than two different organisms at clinically relevant levels (cystocentesis: >1000 CFU/mL, catheterised: >10,000 CFU/mL, free flow: >100,000 CFU/mL)                                                                                                                      | 5        |
| Cytology cut offs                                       | Bacteria: any<br>Pyuria 5 WBCs/hpf<br>Haematuria 10 RBCs/hpf                                                                                                                                                                                                                                                                                         | 5        |
| Funguria                                                | Detection of fungi in urine by cytology or culture. This does not include detection of fungal antigens in urine (e.g. urine <i>Blastomyces</i> antigen testing)                                                                                                                                                                                      |          |
| Fungal cystitis                                         | Cystitis attributable to fungal origin                                                                                                                                                                                                                                                                                                               |          |
| Clinical cure, bacterial/fungal cystitis                | Resolution of clinical signs of cystitis that were attributed to bacterial/fungal infection                                                                                                                                                                                                                                                          |          |
| Microbiological cure                                    | Elimination of the inciting organism from the bladder, based on repeat urine culture                                                                                                                                                                                                                                                                 |          |
| Recurrent bacterial/fungal cystitis                     | Re-development of bacterial/fungal cystitis after a period of clinical cure, with a minimum of two episodes within the preceding 6 months, or 3 episodes within the preceding 12 months                                                                                                                                                              |          |
| Relapse (cystitis)                                      | Re-development of bacterial cystitis within 4 weeks of clinical cure, with an indistinguishable bacterial/fungal species                                                                                                                                                                                                                             | 6        |
| Re-infection (cystitis)                                 | Re-development of bacterial cystitis after a period of clinical cure, with the causative organism being a different bacterial/fungal species than the preceding episode, or cystitis from an indistinguishable bacterium/fungus developing more than 4 weeks after clinical remission                                                                | 6        |
| Persistent bacterial or fungal cystitis                 | Continued bacterial or fungal cystitis (as defined above, without clinical cure), despite antibiotic or antifungal treatment                                                                                                                                                                                                                         |          |
| Bacterial/fungal cystitis in patients with risk factors | Presence of bacterial/fungal cystitis, as defined above, in patients with anatomical, mechanical or functional abnormalities of the urinary tract or systemic conditions that could potentially impact the likelihood of infection, severity of disease, risk of complications or response to treatment                                              |          |
| Bacterial/fungal pyelonephritis                         | Bacterial/fungal infection involving the renal pelvis and the renal parenchyma                                                                                                                                                                                                                                                                       | 7        |
| Subclinical bacterial/fungal pyelonephritis             | Presence of bacteria/fungi in the renal pelvis or renal parenchyma in a patient without clinical signs of illness attributable to pyelonephritis                                                                                                                                                                                                     |          |
| Confirmed bacterial pyelonephritis                      | Pyelonephritis in a patient with positive culture from pyelocentesis or renal biopsy, or when histopathological evidence is present                                                                                                                                                                                                                  | 7        |
| Presumptive bacterial pyelonephritis                    | Pyelonephritis in a patient with bacterial growth detected by culture of urine from the urinary bladder, and presence of (i) signs of systemic inflammation for no other apparent reason and (ii) signs of renal involvement                                                                                                                         | 7, 8     |
| Culture-negative suspected pyelonephritis               | Multiple compatible clinical AND paraclinical signs of systemic inflammation (for no other apparent reason) AND kidney involvement, but with negative bacterial culture. Culture-negative-pyelonephritis is the term used to describe the equivalent rare situation in people. We do not know to which extent this is a problem in companion animals | 9        |
| Pyelonephritis without risk factors                     | Presence of pyelonephritis in animals with no known anatomical, mechanical or functional abnormalities within the urinary tract, or systemic conditions that could potentially impact the likelihood of infection, severity of disease, risk of complications or response to treatment                                                               |          |
| Pyelonephritis with risk factors                        | Presence of pyelonephritis in animals with known anatomical, mechanical or functional abnormalities within the urinary tract, or with systemic conditions that could potentially impact the likelihood of infection, severity of disease, risk of complications or response to treatment                                                             |          |
| Persistent pyelonephritis                               | Continued presence of signs of pyelonephritis despite antimicrobial treatment                                                                                                                                                                                                                                                                        |          |
| Bacterial/fungal urosepsis                              | Sepsis caused by a bacterial/fungal organism that originated from the urinary tract                                                                                                                                                                                                                                                                  |          |
| Bacterial pyonephrosis                                  | Accumulation of pus in the renal pelvis due to bacterial infection with compromised urinary outflow                                                                                                                                                                                                                                                  |          |
| Recurrent pyelonephritis                                | Re-development of pyelonephritis after a period of clinical cure                                                                                                                                                                                                                                                                                     | 10       |
| Urinary catheter-associated bacterial cystitis          | Development of bacterial cystitis in an animal with an indwelling catheter, or where an indwelling catheter was removed within the past 48 hours                                                                                                                                                                                                     |          |
| Subclinical bacteriuria                                 | The presence of bacteriuria, irrespective of the presence of pyuria or haematuria, in the absence of clinical signs of urinary tract disease potentially attributable to bacterial infection                                                                                                                                                         | 11, 12   |
| Subclinical funguria                                    | Detection of fungi in urine by cytology or culture in dogs/cats in the absence of clinical signs of urinary tract disease potentially attributable to fungal infection. This does not include detection of fungal antigens in urine (e.g. urine <i>Blastomyces</i> antigen testing)                                                                  |          |
| Bacteriuria of clinically uncertain significance        | Bacteriuria but unclear presence or relevance of clinical signs of urinary tract disease potentially attributable to bacterial infection                                                                                                                                                                                                             |          |

