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Research article

MANAGEMENT OF ABANDONED DOGS IN SERBIA: DIVERGENT OUTCOMES ACROSS THREE MUNICIPAL SERVICE MODELS

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Management of free-roaming dogs is a continuing challenge for animal welfare, public health and local administration. In Serbia, this challenge is shaped by a structural inconsistency: the Veterinary Law defines zoohygiene as a veterinary public health activity requiring professional competence and traceability, while the Public Utilities Law classifies it as a communal service. This dual framework has produced three institutional models with significantly different outcomes. This study compares the integrated veterinary public-service model, the municipal public utility model and the private contractor model. Legal documents, municipal records, financial reports and operational data obtained from local authorities were analyzed to assess how each model manages abandoned animals and ensures transparency and humane practices. Findings show that the integrated veterinary model provides reliable outcomes, including individual records, verifiable sterilization numbers and low mortality. The public utility model shows fragmented or absent data and high mortality despite substantial public spending. The private contractor model presents the lowest transparency, with municipalities lacking access to operational data and with outcomes inconsistent with humane population management. The results indicate that current Serbian practice diverges from European approaches, which place dog population management within veterinary or public health systems. Strengthening veterinary overview, improving data transparency and limiting reliance on non veterinary participants are necessary to support effective, humane and accountable population management.

Keywords: animal welfare, dog population management, public health, traceability, zoo-hygiene

INTRODUCTION

The management of free-roaming dog populations represents a significant challenge for both animal welfare and public health. As perceptive beings, free roaming dogs possess the capacity to experience pain, fear, stress and positive emotional states,

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a fact recognized in contemporary animal welfare [1-4] and in international legal standards [5-7]. Effective population control requires veterinary overview, transparent monitoring and responsible ownership. Catch–neuter–return (CNR) programs have been shown to reduce population growth, dog bites and zoonotic risks when properly implemented. [8-11].

Evidence from Serbia is consistent with these findings. Studies demonstrate that the incidence of dog bites correlates with the size of uncontrolled roaming populations [12,13] and underline the importance of sterilization and responsible ownership in reducing both population growth and bite-related risks [14,15]. Public and legal debates have additionally highlighted potential abuses of compensation claims for dog bites, including allegations of fabricated injuries, an issue discussed in Serbian civil law scholarship [16].

Serbia's institutional framework for animal control, however, developed relatively late and without earlier coordinated national policies. The 2005 Veterinary Law initially framed zoo-hygiene as a veterinary public health activity, linking it to zoonoses control, biosecurity and animal welfare protection. Municipalities were required to organize services responsible for capturing and caring for abandoned animals, managing shelters, and safely handling animal carcasses and by-products.

At the same time, the law did not specify that zoohygiene must be performed by licensed veterinary institutions or define minimum professional standards for service providers. In contrast, neighboring EU countries such as Croatia and Slovenia restrict zoohygiene activities to licensed veterinary entities, thereby ensuring professional oversight. Serbian legislation, by comparison, left the choice of providers largely open.

Later regulatory developments introduced a parallel classification of zoohygiene as a communal service. Under the Public Utilities Law, zoo-hygiene is grouped together with sanitation, disinfection, pest control and waste management. This shift moved the regulatory emphasis from veterinary governance toward communal service delivery.

As a result, the current system operates through diverse institutional arrangements. In larger cities such as Belgrade and Novi Sad, zoohygiene is conducted by municipal institutions with licensed veterinary capacity. Elsewhere, responsibilities are frequently delegated to general public utility companies or outsourced to private entities that depend on subcontracted clinics rather than in-house veterinary expertise.

Such configurations weaken accountability and reduce traceability of core procedures, including sterilization, vaccination and animal identification. This makes it difficult to verify animal welfare standards, biosecurity compliance and population control outcomes. The implications extend to public health, particularly in relation to rabies prevention, zoonotic risk management and systematic welfare monitoring.

The consequences are both financial and welfare related. Funds allocated for sterilization, vaccination, sheltering and population management often produce a limited measurable impact. At the same time, inspection reports, freedom-of-information proceedings

(FOI) and civil-society findings repeatedly point to overcrowded shelters, incomplete documentation, questionable sterilization records and, in some instances, euthanasia practices or neglect [15].

