

Supporting Triage of Infected Dog Patients in a Veterinary disease control unit: Epidemiological Analysis and Recommendations

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Abstract

The University of Lisbon's teaching hospital houses a Biology Isolate and Containment Unit for the hospitalisation of both confirmed and suspected cases of infectious illnesses in livestock. The goal of the research is to determine and explain the most common infectious illnesses observed over the course of seven years in the dog population in "BICU". With the purpose of classifying cases of infection, the importance of a number of epidemiological parameters was examined. A total of 700 dogs were hospitalised throughout the research time frame, and 400 (58.3%) of them had a confirmed case of an infectious condition, including parvovirus (50.0%; 230 dogs), leptospirosis (22%; 88 dogs), a multidrug-resistant (MDR) bacterial infection (11%; 44 dogs), and dog distemper (9%; 36 dogs). Age under 2 years old ($p = 0.001$), inadequate parvovirus vaccination ($p = 0.001$), age over 10 yrs old ($p = 0.001$), and overall existence of concurrent problems for MDR-infected individuals ($p = 0.03$) was also noted as possible hazard variables for such illnesses. To differentiate between cases as well as controls, logistical regression classifiers were built. For parvovirus, MDR diseases, and distemper diseases, the estimations of both specificity and sensitivity are quite high (>0.83). The accuracy for detecting leptospirosis patients was poorer (0.77). In summary, as infectious illnesses are common, it is crucial to reduce their prevalence via efficient preventative measures.

Keywords: Veterinarians, Dogs, Healthcare, Epidemiology.

Introduction

The development of transmissible illnesses within puppies has become a rising source of worry in the past few years, threatening both their physical and mental well-being (1). By controlling as well as featuring these pandemics, veterinarian infection control centers perform a vital part in protecting the directly dogs impacted and the entire animal community (2). An essential component of efficient disease management in veterinary practice is triage, a method of ranking the level of therapy according to the seriousness of an individual's illness (3). The epidemiological methodology to aid in the evaluation of diseased dog cases inside a veterinarian illness control centre and offers suggestions for improving the procedure (4). Veterinaries and medical personnel have the ability to priorities therapies and allocate limited funding effectively by analyzing epidemiology information and taking into account a variety of parameters, including the extent of the disease, transmitting hazards, and the availability of supplies (5-6). The primary symptoms and serious ailments afflicting dogs globally will be highlighted in the initial part of this review's assessment of the present situation of viral infections in dogs (7). Creating efficient triage strategies requires a comprehension of the

epidemiology and variations in these illnesses (8). The selection procedure mechanism shall be covered in detail, along with its significance, goals, and difficulties when applied to a veterinarian illness control division (9).

Study (10) looked at the different elements that affect evacuation choices, such as the degree of illness, the following section of the paper will analyze epidemiology information acquired from past distance or occurrences of infectious diseases in dogs. In order to create efficient treatment techniques and procedures, it is important to analyze the patterns and traits associated with these epidemics. The next part will offer suggestions for improving the assessment procedure in a veterinarian illness control centre depending on an epidemiology assessment. The suggestions will include mainly preventive and preliminary identification tactics along with more reactionary approaches like risk-based prioritising methods as well as therapy regimens (11). In order to improve the general handling of veterinarian illness highlighted the value of good diagnosis in controlling illness facilities for animal's therapies that are accessible, transfer hazards, and the center's entirety. They may improve the well-being of sick dogs with lowering the chance of illness spreading to additional puppies by prioritising and expediting the medical care procedure (12). The purpose of the research (13) was to investigate how clinicians' and the general population's utilisation of a wildlife poisoning center's (APCC) tele-triage programmer differed in regards to toxins kind, animals lifestyles, accessibility to medical care, and even annual and secular patterns. The American Society for the Avoidance of Suffering to Pets' (ASPCA) APCC supplied information on dog poisoned incidents. The goal of the research (14-15) was to look into regional and social variations in the epidemiological of dog bite presents made to the emergency departments of the primary public medical centres. In order to lessen the load and anxiety related to such incidents, municipalities in regions susceptible of a rise in dog-bite ED appointments might use the results of the research to help them develop focused community-based solutions for the neighborhood pediatric populations.

