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Evaluation of a veterinary triage list modified from a human five-point triage system in 485 dogs and cats

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Abstract

Objectives – To devise a veterinary triage list (VTL) and to determine whether the application of this VTL results in more accurate categorization of emergency patients compared with intuitive triage.

Design – Prospective and retrospective observational study.

Setting – Private veterinary emergency clinic.

Animals – Four hundred and eighty-five client-owned dogs and cats.

Interventions – None.

Measurements and main results – A VTL was composed using a human triage system and data from medical records of the study group. Target waiting times were prospectively determined using intuition by veterinary nurses (TWT-N). Target waiting times were subsequently determined retrospectively by the use of the VTL (TWT-VTL). Both TWT-N and TWT-VTL were compared against target waiting times determined by a review team (TWT-R), which was considered the gold standard. TWT categories included 0, 15, 30–60, and 120 minutes, and were associated with triage categories red, orange, yellow, and green, respectively. Differences in agreement were tested for significance. One hundred and eighty-five dogs and 300 cats fulfilled the inclusion criteria. TWT-N and TWT-R agreed on 30 cases of 67 (44.8%) in triage category red and 22 of 89 (24.7%) in category orange. TWT-VTL and TWT-R agreed on 64 cases of 67 (95.5%) in category red and 75 of 89 (84.3%) in category orange. Agreement between TWT-VTL and TWT-R (Pearson's $R = 0.848$) was significantly greater ($P < 0.001$) than agreement between TWT-N and TWT-R (Pearson's $R = 0.519$).

Conclusions – Intuitive triage performed by veterinary nurses showed significantly less correlation with TWT-R than triage performed with the VTL. A short physical examination in all emergency patients appears to be essential in recognizing critical disease. The use of a standardized VTL can help to categorize veterinary emergency patients.

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Abbreviations

BG	blood glucose
MTS	Manchester Triage System
SIRS	systemic inflammatory response syndrome
TWT-N	target waiting time by nurse
TWT-R	target waiting time by review team
TWT-VTL	target waiting time by means of the triage list

Introduction

Triage is an old concept and is described as a system of sorting patients according to their need of medical care when resources are insufficient for all to be treated

immediately. The word is derived from the French word “trier,” which means “sorting.”^{1,2} It was first used on battlefields and has become a common concept in medical teams who treat victims of disasters and war.³ The utility of triage has evolved in another setting, however, that being the waiting room of emergency departments in hospitals.

During the past few decades the growing workload at human emergency departments has resulted in prolonged waiting times.¹ Therefore, it has become more important to recognize the critically ill and give these patients priority over patients who suffer from only minor illness or injury. Many urgent situations are easily recognized, but the study of Wuerz *et al* indicated that performing triage without specific guidelines can lead to interrater and intrarater inconsistencies in triage decisions.² These problems have led to the development of triage systems, combined with training programs to provide medical emergency staff with clear guidelines on how to assess the individual patient’s clinical needs and priority for care. The so-called “5-point systems,” which use 5 different triage categories, are considered of fundamental importance in the management of human patients presenting to emergency departments.^{4–6} Examples of these 5-point systems are the Emergency Severity Index,^{7,8} the Australasian Triage Scale,⁹ the Canadian Triage & Acuity Scale,¹⁰ and the Manchester Triage System (MTS).¹¹ The MTS was developed by a multidisciplinary consensus group and is the most widely used triage system in Europe.¹¹ It is considered to fit the European human health care system better than the other 5-point systems.^{11,12} It is based on clinical complaints that are easy to understand by nurses and patients. It does not work with diagnoses, with the exception of asthma and diabetes mellitus.¹¹ The system uses 5 different triage categories: red (immediate), orange (very urgent), yellow (urgent), green (standard), and blue (nonurgent) and each category is assigned a maximum target waiting time. Nurses briefly examine and question incoming patients after which they determine the triage category. The signs and symptoms that discriminate between the triage categories are termed discriminators and refer to definitive (eg, “shock”) or possible (eg, “altered conscious level”) urgent underlying causes. Discriminators that indicate higher levels of priority are sought first. The MTS has shown to be a sensitive tool for detecting those who need emergency care.^{5,13}

In veterinary medicine, the use of triage systems is less common. To the authors’ knowledge, established 5-point systems or other defined triage systems are not available, and the severity of the patient’s condition is often assessed intuitively. An intuitive assessment not only involves the risk of overlooking less obvious signs of serious illness, it also does not provide instructions

for how to classify the remaining patients that are not acutely at risk of dying but still require urgent care. The introduction of a standardized triage system in veterinary medicine could potentially increase triage accuracy. Additionally, it would give veterinarians the advantages of standardized terminology and enable them to perform quality-assurance exercises or audits and comparative studies.

