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Mapping Australian Veterinary Diagnostic Laboratory Services Relevant to Antimicrobial Resistance Surveillance – A Scoping Study

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Abstract

Background: Animal-sector antimicrobial resistance (AMR) surveillance requires laboratories capable of recovering bacterial isolates, identifying organisms, performing and interpreting antimicrobial susceptibility testing (AST), retaining isolates and associated metadata, and transmitting standardised isolate-level data. This scoping review mapped publicly available information on Australian veterinary diagnostic laboratory services and assessed their potential contribution to animal-sector AMR surveillance. Public websites, submission forms and test directories were reviewed for laboratory identity, sample-submission pathways, culture and isolate recovery, organism identification, AST, reporting, referral and isolate storage. Australian animal-health sources provided the primary framework, while AURA, WHO and CDC priority lists were used only for contextual One Health comparison.

Results: After duplicating organisational names, former service labels, network-level duplicates, collection centres and unverified internal facilities were reviewed, 20 veterinary laboratory or service entries were retained. These included private laboratory networks, government laboratories, university diagnostic services and selected specialist animal-health and One Health organisations. Publicly available request forms were identified for 14 of 20 entries, sample collection and transport guidance for 10 entries each, turnaround times for seven, and follow-up arrangements for three. AST or "culture and sensitivity" was mentioned for all 20 entries. However, public sources rarely specified the AST platform, antimicrobial panel, interpretive standard and version, minimum inhibitory concentration or inhibition-zone output, quality-control organisms, isolate-selection rules, isolate archiving or submission of isolate-level surveillance data. Pathogen test menus showed broad animal-health and zoonotic

coverage, but detection-only or genus-level listings did not establish species-specific identification, resistance-phenotype detection or surveillance-compatible AST capacity.

Conclusions: Australia has a distributed veterinary diagnostic network with clear potential to support national AMR surveillance. However, publicly available information is insufficient to verify site-level surveillance readiness or determine whether results are produced using comparable methods. A verified registry of physical testing sites, direct confirmation of culture-to-AST workflows, harmonised AST and reporting standards, and a minimum isolate-level dataset are required before routine veterinary laboratory data can be integrated reliably into coordinated national animal-AMR surveillance.

Keywords:

Antimicrobial resistance; antimicrobial susceptibility testing; veterinary diagnostic laboratories; One Health; surveillance; Australia; laboratory capacity

Introduction

Antimicrobial resistance (AMR) threatens the effective treatment of infections in humans and animals and increases morbidity, mortality, production losses and health-care costs. The World Health Organization Global Action Plan identifies five strategic objectives, including strengthening knowledge through surveillance and research; it does not rank surveillance as a "second topmost" objective [1]. AMR surveillance requires more than the detection of a pathogen. For bacterial AMR, the core laboratory pathway includes appropriate specimen collection, culture and isolate recovery, organism identification, antimicrobial sensitivity testing (AST) using a validated method, interpretation against an applicable standard, quality control, isolate and metadata retention, and timely reporting. Australia addresses AMR through a One Health policy framework. Australia's National Antimicrobial Resistance Strategy-2020 and Beyond, covers human health, animal health, agriculture, food and the environment [2]. The Animal Sector AMR Action Plan 2023–2028 was developed by the animal sector and translates the One Health

Master Action Plan into seven animal sector objectives [3]. Accordingly, this study treats veterinary laboratories as established contributors to animal health, biosecurity and One Health systems, rather than as an extension of human health surveillance [3].

Furthermore, Australia's animal health laboratory system includes the Australian Centre for Disease Preparedness (ACDP), central state or territory government laboratories, and private and university laboratories [4]. These services differ in species coverage, client base, sample volume, accreditation scope, emergency-disease responsibilities and access to culture, molecular identification, sequencing and AST [4]. Routine diagnostic laboratories may provide high-volume clinical isolates, whereas government and reference laboratories provide coordination, confirmatory testing, biosecurity functions and emergency response [4].

International animal AMR surveillance systems illustrate both the value and complexity of coordinated laboratory data. DANMAP in Denmark, NARMS in the United States, RESAPATH in France and EARS-Vet in Europe are well-established international animal AMR surveillance systems [5-9]. These programs require sustained funding, harmonised methods, common metadata, governance, quality assurance and mechanisms to avoid duplicate isolates. One potential strategy for effective AMR surveillance is to leverage existing diagnostic laboratories, which could reduce surveillance costs. However, participating sites, AST methods, interpretive criteria, isolate-selection rules and data flows should be uniform and explicitly defined for contribution to national surveillance programs. Effective AMR surveillance is also challenged by fragmented surveillance systems, heterogeneous laboratory and reporting practices, incomplete epidemiological metadata, and insufficient integration of human, veterinary and food-sector data, which constrain understanding of the magnitude and distribution of AMR across human and animal populations [10].

The aim of this scoping study was to map existing publicly discoverable Australian veterinary diagnostic laboratory services to determine what type of national AMR surveillance network could be established from these capabilities. This study also looked at the wider pathogen or disease categories that the World Health Organization (WHO), Centers for Disease Control and Prevention and Antimicrobial Use and Resistance in Australia (AURA) to compare

the list of pathogens tested by Australian veterinary pathology labs to assess their capability to potentially contribute towards AMR surveillance and antibiotic stewardship. The study was not designed as a census of every physical laboratory and did not independently verify service volume, accreditation scope or current site-level AST capacity.

Objectives

1. Map Australian veterinary diagnostic capacity by identifying publicly discoverable government, university and commercial veterinary diagnostic service entities and, where verifiable, their physical testing sites, species coverage and reported pathology capabilities.
2. Characterise laboratory services relevant to AMR surveillance across the diagnostic pathway, including specimen submission and reception, culture and isolate recovery, organism identification and species- or strain-level confirmation using biochemical methods, MALDI-TOF, PCR, sequencing or other approaches, together with AST methods such as disk diffusion, broth microdilution, automated systems and genotypic testing, where reported.
3. Determine potential points of contribution to animal-sector AMR surveillance by assessing where each laboratory could contribute along the pathway from sample collection and isolate recovery to identification, susceptibility testing, interpretation, reporting, referral, isolate storage and data submission.
4. Reconcile and compare laboratory and pathogen information by resolving duplicate organisational aliases, network-level entries, collection centres and specialist or internal facilities before calculating laboratory denominators, and by comparing publicly reported pathogen coverage with Australian animal-health sources and, for contextual One Health purposes only, selected human-health AMR priority lists.
5. Identify gaps and priorities for strengthening surveillance by examining deficiencies in publicly reported capability, workflow standardisation, AST methods and interpretive criteria, metadata capture, reporting and data integration, and by identifying areas where investment and capacity-building are needed to improve coverage of underserved diagnostic steps or pathogen groups within national animal-health AMR surveillance.

Methods

Search Strategy and Eligibility Criteria

A structured web-based scoping search was undertaken using publicly available and accessible laboratory websites, test directories, submission forms and relevant Australian Government and university webpages between November 2024 and June 2025. The key words included “Veterinary”, “Pathology labs”, “Veterinary Pathology Labs”, “Veterinary Laboratory Testing”, “Animal Disease Testing Labs”, “Disease Surveillance Labs” and “Veterinary Diagnostic Labs”. Eligible records included the Australian facilities, and service entities that were publicly described as veterinary diagnostic testing for animal specimens. Although information on the available general veterinary practices, human/ veterinary pathology collection centres, research groups were collected, those without a diagnostic service, and zoological facilities without a publicly verifiable diagnostic laboratory or external test menu were excluded from analysis. Specialist laboratories were retained only when their diagnostic role and eligibility were explicit and added value to AMR surveillance.

