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# Integrated One Health surveillance of canine visceral leishmaniasis in a military institutional kennel in Brazil: retrospective implementation analysis and international benchmarking

**Priscila Menezes Henrique**
State University of Ceará
**Virna Ribeiro Feitosa Cestari**
State University of Ceará
**Lara Lídia Ventura Damasceno**
State University of Ceará
**Thiago Martins de Sousa**
State University of Ceará
**Samuel Miranda Mattos**
State University of Ceará
**Thereza Maria Magalhães Moreira**
State University of Ceará
**Thiago Santos Garces**
santos.garces@uece.br
State University of Ceará

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# Abstract

Canine visceral leishmaniasis surveillance in institutional kennels requires more than diagnostic testing because dogs, handlers, vectors, public-health services and institutional management interact within a shared environment. We conducted a retrospective implementation analysis of routine surveillance records from 2022 to 2026 in a military kennel in northeastern Brazil and benchmarked its surveillance architecture against selected international canine and One Health models. Institutional sources included health records, laboratory reports, technical communications and dual-path platform (DPP)-reactive screening episodes referred for enzyme-linked immunosorbent assay (ELISA) confirmation. Seven surveillance domains were predefined: working or institutional dog setting, repeated surveillance, Leishmania testing, prevention or control, environmental or vector component, human or public-health integration, and institutional management or governance integration. Comparator models comprised French military kennels, U.S. government working dogs, and integrated human-canine-sand-fly surveillance in Sicily. The kennel pathway introduced standardized records, sequential testing, deltamethrin-collar management, sanitary criteria for dog movement, environmental measures, staff education, municipal zoonosis-surveillance coordination and management communication. Thirteen DPP-reactive episodes were referred for confirmation; five were ELISA-reactive. Benchmarking showed complementary international emphases: long-term prevention in French military kennels, sentinel pathogen surveillance in U.S. working dogs, and human-canine-vector integration in Sicily. The Brazilian institutional pathway explicitly combined all seven predefined operational domains. This integrated architecture provides a practical One Health model for managed dog populations in endemic settings and links animal health, public health, environment and institutional governance.


# 1. Introduction

Visceral leishmaniasis is a vector-borne zoonosis classified among the neglected tropical diseases and remains relevant to public health in the Americas. Persistent transmission, the severity of human disease and the complexity of prevention and control require continuous surveillance adapted to local settings. In the Brazilian urban zoonotic cycle, dogs (Canis lupus familiaris Linnaeus, 1758) are central reservoirs of Leishmania infantum, making canine surveillance part of a broader strategy that connects animal, human and environmental health. Recent canine surveillance in northeastern Brazil has also documented exposure to multiple vector-borne pathogens, including L. infantum, reinforcing the value of dogs as sentinels in endemic landscapes (Pan American Health Organization 2025; Brazil 2026; Ubirajara Filho et al. 2026).

The One Health approach recognizes the interdependence of human, animal and ecosystem health and promotes coordinated action across sectors and disciplines. For zoonotic vector-borne infections, this implies not only pathogen detection but also information flows, preventive measures, environmental actions and coordination with public-health services. A global environmental scan identified 33 companion-animal health surveillance systems and found that fully integrated One Health models remain uncommon; only three systems integrated environmental or public-health data at the point of data collection (Grieve et al. 2026).

In Brazil, the recommended serological protocol for canine visceral leishmaniasis surveillance uses a dual-path platform rapid immunochromatographic test (DPP) for screening and an enzyme-linked immunosorbent assay (ELISA) for confirmation. A reactive screening result does not, by itself, represent the final classification

of an animal; interpretation requires completion of the diagnostic sequence (Schubach et al. 2014; Figueiredo et al. 2018; Brazil 2026).

Institutional kennels housing working or service dogs occupy a distinctive human-animal-environment interface. International surveillance models have emphasized different dimensions of this interface: long-term clinical and serological follow-up with deltamethrin-collar prevention in French military kennels, sentinel surveillance of vector-borne pathogens among U.S. government working dogs, and integrated human-canine-vector surveillance in Sicily (Davoust et al. 2013; Meyers et al. 2021; Bruno et al. 2026). Less documented is how these dimensions can be combined operationally within the routine management of an institutional kennel.

This study aimed to describe the implementation and operational outcomes of canine visceral leishmaniasis surveillance in a military institutional kennel in northeastern Brazil and to benchmark its surveillance architecture against selected international canine and One Health models using predefined operational domains.