Similar structural challenges have been observed in Romania, where fragmented responsibilities, weak oversight and the classification of stray dog management as a municipal sanitation service resulted in persistent deficits in sterilization, traceability and humane handling [17]. These patterns are closely associated with the legal ambiguity between the Veterinary Law and the Public Utilities Law, which can enable outsourcing arrangements that disperse responsibility and dilute oversight. Such arrangements also appear less aligned with prevailing European approaches, where dog-population management is more closely integrated into veterinary public-health systems and subject to transparency requirements [6,7,17,18].

The purpose of this study is to identify and describe the three institutional models currently operating within Serbia's zoohygiene system – one structurally aligned with veterinary governance and two that deviate substantially from it, and to analyze how these models shape actual practices, including financial flows, reporting systems, compliance with CNR obligations and the treatment of animals. By comparing these models and examining the proposed classification of zoo-hygiene as a communal activity in the Draft Animal Welfare Law, the study aims to identify structural factors that hinder humane population management and to outline measures needed for alignment with contemporary veterinary and public-health standards.

MATERIAL AND METHODS

This study applies a qualitative, documentary and legal-analytic methodology commonly used in socio-legal veterinary research [13]. Primary legal sources were examined, including the Veterinary Law, the Public Utilities Law, the Animal Welfare Act and the 2025 Draft Animal Welfare Act [19-22]. These were compared with relevant EU standards on animal welfare governance [7,23,24].

Documentary materials were obtained from Serbian municipalities and included annual budget allocations for zoo-hygiene services, local Programs of Control and Reduction of Abandoned Dogs and Cats, responses to freedom of information (FOI) requests, municipal and veterinary inspection reports, and the 2021 performance/audit findings of the State Audit Institution pertaining to abandoned animal management [25]. Where available, officially reported operational data (captures, sterilization, vaccination, microchipping and euthanasia numbers) were extracted and analyzed descriptively.

Three institutional models were selected for comparative assessment: (1) the integrated veterinary public service model; (2) the municipal public utility outsourcing model; and (3) the private contractor model. Case selection followed a purposive sampling approach aimed at capturing legally and operationally distinct institutional

arrangements in dog population management in Serbia. The objective was analytical comparison of governance models rather than statistical representativeness, and the selected cases are intended as illustrative examples of these arrangements.

Novi Sad was selected to illustrate the integrated veterinary model because zoohygiene services are delivered within a licensed veterinary institution and supported by comprehensive animal-level records. This model is also implemented in Belgrade (JKP "Veterina Beograd"). However, Novi Sad was selected as the primary case because Novi Sad is more comparable in size and governance structure to other Serbian municipalities, while Belgrade has a unique administrative and demographic profile as the capital city.

Požega and Bačka Topola were selected as examples of the municipal public utility model, which is the most widespread arrangement in practice and relies on public utility companies without in-house veterinary capacity. Alternative municipalities operating under similar arrangements were considered, but these two were selected due to data accessibility and availability of FOI-derived documentation.

The private-contractor model is illustrated by "Avenija MB" d.o.o., the most frequently contracted provider of animal control services through municipal public procurement procedures in Serbia. Its selection reflects its extensive engagement across municipalities and the availability of procurement data. Together, these cases illustrate the principal institutional arrangements through which zoohygiene services are implemented in Serbia.

The analytical framework draws on established corruption-governance literature [26-28] and international evidence on catch–neuter–return (CNR) effectiveness [8-11].

No experimental procedures were performed on animals, and no client owned animals were examined or handled for the purposes of this study. All data concerning animals were obtained from municipal administrative records, public sector reports, and official veterinary documentation, without direct interaction with animals or owners.

Ethical approval

The conducted research is not related to animal use. No ethical approval was required or obtained because the study did not involve laboratory animals, experimental procedures or any interventions on live animals, and relied solely on administrative and documentary sources.

RESULTS

Model I – Integrated Veterinary Public-Service Model (JKP "Zoohigijena i veterina Novi Sad", 2024)

The integrated veterinary public-service model, consistent with the Veterinary Law. is exemplified by JKP "Zoohigijena i veterina Novi Sad", which functions both as a municipal utility company and a licensed veterinary institution. In contrast to public utility companies or private contractors, this model conducts all animal control activities in-house, employs professional veterinary staff, and maintains full traceability of procedures and outcomes.