The purpose of this paper is to offer veterinarians who participate throughout the assessment of diseased dog cases inside a veterinarian illness control unit helpful ideas and suggestions. They may considerably enhance the assessment procedure by integrating epidemiology research alongside both reactive and proactive actions, which will eventually end up in improved and successful illness control and avoidance techniques. The aim is to improve the animal illness control section's overall efficacy and effectiveness of the triage procedure for sick puppies' cases. The research's conclusions and suggestions can assist to manage sick canines better, lower the likelihood of delivery, allocate resources more effectively, and eventually boost the standard of care given to patients in the facility.

The remaining sections of this paper are as follows: Part 2 describes materials and methods; Part 3 summarizes result; and Part 4 accomplishes with conclusion.

Materials and Methods

Studying Biomedical Isolate along with Container Units

The faculty of Veterinary Medical Sciences at the College of Lisbon's BICU is operating since December 2017 in a structure which is geographically distinct to the primary academic medical centre. This serves as a multispecies establishment that provides hospitalization of creatures who either have confirmed or are believed to be that require an ID being diagnosed. There are a pair of hospitalization units of canines and a pair to felines, each with a space for 4 sufferers. It runs on a lack of atmosphere, high-efficiency particulate air (HEPA) filters, a security camera structure, personal protective equipment, and standard operating procedures. Puppies with digestive tract, breathing, or skin diseases that have a believed ID are admitted to the BICU. These conditions include those brought on by parvovirus, digestive corona virus, rota virus, the bacterium *Camp* spp., canine distemper, canine transmissible tracheobronchitis, canine transmissible liver disease, a condition known as MDR-induced irritation, a condition called and others.

Variables

Information from patients health files kept within the Health administration application Guru vet® was obtained for every puppy hospitalized to BICU coming from 1 December 2017 to 30 November 2022. After compiling and validating the information, Microsoft® Office Excel 365 worksheets emerged.

Animal's data

Initially the 700 puppies who received acceptance were separated into three groups: verified ID ($n = 400$), questionable ID ($n = 180$), and non-ID ($n = 120$). Hospitalized puppies having a verified ID diagnostic are included in the established ID category. The canines in the questionable ID category are those whose tests for identification were unreliable. Puppies having a belief of ID but without a positive diagnosis evaluation were placed in the non-ID category. According to a number of medical indicators and an overall test examination, clients are brought in to the BICU with a medical belief of an infected condition. Creatures who have an inconsistent diagnosis (such as an elevated antigen examination yet very current vaccine, a successful antibody testing yet a recent vaccine), creatures lacking diagnosis because of proprietors' rejection, other creatures having questionable ID are included in the questionable ID category. Individuals with characteristic illness signs clinically and testing results that support the belief are included in the category of people with verified ID. The occurrence of digestive symptoms like nausea, diarrhea, leucopenia or neutropenia, anorexia, or in appetite within parvoviruses; liver, kidney, or lung symptoms in leptospirosis; the skin. Urination, or MDR symptoms of bacterial an infection; along with respiration, digestive tract, neurologic, or dermatologic symptoms in distemper. The particular day of the initial hospitalization was utilized in the information's analyses for hospitalizations having the identical ID circumstance, with the exception of the parameter called the end result.

Measurements with Factors

The subsequent stage of the research's eligibility requirements for patients required laboratory-confirmed viral diagnoses. A statistical study of the verified ID organization's gender, age, species, neutering, and immunization position, concurrent illnesses, admittance currently, duration of hospitalization, and prognosis was conducted. Only four of the most common diagnoses—parvovirus's (n = 230), the disease (n = 67), MDR infections (n = 38), and dog distemper (n = 36)—were examined independently using identical factors. Haphazard chosen out of the BICU populations throughout the same period of time, a twice-larger placebo group for each one of the aforementioned infections was used for contrast with the assessing objective. This category included creatures whose were free of the illnesses, either examined unfavorable or provided in clinical symptoms which eliminated this. Although there was either age or gender matched among the instances and controls, the impacts of these factors were nevertheless taken into account in the computation (refer to the chapter on Statistics Techniques). According to the Canine Life Stage Guidelines, age information was categorized as follows: young (youth), grownup (2 and older than ten), and senior (those over ten years old). Puppies were separated into type and mixture type due to a small number of people who belonged to a single type. Multiple tests were carried out on each dog in accordance with its age, clinical signs, and immunization history in order to arrive at a final diagnosis, as indicated in Table 1.