Data extraction and definitions

Only confirmed laboratory testing sites were included in the analysis. A website describing a national or state-wide laboratory network was not counted as a separate laboratory unless a physical testing site could be identified. Different names, branches or organisational labels referring to the same laboratory service were combined. Sample collection centres were not counted as testing laboratories. A function was recorded as **“reported”** only when it was clearly described in a publicly available source. When information was not found on a website, it was recorded as **“not publicly reported”** rather than **“not performed.”** We also did not assume that testing at the genus level meant that a laboratory could identify individual species, detect resistance, perform AST, or identify multidrug-resistant organisms.

Reference frameworks for pathogens

Australian animal health sources included Department of Agriculture Fisheries and Forestry (DAFF) descriptions of the national laboratory system, animal health laboratory stakeholders, national diagnostic arrangements and animal sector AMR policy [4, 11-14]. Bacterial pathogens reported by the World Health Organisation (WHO) and the recent WHO Bacterial Priority Pathogens List 2024 [5, 15-17], the Centers for Disease Control and Prevention (CDC) Antibiotic Resistance Threats report [15, 18], AURA 2023 [19], U.S Food and Drug Administration (FDA) reported pathogens [6] were used as contextual human-health comparators. The WHO, CDC and AURA lists mainly identified antimicrobial resistant organisms that are important to human health. In this study, they were used only to compare human and animal health priorities within a One Health context. They were not considered official Australian animal AMR priority lists, and their inclusion did not mean that veterinary laboratories were assumed to perform AST for those organisms.

Data curation and analysis

The dataset was reviewed before analysis to identify duplicate records, alternative laboratory names and entries that represented laboratory networks, administrative offices, sample collection centres or internal facilities rather than confirmed testing services. Records referring to the same laboratory or service were merged, and non-testing locations were excluded unless a separate testing role could be verified. Heatmaps were therefore prepared using a reconciled list of eligible veterinary diagnostic laboratories and service entities (Appendix 1).

For the laboratory capability matrices, a value of **1** (designated to a colour) indicated that a pathogen, test or workflow function was explicitly reported in a publicly available source, whereas **0** (either designated to a colour or not designated to a colour) indicated that it was not publicly reported. A value of 0 did not mean that the laboratory did not perform the test. Where the combined One Health heatmap used numerical codes to distinguish laboratory testing, One Health relevance, AURA coverage and Australian public-source coverage, these codes were treated as

categories rather than ranked scores. Biosecurity, surveillance, emergency-disease preparedness and AMR roles were recorded separately and were not interpreted as an ordinal scale.

The curated datasets were used to generate three heatmap formats in R: veterinary pathology laboratories and test forms and the information provided within the test request forms; a pathogen-by-laboratory compared with AURA report, laboratory-by-pathogen map covering WHO and CDC, and an integrated heatmap comparing laboratory coverage with selected One Health, AURA and Australian veterinary laboratories testing regime. Because the source matrices were not completely identical, they were retained as separate datasets rather than assumed to be exact matching tests and/or pathogens. Disease and pathogen names were replaced in the figures with sequential labels such as D1, D2 and D3 to improve readability, while the full names were retained in corresponding supplementary disease keys. Laboratory names were shortened only for figure presentation; the original names and retained matrix values were preserved in the curated datasets and figure captions. The curated CSV files, duplicate-removal record, disease keys and R scripts were retained to support reproducibility.

Results

Laboratory test request forms and information provided within the forms

The original dataset contained a mixture of laboratory networks, individual testing services, government agencies, university laboratories and specialist research services. Laboratory names were reviewed and consolidated to remove duplicate records, alternative organisational names and entries that referred to the same testing service. Administrative offices, sample collection centres, historical facilities and internal zoo or wildlife services without a verified external diagnostic role were excluded.

Following this review, **20 laboratory service entries** were retained for the heatmap analysis. These included private laboratory networks, government veterinary laboratories and university diagnostic services. . The entries were: (1)

IDEXX, (2) Gribbles Veterinary Pathology, (3) Vetnostics, (4) Aurora Veterinary Pathology (5)ACE Laboratory Services (6) Animal Pathology Services WA (7) Berrimah Veterinary Laboratory (8) Charles Sturt University Veterinary Diagnostic Laboratory (9) University of Sydney Veterinary Pathology Diagnostic Services (10) NSW Animal and Plant Health Laboratories (11) University of Queensland Veterinary Laboratory Services (12) Biosecurity Sciences Laboratory, Queensland (13) CSIRO ACDP (14) Primary Industries and Regions South Australia (15) South Australian Research and Development Institute (16) Department of Natural Resources and Environment Tasmania (17) Agriculture Victoria State Veterinary Laboratory (18) University of Melbourne veterinary diagnostic services (19) DPIRD Diagnostics and Laboratory Services Animal Pathology (20) Murdoch University Veterinary Pathology services.

Duplicate and overlapping records that were combined included NSW Animal and Plant Health Laboratories and the former NSW DPI State Veterinary Diagnostic Laboratory; Biosecurity Queensland and the Department of Agriculture and Fisheries Biosecurity Sciences Laboratory; the Tasmanian Animal Health Laboratory, Tasmanian Institute of Agriculture (TIA) and Department of Natural Resources and Environment Tasmania (NRE) Tasmania labels; AgriBio and the Agriculture Victoria State Veterinary Laboratory; and the two DPIRD animal-pathology labels. QML Vetnostics was included under the broader Vetnostics service rather than being treated as a separate entry. PIRSA was retained because it has a distinct role in South Australian animal health surveillance, Biosecurity, disease investigation and the coordination of government supported testing. However, routine veterinary laboratory testing associated with PIRSA programs is largely delivered through Gribbles VETLAB at Glenside. PIRSA was therefore included as an animal health surveillance and service entry rather than being interpreted as a separate physical testing laboratory. SARDI was also retained because of its specialist agricultural, aquatic, food-microbiology and research capabilities. Its role differs from that of a routine veterinary pathology laboratory and was interpreted as a specialist One Health and primary-industries service as this can also serve for combatting AMR. Gribbles was represented as one laboratory network in the heatmap, although two veterinary testing sites were publicly identified at Clayton, Victoria, and Glenside, South Australia. IDEXX and Vetnostics were similarly retained as network-level entries because the testing functions of every individual location could not be consistently

confirmed from public information. Human pathology collection centres associated with the broader Gribbles network were excluded because they were not veterinary testing laboratories. Accordingly, the final heatmap count of 20 entries represents publicly identifiable veterinary diagnostic organisations, laboratory networks, government animal-health services and selected specialist One Health services. It should not be interpreted as the number of individual physical veterinary laboratories operating in Australia.

Publicly reported submission and testing information

The amount of information available online varied across the 20 laboratory and service entries. A test request form was publicly available for 14 entries (70%). Sample collection guidance and sample transport instructions were each reported for 10 entries (50%), while turnaround times were reported for 7 entries (35%). Only 4 entries (20%) clearly stated that sample collection was offered as a service. Information about interpreted reports, non-interpreted reports and follow-up arrangements was less commonly available, being reported for 3 (15%), 4 (20%) and 3 entries (15%), respectively.

All six commercial laboratory services provided a publicly available request form. However, information about specimen collection, transport, turnaround times, report interpretation and follow-up varied across both commercial and public-sector services. For several government, university and specialist services, some fields were recorded as "other or no information" because the available material did not allow a clear classification to note as a "Yes" or "No". Therefore, a missing item should be interpreted as not clearly reported online.

AST was reported for all 20 entries, and all entries also indicated access to reporting or referral pathways as appropriate involving national and/or reference laboratories. Additional AST costs were reported for 8 entries (40%). However, only limited information was available about how AST was performed and interpreted. The public sources did not consistently describe the testing platform, antimicrobial panel, interpretive standard, minimum inhibitory concentration or inhibition-zone reporting, quality-control procedures, isolate-selection rules, isolate storage or submission of isolate-level surveillance data.