As shown in Table 1, the service captured 3,100 dogs in 2024, sterilized 1,281 animals, administered 2,931 anti-rabies vaccinations and returned all sterilized dogs to their original locations within the CNR programme.

Table 1. Comparative operational indicators and data availability across three institutional models (2024)

Indicator	Model I – JKP "Zoohigijena i veterina Novi Sad"	Model II – JKP "Naš Dom" Požega	Model II – Bačka Topola	Model III – "Avenija MB" d.o.o.
Municipal human population (approx.)	370 000	29 000	26 000	5 000 – 60 000 per municipality (variable)
Institutional type	Municipal veterinary institution (JKP with licensed veterinary unit)	Public utility (no veterinary unit)	Public utility (no veterinary unit)	Private contractor
Captured dogs (n)	3100	1098	177 (reported)	No data
Sterilised dogs (n)	1281	No data	26 (reported)*	No data
Sterilisation rate (%)	41.3 %	No data	26 (reported)*	No data
Microchipped dogs (n)	1281	No data	26 (reported)*	No data
Anti-rabies vaccinations (n)	2931	No data	26 (reported)*	No data
Returned dogs (CNR) (n)	1281	No data	26 (reported)*	No data
Euthanasia (n)	1	27	33	No data
Recorded deaths (n)	27	665	80	No data
Combined mortality (%)	0.9%	63.0%	63.8%	No data
Veterinary infrastructure	Licensed veterinary unit	Subcontracted	Subcontracted	Not required
Operational data availability	Complete individual records (microchip, sterilisation, vaccination, outcome)	Aggregate data only**	Aggregate data only**	Not available
FOI status	Full	Partial	Partial	Not applicable
Annual expenditure / contractual value	44 011 569.96 RSD	8 000 000 RSD	14,250,000 RSD	60 543 656 RSD (33 municipalities)
Revenue model	Municipal price list, procedure-based billing	Municipal budget allocation + subcontracting	Municipal budget allocation + subcontracting	Public procurement (per-contract invoicing)
Traceability of animals	Full	None	None	None
Compliance with CNR	Full	Not evidenced	Not evidenced	None
Systemic risks	Low	High	High	Very high

*Reported CNR figures for Bačka Topola differ from FOI-derived veterinary records, which indicate that only 25 sterilisations were performed between early 2023 and July 2025. These discrepancies limit verification of reported CNR implementation. **Aggregated data refer to summary figures provided by municipal authorities without individual animal-level records (e.g., microchip identification, sterilisation dates, vaccination history, or individual outcomes).

Only one euthanasia and 27 deaths (natural or unavoidable causes) were recorded. Individual records were available for every animal, including microchip number, sterilization status, vaccination history and final outcome.

The financial allocation for animal control services in 2024 amounted to 44 011 569.96 RSD, paid on the basis of completed procedures according to the official municipal price list (Službeni list Grada Novog Sada 67/22, 45/24). Because clinical and operational procedures are performed within the same institution, budget expenditures can be directly linked to documented veterinary interventions. This organizational structure enables a high level of financial transparency and allows verification of how public funds allocated to zoohygiene are translated into measurable veterinary and population management outcomes.

Model II – Municipal Public-Utility Model (JKP "Naš Dom", Požega, 2024 and JKP ''Komgrad'' Bačka Topola)

The second institutional model consists of public utility companies (JKP) assigned animalcontrol responsibilities under the Public Utilities Law despite lacking licensed veterinary infrastructure. Veterinary procedures are routinely subcontracted to private clinics, creating multi-layered delegation chains and weakening accountability. Importantly, private veterinary clinics — like private contractors — are not public authorities under FOI legislation and are therefore not legally obliged to provide information in response to FOI requests.

Table 1 summarizes the available 2024 data for JKP "Naš Dom" Požega. The company captured 1,098 dogs but reported no data on sterilization, microchipping, vaccination or CNR outcomes. Mortality was extremely high: 27 euthanized and 665 recorded deaths (combined mortality 63%). The municipal budget allocation for animal-control services amounted to 8 000 000 RSD.