Table (1): Testing on the primary Identification of diagnosis

Infection	Assessments
Parvovirosis (n = 230)	Quick immunomigration assay (n = 110) ¹ Actual duration PCR (RT-qPCR) (n = 120)
Leptospirosis (n = 67)	Semi-quantitative indirectly immunofluorescence for the measurement of just one dose of IgM (n = 64) ² PCR on Urinary sputum (n = 3)
MDR (n = 38)	screening for resistance to antibiotics and bacterial culture using appropriate tissues (such as faeces, the skin, exudate fluids, wounds with infections, and more)., n = 38)
Distemper (n = 36)	Antibodies IgM/IgG identification by serology (n = 29) 3 Oronasal, rectal, brain fluid, or blood specimens were used for real-time quantitative PCR (RT-qPCR). (n = 6) fast immunomigration test (n = 1) ⁴

The 2015 Guidelines for the Vaccination were used to determine the vaccination status. Considering the basic vaccinations as well as its leptospirosis vaccine due to the possibility of contact during designated geographical region of action, of Dogs and Cats by the "International Small Animal Veterinary Association". Inoculations became out of date if the dog's initial vaccination proved unfinished because of the puppy's premature age or if there had been any omitted dosages in the dog first vaccination, 12-month booster, or adult

revaccinations. If the puppy's first vaccination had been incomplete owing to the puppy's younger age, the 12-month boosters or adults revaccinations were also deemed out for time. Regardless of the time of year, a seasonal pattern according to the time of admission was added as a category a covariate regarding the time of year of the illness. In accordance with Portuguese climatic norms, this covariate was divided into two distinct groups: winter (November to April) and warm season (May to October).

Prejudice

In this research, both cases and controls were chosen with equal consideration for the danger of being exposed to the primary pathogens in the outside world, taking into account the possibility of selection bias in a case-control investigation among a sample of medically admitted patients.

Analytical Procedures

The programming language R 3.6.1 was used for the statistical evaluation. The outcomes expressed as proportions, frequency of happening, and median with range for category and constant information, respectively. They used a case-control research layout, wherein information from infected cases was juxtaposed with information from the control population from the BICU, to develop prioritization algorithms for every infection. As a result, they were able to build logistical regression models based on independent Bernoulli trials and account for the impact of several variables connected to important health variables. With the use of all of these mathematical models, they managed to calculate the likelihood that a dog presenting to the BICU was indeed suffering from the viral illnesses that were the subject this assessment. The previously finalized analyses for every illness contained all confounders in the factor choice stage having the p-value 0.2. The p-value 0.05 in the last analyses were suggestive of the relevant covariate's statistical relevance. Calculations were carried out using the logistic regression models to determine the estimated coefficient and the corresponding standard deviations. As the model's diagnosis stage, testing for multicollinearity among variables were carried out. The C-statistic and the region underneath the curve of receiver operating characteristics were computed utilizing the software pROC in order to evaluate the prediction effectiveness of the last set of models. Lastly, utilizing the software Optimum Cut points, precision and sensitivity were determined. The location on a ROC curve where the Yourdon Rating was maximized determined from the associated estimations for any particular ID.