These findings show that AST was widely mentioned as a service, but the publicly available information was not detailed enough to determine whether results from the different services were produced using comparable methods or could be combined directly within a standardised national animal AMR surveillance program. Figure 1 illustrates the differences in the availability of test forms for veterinary pathology testing labs and the information provided within test request forms.

Comparison with AURA organisms and resistant microbial phenotypes

Thirty organisms including resistance phenotypes listed in AURA 2023 [19] were compared with publicly reported testing capability across 20 Australian veterinary diagnostic laboratory testing services for this study. AURA was included as a contextual One Health reference as mentioned in the methods, not as a direct comparator.

Publicly reported testing corresponding to at least one AURA entry was identified for 20 of the 30 organisms, while there was no corresponding information found for the remaining 10 organism. However, the extent of reported coverage varied substantially. *Klebsiella* testing was reported across all veterinary services, although this broad genus-level listing did not demonstrate testing for a particular species or resistance phenotype of *Klebsiella* species. *Salmonella* spp., *Shigella* spp. and *Escherichia coli* O157:H7 were each reported by six services.

AURA reported coverage was more limited for resistance-defined organisms. Methicillin-resistant *Staphylococcus aureus* which were reported by four services, fluoroquinolone-resistant *Salmonella* by three, and carbapenem-resistant *Acinetobacter*, *Candida auris* and drug-resistant *Mycobacterium tuberculosis* by two services each. Several resistance-defined organisms were reported by only one service, IDEXX including multidrug-resistant *Pseudomonas aeruginosa*, carbapenem-resistant *Acinetobacter baumannii*, vancomycin-resistant *Staphylococcus*

aureus, fluoroquinolone-resistant *Shigella* spp and penicillin-non-susceptible *Streptococcus pneumoniae*. Following IDEXX, AURORA, ACE and Vetnostics performed high number of AURA listed pathogens.

We could not find matching for 10 AURA entries, including carbapenem-resistant *Pseudomonas aeruginosa*, carbapenem-resistant and extended-spectrum β-lactamase-producing Enterobacteriaceae, vancomycin-resistant *Enterococcus faecium*, several *Candida* species, Enterobacterales, *Neisseria meningitidis* and *Streptococcus agalactiae* among the veterinary testing services.

The findings reflect information explicitly available in public sources and should not be interpreted as verified national laboratory capacity. A value of zero indicated that relevant testing was **not publicly reported**, rather than that it was not performed. Broad organism descriptions were not used to infer species-level identification or resistance-specific capability. For example, a listing for *Klebsiella* did not demonstrate detection of carbapenem-resistant *Klebsiella pneumoniae*, and general *Pseudomonas* testing did not establish a validated workflow for carbapenem-resistant or multidrug-resistant *Pseudomonas aeruginosa*. Figure 2 therefore illustrates areas of publicly visible One Health overlap, however, does not measure alignment with Australian animal-health priorities or readiness for a standardised national veterinary AMR surveillance program.

Pathogen coverage and contextual comparison with AMR priority lists:

The pathogens and/or disease lists from AURA, WHO and CDC were collated to produce 151 items and were compared with 20 Australian veterinary laboratory and service entries to match the tests that are performed by these labs. The WHO, CDC and AURA classifications were included only to show where pathogens of human-health concern overlapped with veterinary and One Health testing as explained earlier in the methods. Figure 3 illustrates numerical codes representing categories and were not interpreted as increasing levels of laboratory capability.

Publicly reported testing was identified for 55 of the 151 entries (36.4%), while 96 entries had no testing information identified for any of the included services. Coverage varied considerably among pathogens. Sixteen animal health or zoonotic entries were recorded across all 20 services, including anthrax, bluetongue, bovine spongiform encephalopathy, bovine ephemeral fever, foot-and-mouth disease, equine influenza, Johne's disease, Shiga toxin-producing *Escherichia coli*, MRSA and toxoplasmosis. *Klebsiella* testing was recorded for 19 services.

Coverage was less consistent for several commonly recognised zoonotic and foodborne pathogens. Publicly reported testing was identified for *Campylobacter* in seven services, *Escherichia coli* O157:H7 in six, *Salmonella* spp. in five, *Leptospira* in three and *Brucella* or brucellosis in two. Mycoplasma PCR was reported for eight services.

The heatmap also showed gaps for several resistance-defined human-health priority threats. Testing was recorded for fluoroquinolone-resistant *Salmonella* in three services, drug-resistant *Mycobacterium tuberculosis* and *Clostridioides difficile* in two services each, and multidrug-resistant *Pseudomonas aeruginosa* in one service. No publicly reported laboratory coverage was identified for several specifically defined threats, including carbapenem-resistant *Acinetobacter*, carbapenem-resistant Enterobacterales, carbapenem-resistant *Pseudomonas aeruginosa*, vancomycin-resistant *Enterococcus faecium* and *Candida auris*. This demonstrates some overlap between human- and animal health priorities, particularly for enteric, zoonotic and selected resistant organisms, but also shows that many human health priority threats were not represented in publicly available veterinary testing information, which was expected in this scoping research, given that veterinary pathology labs primarily focuses only on veterinary pathogens.

These findings should not be interpreted as confirmed absence of testing. A zero in the matrix indicated that testing was not publicly reported, rather than that it was not performed. Similarly, a general genus-level test listing was not considered evidence of species-specific or resistance-phenotype detection. For example, reported testing for *Pseudomonas* spp. did not establish capability for carbapenem-resistant *Pseudomonas aeruginosa*, and *Staphylococcus* testing alone did not confirm a validated MRSA workflow.

Discussion

This scoping review identified a geographically distributed Australian veterinary diagnostic system with substantial potential to contribute to AMR surveillance. After duplicate names, former organisational labels and overlapping services were removed, the final analytical set contained 20 veterinary laboratory, diagnostic-service, government and specialist One Health entries. These entries should not be interpreted as 20 individual physical laboratories because some represent multi-site networks or government services, whereas others represent confirmed testing facilities. The study therefore provides a map of publicly identifiable services rather than a complete national census of physical veterinary laboratories.

The findings also demonstrate that publicly advertised pathogen testing cannot be used on its own to determine AMR surveillance capability. A laboratory may report PCR, serology, culture or organism identification without providing evidence that bacterial isolates are recovered and subjected to a standardised AST workflow. Effective AMR surveillance requires more than pathogen detection. It depends on isolate recovery, reliable organism identification, a validated AST method, an appropriate interpretive standard, quality control, defined isolate-selection rules, retention of isolates and associated metadata, and submission of comparable isolate-level results.

Publicly available information was more complete for routine submission processes than for the technical details needed to evaluate AMR surveillance readiness. Commercial services commonly provided request forms, specimen requirements, transport instructions and turnaround guidance. Government and university services more often described biosecurity, reference, emergency-disease or surveillance functions, although the level of site-specific information varied. Importantly, the absence of a test, form or method from a website should be interpreted as **not publicly reported**, rather than evidence that the service is not performed.

AST was mentioned across the included services, often through terms such as “culture and sensitivity.” However, public sources rarely described the AST platform, antimicrobial panel, Clinical and Laboratory Standards Institute, European Committee on Antimicrobial Susceptibility Testing or VetCAST document used, quantitative minimum

inhibitory concentration or inhibition-zone output, quality-control organisms, isolate-storage arrangements or submission of results to a surveillance database. Consequently, the present study could identify potential contributors to surveillance but could not determine the proportion of services able to participate immediately in a defined and standardised national AST program.