The aims of this study are to compose a list of veterinary triage discriminators and to determine whether the application of this list results in more accurate categorization of emergency patients than intuitive triage.

Materials and Methods

The study was performed at the emergency clinic (EC) Animal Medical Center (AMC). The study group consisted of dogs and cats that were presented to the clinic as an emergency patient during the months June, July, and August 2008. All dogs and cats that were presented to the AMC and attended by one of the primary investigators (LR or MG) during the study period were enrolled. Animals were excluded from the study when no urgency assessment could be made due to insufficient data, when a treatment had already been initiated by a referring veterinarian, when an animal came for a routine checkup (eg, blood glucose [BG] measurement in a diabetic animal), or when the animal was assessed as “nonurgent” (eg, physical examination to obtain a health certificate).

Data for the study were collected by the 2 primary investigators. In addition to keeping a medical record file, the attending emergency veterinarians completed a standardized form at arrival detailing mental status, respiration rate, respiration type, presence of respiratory distress, heart rate, pulse quality, core temperature, peripheral temperature, color and character of mucous membranes, capillary refill time, turgor, findings at thoracic auscultation, and findings at abdominal palpation.

Prospective triage performed by nurses

Prior to the start of the study, nurses and veterinarians at the study center were informed of their role in the study and attended a training session on critical illness and the basics of triage.^{11,12} Fifteen nurses with varying levels of triage experience participated in the study. The nurses were either certified veterinary nurses ($n = 12$) or senior veterinary students ($n = 3$).

As animals were registered at the EC, nurses were asked to estimate an appropriate target waiting time (TWT-N). TWT categories were based on the MTS but modified: 0 minutes, 15 minutes, 30–60 minutes, and 120 minutes, and these were assigned to the following triage categories: red, orange, yellow, and green, respectively

Table 1: Veterinary triage list categories based on the 5 point Manchester Triage System¹¹

Triage Category	Description	Target waiting time
Red	Immediate	0 minutes
Orange	Very urgent	15 minutes
Yellow	Urgent	30–60 minutes
Green	Standard	120 minutes
Blue*	Nonurgent	240 minutes

*Not included in present study.

(Table 1). A TWT of 0 minutes (category red) implied that a patient would be transferred to a veterinarian immediately after the triage, but before registration. The estimation of the TWT by the nurse was based on the history provided by the owner and on visual inspection of the animal. Performance of a short physical exam was encouraged but was left to the discretion of the nurses. The TWT-N was not passed to the emergency veterinarian automatically. The nurses were to inform the veterinarian if they considered an animal in need of immediate help or in need to be prioritized over other patients. In order to determine if an animal had been given priority over other animals, the primary investigators recorded the following time points of every animal: time of arrival at the clinic, time of the start of triage by the nurse and registration at the reception, and time of first contact with the veterinarian. An animal was considered being given priority over other animals when the time they were seen by a veterinarian was advanced compared to animals that had arrived at the EC earlier. No written guidelines were available for the nurses during the study.

Compilation of the veterinary triage list

The veterinary triage list (VTL) was constructed using the MTS as a model. The MTS was screened for discriminators that were considered useful in veterinary medicine. MTS discriminators were considered not useful when they were specific for human disease processes (eg, “cardiac pain,” “significant psychiatric history”), or were difficult to ascertain when a patient is unable to express the problem verbally (eg, “recent reduced visual acuity,” “colicky pain”). The primary investigators then screened the medical records of the study group for possible new discriminators. The following method to select new discriminators was used: a TWT that seemed appropriate retrospectively was determined for every patient, using all available data including history, physical exam results, diagnostic test results, diagnosis (when known), response to therapy, and survival. The clinical complaint that was deemed as the primary problem driving this TWT was considered a suitable discriminator for