FOI responses indicate that all operational records are held exclusively by the contracted private veterinary clinic, and that the municipal Programme for the Control and Reduction of Abandoned Dogs and Cats contains no reference to sterilization or CNR measures.

Records from previous years indicate an additional 897 euthanized dogs in 2021 (1,296 captured; 897 euthanized; 423 dead) and 1,384 euthanized dogs in 2022 (1,677 captured; 1,384 euthanized; 264 dead). These figures are presented as contextual trend information illustrating longer-term implementation patterns. They are not included in Table 1 because the comparative analysis across models is based on harmonized 2024 data to ensure temporal comparability between cases. Given previously observed inconsistencies between municipal reports and clinic-level documentation, these historical figures should be interpreted with caution.

Similar institutional features were observed in the municipality of Bačka Topola, where zoo-hygiene responsibilities are assigned to a public-utility company without

in-house veterinary capacity and clinical procedures are subcontracted to a private veterinary clinic.

According to FOI-derived municipal budget data, total allocations for zoo-hygiene services amounted to 13,250,000 RSD in 2023, 14,250,000 RSD in 2024, and 13,500,000 RSD in 2025. Within these amounts, funding specifically earmarked for CNR implementation totaled 6,261,350 RSD between 2023 and 2025.

FOI responses submitted by the public-utility company reported 26 sterilizations in 2024. However, veterinary specifications obtained through the same FOI procedure indicate that only 25 sterilizations were performed in total between early 2023 and July 2025. This discrepancy between annual reporting and clinic-level records complicates verification of the actual scope of CNR implementation.

Available documentation further indicates fixed monthly payments to the subcontracted clinic that were not directly linked to the number of documented veterinary interventions. Data on captured dogs show high levels of mortality and euthanasia relative to the number of recorded sterilizations.

Taken together, these findings indicate limited traceability of veterinary procedures and restricted ability to link financial inputs with documented population-management outcomes.

Model III – Private Contractor Model ("Avenija MB" d.o.o.)

The third model comprises private companies that obtain municipal contracts for capture-based animal-control services through public-procurement procedures. Unlike public utilities (JKP), these companies are not public authorities under FOI legislation, are not integrated into the veterinary public-service system and are not subject to mandatory transparency or record-keeping obligations.

As shown in Table 1, "Avenija MB" concluded contracts with 33 municipalities in 2024, with a total contractual value of 60 543 656 RSD. However, municipalities reported no data on captures, sterilization, vaccination, microchipping, CNR outcomes or euthanasia. FOI responses consistently state that operational records are "held by the contractor" and are not part of municipal documentation.

Reports from civil society and media describe recurrent practices of capturing dogs in one municipality, transporting them to distant facilities, returning or relocating them, and subsequently re-capturing and re-invoicing the same animals under different contracts [30,31]. Such practices are structurally incompatible with CNR principles, which require stable, identifiable local populations and verifiable outcomes.

Population–based considerations

Although absolute annual expenditures are lower in Models II and III, these municipalities have substantially smaller human populations and correspondingly

smaller free-roaming dog populations. Therefore, absolute budget size is not a meaningful comparative indicator; cost normalization (e.g., per 1,000 inhabitants or per captured dog) is required for valid interpretation.

DISCUSSION

The findings of this study reveal a structural misalignment between the formal legal framework governing the management of abandoned dogs and cats in Serbia and the institutional arrangements through which these responsibilities are implemented. Although the Veterinary Law conceptualizes zoohygiene as a veterinary public health activity requiring clinical competence, traceability, and biosecurity standards, the Public Utilities Law classifies it as a communal service comparable to sanitation or pest control. This duality generates what governance theory identifies as a persistent "rule-practice gap" [27], in which legally mandated veterinary based obligations are executed by institutions that lack the operational capacity or incentive to fulfil them.

For the purposes of this study, governance related concepts such as procurement related corruption risks, rent seeking opportunity, and high corruption equilibrium are used in an analytical sense based on observable institutional features. These include absence of traceable operational records, FOI inapplicability or systematic non disclosure of data, invoicing structures disconnected from measurable outputs, multi layered subcontracting chains and lack of performance indicators or reporting duties.