The One Health and AURA heatmaps identified areas of overlap between organisms of human-health concern and pathogens reported by veterinary diagnostic services (Figures 2 and 3). These comparisons are beneficial as resistant antimicrobial resistance genes and/or genetic material may get transferred between humans, animals, food and the environment. However, the WHO bacterial priority pathogen list, the CDC threat list and AURA address human-health priorities. They should therefore be used as contextual One Health references and not as the principal standards against which Australian veterinary laboratories are assessed.

The analysis applied a conservative interpretation to pathogen coverage. Genus-level testing was not considered evidence of species-specific identification or detection of a resistance phenotype. For example, a listing for *Pseudomonas* spp. did not demonstrate the ability to detect multidrug-resistant or carbapenem-resistant *Pseudomonas aeruginosa*. Similarly, general *Staphylococcus* testing did not establish a validated methicillin-resistant *Staphylococcus aureus* workflow, and testing for Enterobacterales did not demonstrate detection of carbapenem-resistant Enterobacterales. This stricter approach reduced the risk of overstating publicly demonstrated veterinary AMR capability.

Australian animal health policy, nationally notifiable animal diseases, livestock and companion-animal surveillance objectives, and aquatic and wildlife priorities should provide the main framework for evaluating veterinary laboratory contributions. Human-health priority lists can then be used to identify areas where cross-sector surveillance may be particularly valuable. This approach would better reflect the distinct responsibilities of veterinary laboratories while supporting One Health collaboration.

Strengths and limitations of the Australian veterinary diagnostic laboratory network

A major strength of the Australian system is the combination of government, private, university and national reference services. These sectors provide different but complementary functions. Routine private and university laboratories receive clinical specimens from geographically dispersed animal populations and may therefore provide large numbers of isolates and longitudinal diagnostic records. Government and reference laboratories contribute confirmatory testing, exotic and emergency animal-disease diagnosis, biosecurity functions, quality assurance, coordination and national reporting. CSIRO's ACDP provides additional national reference and high-containment capability.

National coordination arrangements, including the Subcommittee on Animal Health Laboratory Standards and the Laboratories for Emergency Animal Disease Diagnosis and Response network [20], provide an established foundation for test harmonisation, quality assurance, training and emergency preparedness. These structures indicate that Australia already has many of the institutional elements needed to develop a stronger animal AMR surveillance system.

Previous multi-laboratory studies demonstrate the practical value of this network. A national collaboration collected 888 clinically relevant coagulase-positive staphylococcal isolates from 22 Australian veterinary diagnostic laboratories during 2013–2014 [21]. The study generated baseline information on methicillin resistance and showed that existing laboratories could contribute isolates to coordinated identification, AST and molecular-characterisation programs. Clinical *Escherichia coli* isolates from companion animals were also examined through the same collaborative network, further demonstrating the feasibility of national isolate collection and advanced AMR characterization [22].

Routine laboratory records can also provide substantial geographical and temporal information. Langhorne et al. analysed 22,102 milk samples from bovine submitted to four of the veterinary diagnostic testing laboratories in Australia between 2015 and 2019 [23]. The data covered seven Australian dairy regions out of eight and supported analysis of pathogen occurrence and antimicrobial susceptibility across time and location. Archived isolates collected through veterinary diagnostic networks have similarly supported genomic and molecular investigations

of methicillin-resistant *Staphylococcus pseudintermedius*. [23]. These studies show that veterinary laboratories can be used in networks to generate evidence for clinical antimicrobial stewardship, outbreak investigation, disease control and informing policy at a national level, in addition to producing results for individual animals.

Barriers to nationally comparable AMR data

Despite these strengths, variation in AST practices remains an important limitation. Hardefeldt et al. found substantial differences among Australian veterinary diagnostic laboratories in antimicrobial panels, testing methods, interpretive criteria and reporting practices [24]. No consistent antimicrobial panel was used across the surveyed laboratories for the bacterial species examined. Such variation can produce different resistance classifications even when laboratories test similar bacterial populations. It also limits the development of pooled antibiograms and makes comparisons between laboratories, jurisdictions and time periods difficult.

These challenges are reflected in the National Animal Health Diagnostics Business Plan 2021–2026 [25] . The plan identifies priorities including nationally accessible NATA-accredited minimum inhibitory concentration testing, consistent proficiency testing, standardised AMR reporting guidance, consideration of a veterinary AMR reference laboratory, expanded whole-genome sequencing and improved real-time collation of animal-health AMR data. These priorities indicate that substantial laboratory capability exists, but nationally comparable testing and reporting have not yet been achieved across all relevant services.

Routine diagnostic submissions also introduce epidemiological bias. Samples are generally collected from diseased animals presented to veterinarians and may overrepresent severe, recurrent or treatment-unresponsive infections. Animals previously exposed to antimicrobials may also be more likely to undergo culture and AST. Submission-derived data are therefore highly valuable for detecting clinically important resistance and guiding treatment, but they should not automatically be interpreted as estimates of resistance prevalence in the wider animal population.

This limitation was evident in the Australian bovine mastitis study [25]. Information distinguishing clinical from subclinical disease was unavailable, reasons for testing were not recorded, and recurrent or treatment-unresponsive cases may have been overrepresented. Farm identifiers were also unavailable, preventing assessment of whether

repeated submissions from individual farms influenced regional results. The authors therefore interpreted their findings as a broad description of mastitis patterns rather than a population-level prevalence estimate. This illustrates why large sample numbers cannot compensate for incomplete clinical and epidemiological metadata.

For the same reason, a future national veterinary AMR surveillance system should define a minimum dataset. At a minimum, this should include the laboratory and physical-site identifier, animal species and production class, specimen type, clinical syndrome, geographical location, collection date, organism and identification method, isolate-selection rule, AST method, interpretive standard and version, antimicrobial panel, quantitative result, interpretation, quality-control status and isolate-storage identifier.

Data interoperability is another important barrier. Earlier evaluations of Australian laboratory information systems identified inconsistent terminologies and limited electronic exchange between jurisdictions [14]. Effective data integration requires agreement on organism names, specimen categories, test definitions, antimicrobial names, interpretive categories and minimum reporting fields. Connecting laboratory information management systems without first standardising these elements would not produce reliable national surveillance data, and it may not be practical in a vast country like Australia. However, despite these barriers certain strategies can be implemented for better data interoperability. For example, a practical first step towards interoperability could begin with standardising laboratory test request forms, which represent the first point of data capture for diagnostic laboratories. Harmonising these forms would promote consistent terminology, specimen classifications, test requests and reporting requirements across laboratories. This, in turn, could support the development of a nationally agreed minimum dataset and establish an initial level of interoperability.

Such an approach could be progressively implemented without replacing the existing laboratory information systems and with minimal disruption to routine laboratory workflows. Standardised data-extraction and mapping tools could then be used to convert locally stored laboratory data into a common surveillance format. Laboratories would continue to retain and manage their complete internal datasets, while a defined minimum dataset could be

securely shared through a national surveillance platform. This staged model could initially be piloted in selected laboratories and gradually scaled as data standards, technical capacity and participation improve.

Workforce and funding constraints may also affect long-term implementation. Richards identified shortages of veterinary diagnosticians, particularly veterinary pathologists, as a threat to the Australian and New Zealand laboratory network [26]. National planning documents continue to identify needs in sequencing, bioinformatics, proficiency testing, surge capacity and AMR harmonisation. Many proposed activities depend on project-specific funding and in-kind contributions, which may make sustained surveillance vulnerable to changes in institutional priorities and staff availability.

Implications of the heatmap analysis

Overall, Australian veterinary laboratories are best described as a high value but incompletely integrated sentinel network. The system has substantial diagnostic expertise, quality infrastructure, routine sample throughput, biosecurity responsibilities and demonstrated capacity to support national isolate-based studies. Its main limitations are variation in AST methods and reporting, passive-submission bias, incomplete metadata, inconsistent public information, limited interoperability, workforce pressures, geographical constraints and dependence on activity-specific funding.