## 2. Materials and methods

# 2.1. Study design and setting

This retrospective descriptive implementation study was based on secondary data from routine canine visceral leishmaniasis surveillance records in an institutional kennel linked to a public military organization in northeastern Brazil. The study period extended from 2022 to 2026, from the beginning of process reorganization to the most recent laboratory records available for analysis.

The implementation process involved the institutional veterinary service, staff responsible for dog care and handling, the municipal zoonosis surveillance unit, and institutional management. Activities included clinical and sanitary assessment, follow-up of the diagnostic pathway, organization of records, use and replacement of preventive supplies, environmental management, staff guidance, and communication of needs to management.

# 2.2. Institutional data sources and surveillance components

Secondary data sources consisted of routine health records, a control spreadsheet of episodes with reactive screening tests referred for ELISA confirmation, a spreadsheet documenting the disposition of confirmed cases, available laboratory reports and technical communications addressed to management. These sources were reviewed to reconstruct the surveillance pathway and operational changes implemented during the study period.

Institutional information was organized around surveillance components identifiable in routine practice: health records; diagnostic pathway; preventive measures; environmental management; staff education; criteria for animal movement; interinstitutional coordination; communication with management; documented laboratory results; and incorporation of actions into routine practice.

# 2.3. Diagnostic pathway and quantitative summary

The diagnostic pathway used the dual-path platform rapid immunochromatographic test (DPP) for screening and ELISA as the confirmatory test for episodes with reactive screening results, in accordance with the national protocol in force. From the control spreadsheet, we extracted year of sample collection, screening result, confirmatory ELISA result, and the aggregate classification of each testing episode.

The study dataset comprised 13 documented testing episodes with reactive DPP screening results referred for ELISA confirmation. Some dogs had more than one record over the study period; therefore, the unit of analysis was the testing episode. From the control spreadsheet, year of sample collection, screening result, confirmatory ELISA result and aggregate classification were summarized using absolute frequencies.

## 2.4. International surveillance benchmarking

A structured international benchmark was constructed to compare the surveillance architecture of the kennel with canine models directly relevant to working-dog or integrated One Health surveillance. Targeted searches in PubMed and SpringerLink used combinations of the terms “canine leishmaniasis”, “working dogs”, “military dogs”, “surveillance”, “One Health” and “companion animal surveillance”. Three peer-reviewed comparators were selected because they represented distinct but directly relevant models: long-term military kennel surveillance in France (Davoust et al. 2013), vector-borne pathogen surveillance among U.S. government working dogs (Meyers et al. 2021), and integrated human-canine-sand-fly surveillance in Sicily (Bruno et al. 2026).

Seven domains were coded from each source: working or institutional dog setting; repeated or multi-year canine surveillance; Leishmania laboratory testing; preventive or control intervention; environmental or vector component; human or public-health integration; and institutional management or governance integration. A domain was classified as reported only when explicitly described in the source; otherwise it was classified as not reported. Domain selection was informed by categories used in the global companion-animal surveillance scan of Grieve et al. (2026), particularly surveillance scope and environmental or public-health integration.

## 2.5. Confidentiality and data protection

Results were reported in aggregate. Names of people and animals, sample codes, potentially identifying dates, the exact location, unit identification and operationally sensitive information were excluded. Outcomes of confirmed cases were used only in aggregate, without individual reconstruction or nominal linkage.

# 3. Results

## 3.1. Reorganization of the surveillance system

In 2022, canine health monitoring relied on individual records documenting vaccination, deworming, use of antiparasitic collars, and clinical care. Testing for leishmaniasis was requested mainly in response to clinical changes or specific sanitary demands. Although care practices were in place, laboratory results, decisions, and outcomes remained dispersed and were not consolidated in a single monitoring system.

During the transition in technical responsibility, previous prevention and management practices were identified, including vaccination with the product then available, use of deltamethrin-impregnated collars and

clinical follow-up. From 2023 onward, after the previously used vaccine became unavailable, prevention relied mainly on diagnostic surveillance, collars, environmental management and staff education.

The presence of reactive confirmatory results in the records and reported loss of animals increased the need to organize the surveillance process. Reorganization formalized communication with the municipal zoonosis surveillance unit and integrated clinical follow-up, prevention, environmental actions, education, record keeping, and communication with management. The main operational changes are shown in Table 1.