the VTL (eg, “rapid onset of abdominal distension,” “ingestion of foreign body”). The next step involved transferring selected discriminators between triage categories if this was deemed more appropriate (eg, “acute chemical eye injury” was moved from red to orange, “urethral obstruction” was moved from yellow to orange). Several discriminators were reformulated as compared to the MTS in order to fit veterinary illness more appropriately (eg, “vascular compromise” in MTS versus “signs of arterial thromboembolism” in the VTL). In instances of uncertainty, the primary investigators consulted veterinary and human experts (eg, veterinary nurses, veterinary specialists, human neurologist, human triage nurse) and the literature. Discriminators deemed not to confer a state of emergency were removed (eg, “bloody stools,” “acutely avulsed tooth”). The TWT generated after the aforementioned procedure will be referred to as “TWT-basic” and were used only to select and evaluate discriminators. The primary investigators were blinded to the TWT-N during the TWT-basic assessment.

Compilation of the “gold standard”

As the compilation of the VTL was a dynamic process during the study period, patients recruited early in the study could have been theoretically categorized differently than patients that were assessed later, even if they had similar complaints. For this purpose, a second TWT assessment was performed (approximately 1 y later) by the primary investigators. This TWT assessment is referred to as the “review TWT” (TWT-R) and was considered as the “gold standard” in this study.

Retrospective triage with the veterinary triage list

In the last phase of the study, the study group was triaged retrospectively using the VTL by the main investigator (LR) (TWT-VTL). Of the physical parameters, only those that would have been available for veterinary nurses were used (eg, knowing that an animal has a fracture may influence pain assessment. Not all fractures are detectable at visual inspection for a nurse. In those cases, other clinical features had to be used for pain assessment).

TWT-N and TWT-VTL were both compared to the TWT-R. Differences in agreement and under- and overtriage (defined as the processes of under- and overestimating the severity of an illness or injury) were tested for significance.

Statistical analysis

Descriptive statistics (and 95% confidence intervals [CIs]) were used. The method used to calculate a confidence interval for a proportion was the Wilson score

method without continuity correction.¹⁴ Association between ranked variables was tested with the Spearman's rank correlation test. Significance of differences between correlation coefficients was calculated according to Fieller.¹⁵ A commercial statistical software^a was used for statistical analysis. $P < 0.05$ was considered significant.

Results

Four hundred and eighty-five animals were recruited into the study and included 185 dogs (38.1%) and 300 cats (61.9%). Median age was 5 years (range 7 wk–19 y) in dogs, and 6 years (range 3 wk–24 y) in cats. In 14 animals, the age was unknown. Among the dogs there were 76 intact males, 24 castrated males, 31 intact females, and 54 spayed females. Among the cats there were 36 intact males, 140 castrated males, 23 intact females, and 96 spayed females. In 5 female cats, the status was unknown.

Veterinary triage list

Sixty-eight discriminators were selected to form the VTL, which were divided in 8 subcategories (ie, respiratory, circulatory, neurological, trauma, gastrointestinal, obstetrical, urogenital, and generalized) (Table A1). Time frames that characterized onset of a specific problem included “abrupt” (within seconds to minutes), “rapid” (within the preceding 12 h), “acute” (within the preceding 24 h), and “recent” (within the preceding 7 d).¹¹ Discriminators that could have been interpreted in different ways are clarified in Table A2. These discriminators were mainly classified by using literature. Other discriminators that were mainly classified with literature include hypothermia,²⁴ hyperthermia,^{25–27} acute complete loss of vision, altered level of consciousness, acute abnormal behavior,^{28,29} proptosis,^{30,31} acute chemical eye injury,³² and head tilt.³³

Target waiting times

The TWT-N was 0 minutes in 52 animals (10.7%; 95% CI 8.3–13.8), 15 minutes in 70 animals (14.4%; 95% CI 11.6–17.8), 30–60 minutes in 249 animals (51.3%; 95% CI 46.9–55.8), and 120 minutes in 114 animals (23.5%; 95% CI 19.9–27.5) (Table 2). The nurses and the primary investigators agreed on 30 cases of 67 (44.8%; 95% CI 33.5–56.6) in triage category red, 22 of 89 (24.7%; 95% CI 16.9–34.6) in category orange, 63 of 117 (53.8%; 95% CI 44.8–62.6) in category yellow, and 82 of 212 (38.7%; 95% CI 32.4–45.4) in category green.