The next stage should move beyond website mapping to direct verification with participating laboratories, with the aim to build a national model. This would also require agreed participation arrangements, harmonised AST panels and interpretive standards, common metadata, isolate de-duplication, proficiency testing, data governance, reference-laboratory support and regular feedback to laboratories and submitting veterinarians. Routine diagnostic AMR surveillance should also be complemented by targeted or population-based sampling to address the biases of clinical submissions.

Limitations

This study relied mainly on publicly available websites, forms and service descriptions. These sources are dynamic and may not include tests available through consultation, referral and/or restricted government programs. The study did not independently verify accreditation scope, testing volume, staffing, operating status, AST method, antimicrobial panels, isolate retention and routine surveillance participation. The original search dates, complete search strings, screening records and site-selection rules were not fully documented, and they were collected with standard key words mentioned in the methods. These details should be reconstructed where possible and reported transparently in the final manuscript. The final analytical set included laboratory networks, testing services, government animal-health programs and specialist One Health services. It should therefore not be interpreted as a count of individual physical laboratory sites.

Recommendations

A version-controlled national registry should be established for veterinary diagnostic service entities and confirmed physical testing sites. The registry should record network affiliation, service scope, accreditation, testing location, referral pathways and relevant surveillance responsibilities. Each eligible laboratory should then be contacted using a standardised questionnaire covering the complete pathway from specimen receipt and isolate recovery to identification, AST, interpretation, isolate storage and data submission. A minimum national animal-AMR dataset should be agreed, together with harmonised AST panels, interpretive standards, quality-control requirements and isolate-selection rules. Standard terminology should be adopted for organisms, specimens, clinical syndromes, antimicrobial agents and resistance interpretations.

Routine electronic data transfer should initially be piloted with a representative group of government, university and private laboratories. The pilot should assess data quality, duplicate-isolate removal, laboratory information system compatibility, governance, feedback mechanisms and the resources required for national expansion.

Conclusion

Australian veterinary diagnostic laboratories provide a strong foundation for animal health and One Health AMR surveillance. The network includes routine clinical laboratories, university services, government diagnostic

facilities, specialist services and national reference capability. Previous collaborative studies demonstrate that these laboratories can contribute large numbers of clinical isolates and records to coordinated national investigations.

However, publicly available information alone cannot confirm the number of physical testing sites or provide reliable national estimates of standardised AST capability. Direct verification of laboratory workflows, harmonisation of AST and reporting practices, collection of a minimum epidemiological dataset and interoperable isolate-level reporting are essential before routine veterinary diagnostic data can be incorporated into a coordinated national AMR surveillance system.

References:

1. WHO: **Global Action Plan On Antimicrobial Resistance**. In. Edited by Antimicrobial Resistance Division (AMR) NAPaMaEN. Geneva: World Health Organization; 2016.
2. DOHAC: **Australia's National Antimicrobial Resistance Strategy - 2020 and Beyond. Canberra; 2020**. In. Edited by Department of Agriculture WatE. Canberra: Australian Governement; 2020.
3. DAFF: **Australia's Animal Sector Antimicrobial Resistance Action Plan 2023-2028**. In. Edited by Department of Agriculture FaF. Canberra: Australian Goverment; 2023: 18.
4. Australian Government Department of Agriculture F, Forestry: **Australia's animal health laboratories**. 2025.
5. Statens Serum I, National Food Institute TUoD: **DANMAP 2024 - Use of antimicrobial agents and occurrence of antimicrobial resistance in bacteria from food animals, food and humans in Denmark**. In. Copenhagen: Statens Serum Institut and National Food Institute, Technical University of Denmark; 2025.
6. FDA: **2019 NARMS Integrated Report Summary**. In. Edited by Food US, Drug A, Centers for Disease C, Prevention, Agriculture USDo. Rockville, MD: U.S. Department of Health and Human Services; 2022.
7. Gribbles Veterinary P: **Our laboratories**. 2026.
8. European Committee on Antimicrobial Susceptibility T: **Veterinary Committee on Antimicrobial Susceptibility Testing (VetCAST)**. 2026.
9. Anses: **Resapath - French surveillance network for antimicrobial resistance in bacteria from diseased animals, 2024 annual report**. In. Lyon and Ploufragan-Plouzané-Niort: French Agency for Food, Environmental and Occupational Health & Safety; 2025.
10. Tacconelli E, Sifakis F, Harbarth S, Schrijver R, van Mourik M, Voss A, Sharland M, Rajendran NB, Rodríguez-Baño J, Bielicki J *et al*: **Surveillance for control of antimicrobial resistance**. *The Lancet Infectious Diseases* 2018, **18**(3):e99-e106.

11. Australian Government Department of Agriculture F, Forestry: **Australia's Animal Sector Antimicrobial Resistance Action Plan 2023-2028**. In. Canberra: Australian Government Department of Agriculture, Fisheries and Forestry; 2023.
12. Australian Government Department of Agriculture F, Forestry: **Animal health laboratory stakeholders**. 2025.
13. Australian Government Department of H, Australian Government Department of Agriculture W, the E: **Australia's National Antimicrobial Resistance Strategy - 2020 and Beyond**. In. Canberra: Australian Government; 2020.
14. Animal, Health, Australia: **National Animal Health Information System and nationally notifiable animal diseases**. In.; 2026.
15. CDC: **Active Bacterial Core surveillance (ABCs)**. In. Edited by Prevention CfDCa: https://www.cdc.gov/abcs/about/pathogens.html; 2024.
16. Jesudason T: **WHO publishes updated list of bacterial priority pathogens**. *Lancet Microbe* 2024, **5**(9):100940.
17. WHO: **WHO Bacterial Priority Pathogens List, 2024**. In. Edited by ORGANISATION WH. https://iris.who.int/bitstream/handle/10665/376776/9789240093461-eng.pdf?sequence=1; 2024.
18. Centers for Disease C, Prevention: **Antibiotic Resistance Threats in the United States, 2019**. In. Atlanta: U.S. Department of Health and Human Services, CDC; 2019.
19. **AURA 2023: Fifth Australian report on antimicrobial use and resistance in human health - Report** [https://www.safetyandquality.gov.au/antimicrobial-use-and-resistance-in-australia/]
20. Animal, Health, Australia: **Management manual: Laboratory preparedness.** In. Edited by Animal Health A, 5 edn. Canberra, ACT: Australian Veterianry Emergency Plan (AUSVETPLAN); 2024.

21. Saputra S, Jordan D, Worthing KA, Norris JM, Wong HS, Abraham R, Trott DJ, Abraham S: **Antimicrobial resistance in coagulase-positive staphylococci isolated from companion animals in Australia: A one year study**. *PLOS ONE* 2017, **12**(4):e0176379.

22. Saputra S, Jordan D, Mitchell T, Wong HS, Abraham RJ, Kidsley A, Turnidge J, Trott DJ, Abraham S: **Antimicrobial resistance in clinical Escherichia coli isolated from companion animals in Australia**. *Veterinary Microbiology* 2017, **211**:43-50.

23. Langhorne C, Gupta SD, Horsman S, Wood C, Wood BJ, Barker L, Deutscher A, Price R, McGowan MR, Humphris M *et al*: **Bacterial culture and antimicrobial susceptibility results from bovine milk samples submitted to four veterinary diagnostic laboratories in Australia from 2015 to 2019**. *Frontiers in Veterinary Science* 2023, **Volume 10 - 2023**.