emphasised concerns about overtreatment of suspected pyelonephritis cases and highlighted that the inclusion of culture-negative suspected pyelonephritis could lead to excessive antimicrobial

treatment based on an unsubstantiated fear of pyelonephritis. One individual asked for clarification of “bacteriuria of uncertain significance”.

**Table 4. Footnotes for final terms and definitions for infectious urinary tract disease in dogs and cats**

| Number | Footnote                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1      | None of these lower urinary tract signs are definitive for bacterial cystitis. They simply suggest that lower urinary tract disease of some form is present. In particular, periuria and haematuria are commonly due to non-infectious disease. Periuria and haematuria are not exclusively related to diseases of the lower urinary tract                                                                                                                                                                                                                                                                                                                     |
| 2      | Bacterial origin is determined through a positive urine or bladder wall culture, ideally with supporting cytology and lack of another apparent cause                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 3      | Limited data are available regarding cut-offs for dogs and cats, particularly for samples collected from catheterisation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 4      | These cut-offs are used to infer contamination <i>versus</i> colonisation. Levels above the cut-offs simply mean that the cut result is likely representative of bacteria being present in the bladder. These cut-offs do not infer clinical relevance of a positive culture                                                                                                                                                                                                                                                                                                                                                                                   |
| 5      | The impact of specimen type and potential impact of the specimen collection process (e.g. traumatic catheterisation, cystocentesis with likely blood contamination) should be considered when interpreting these values                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 6      | Timeframes for re-infection <i>versus</i> relapse is an arbitrary cut-off and there is significant uncertainty. The 4-week cut-off is consistent with human medicine but no data are available for animals                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 7      | When used in the clinical context it is implicit that there is a clinical manifestation of infection. Clinical signs may be vague and non-specific and can include lethargy, polyuria/polydipsia and gastrointestinal signs, mainly inappetence/anorexia. Pyrexia and/or renal/abdominal pain is sometimes present                                                                                                                                                                                                                                                                                                                                             |
| 8      | Signs of systemic inflammation can be either clinical (pyrexia) AND/OR paraclinical (increased acute phase proteins AND/OR high OR low neutrophil count AND/OR increase in immature neutrophils)<br>Signs of renal involvement can be either clinical (kidney OR flank pain) AND/OR paraclinical (acute onset, or progression, of azotemia, AND/OR elevation of other kidney biomarkers AND/OR excretory radiographic, ultrasonographic or CT alterations compatible with pyelonephritis)                                                                                                                                                                      |
| 9      | Culture-negative-pyelonephritis is the term used to describe the equivalent rare situation in people. It is unknown to which extent this situation is present in companion animals. If present, it should be regarded as rare. The definition is not aimed to promote a diagnosis of pyelonephritis among animals with negative cultures. The definition is meant to capture those very few animals that have all possible signs and laboratory findings indicative of pyelonephritis but no positive culture. A plausible cause for culture negativity, such as current antimicrobial use, and a positive response to treatment, can strengthen the suspicion |
| 10     | As opposed to cystitis, no time cut-off (number of episodes per year) was established for recurrent pyelonephritis because sporadic pyelonephritis is rare and any recurrence of disease is notable and potentially linked to the preceding episode                                                                                                                                                                                                                                                                                                                                                                                                            |
| 11     | The definition does not aim to differentiate whether clinical signs are not present or not able to be observed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 12     | Bacteriuria is represented by positive urine culture or cytological detection of bacteria using the described cut-offs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

Final terms and definitions are presented in Table 3, with associated footnotes in Table 4. Terms that were removed are presented in Table 5.

## DISCUSSION

Consensus-based terms and definitions are important to ensure accurate communication, evidence gathering and guidance (Bilsen et al., 2024). Variable use of terms and definitions has been particularly common in infectious urinary tract disease in dogs and cats where the general term “urinary tract infection” has been used to represent a range of diseases and subclinical conditions. This is one reason that it was suggested that the term be avoided (Weese et al., 2019) although alternative terms and definitions are needed to avoid replication of uncertainty.