The TWT-VTL was 0 minutes in 71 animals (14.6%; 95% CI 11.7–18.0), 15 minutes in 114 animals (23.5%; 95%

Table 2: Categorization breakdown of 485 dogs and cats triaged with 3 triage methods.

	Target waiting times in minutes (and urgency categories)			
	0 (red)	15 (orange)	30–60 (yellow)	120 (green)
Nurses	52	70	249	114
VTL	71	114	104	196
Primary investigators (review team)	67	89	117	212

VTL, veterinary triage list.

CI 19.9–27.4), 30–60 minutes in 104 animals (21.4%; 95% CI 18.0–25.3), and 120 minutes in 196 animals (40.4%; 95% CI 36.1–44.8) (Table 2). The VTL and the primary investigators agreed on 64 cases of 67 (95.5%; 95% CI 87.6–98.5) in category red, 75 of 89 (84.3%; 95% CI 75.3–90.4) in category orange, 69 of 117 (59.0%; 95% CI 49.9–67.5) in category yellow, and 172 of 212 (81.1%; 95% CI 75.3–85.8) in category green.

The TWT-R was 0 minutes in 67 animals (13.8%; 95% CI 11.0–17.2), 15 minutes in 89 animals (18.4%; 95% CI 15.2–22.0), 30–60 minutes in 117 animals (24.1%; 95% CI 20.7–28.3), and 120 minutes in 212 animals (43.7%; 95% CI 39.2–47.9) (Table 2). The agreement between the TWT-VTL and the TWT-R (Pearson's $R = 0.848$) was significantly greater than the agreement between the TWT-N and the TWT-R (Pearson's $R = 0.519$, $P < 0.001$).

Under- and overtriage: TWT-VTL versus TWT-R

The VTL and the primary investigators agreed on 380 cases and disagreed on 105 cases. Ten of the cases that were disagreed upon were assessed as red by either the VTL or the review team. Three of these animals were allocated to red by the review team and to orange by use of the VTL and were therefore undertriaged by 1 category by the VTL. Two cases involved cats with different assessments of respiratory distress (severe versus moderate). The third was a cat with urethral obstruction that was hyperkalemic and assessed as being in shock by the primary investigators based on bradycardia and acidosis. This case was assessed cardiovascularly normal by VTL triage due to pink mucous membranes and a normal peripheral temperature. Rectal temperature was 37.0°C. Five animals were allocated to red by the VTL and to orange by the primary investigators and were therefore overtriaged by 1 category by the VTL. Two of these animals were cats with different assessments of respiratory distress (severe versus moderate). A third case was a cat triaged to orange by the primary investigators based on

dehydration >8% but triaged to red with the VTL based on hypothermia (Temperature 36.4°C). The fourth animal was a dog with a distended abdomen due to a traumatic hemoabdomen without shock. It was triaged to orange by the primary investigators based on severe pain due to presence of a femoral fracture. The fifth animal was a cat with severe pain due to arterial thromboembolism and hypothermia (Temperature 36.6°C). Two animals were allocated to red by the VTL and to yellow by the primary investigators and were therefore overtriaged by 2 categories by the VTL. One was a cat with paraplegia that was triaged to red with the VTL based on hypothermia (Temperature 36.3°C), the other was a dog with a rapid onset of abdominal distension. The dog was later diagnosed with an esophageal foreign body. Only 1 cat with a rectal temperature <36.8°C was not assigned to triage category red or orange. There were no dogs with hypothermia.

Priority

Fifty-two animals were assigned by the nurses to category red. Twenty-six of these were the sole patients being treated and therefore did not require prioritization. The other 26 cases arrived when there were other animals awaiting to be treated. Twenty-one (80.8%; 95% CI 62.1–91.5) of these were prioritized over animals that were considered to be less urgent. Five cases (19.2%; 95% CI 8.5–37.9) were not prioritized over other animals. Seventy animals were assessed by the nurses as orange. Forty-five of these were the sole patients being evaluated. The other 25 animals were awaiting along other cases. Twelve (48.0%; 95% CI 30.0–66.5) of these cases were prioritized, while 13 cases (52.0%; 95% CI 33.5–70.0) were not.