Table 1
Operational changes before and after reorganization of canine visceral leishmaniasis surveillance in an institutional kennel, northeastern Brazil 2022–2026.

| Component | Before reorganization (2022) | After reorganization (2022–2026) |
|---|---|---|
| Health records | Manual and heterogeneous individual records, with incomplete and non-standardized information. | Standardized and systematized records, with updated individual information and periodic consolidation. |
| Diagnostic pathway | Testing mainly driven by clinical demand, without a formal pathway. | Pathway coordinated with municipal surveillance: DPP screening, ELISA confirmation, and communication of the final classification. |
| Deltamethrin collars | Use of collars without systematic control of placement and replacement dates. | Control of placement and replacement dates, with scheduled replacement and supply planning. |
| Interinstitutional communication | Occasional and informal contact with municipal zoonosis surveillance. | Formalized communication channel with the municipal zoonosis surveillance unit. |
| Animal movement | No formal sanitary criteria for admission, departure, or transfer. | Sanitary criteria defined for admission, movement, and disposition, with documented information. |
| Staff education | Sporadic and non-systematized guidance. | Periodic guidance on leishmaniasis, other zoonoses, and implementation of preventive measures. |
| Environmental management | Occasional actions without a defined routine. | Enhanced routine for cleaning, organic matter removal, vegetation management, and reduction of moisture sources. |
| Monitoring and evaluation | No systematic data consolidation. | Periodic consolidation of records to monitor the process and support decision-making. |

Note. DPP, dual-path platform rapid immunochromatographic test; ELISA, enzyme-linked immunosorbent assay.

## 3.2. Interinstitutional coordination and surveillance pathway

Coordination with the municipal zoonosis surveillance unit began with presentation of the sanitary situation, a technical meeting, and a visit to the kennel. Cooperation expanded access to the public diagnostic pathway, including screening, referral of reactive samples for confirmation, and communication of the final classification.

The process then involved the institutional veterinary service, dog-handling staff, municipal surveillance professionals, the laboratory, and institutional management in a coordinated manner. Kennel staff contributed to observation of the dogs, maintenance of preventive measures, organization of access for sample collection, record updating, and implementation of environmental guidance. Management received formal communications about supply needs and opportunities for structural improvement.

The operational pathway came to connect identification of a clinical need or sanitary assessment, communication with municipal surveillance, sample collection, DPP screening, ELISA confirmation when indicated, communication of the final classification, record updating, and definition of clinical, sanitary, environmental, and institutional measures. The sequence and its One Health interfaces are summarized in Table 2.

Table 2
Integrated canine visceral leishmaniasis surveillance pathway and One Health interfaces in an institutional kennel, northeastern Brazil 2022–2026.

| Step | Implemented pathway | One Health interfaces |
|---|---|---|
| 1 | Identification of a clinical need or sanitary assessment | Dogs, handling staff, and veterinary service |
| 2 | Coordination with the municipal zoonosis surveillance unit | Institutional service and public health surveillance |
| 3 | Sample collection and DPP screening | Dogs, collection team, and laboratory |
| 4 | ELISA confirmation when screening was reactive | Laboratory and municipal surveillance |
| 5 | Communication of the final classification and sanitary follow-up | Veterinary service and kennel staff |
| 6 | Measures directed at animals, the environment, and staff education | Animal health, environment, and occupational health |
| 7 | Record updating and communication with management | Surveillance, institutional management, and public health |

Note. Numbering indicates the operational sequence. DPP, dual-path platform rapid immunochromatographic test; ELISA, enzyme-linked immunosorbent assay.

## 3.3. Preventive, environmental and educational measures

Follow-up expanded beyond clinical demands to include sanitary assessments coordinated with municipal surveillance. Sanitary criteria were incorporated for admission, movement, and disposition of animals, with prior assessment and documentation intended to improve sanitary traceability.

Deltamethrin-impregnated collars were maintained on the dogs, with control of placement dates and early replacement in the event of damage or loss. The local routine scheduled replacement every four months according to the established practice for the product used during the period, and supply requests became planned to support continuity.

Environmental measures included reinforced vegetation management, removal of organic matter and reduction of moisture sources. Citronella-based products and light traps were used as complementary measures. Guidance on leishmaniasis and other zoonoses, collar maintenance, animal observation and cleaning was intensified, while structural adaptations, including installation of screens, remained options for subsequent stages.

## 3.4. Laboratory findings and institutional outcomes

Thirteen episodes with reactive DPP screening results were referred for ELISA confirmation. Five were reactive by ELISA and eight were non-reactive. Four episodes occurred in 2022, one in 2023, three in 2024, two in 2025 and three in 2026. Confirmatory reactive results occurred in 2022, 2023, 2024 and 2026; in 2025, neither reactive screening episode was confirmed (Table 3).