These features are widely recognized in governance and anti-corruption literature as risk factors for reduced accountability and potential misuse of public funds [26-28]. The study does not claim to demonstrate corruption per se but identifies institutional arrangements associated with elevated corruption risks.

Divergent outcomes across institutional models

The contrast between the three institutional models is pronounced. Model I, embedded within a veterinary public institution, provides measurable outcomes across key indicators: sterilization, vaccination, mortality, and CNR return rates. These data are consistent with international evidence that veterinary-led CNR programmes reduce population growth, shelter admissions, bite incidence, and zoonotic risks [8,9,11]. Importantly, Model I maintains individual animal records, in line with EU recommendations that highlight traceability as essential for welfare assurance and population control efficacy [29].

Model II illustrates how the communal services classification enables entities without veterinary infrastructure to receive substantial public funding for animal-control activities. In both Požega and Bačka Topola, veterinary procedures were outsourced to private clinics operating outside direct municipal reporting systems. This institutional design creates multi-layered delegation chains and limits transparency regarding the actual delivery of clinical services.

In Požega, more than 1,000 dogs were captured in 2024, yet no records on sterilization, microchipping, vaccination or CNR outcomes were available. The reported mortality rate exceeded 60%, suggesting a reliance on reactive rather than preventive population control measures. Similar patterns of limited output monitoring have been noted in performance audits of abandoned animal management in Serbia [25].

Comparable institutional features were observed in Bačka Topola. Although budget allocations for zoohygiene were substantial, FOI derived documentation revealed inconsistencies between municipal reports and clinic level veterinary records. Reported sterilization numbers were low relative to overall expenditures, and payment structures were not clearly linked to documented veterinary outputs. High mortality and euthanasia figures further indicate limited emphasis on preventive population-control strategies. Taken together, these cases demonstrate how outsourcing arrangements combined with weak reporting obligations can result in fragmented or incomplete operational data. Governance literature recognizes fixed monthly payments, uniform invoices and limited output verification as risk factors for reduced accountability in public procurement [26,27]. In the context of dog population management, such arrangements make it difficult to assess programme effectiveness or ensure alignment with veterinary public health objectives.

Model III amplifies these deficiencies. As private contractors are not public authorities, they are not bound by FOI legislation, are not integrated into veterinary systems, and face no statutory obligation to maintain or disclose operational records. Municipalities typically possess only aggregate invoices, while operational datasets (sterilization, vaccination, euthanasia, microchipping, outcomes) remain exclusively with the contractor. Reports from civil society and local media describe long distance transfers, overcrowded shelter conditions, and repeated captures of the same animals across multiple municipalities [30,31]. This creates a situation in which dogs may be captured and invoiced repeatedly, with no mechanism for verifying outcomes. Such opacity aligns with a "high corruption equilibrium" [27], in which low transparency and wide administrative discretion make non performance difficult to detect.

Incentive structures and systemic effects

In the private contractor model, incentive structures may not always be fully aligned with the public interest. While public policy aims to reduce the number of abandoned dogs through CNR programmes and responsible ownership, private contractors are typically remunerated for carrying out animal control services such as capture and handling. Within such arrangements, the continued presence of the problem does not necessarily lead to a reduction in service demand.

Where contractual obligations, performance monitoring and transparency requirements are limited, this model may be associated with repeated capture and transport of dogs, higher mortality levels and less transparent invoicing practices. Municipalities may therefore demonstrate formal activity in addressing the issue, while the underlying

drivers — such as abandonment and uncontrolled breeding — remain insufficiently addressed over the long term.

This study does not establish causal relationships. Rather, it documents how different systems are organized and discusses their possible implications. In governance literature, similar institutional arrangements have been described as creating conditions that may enable rent seeking behavior [28].

From a veterinary and animal welfare perspective, this model is the least aligned with contemporary European standards, reflecting not only a governance deficit but also a normative step backwards in the legal and ethical treatment of abandoned animals.

The normative and institutional contradiction

At the core of these outcomes lies a fundamental normative contradiction. The Veterinary Law frames zoohygiene as a clinical, traceable, biosecurity sensitive activity. The Public Utilities Law frames it as a general communal service. This dual classification grants municipalities wide discretion: they may select a veterinary public service (Model I), a communal enterprise without veterinary capacity (Model II), or a private contractor (Model III). In the context of weak oversight, such discretionary space represents a documented risk factor for corruption [26].