Discussion

Triage is a well-established medical protocol in human medicine. To the authors' knowledge, this is the first study that has devised a VTL for dogs and cats that links clinical complaints to urgency and target waiting times. The VTL presented in this study represents 4 urgency categories; 5 when nonurgent patients are included. This list however is not yet ready for use as a triage system. This study was intended as an introduction to a method, to be followed by audits and evaluation of the system in use.¹¹

Compiling the VTL based on veterinary clinical complaints posed several challenges. Even though there is ample information on the various illnesses, there is a paucity of specific guidelines on the time frame in which patients should be seen, especially when there is no imminent risk of dying. The limited veterinary litera-

ture that exists relating to triage of emergencies focuses on verifying the stability of the major organ systems and initiating stabilization measures in unstable critical patients.^{34–39} Hanson alluded to a 4-point triage concept in 2005 in which examples are offered for every triage category, but no detailed categorization is made and no target waiting times are mentioned.⁴⁰

A human triage system formed the basis of the current study. The MTS was selected since it is the most widely used triage system in Europe and the MTS guidelines are quite comprehensive.¹¹ Refinement of the list of discriminators was based on the relative incidence and significance of certain condition in the study group but the process remained basically subjective. The veterinary literature was consulted in order to formulate the list but sometimes assumptions had to be made. For example, "retention of urine" is a category yellow discriminator in the MTS. This condition is described as "inability to pass urine per urethra, combined with an enlarged bladder." Retention of urine is usually very painful, unless it is combined with an altered (diminished) sensation.¹¹ Animals, especially cats, often present to the veterinarian in a much later stage of the disease and therefore are considered to be at much higher risk to have severe pain, azotemia, acidosis, and hyperkalemia, even before shock develops. For this reason, the discriminator was moved to orange. An example of a new discriminator is "proptosis," which is exceedingly rare in human medicine, even after trauma and not necessarily associated with rapid and permanent loss of vision.³¹

Discriminators that were difficult to translate to veterinary medicine included hypothermia, abnormal pulse, and hypo- and hyperglycemia. In cats, hypothermia is a well-recognized symptom of critical diseases such as shock, sepsis, and systemic inflammatory response syndrome.²⁵ In this study, 1 cat was suffering from primary hypothermia, due to a fall in the water. The other cases were assessed as having secondary hypothermia. In the MTS, a "cold" patient, described as having a core temperature of <35°C, is allocated to orange, assuming no other symptoms are observed that may justify allocation to red. Based on the MTS and the study of Oncken et al., in the preliminary VTL severe secondary hypothermia was defined as a rectal temperature ≤36°C and was selected as a discriminator for orange.^{11,25} However, during the TWT-basic all patients with a rectal temperature ≤36.2°C were allocated to red based on accompanying data. Therefore, the review team decided to use the upper limit of moderate secondary hypothermia (36.7°C) as a discriminator for category red. As explained earlier, 3 cats were overtriaged with this discriminator. This raises the question whether this temperature is a suitable discriminator for triage category red, and whether hypothermia deserves a separate discriminator in the VTL.

There are several arguments in favor of the current classification. The first is that shock, systemic inflammatory response syndrome, and sepsis in cats may be difficult to recognize, especially by nurses, while a rectal temperature is easy to measure. Furthermore, while some discriminators are justified by their definition (eg, "exsanguinating hemorrhage"), others will represent only a high probability for the presence of critical disease (eg, "altered conscious level"). A small percentage of overtriage can be accepted, to decrease the chance of undertriage. Whether the cutoff value of 36.7°C is justified for secondary hypothermia in dogs and primary hypothermia requires further investigation.

In the MTS, "abnormal pulse" is a discriminator for category orange. The most significant pulse abnormality in the study group was bradycardia, defined as a heart rate of ≤ 120 beats/min in cats and ≤ 60 in dogs.²³ None of the patients in this study had bradycardia as the definitive discriminator. On the other hand, 12 animals (7 dogs, 5 cats) with bradycardia were reviewed as yellow or green, which would lead to overtriage. For these reasons, bradycardia was not used as a separate discriminator in the VTL.