Result

Analysis of Dogs with a Confirmed infectious illness Diagnose

In the first databases, there were 700 canines overall, of whom 400 (58.3%) received a confirmed infection diagnoses. The primary host and ecological trends, hospitalization trajectory, and corresponding medical result were used to characterize this contaminated group before being divided by diagnostic. Initially an overall evaluation of animals utilizing inflammatory diagnoses took out. The majority of the pups were younger canines (less than

two years old), with a mean aged of ten months (0.8 yrs). The majority of dog breeds, complete men, and categories were each present. Most of affected canines did not have concurrent diseases and had outdated vaccination records as shown in Table 2. Based on the period of hospitalization (Figure 1), July had the lowest hospital stays of infections (4.4%; $n = 19$) and November had the greatest inpatient hospitalizations (15.1%; $n = 47$). 81.9% of the mentioned animals were released ($n = 289$), which is comparable when hospitalizations took.

Table (2): Vaccination content

Infection	Parvoviruses	Leptospirosis	MDR	Distemper
Factors	p- rate	p- rate	p-rate	p- rate
	predict	Predict	predict	predict
	Std problem	Std problem	Std problem	Std problem
Age group				
<2 12 months	<0.003	-	-	<0.003
	5.36			4.89
	1.05			2.29
≥2 to and<10 duration of month	-	<0.003	0.28	-
		2.77	2.68	
		0.60	2.26	
≥10 years	0.55	0.9	<0.03	0.74
	-0.97	-0.52	4.62	-0.74
	2.25	1.89	2.28	2.38
Sex				
Women	-	-	-	-
Men	-	-	-	1.9
				-0.55
				0.99
Middle capacity				
Nil	-	-	-	-
occurs	0.99	-	0.68	0.9
	-1.77		-0.65	-4.37
	1.8		1.3	1.65
Uploading of Immunisation Information				
occurs	-	-	-	-
Nil	<0.002	-	0.04	0.05
	4.27		-2.08	2.72

	1.08		0.87	1.28
Develop				
Develop	-	-	-	-
A Combo of Develop	0.09	-	-	0.33
	-0.01			2.28
	0.65			0.10
Related Conditions				
Nil	-	-	-	-
occurs	0.98	<0.003	0.04	0.3
	-0.94	-1.74	3.48	-0.98
	0.55	0.51	2.22	0.96
Time of year				
Winter	-	-	-	-
Summer	0.9	0.09	-	-
	0.37	-0.79		
	0.55	0.49		

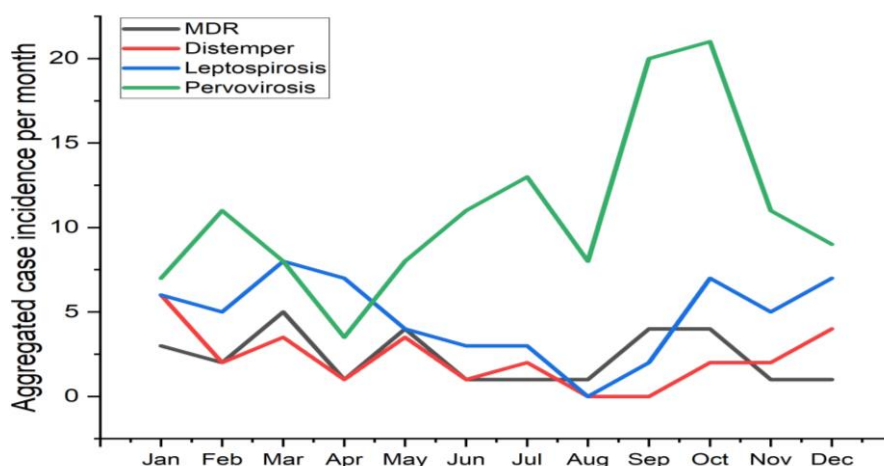
Leptospirosis and parvovirus's (50.0%; n = 200) were among the most commonly confirmed IDs Dog influenza (9%; n = 36), MDR infections (11%; n = 44), and 22%; n = 88. Dermatophytosis, a form of viral tracheobronchitis, sarcastic scabies, herpes virus, and Cryptosporidium species were among the remainder of IDs (8%; n = 32).