Traceability as a critical determinant of welfare and governance

International guidelines stress that traceability, linking each animal from capture through sterilization, vaccination, and release, is a cornerstone of humane population management [8,29]. Only Model I meets basic traceability standards. In Models II and III, data are fragmented, inaccessible, or non-existent. This absence of records has two major consequences. First, programme effectiveness cannot be assessed, which renders policy decisions essentially arbitrary. Second, non-performance and misuse of funds cannot be detected, as there are no verifiable output metrics. The interaction between opacity and outsourced service delivery is widely recognized as enabling the conversion of public responsibilities into private rents [26,27].

Methodological note on data asymmetry and population-control capacity

Differences in data availability across the three models were not treated only as a research limitation but also as an analytical finding. Variations in data accessibility reflect differences in legal obligations, institutional organization, and reporting requirements.

In Model I, individual animal records are maintained, which allows monitoring of sterilization coverage, vaccination rates, and CNR outcomes. These data are essential for evidence-based dog-population management. In contrast, Models II and III operate under governance arrangements where systematic data recording and disclosure are not mandatory.

The absence of operational records has consequences that go beyond research constraints. Without reliable data on sterilization, vaccination, microchipping, and return rates, it is not possible to assess programme effectiveness, monitor population trends, or plan improvements. In practice, this means that dog-population control cannot be based on verifiable information.

If operational data are not linked to financial data, it is also not possible to assess whether public funds allocated to zoohygiene are actually used for zoohygiene activities. For these reasons, this study interprets the absence of data as an indicator of limited governance capacity and a reduced ability to implement effective population-management strategies.

Implications for Serbia's EU alignment

The systemic deficiencies identified in Models II and III have direct implications for Serbia's alignment with EU standards. Across the European Union, dog-population management is generally integrated into veterinary or public health systems in order to support disease surveillance, biosecurity in the handling and disposal of animal by-products, and transparent reporting through registries. While regulatory frameworks and institutional arrangements vary among Member States, veterinary oversight, traceability and welfare based population control are widely recognized policy objectives.

Serbia's current trajectory, reinforced by the 2025 Draft Animal Welfare Act, which classifies zoohygiene as a communal service, appears less aligned with these prevailing approaches. This classification may weaken compliance with animal sentience and welfare obligations under Article 13 TFEU, undermine veterinary public health standards relevant to zoonoses control and by-product management, and limit transparency consistent with EU public procurement and anti-corruption frameworks.

Overall interpretation

Altogether, the results suggest that the deficiencies observed in Models II and III are not isolated administrative shortcomings but predictable consequences of the institutional design. When animal control is delegated to actors without veterinary capacity, without reporting obligations, and without mechanisms for external oversight, incentives shift toward practices that minimize costs and maximize revenues – often at the expense of animal welfare, public health, and fiscal integrity. The comparatively successful outcomes observed in Model I indicate that these failures are avoidable and stem not from resource limitations but from governance arrangements that priorities administrative expediency over veterinary standards and evidence based practice.

CONCLUSION

The results of this study demonstrate that the effectiveness and humaneness of dog population management in Serbia depend primarily on the institutional framework through which zoohygiene responsibilities are implemented. The coexistence of two contradictory legal classifications, with zoohygiene as a veterinary public health function under the Veterinary Law and as a communal service under the Public Utilities Law, has produced structurally divergent models with markedly different outcomes.

The integrated veterinary public service model (Model I) aligns with international evidence and EU expectations by ensuring clinical competence, traceability, and measurable outputs across key indicators such as sterilization, vaccination and CNR return rates. In contrast, the communal-enterprise model (Model II) and the private-contractor model (Model III) operate with limited or no veterinary infrastructure, fragmented or non-existent data, and weak accountability mechanisms. These models consistently exhibit high mortality, minimal sterilization, and unverifiable service delivery, reflecting systemic misalignment between legal obligations and institutional practice.