Table 3
Distribution of testing episodes with reactive screening results according to confirmatory test result by year, military institutional kennel, northeastern Brazil 2022–2026 (n = 13).

| Year | Reactive screening episodes referred for ELISA (n) | ELISA reactive (n) | ELISA non-reactive (n) |
|---|---|---|---|
| 2022 | 4 | 2 | 2 |
| 2023 | 1 | 1 | 0 |
| 2024 | 3 | 1 | 2 |
| 2025 | 2 | 0 | 2 |
| 2026 | 3 | 1 | 2 |
| Total | 13 | 5 | 8 |

Note. Data represent testing episodes with reactive screening results referred for ELISA confirmation; some dogs contributed more than one testing episode. ELISA, enzyme-linked immunosorbent assay.

The eight non-reactive ELISA results after reactive DPP screening underscored the operational importance of completing the sequential diagnostic protocol before final classification and sanitary decision-making.

Disposition records associated with confirmed episodes included euthanasia, rehoming through donation and deaths attributed to disease progression, according to veterinary assessment, applicable regulations and animal-welfare criteria. These outcomes were summarized in aggregate.

## 3.5. International surveillance benchmark

International benchmarking identified complementary surveillance architectures. The French military-kennel model explicitly reported a working-dog setting, repeated follow-up, Leishmania testing and a preventive intervention based on deltamethrin-impregnated collars. The U.S. government working-dog model combined a defined working-dog population with multi-pathogen surveillance including Leishmania, whereas repeated follow-up, integrated preventive intervention, environmental surveillance and public-health service integration were not reported as study components. The Sicilian model combined multi-year canine surveillance with

human case detection and entomological and climatic monitoring, while a working-dog setting, preventive intervention and institutional management integration were not reported as core components.

In the present kennel, all seven predefined domains were explicitly documented: institutional working-dog setting, repeated surveillance, Leishmania laboratory testing, prevention and control, environmental management, municipal public-health integration, and institutional management or governance integration. The distinguishing configuration was the operational linkage of these domains in routine practice rather than the presence of any single component. At the broader companion-animal level, only 3 of 33 surveillance systems identified by Grieve et al. (2026) integrated environmental or public-health data at data collection, underscoring the relative scarcity of explicitly integrated surveillance models.

## 3.6. Incorporation into routine practice and priorities for continuity

Implementation consolidated an ongoing partnership with the municipal zoonosis surveillance unit, completion of sequential testing, organized collar replacement, sanitary criteria for animal movement, periodic staff guidance, and communication of needs to management. Surveillance became part of the kennel's routine sanitary practice.

Priorities for continuity included infrastructure improvement, continued coordination of environmental management, supply planning, further standardization of records and definition of process indicators.

# 4. Discussion

This study combines retrospective implementation analysis with a structured international benchmark to examine not only what occurred in the kennel, but how its surveillance architecture compares with established canine and One Health models. The principal contribution is the explicit operational linkage of diagnostic surveillance, prevention, environmental management, public-health coordination and institutional governance within a managed working-dog population.

The international comparison highlighted complementary surveillance emphases. The French military-kennel experience demonstrated the value of long-term follow-up and systematic deltamethrin-collar prevention; U.S. government working-dog surveillance illustrated the sentinel value of highly exposed managed dogs for vector-borne pathogens; and the Sicilian model integrated canine infection with human cases, sand-fly surveillance and climatic variables (Davoust et al. 2013; Meyers et al. 2021; Bruno et al. 2026). The present pathway differed by embedding several of these dimensions into routine service organization, including formal coordination with municipal zoonosis surveillance and institutional management.

This operational integration is relevant to companion-animal surveillance more broadly. In a global environmental scan of 33 systems, Grieve et al. (2026) found few fully integrated One Health examples and only 9.1% incorporated environmental or public-health data at the point of data collection. Managed kennels may therefore function as bounded settings in which veterinary records, laboratory pathways, prevention, environmental actions and public-health communication can be connected in a traceable routine. Recent surveillance of rural dogs in northeastern Brazil similarly reinforces the epidemiological value of canine

monitoring for vector-borne pathogens, although the present study extends this perspective toward institutional coordination and governance (Ubirajara Filho et al. 2026).