Investigation of Puppies who have a Known Case of Parvovirus's

Puppies (less than two years old) were more prevalent and significantly related having a higher risk of the logistic regression model for parvovirus's (n = 230), having a mean age of just over four months (0.3 yrs). Although there was no statistically significant difference, men, unaltered, big purebred canines are greater in number. The logistic regression approach significantly linked a lack of current vaccinations to a higher risk. In the last logistical regression approach, this factor was barely meaningful because the majority of patients did not have a coexisting disease. The majority of individuals with parvovirus's were admitted in December (26.2%; n = 60.26) and November (25.4%; n = 58.42), although every month included a minimum of one occurrence of the disease (Figure 1), and this factor proved not important in the final analysis. A predicted AUC of 0.96 was found in the final logistic regression equation as shown in Table 3 and Figure 1. The estimations for the two parameters was 0.94 or 0.92, accordingly, indicating this framework does a good job of predicting both contaminated people and uninfected. 83.8% of the patients made it through their medical facility stay.

Table (3): Monthly mean case occurrence for every primary Identification

Month	MDR	Distemper	Leptospirosis	Pervovirosis
Jan	3	6	6	7
Feb	2	2	5	11
Mar	5	3.5	8	8
Apr	1	1	7	3.5
May	4	3.5	4	8
Jun	1	1	3	11
Jul	1	2	3	13
Aug	1	0	0	8
Sep	4	0	2	20
Oct	4	2	7	21
Nov	1	2	5	11
Dec	1	4	7	9

**Figure (1):** Monthly mean case occurrence for every primary Identification

Investigation of Animals who had a Known Case of Leptospirosis

The logistic regression analysis showed that puppies were substantially more prevalent and strongly related having a greater likelihood of the disease ($n = 67$), with a mean age of 6.0 yrs (2 and a half decades old). A man, intact, and purebred animals predominated. Despite not being strongly connected with this infectious condition. The majority of the animals lacked current vaccines, although this was likewise never strongly correlated with illness. The majority of those affected did not have any concurrent diseases, and the results of the logistic regression study indicated that this might reduce the probability of leptospirosis. The month of September failed to record any cases, whereas March (24%; $n = 36$) recorded the majority of hospital hospitalizations but there was no significant association in the multivariate approach.

As contrasted with the untreated category, the final result of the logistic regression equation accurately predicted the proportion of canines with an established diagnostic of the disease (AUC = 0.79) as shown in Table 4 and Figure 2. According to estimates of 0.77 and 0.68 for both sensitivity and specificity, accordingly, the aforementioned model performs poorly in terms of incident identification. At a final mortality percentage of 50.9%, over fifty percent of the instances (54.4%) were released from the medical facility.

Table (4): The locations which lead to the sensitivity as well as the specificity estimations stated in the primary portion of the article are symbolised by the dotted lines in the "ROC" curve

1-specificity	MDR	Distemper	Leptospirosis	Pervovirosis
0.03836	0.046628	0.046628	0.03836	0.440548
0.03836	0.267645	0.339945	0.03836	0.576143
0.036969	0.532403	0.543209	0.036969	0.694241
0.036969	0.611135	0.549899	0.036969	0.85608
0.053131	0.613193	0.823404	0.053131	0.910884
0.059039	0.807966	0.823404	0.059039	0.910884
0.116733	0.803592	0.871518	0.116733	0.943561
0.124206	0.847332	0.869203	0.124206	0.943561
0.16991	0.842958	0.917317	0.16991	0.947935
0.16991	0.88464	0.915258	0.16991	0.941503
0.304414	0.88464	0.963373	0.304414	0.954625
0.305978	0.919633	0.958999	0.305978	0.958999