Most proposed definitions presented to the stakeholder groups received widespread support, and dissenting opinions were typically minor and often merely requests for clarification rather than concerns. Some definitions were more problematic. For example, “culture-negative suspected pyelonephritis” generated considerable discussion among the Methodology Group, including whether the term was needed, the most appropriate term to use and ultimately the definition. Similar points were raised by participants from the Working Group and wider stakeholder group, ultimately resulting in good agreement, but with some concerns about application of the term. Demonstrating the multi-faceted issues around terminology, concern was expressed that providing a formal term for a culture-negative disease that cannot be readily excluded

as a differential diagnosis could lead to overtreatment through fear-based, just-in-case or “abundance-of-caution” rationales. The footnotes provided can potentially assist understanding of the terminology, but treatment recommendations should be reserved for evidence-based guideline development and are not an objective of this work. By linking definition and guideline initiatives, the terms and definitions developed here can support guideline development, optimising the clinical impact of standardised terminology.

This study used an iterative approach that involved many experts in fields relevant to infectious urinary tract disease, and from a wide geographic range. Broad efforts to engage stakeholders and ensure input from diverse groups are critical for development of consensus efforts such as this. Since 100% agreement is difficult to achieve, this is rarely set as a required threshold. Nonetheless, there was ultimately very high levels of agreement with the proposed definitions here, likely in part attributable to the multiple rounds of development and review. Some comments or questions provided by stakeholders were ancillary to the definition initiative but have broader importance. Despite the explanatory pre-ambles circulated with each survey round, outlining that this effort was focussed solely on standardising terms and definitions, some participants asked questions about whether treatment was indicated for certain conditions. This highlights the importance of clinical treatment guidelines to support clinicians in their daily management of the conditions defined here by the standardised terms.

Any expert elicitation has an inherent risk of bias. The large population size, broad recruitment and international scope reduced potential biases and the repetitiveness of comments suggests that theoretical saturation was achieved. However, it remains possible

**Table 5. Proposed terms that were removed during the iterative process**

| Term                                        | Comment                                                                                                                                                                                                |
|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Confirmed bacterial cystitis                | This was deemed redundant.                                                                                                                                                                             |
| Re-infection (separate diagnostic criteria) | Separate diagnostic criteria definition was removed and the single term definition was retained                                                                                                        |
| Microbiological cure, fungal cystitis       | Separate fungal definition removed as microbiological cure definition was edited to cover both bacterial and fungal cure.                                                                              |
| Acute pyelonephritis                        | Term was deemed redundant                                                                                                                                                                              |
| Pyrexia                                     | It was agreed not to set a specific threshold value for pyrexia as this does not relate specifically to urinary tract disease.                                                                         |
| Asymptomatic bacteriuria                    | This term was included initially to allow discussion but was removed by consensus since asymptomatic is not a term that applies to animals. Subclinical bacteriuria was retained as the relevant term. |
| Fungal cystitis                             | Fungal cystitis was inadvertently included twice in the Round 1 survey. The duplicate was removed.                                                                                                     |
| Relapse (diagnostic criteria)               | This term related to the diagnostic criteria underlying the definition rather than a defined term                                                                                                      |
| Suspected bacterial pyelonephritis          | This term added little and could not be readily differentiated from presumptive bacterial pyelonephritis                                                                                               |
| Bacterial/fungal pyelitis                   | This is predominantly a histological rather than a clinical diagnosis. Consequently, it was deemed out of scope                                                                                        |

that other opinions or suggestions from individuals outside the invited population or from individuals that did not respond to the invitation could have introduced a novel perspective. The exercise was performed in English, which introduces a further potential bias. While the participants included many individuals from non-English-speaking countries, the requirement that people speak English to participate could have affected engagement. Similarly, the terms and guidelines were only developed in English. While they might be directly translatable into other languages, any future efforts to extrapolate these to other languages would ideally be performed using a similar iterative approach including stakeholders to ensure that the intended nuances in wording could be captured appropriately. This effort also focussed on a small number of expert groups. It would not necessarily cover all individuals with expertise and interest in infectious urinary tract disease. Participants from other specialties such as microbiology and clinical pathology were not specifically recruited as there would be some representation in the targeted groups (e.g. ISCAID). However, this may have limited the breadth of expertise.

Standardisation of terminology is a foundational component of clinical communication, clinical research, surveillance and guideline development. This initiative has allowed for the creation of terms and definitions based on broad stakeholder consensus. The study's output should assist with ongoing and

future efforts to improve the evidence base pertaining to infectious urinary tract disease and foster improved clinical guidance.

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No consulting in regard to method took place.

### Author contributions

**J. S. Weese:** Conceptualization; investigation; writing – original draft; methodology; validation; writing – review and editing; formal analysis; project administration; data curation; supervision. **F. Allerton, K. Scahill, T. M. Sørensen and L. R. Jessen:** Conceptualization; methodology; validation; writing – review and editing; formal analysis.

### Conflict of interest

The authors declare no conflicts of interest.

### Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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### Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

**Appendix 1.** Completed DELPHISTAR (Delphi studies in social and health sciences – recommendations for an interdisciplinary standardized reporting) checklist.