24. Hardefeldt LY, Marenda M, Crabb H, Stevenson MA, Gilkerson JR, Billman-Jacobe H, Browning GF: **Antimicrobial susceptibility testing by Australian veterinary diagnostic laboratories**. *Aust Vet J* 2018, **96**(4):142-146.

25. Australian Government Department of Agriculture W, the E: **National Animal Health Diagnostics Business Plan 2021-2026**. In. Canberra: Department of Agriculture, Water and the Environment; 2022.

26. Richards R: **The laboratory network in Australia and New Zealand – an evolving system**. *Australian Veterinary Journal* 2009, **87**(4):121-124.

Figures:

Figure 1. **Publicly reported submission, testing and referral information across Australian veterinary diagnostic laboratories and services.** Columns represent the 20 laboratory service entries included in the analysis, and rows represent publicly available information within the test request forms including request forms, sample collection and transport guidance, turnaround times, reporting arrangements, antimicrobial susceptibility testing (AST), additional AST costs, follow-up, and referral or reporting to national or reference laboratories. A value of **1**

indicates that the function was explicitly reported in a publicly available source, **0** indicates that it was not publicly reported, and **3** indicates that the available information was unclear or could not be classified or accessed. These codes are categorical and do not represent an ordered score. The absence of publicly available information should not be interpreted as evidence that a laboratory does not provide the service.

Figure 2: Contextual comparison of AURA 2023 organisms and resistance phenotypes with publicly reported testing across Australian veterinary diagnostic laboratories and services. Rows represent included in AURA 2023, and columns represent 20 Australian veterinary laboratory entries. The **purple** indicates that the relevant organism, phenotype was explicitly identified, while **grey** indicates it is not. Disease key codes are presented as a table disease key code below

D1	*Salmonella* spp.,	D17	Carbapenem-resistant, ESBL-producing Enterobacteriaceae
D2	*Escherichia coli* O1.157:H7,	D18	Vancomycin-resistant *Enterococcus faecium*
D3	*Shigella* spp.	D19	*Candida auris*-resistant
D4	Carbapenem-resistant Acinetobacter	D20	*Aspergillus fumigatus*
D5	*Candida auris*	D21	*Candida albicans*
D6	*Clostridioides difficile*	D22	*Candida glabrata*
D7	Carbapenem-resistant Enterobacteriaceae (CRE)	D23	*Candida tropicalis*
D8	Drug-resistant *Neisseria gonorrhoeae*	D24	*Candida parapsilosis*
D9	Multidrug-resistant *Pseudomonas aeruginosa*	D25	*Klebsiella*
D10	Methicillin-resistant *Staphylococcus aureus* (MRSA)	D26	*Enterobacterales*
D11	Drug-resistant *Streptococcus pneumoniae*	D27	*Neisseria meningitidis*
D12	Drug-resistant *Mycobacterium tuberculosis*	D28	*Streptococcus agalactiae*
D13	Vancomycin-resistant *Staphylococcus aureus* (VRSA)	D29	Fluoroquinolone-resistant *Salmonella* spp.
D14	Erythromycin-resistant Group A *Streptococcus*	D30	Penicillin-non-susceptible *Streptococcus pneumoniae*
D15	Carbapenem-resistant *Acinetobacter baumannii*	D31	Fluoroquinolone-resistant *Shigella* spp.
D16	Carbapenem-resistant *Pseudomonas aeruginosa*		

Figure 3. **Publicly reported pathogen testing coverage across Australian veterinary diagnostic laboratories and comparison WHO, CDC, AURA priority pathogens or diseases.** Rows represent 146 pathogens or disease-related entries, and columns represent the 20 veterinary laboratory or service organisations included in the analysis. Heatmap colours indicate the categories defined in the figure legend and should not be interpreted as an ordered measure of laboratory capability. A laboratory entry indicates that testing was explicitly described in a publicly available source; absence of an entry means that testing was not publicly reported and does not confirm that the service was unavailable. General genus-level testing was not considered evidence of species-specific identification, resistance-phenotype detection or surveillance-compatible antimicrobial susceptibility testing. Disease key codes are presented as table disease key codes below.

D1	Ampicillin-resistant *Haemophilus influenzae*	**D50**	Barmah Forest virus infection	**D99**	Leptospira
D2	*Aspergillus fumigatus*	**D51**	Bluetongue	**D100**	Listeriosis
D3	*Brucellosis*	**D52**	Botulism	**D101**	Lumpy Skin Disease
D4	*Burkholderia mallei*	**D53**	Bovine Ephemeral Fever.BEF	**D102**	Malaria
D5	*Burkholderia pseudomallei*	**D54**	Bovine Spongiform Encephalopathy.BSE	**D103**	Measles
D6	*Candida albicans*	**D55**	Bovine tuberculosis	**D104**	Meningococcal disease .invasive
D7	*Candida auris*	**D56**	Calf scour	**D105**	Middle East respiratory syndrome.MERS
D8	*Candida glabrata*	**D57**	Campylobacter	**D106**	Mpox
D9	*Candida parapsilosis*	**D58**	Cattle tick	**D107**	Mumps
D10	*Candida tropicalis*	**D59**	Chickenpox	**D108**	Murray Valley encephalitis virus infection
D11	Carbapenem-resistant *Acinetobacter*	**D60**	Chikungunya virus infection	**D109**	*Mycobacterium tuberculosis*
D12	Carbapenem-resistant Enterobacteriaceae .CRE	**D61**	*Chlamydia* spp	**D110**	Mycoplasma PCR
D13	Carbapenem-resistant *Pseudomonas aeruginosa*	**D62**	Chytridiomycosis.*Batrachochytrium dendrobatidis*	**D111**	*Neisseria gonorrhoeae*
D14	Carbapenem-resistant.ESBL-.Enterobacteriaceae	**D63**	Coccidia	**D112**	*Neisseria meningitidis*
D15	Clarithromycin-resistant *Helicobacter pylori*	**D64**	Creutzfeldt.Jakob disease .CJD	**D113**	Neospora
D16	*Clostridioides difficile*	**D65**	*Cryptococcus gattii*	**D114**	Paratyphoid fever
D17	Coronaviruses	**D66**	Dengue virus	**D115**	Pasturella typing
D18	*Coxiella burnetii*	**D67**	Dermatophytosis.Ringworm	**D116**	Pertussis
D19	Cryptococcus neoformans	**D68**	Diphtheria	**D117**	Pneumococcal disease. invasive
D20	Cryptosporidiosis	**D69**	Donovanosis	**D118**	Poliovirus infection
D21	Drug-resistant *Mycobacterium tuberculosis*	**D70**	*Echinococcus granulosus*	**D119**	Psittacosis
D22	Drug-resistant Neisseria gonorrhoeae	**D71**	Enterobacterales	**D120**	Rabies
D23	MDR *Streptococcus pneumoniae*	**D72**	*Enterococcus faecium*	**D121**	Respiratory syncytial virus
D24	ER Group A Streptococcus	**D73**	*Enterococcus faecium.*VRE	**D122**	Ross River virus infection
D25	*Escherichia coli* O111:H1	**D74**	*Equine Influenza*	**D123**	Rotavirus infection
D26	FR.Campylobacter spp.	**D75**	Flavivirus infection.Zika	**D124**	Rubella
D27	Fluoroquinolone-resistant *Salmonella* spp.	**D76**	FMD	**D125**	Sarcocystis spp.
D28	Fluoroquinolone-resistant *Shigella* spp.	**D77**	Francisella tulare. Tularemia	**D126**	Sarcoptic mange
D29	Fusarium spp.	**D78**	Fungal ID	**D127**	Scrapie
D30	Hantaviruses	**D79**	Giardia spp	**D128**	Screw-worm fly
D31	*Histoplasma* spp.	**D80**	Group A strep. invasive	**D129**	STEC
D32	Influenza viruses with pandemic potential	**D81**	Haemolytic uraemic syndrome	**D130**	Shingles
D33	Mucorales -Rhizopus spp.	**D82**	Haemophilus influenzae type b	**D131**	Smallpox