A central finding of this study is that traceability, the ability to follow an animal from capture to sterilization, vaccination and release, functions as a critical determinant of both welfare outcomes and governance quality. Only institutions embedded within veterinary systems maintain adequate traceability. Where records are absent or inaccessible, programme effectiveness cannot be evaluated, and misuse of funds cannot be detected. This structural opacity creates conditions under which non-performance becomes difficult to identify and correct, enabling what governance theory describes as a high-corruption equilibrium.

The analysis also highlights a deeper incentive problem. In institutional models that delegate animal control to non-veterinary or private actors without performance indicators or reporting duties, financial incentives favor repeated capture, transport or removal of animals rather than preventive measures such as sterilization and responsible-ownership programmes. Such arrangements are not merely inefficient; they are incompatible with modern veterinary and ethical standards, including the obligation to treat animals as sentient beings under Article 13 TFEU.

From the perspective of EU alignment, Models II and III diverge from established European practice, in which dog-population management is integrated into veterinary or public health systems to guarantee surveillance, biosecurity and transparent reporting. The 2025 Draft Animal Welfare Act, by placing zoohygiene explicitly within the communal services framework, risks entrenching the very institutional arrangements associated with poor welfare outcomes, weak oversight and fiscal inefficiency.

Overall, the findings indicate that the deficiencies observed in Models II and III are not incidental but structurally determined by the institutional design through which zoohygiene is organized. Strengthening legal coherence, restoring veterinary oversight,

and mandating standardized, publicly accessible operational records are essential steps for ensuring humane, evidence-based and accountable population-management practices. The success of Model I demonstrates that effective solutions already exist within the Serbian system; however, their sustainability depends not only on veterinary governance but also on a regulatory framework that systematically enforces responsible ownership. Aligning national legislation and administrative practice with veterinary public-health principles, while simultaneously strengthening mechanisms that prevent abandonment and uncontrolled breeding, is therefore both feasible and necessary for improving animal welfare, public health and governance integrity. These findings indicate that aligning zoohygiene services with veterinary governance structures is a prerequisite for achieving sustainable, transparent and humane population-management outcomes.

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Authors' contributions

VB contributed to the conceptualisation, study design, legal analysis, data interpretation, drafting of the manuscript, and critical revision. NŽ contributed to data collection, analysis of operational records, literature review, drafting of specific sections, and critical revision. Both authors approved the final manuscript.

Declaration of conflicting interests

The authors declare that they have no competing interests.

Statement of informed consent

Informed consent was not applicable, as no client owned animals or personal data of owners were included in the study.

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UPRAVLJANJE POPULACIJOM NAPUŠTENIH PASA U SRBIJI: TRI RAZLIČITA MODELA

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Upravljanje populacijom napuštenih pasa u Srbiji predstavlja trajni izazov u pogledu dobrobiti životinja i javnog zdravlja. Ovaj problem je otežan strukturnom nedoslednošću pravnog okvira: Zakon o veterinarstvu definiše zoohigijenu kao veterinarsku javno-zdravstvenu delatnost, dok Zakon o komunalnim delatnostima ovu oblast tretira kao komunalnu uslugu. Kao posledica, u praksi su se razvila tri institucionalna modela sa izrazito različitim ishodima. U ovom radu upoređuju se integrisani veterinarski model, komunalni model javnog preduzeća i model privatnog izvođača. Analizirani su relevantni propisi, budžetski podaci, odgovori dobijeni putem zahteva za pristup informacijama od javnog značaja, kao i zvanični podaci lokalnih samouprava. Rezultati pokazuju da integrisani veterinarski model obezbeđuje najpouzdanije ishode, uključujući transparentnost, merljive stope sterilizacije i nisku smrtnost pasa. Komunalni model karakterišu fragmentirani ili potpuno odsutni podaci, uz izrazito visoku smrtnost i nedostatak veterinarskog nadzora. Privatni model ispoljava najniži nivo transparentnosti, budući da jedinice lokalne samouprave uglavnom poseduju samo zbirne fakture, bez ikakvih operativnih evidencija. Utvrđeno je da su razlike među modelima

sistemskog karaktera i da proizlaze iz normativne nedoslednosti. Nalazi ukazuju na potrebu za jačanjem veterinarskog nadzora, uspostavljanjem obaveznih javno dostupnih evidencija i usklađivanjem sa savremenim evropskim praksama upravljanja populacijama napuštenih pasa.