Formalization of records and interinstitutional communication was a central component of this architecture. Dispersed clinical, laboratory and preventive information limited longitudinal assessment; after reorganization, records supported follow-up of the diagnostic pathway, supply replacement, animal movement and communication with management. In institutional settings, this traceability supports continuity when professionals or responsibilities change and creates a practical information bridge between veterinary care and public-health surveillance.

Incorporating disposition records extended this traceability. In an institutional kennel, the outcome of a confirmed case is not limited to individual clinical care; it may require sanitary decisions, animal-welfare assessment, formal communication, and administrative action. Aggregated presentation of these outcomes documented the complexity of the process without exposing animals, professionals, or internal procedures. Similarly, harmonizing identification, dates, laboratory reports, and individual records became part of the surveillance system itself rather than an ancillary documentation task.

The sequential diagnostic protocol was another structural element. DPP is used for screening and ELISA for confirmation in the Brazilian protocol; therefore, a reactive screening result should trigger completion of the pathway rather than definitive classification of the animal (Brazil 2026). Brazilian studies show variation in test performance and agreement according to population, clinical status, biological matrix, and reference standard (Schubach et al. 2014; Figueiredo et al. 2018; Teixeira et al. 2019; Sevá et al. 2021). In the present records, eight of 13 episodes with reactive screening results were non-reactive by ELISA, operationally illustrating the importance of completing the protocol before sanitary or institutional decisions are made.

Preventive and environmental measures broadened surveillance beyond diagnosis. Scheduled use of deltamethrin-impregnated collars was incorporated into routine practice with monitoring of replacement, paralleling the long-term preventive emphasis reported in French military kennels (Davoust et al. 2013). Brazilian studies also indicate protective effects in dogs and potential contributions to collective strategies, while documenting challenges related to coverage, continuity and retention (Leite et al. 2018; Silva et al. 2019; Werneck et al. 2024; Matsumoto et al. 2025). Vegetation management, organic matter removal, moisture control, citronella, light traps and proposed structural screens connected individual dog protection with management of the shared environment in which animals and handlers interact.

Vaccination was part of the historical context rather than an evaluated intervention. Until 2022, the product then available was reported as one of the preventive measures; from 2023, its unavailability shifted the operational emphasis toward diagnostic surveillance, collars, environmental management, and education. The current national manual considers vaccination an individual protective measure and emphasizes insufficient evidence to attribute reductions in transmission to mass canine vaccination; a field trial demonstrated individual efficacy of Leish-Tec under specific conditions (Regina-Silva et al. 2016; Brazil 2026). Therapeutic decisions, in turn, remain dependent on veterinary assessment, applicable regulations, animal welfare, and sanitary risk considerations.

Daily participation of workers in dog handling and environmental hygiene strengthens the human-animal interface of surveillance. Continuing education, safe work practices and risk communication were incorporated into routine activities. Research in Brazilian military settings has also documented sand fly fauna and potential Leishmania hosts, reinforcing the relevance of contextualized vector and host surveillance in these environments (Sousa et al. 2026). The military nature of the institution required alignment of sanitary decisions with formal administrative processes and protection of operationally sensitive information while maintaining cooperation with public health surveillance.

Sustainability depended less on any single intervention than on embedding tasks into routine practice: a communication channel with municipal surveillance, completion of the diagnostic protocol, traceable records, supply planning, movement criteria, staff education, and coordination with management. These components may be useful in other institutional kennels, whether military or civilian, provided they are adapted to local technical responsibilities, risks, resources, and capacities.

Interpretation should consider the retrospective use of routine records, the episode-based unit of analysis, the absence of complete annual denominators and the lack of entomological measurements. The international benchmark was targeted rather than exhaustive and depended on what comparator publications explicitly reported. To reduce interpretive overreach, domains were coded only when directly documented, non-reporting was not treated as proof of absence, and no prevalence or effect estimates were compared across heterogeneous dog populations. The comparison was therefore restricted to surveillance architecture, while the institutional results remained based on the kennel records.

Overall, the study shows how canine visceral leishmaniasis surveillance can be organized as an integrated One Health routine rather than as an isolated diagnostic activity. By linking sequential testing, preventive and environmental measures, staff engagement, municipal zoonosis surveillance and institutional governance, the kennel model combined operational domains that international comparators generally emphasized separately. This architecture may be adaptable to other managed dog or companion-animal settings in endemic areas, with local adjustment of diagnostic, environmental and public-health responsibilities.

## Declarations

# Competing interests

The authors have no relevant financial or non-financial interests to disclose.

**Ethics approval**

Ethical approval was not required for this retrospective analysis of routinely collected surveillance records.