Measurement of BG is described as a part of the triage process in the MTS. One could argue whether taking a blood sample belongs in the triage process and whether indications for measuring BG can be recognized by veterinary nurses. In the authors' clinic, emergency measurement of BG is executed in cases where the history suggests the presence of hypo- or hyperglycemia (Table A2). Even though BG measurement may not be feasible or necessary in all patients, in specific cases this discriminator may serve its purpose. Hypo- and hyperglycemia were therefore maintained as discriminators in the VTL.

The second aim of the study was to compare 2 different triage systems: intuitive based and VTL based in relation to the urgency categorization determined retrospectively using all available information (TWT-R). Triage performed with the VTL resulted in more accurate categorization of emergency patients than by intuitive triage performed by veterinary emergency nurses. More than half of the animals deemed as category red were not detected as such by the nurses (37 of 67 animals, 52.2%). While some disease processes were easily recognized (eg, no animal with gastric dilation-torsion or status epilepticus was missed), others such as shock and even severe respiratory distress were not always detected. Possible explanations for not detecting such emergency presentations appropriately include insufficient familiarity with this condition, and the fact that not all patients were examined physically during the triage process. In this study, it was left to the discretion of the nurses whether they wanted to perform a physical examination. Stricter instructions would have decreased the intuitive nature

of their triage. Important reasons given by the nurses for not performing a physical exam in all patients were their impression of having insufficient time and their assessment that they could detect critical states by visual inspection alone. A physical examination may therefore only have been performed when critical states were already suspected. Increasing awareness concerning the importance of triage in both nurses and veterinarians and time management training are issues that need to be addressed in veterinary medicine. Several studies in human medicine have shown that the implementation of a triage system in hospitals combined with specific triage training improved triage decisions.^{41,42}

Another finding in this study was that patients assessed and assigned to triage category orange were prioritized less frequently than patients assigned to category red (48.0% versus 80.8%). Patients not assigned to category red by intuitive triaging were less likely to achieve their target waiting time chosen by the triaging nurse as they were prioritized less frequently. Providing clear instructions for when to give priority to patients that are not acutely at risk of dying is one of the most important advantages of a standardized triage system.

Even though the VTL agreed more frequently with assessment by primary investigators rather than those made by nurses, they did not agree in all cases. Of particular interest were patients that were assigned to category red by 1 of the 2 methods (VTL or primary investigators). Of the 10 cases assigned to category red by the VTL or primary investigators, 4 concerned animals with dyspnea. This may be attributable to difficulties in assessing the degree of dyspnea using the VTL without actually seeing the patient. Seven out of these 10 patients were overtriaged by the VTL.

Interestingly, the group with a TWT-VTL category red (71 of 485, 14.6%) was larger than the group of emergency patients triaged as category red in an evaluation of the workability of the Dutch triage guidelines in 14 Dutch hospitals (116 of 10,737 patients, 1.08%), using the MTS.¹² This may be influenced by the use of different discriminators and the retrospective nature of applying the VTL. The possibility that animals were truly at greater risk to become more critically ill seems unlikely. A more plausible explanation may be that people wait longer to visit a veterinarian with their pet than they would to see a physician for themselves. Therefore, the disease will be in a more advanced stage at presentation. This may be intentional, for example, for financial or emotional reasons, but also unintentional. However, a similar study in a different region may show different results.