D34	MDR.Pseudomonas aeruginosa	**D83**	HBV. HCV	**D132**	*Staphylococcus aureus.*MRSA
D35	Nipah	**D84**	Heartworm	**D133**	*Streptococcus agalactiae*
D36	Penicillin-R-*Streptococcus pneumoniae*	**D85**	Hendra virus	**D134**	*Streptococcus pyogenes*
D37	*Rickettsia prowazekii*. Typhus	**D86**	Hepatitis A	**D135**	*Strongyloides stercoralis*
D38	*Salmonella* spp.	**D87**	Hepatitis B	**D136**	Syphilis
D39	Scedosporium spp.	**D88**	Hepatitis C	**D137**	Tetanus
D40	*Shigella* spp.	**D89**	Hepatitis D	**D138**	*Toxoplasma gondii*
D41	Vancomycin-resistant Enterococcus faecium	**D90**	Hepatitis E	**D139**	Trichomonas
D42	Van-Staphylococcus aureus. VRSA	**D91**	Human immunodeficiency virus	**D140**	Trichophyton spp.
D43	Vibrio cholerae	**D92**	Hydatid disease	**D141**	Typhoid fever
D44	Viral hemorrhagic fevers.Ebola.Marburg.Lassa	**D93**	Influenza AB	**D142**	Varicella zoster infection
D45	Alphaviruses	**D94**	*Japanese encephalitis*	**D143**	Viral haemorrhagic fever
D46	Australian bat lyssavirus infection	**D95**	Johne's disease	**D144**	West Nile virus infection.Kunjin virus
D47	*Avian Influenza*.HPAI.LPAI	**D96**	*Klebsiella*	**D145**	Yellow fever
D48	Avian influenza in humans.bird flu	**D97**	*Legionella pneumophila, L. longbeachae*	**D146**	*Yersinia pestis* - Plague
D49	*Bacillus anthracis*. Anthrax	**D98**	Leprosy		

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Author contribution:

Vathsala Mohan – Conceptualization of AURA, WHO and CDC -- One health related analysis, methodology design, Conducted interviews and stakeholders' engagement, data collection and analysis, manuscript writing.

Kylie Hewson – Conceptualization, methodology design, manuscript review and editing