# Funding

No funding was received for conducting this study.

# Author Contribution

PMH: Conceptualization, Investigation, Data curation, Methodology, and Writing – original draft. TSG: Conceptualization, Methodology, Supervision, and Writing – review and editing. VRFC, LLVD, TMS, SMM, and TMMM: Writing – review and editing. All authors critically reviewed the manuscript, approved the final version, and agreed to be accountable for the work.

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# Data Availability

The institutional data supporting the findings of this study are available from the corresponding author upon reasonable request. Data used for the international benchmarking were obtained from publicly available sources cited in the manuscript.

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## Figures

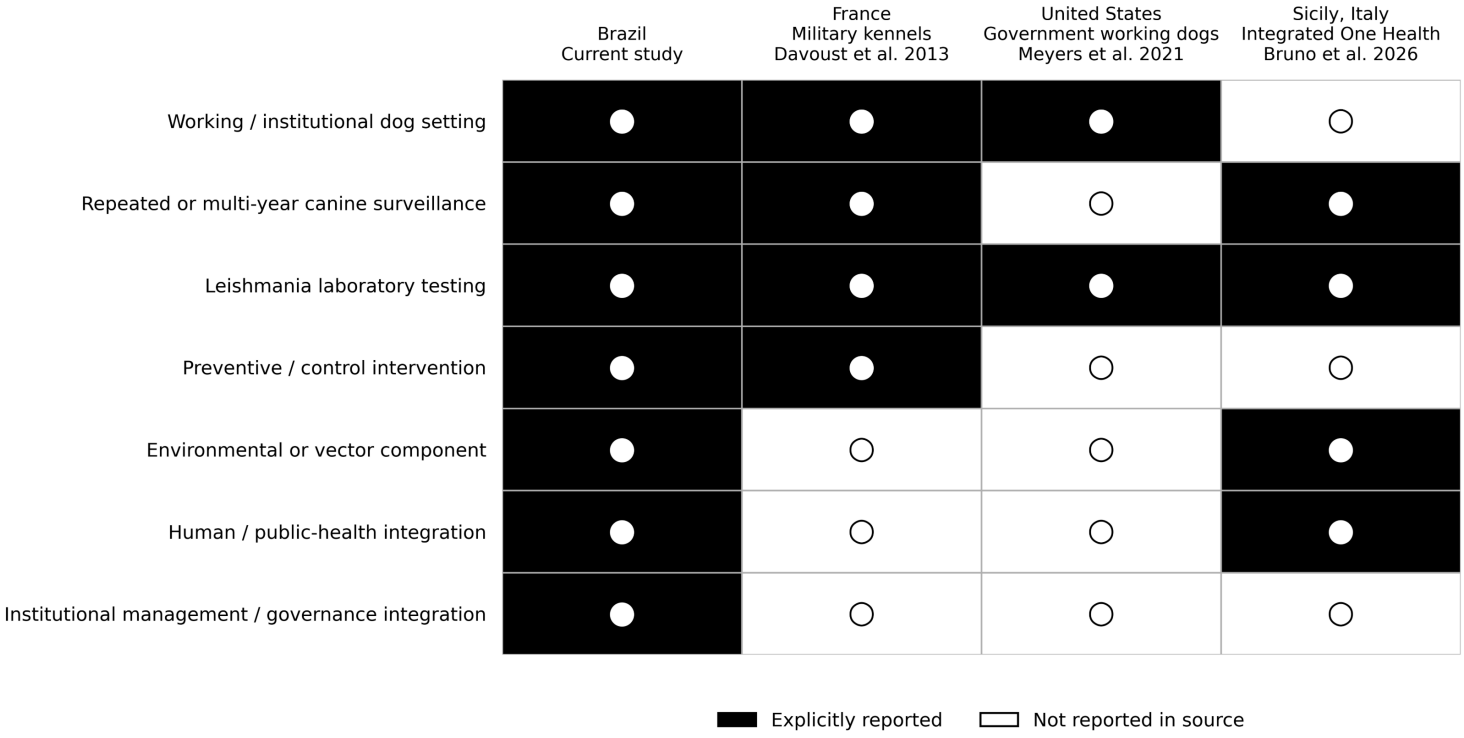



**Figure 1**

International benchmarking of reported surveillance components in the current institutional kennel and selected international canine and One Health models. Filled cells indicate explicitly reported components; open cells indicate components not reported in the source. Comparators: Davoust et al. (2013), Meyers et al. (2021), and Bruno et al. (2026).