The relationship between assessments and level of experience of the nurses was not evaluated in this study. The reason for this omission was that no independent significant relationship between experience and

triage decision making has been demonstrated in human studies.⁴³

The major limitation of this study is that the TWT-R assessments were inevitably subjective. In addition, the review team consisted of only 2 investigators. For this reason, experts were consulted in cases of uncertainty. Even though these experts were not involved in the assessment of all cases, or in the development of the VTL itself, the contributions of the additional expert opinions on the VTL were regarded as substantial. The retrospective determination of the VTL triage categories was another limitation. While the TWT-N was assessed in the waiting room during busy working hours, the TWT-VTL were performed later by one of the authors. The results of the physical examination, performed by the emergency veterinarians that had treated the patients were available for the VTL triage, mimicking a situation where all patients received a triage physical exam. A part of the favorable results of the VTL triage may therefore be attributable to the retrospective nature and the availability of the physical parameters. Furthermore, the same patient group was used for both generation and testing of the VTL. This may have biased the accuracy of the VTL triage. However, the study group was relatively large and likely represented an average patient load in this particular clinic. Other points of concern are that not all clinical parameters could be recorded due to a high workload and ethical considerations (eg, a dying patient of which the owner wished euthanasia) and that the diagnosis could not be made in all patients. The latter may not be clinically relevant, as a diagnosis in itself is not accurately linked to clinical priority.¹¹ When it was not possible to categorize a patient based on the available data, it was excluded from the study. A final point of interest is that cats were overrepresented in this study (61.9%). Future studies are warranted to evaluate whether separate lists would be more appropriate for dogs and cats.

Conclusions

This study demonstrated that an intuitive triage (TWT-N) was less strongly correlated with the retrospectively assessed triage of the cases (TWT-R) than triage performed using a VTL (TWT-VTL). A short physical examination in all emergency patients appears to be essential in recognizing critical states. Specific training for veterinary nurses and emergency physicians in how to perform triage and how to implement the use of a standardized triage system in clinical practice is likely to result in more appropriate target waiting times for emergency patients. Using a triage system can help sort veterinary emergency patients into appropriate triage categories. Further evaluation of the VTL by a multidisciplinary

group and prospective evaluation of the triage list is warranted.

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Appendix

Table A1: Proposed Veterinary Triage List. Changes made compared with Manchester Triage System are indicated as follows: ↑ raised one triage category; ↓ lowered one triage category; * defined differently; § added.

Triage category	Subcategory	Discriminator
Red	Respiratory	Severe respiratory distress*
	Circulatory	Shock (decompensated) Exsanguinating hemorrhage
	Neurological	Currently seizing Unresponsive
	Gastrointestinal	Rapid onset abdominal distension
	Obstetrical	Presenting fetal parts
	Generalized	(Suspicion of) hypoglycemia Rectal temperature $\geq 41^{\circ}\text{C}$ * ↑ Rectal temperature $\leq 36.7^{\circ}\text{C}$ * ↑
Orange	Respiratory	Moderate respiratory distress* Acute stridor* ↓
	Circulatory	Subcutaneous emphysema
		Uncontrollable major hemorrhage
		Signs of arterial thromboembolism*
		Pale mucous membranes in absence of shock §
	Neurological	Abdominal fluid thrill §
		Altered level of consciousness
		Acute abnormal behavior*
		Acute continuous vocalization §
	Trauma	Cluster seizures §
		Acute complete loss of vision
		Evisceration
		High lethality envenomation
	Gastrointestinal	Proptosis of eye §
		Penetrating or acute chemical ocular injury ↓
		Toxin ingestion (Possible) foreign body ingestion >24 hours with anorexia or vomiting
	Obstetrical	Active labor
	Urogenital	History of seizures*
		Rapid onset of testicular swelling and pain § Urethral obstruction * ↑

Table A1: Continued

Triage category	Subcategory	Discriminator
Yellow	Generalized	Petechiae/purpura/ecchymosis * (Suspicion of) hyperglycemia with ketosis Severe pain General weakness* Severe dehydration (>8%)* Rectal temperature 40.5–40.9°C*↑ Mild respiratory distress*
	Respiratory	Uncontrollable minor hemorrhage
	Circulatory	Acute spinal/peripheral neurological deficit
	Neurological	or acute deterioration *↓ Head tilt § History of unconsciousness (excluding uncomplicated seizures) *
	Trauma	Moderate lethality envenomation Oral stick trauma § Open fracture/gross deformity Medium to large skin wound § (Possible) foreign body ingestion § Persistent vomiting Melena *↓
	Obstetrical	Recent history of trauma Abnormal blood loss per vagina in pregnant animal
	Urogenital	Red discoloration of urine without stranguria *
	Generalized	Ventroflexion of the head and neck § Facial edema ↓ Moderate pain * Moderate dehydration (5–8%) * Severe pruritus *↓ Anorexia in puppy or kitten § Rectal temperature 40.0–40.4°C*↑ Local inflammation Stranguria/tenesmus § Vomiting Recent mild pain or pruritus Recent isolated seizure § Swelling Rectal temperature 39.0–39.9°C* Recent problem
Green		