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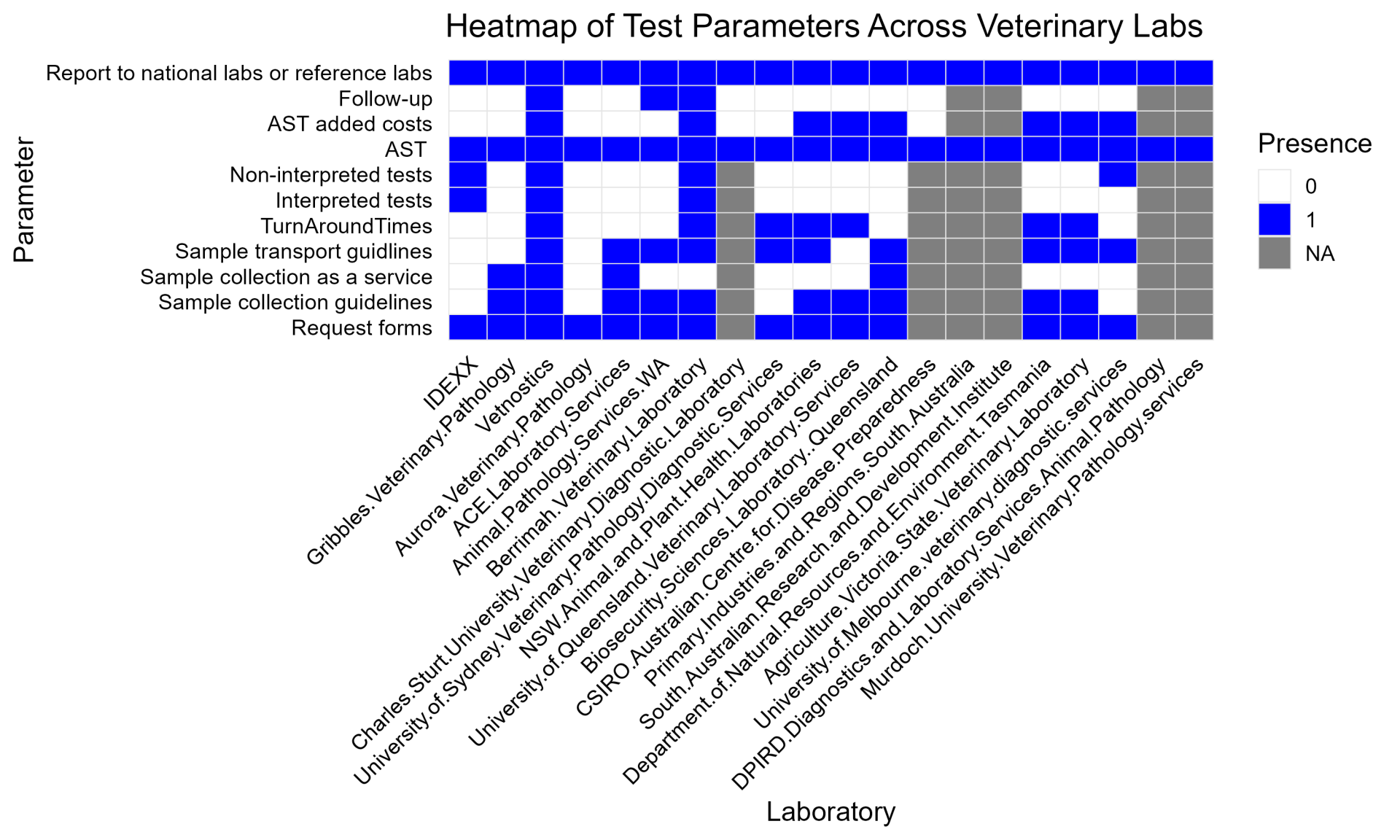
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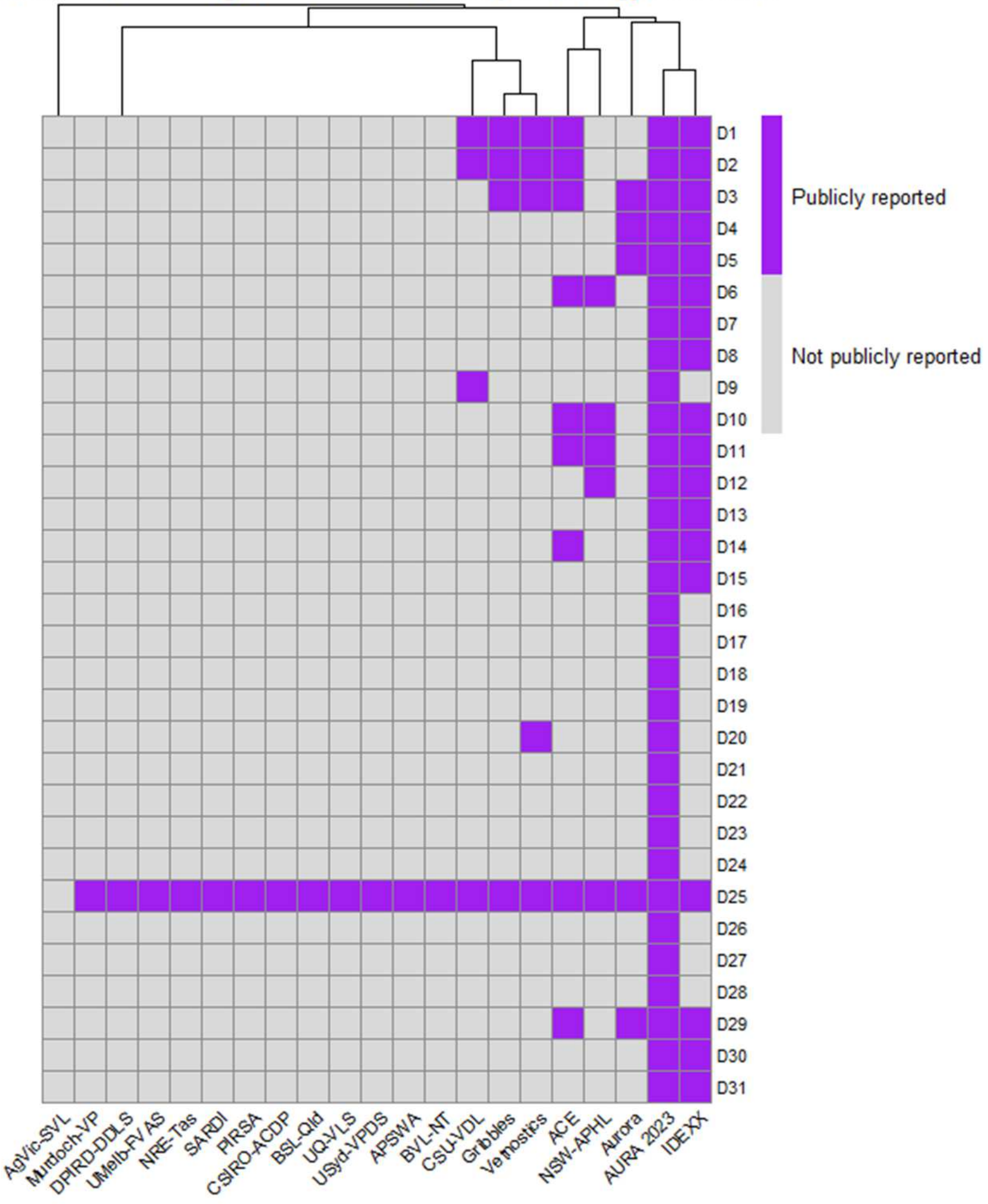
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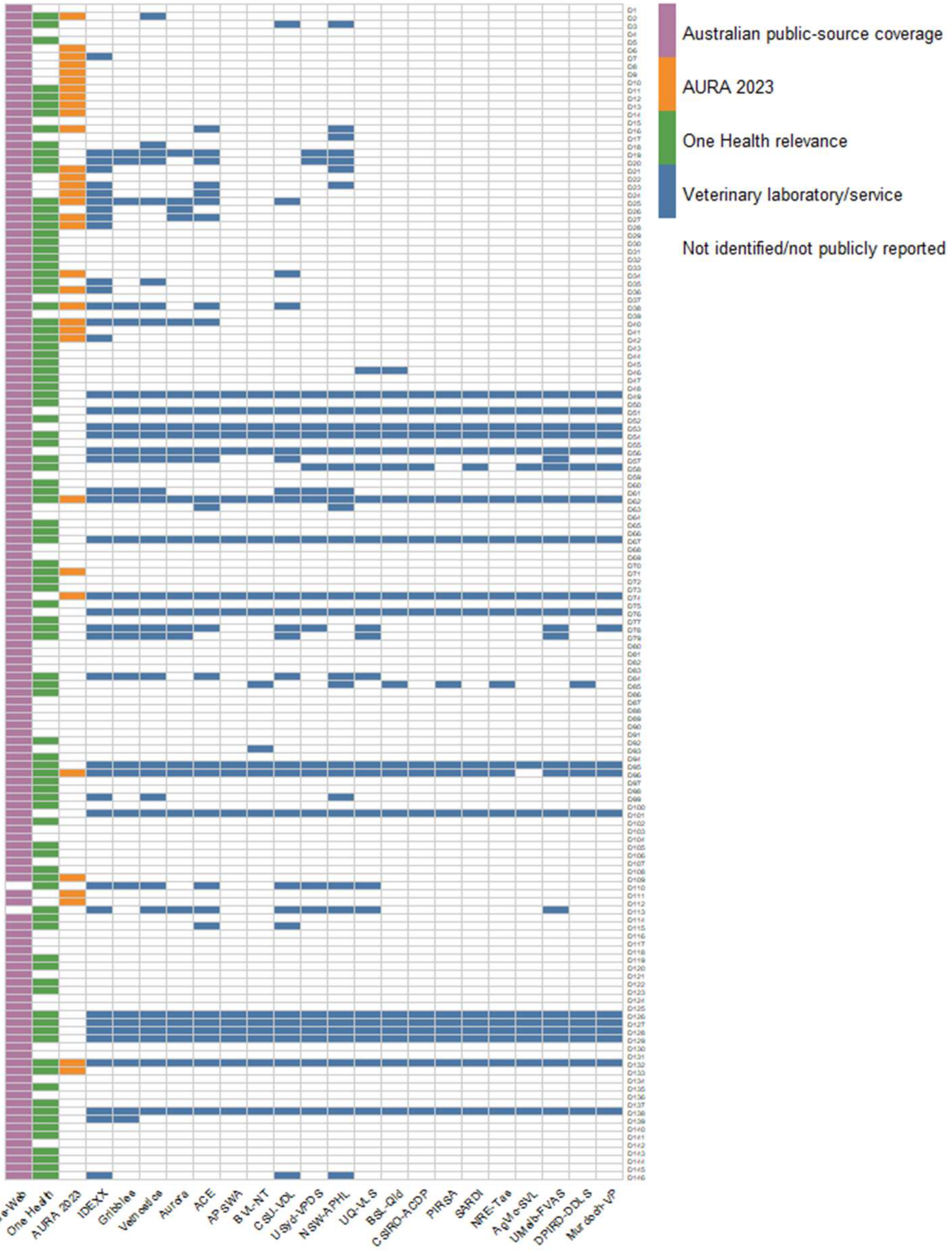
Appendix 1 : This appendix consists of the raw data of the list of labs used for antimicrobial resistance research and analysis.


Heatmap of Test Parameters Across Veterinary Labs
Parameter
Report to national labs or reference labs
Follow-up
AST added costs
AST
Non-interpreted tests
Interpreted tests
TurnAroundTimes
Sample transport guidlines
Sample collection as a service
Sample collection guidelines
Request forms
IDEXX
Gribbles.Veterinary.Pathology
Vetnostics
Aurora.Veterinary.Pathology
ACE.Laboratory.Services.WA
Animal.Pathology.Services
Berrimah.Veterinary.Laboratory
Charles.Sturt.University.Veterinary.Pathology.Diagnostic.Laboratory
University.of.Sydney.Veterinary.Diagnostic.Services
NSW.Animal.and.Plant.Health.Laboratories
University.of.Queensland.Veterinary.Laboratory.Services
Biosecurity.Sciences.Laboratory..Queensland
CSIRO.Australian.Centre.for.Disease.Preparedness
Primary.Industries.and.Regions.South.Australia
South.Australian.Research.and.Development.Institute
Department.of.Natural.Resources.and.Environment.Tasmania
Agriculture.Victoria.State.Veterinary.Laboratory
University.of.Melbourne.veterinary.diagnostic.services
DPIRD.Diagnostics.and.Laboratory.Services.Animal.Pathology
Murdoch.University.Veterinary.Pathology.services
Laboratory
Presence
0
1
NA

AURA Listed Pathogens versus Veterinary Pathology Lab Tests



One Health and AURA comparison with publicly reported Australian veterinary laboratory testing



Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- AppendixTable1.xlsx