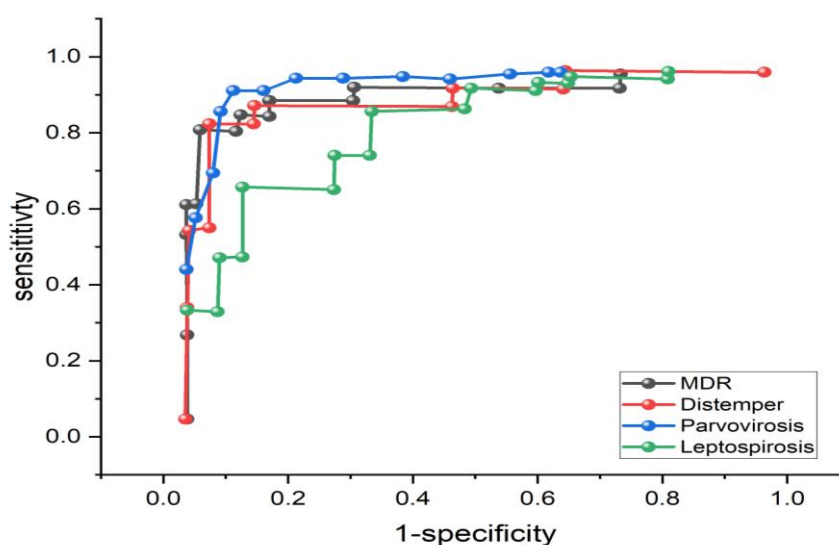


Figure (2): The locations which lead to the sensitivity as well as the specificity estimations stated in the primary portion of the article are symbolised by the dotted lines in the "ROC" curve.

The projected sensitivity as well as specificity were exceptionally high: 0.83 and 0.95, same like in the instance of parvovirus. When hospitalizations are taken into account, the percentage of canines who sustained their initial hospitalization (71.4%) falls to 53.6%.

Examination of Canines with a Known Distemper Diagnose

Children were the least prevalent demographic (2 years old), significantly related with an elevated risk, having an average age of 1 year for smallpox ($n = 36$). While sexuality, reproduce, and frequency of men, unaltered, and dogs of various breeds were not statistically.

Investigation of Canines having a Known MDR Disease

Canines with MDR illnesses were on average 9.5 years old ($n = 44$), having seniors (10 years old) being the most prevalent category and significantly more at risk. While more common, male, intact, and breed dogs were not significantly different. Unvaccinated individuals were shown to have a lower likelihood of contracting MDR infections. The majority of cases had a concurrent condition, which had a strong connection with a higher risk. There were a total of at least five MDR-infected patients admitted reported in March (17.9%; $n = 5$; Figure 1), although the months that followed each included a minimum of one instance that was not of statistical significance. With an AUC of 0.93, the final logistical regression models significant, having spayed was significantly recognized as possibly decreasing the incidence of influenza. The majority of the study's animals had outdated vaccination records that were significantly linked to a higher risk. The majority of individuals weren't suffering from concurrent diseases; however they were not significant in the final simulation. Statistically speaking, there were no incidents reported in August or September, and the majority of fever diagnoses were documented during the first month (23.1%; $n = 6$). According to the ultimate logistic regression model's outcome (AUC = 0.93; sensitivity = 0.85; selectivity = 0.96; Figure 2), the cases as well as the controls could be accurately predicted. Only 34.6% of all the dogs hospitalized surviving when return visits were taken into account, while fifty percent of the animals surviving the initial hospitalization.

Conclusion

The most recent logarithmic regression algorithms for doggie distemper, MDR diseases, and parvovirus's demonstrated strong predictive accuracy and thus may help with the early identification and management of these individuals. The disease models proved excellent, notwithstanding may be enhanced to operate well as a screening tool. The adoption of such designs, particularly for highly transmissible pathogens like the CDV and CPV, can help to stop epidemics. Given the researches observational the natural world applies. Firstly, the reliability of the details provided by pet proprietors and the reliability of the anamnesis records recorded by a number of veterinarians during the course of the investigation's seven-year period are two criteria that affect the standard of the statistics obtained. Secondly, the individual's medical state and the dog owners' ability to bear the associated expenses will determine if an assessment can be made with certainty. The amount of time of a medical facility stay and possibly its result are also impacted by the household's financial position. In

general, the research we conducted shows that viral illnesses continue to be widespread among dogs. It's an appeal for stronger safeguards like immunization. Additionally, earlier evaluation, assessment, and diagnosis—which are essential to predicting and avoiding the likelihood of illness occurrence—can be aided by having an understanding of the demographic aspects connected to the illness in question.

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