Table A2: Definitions of discriminators used in alphabetical order

Anorexia in puppy or kitten	A dog or cat younger than 12 weeks ¹⁶ that has not eaten for ≥12 hours.
Cluster seizures	More than 2 generalized seizures in 24 hours. ¹⁷
Dehydration	Severe (>8%) – tented skin stands in place, prolonged capillary refill time but < 2 seconds, sunken eyes and dry mucous membranes. ¹⁸ Moderate (5–8%) – subtle decrease in skin turgor, slight prolongation in capillary refill time, eyes possibly sunken in orbit, possible dry mucous membranes. ¹⁸
General weakness ¹¹	A general reduction in muscle tone combined with mental depression. Animals are usually able to stand or walk but are reluctant to rise and will lay down as soon as they are allowed.
Gross deformity ¹¹	Gross and abnormal angulation or rotation is implied.
Hemorrhage ¹¹	Exsanguinating – occurring at such a rate that death will ensue unless the bleeding is stopped. Uncontrollable major – not rapidly controlled by the application of sustained direct pressure and in which blood continues to flow heavily or soak through large dressings quickly. Uncontrollable minor – not rapidly controlled by the application of sustained direct pressure and in which blood continues to flow slightly or ooze.
Hypoglycemia	Serum glucose ≤3.3 mmol/L (60 mg/dL). ^{19,20} Animals that are on insulin therapy and lethargic puppies and kittens are at risk of hypoglycemia. Typical signs include decreased responsiveness, general weakness, and a staring look.
Hyperglycemia with ketosis	Serum glucose ≥11 mmol/L (200 mg/dL) combined with signs of ketosis. ¹¹ Animals with a history of diabetes mellitus that did not receive insulin for a certain period of time are at risk of having hyperglycemia with ketosis. Sometimes an acetone breath can be perceived.
Medium to large skin wounds ¹¹	Subjective assessment. Lacerations of skin and subcutis that are medium to large for the size of the animal are implied. In deeper wounds pain assessment will prevail.

Table A2: Continued

Persistent vomiting ¹¹	Vomiting that is continuous or that occurs without any respite between episodes.
Pain	Severe: uncontrollable and intense. Stops normal activities. Animals may cry out when touched and may become tachycardiac and tachypneic. Painful extremities will not be used or the animal is unable or unwilling to rise. ^{11,21} Moderate: Stops some activities. Animals may respond with groaning when touched, may demonstrate trembling and can have anorexia. Painful extremities will most likely not be used. ^{11,21} Mild: Animals can perform most activities. Painful extremities will still be (intermittently) used. ^{11,21}
Respiratory distress	Severe: Directly life threatening or rapidly worsening. Patient can have blue or very pale mucous membranes, open mouth breathing, increased work of breathing, may demonstrate exhaustion or depression, may have oral moist breathing sounds, and very likely have abnormal lung sounds. Moderate: Not immediately life threatening, not worsened in the past hour. Animals can have pale or pink mucous membranes, clear increased work of breathing, may have (intermittent) open mouth breathing, especially when stressed and may have abnormal lung sounds. Mild: Mildly increased work of breathing. Patients do not have open mouth breathing, do not require oxygen therapy and may have localized abnormal lung sounds.
Shock (decompensated)	Inadequate perfusion of tissues. Classical symptoms of early decompensated shock include a reduced level of consciousness, pale mucous membranes, a capillary refill time > 2 seconds, poor peripheral pulse quality, low rectal and peripheral temperature, bradycardia in cats (defined as a heart rate < 120/min) ²² and tachycardia in dogs ²² (defined as a heart rate > 160/min). ²⁰ Symptoms of late decompensated shock include bradycardia and an absent capillary refill time. ²³

Footnote

^a SPSS 15.0 for Windows. Statistical Package for Social Sciences, SPSS Inc, Chicago, IL.

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