Stress—Its Effects on Health and Behavior: A Guide for Practitioners

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KEYWORDS

• Stress • Health • Behavior • Arousal • Emotions • Stress audit

KEY POINTS

- Stress may affect the physical, mental, and social health of an animal.
- The effect of stressors is individual to the animal concerned and results from the appraisal of the stressor by the animal.
- Emotional states are not mutually exclusive and emotional conflict can also have serious behavioral consequences.
- Treatment of animals presenting with problems deemed to be stress-related should focus on the amelioration of background stress as well as specific stress-related triggers.
- Providing animals with certain coping mechanisms as well as teaching them some key life skills may be beneficial for the prevention of stress-related problems.

INTRODUCTION

The impact of stress on human health is widely recognized but recognition in the veterinary literature seems more limited. Health has physical, mental, and social dimensions,[1] and the growth of veterinary behavioral medicine has led to the development of paradigms for assessing the impact of stress on each of these. All of these health dimensions impact on the well-being of the patient, albeit in different ways, and perceived problems in any dimension are often a cause for concern by owners. It is therefore important not only that practitioners recognize the relationship between stress and these problems but also that they are prepared to manage them. Achieving this requires a clear understanding of the nature of the risk factors, which increase the likelihood of a stress response (stressors) and how this response may be manifest in the physical, mental, and social health of the individual. Only then can sound preventive advice and intervention be offered with confidence.

The stress response consists of the physiologic, behavioral, and psychological changes that occur in the face of a challenge to an individual's state of well-being.[2]

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Many approaches are used to infer an animal's level of stress, but there is no single valid way of doing this, nor is there ever likely to be, because, contrary to the initial theories regarding the stress response (eg, general adaptation syndrome[3]), responses are in fact determined by the nature of the stressor. Appreciation of this fact should lead to clinical recognition that different types of stressors require different interventions to manage them according to the fundamental quality of the stressor involved. As discussed in this article, this quality is defined by the emotional processes that the stressor arouses within the individual.

ASSESSING SPECIFIC STRESS RESPONSES

Cortisol has historically been used as a biomarker of stress, but raised cortisol level is really just a physiologic reaction to environmental changes that increase arousal, whether that is in a positive or negative way. To assess emotional distress, it is necessary to systematically triangulate a range of measures to make an inference with the necessary objectivity for this process to be considered scientific. For example, for the evaluation of the effect of a potential auditory stressor on a dog (eg, a loud noise), all available indicators of physiologic (eg, tachypnea, tachycardia, drooling, pupil dilation) and behavioral change (eg, dog runs up to its owner or runs away, dog shows hypervigilance or increased tendency to startle) need to be considered to evaluate the psychological quality of this stimulus *to this dog*, *in this situation*. This statement is particularly important, but potentially challenging, when trying to differentiate an active emotional response to aversion from a conditioned response (learned habit) that gains the owner's attention.

In addition, it must be noted that stressors may differ not only in type (qualitative aspect) but also quantitatively (in intensity), and that different behavioral and physiologic signatures may be associated with these differences or a change in the stressor's quality and/or quantity. Continuing the previous example, this might involve a shift from freezing to flight behavior in the case of a more intense (louder) or less predictable sound, which may also indicate the need for different interventions, although still focused on the same broad type of emotional response (fear).

To infer that a given event evokes an emotional response, 4 lines of evidence should be used[4]:

1. The event is of personal importance to the individual and the response is associated with its anticipated or actual arrival or removal. From an affective neuroscientific perspective, it has been argued (Mills and colleagues[5] adapted and developed from Panksepp[6]) that the stimuli associated with these events (emotionally competent stimuli) can be broadly classified into
   a. Desirables (resources the animal wants)
   b. Frustrations (the denial or absence of things that the animal wants)
   c. Fears (threats to the animal)
   d. Pains (bodily damage)
   e. Those with whom an affectionate bond is shared (social play and similar positive interactions)
   f. Attachment figures and objects (sources of safety and security)
   g. Offspring (parental activity)
   h. Potential sexual partners (courtship and reproductive activity), to which a ninth category is now added:
   i. Undesirables (avoidance, including aggressive responses focused on stimuli which do not pose an actual or perceived physical threat)

2. The response reflects a change in arousal (increase or decrease depending on the emotional state involved), which provides underlying physiologic support for the action to be taken in association with the triggering event
3. The response is associated with general changes in behavioral tendency (eg, the tendency to escape), which may vary with the options available to the animal (ie, the form of escape used varies with the circumstances). A relatively invariate response may imply either an extreme reaction or the development of a conditioned habit
4. The event produces changes in behavior associated with communication of the animal's internal state (eg, certain facial expressions)

Emotional responses are not mutually exclusive and more than one may occur at any given time within an individual. For example, a dog that does not appear comfortable around other dogs may be reacting for many reasons, but to take just 2 of these possibilities: he may be afraid of other dogs or he wants to approach but is frustrated by being on the leash (2 concurrent emotions). In both scenarios, the dog may appear superficially to express similar responses (eg, lunging behavior and barking), but fear will typically include well-established elements of body posture, such as the ears drawn backwards, gaze aversion, tail tucking, and a lowered body stance before any aggressive response.[7] By contrast, an animal that is frustrated from interacting with another will show signs of positive approach and engagement before any aggressive behavior, with ambivalent, displacement, or redirected behaviors, like walking on the spot, circling, yawning, leg cocking, when he is excited.[5] It is worth emphasizing, that, in this example, the different emotional responses are associated with different emotionally competent stimuli, even though the general circumstances are the same—in the first, it is the arrival of the dog, and in the second, it is the combined stimuli of the presence of the dog and the presence of the leash. These circumstances may be partly differentiable because of the evidence provided by the animal's behavior when off leash. Also, if the frustrated dog is punished by its owner for this display, a change in (or addition of) emotion may occur with fear displayed that has the owner as its focus (**Fig. 1**). If this situation of the dog reacting to dogs occurs regularly with either a specific dog (or dogs in general), the other dog (or dogs in general) may become an undesirable stimulus so that a pre-emptive aggressive display is made to prevent contact, before any signs of fear or frustration. The subtleties of the distinguishable ethological elements associated with this latter response are the subject of ongoing research by the authors' research group.

Another important consideration when assessing the stress response in any given individual revolves around the neurochemistry of the underlying behavior. In behavioral medicine it has been noted that not all patients with the same broad behavioral diagnosis respond in the same manner to the same intervention and this may reflect different underlying mechanisms, giving rise to a common end point. Different neurotransmitters may be implicated in the presentation of the same superficial behavior. For example, Pageat and colleagues,[8] described a positive correlation between anxious behaviors and prolactinemia and that prolactinemia may be useful in guiding the choice of medication; thus, animals with behavioral manifestations of anxiety and lower levels of prolactinemia tend to improve after fluoxetine (a selective serotonin reuptake inhibitor) administration, whereas dogs with increased prolactinemia improved more after administration of selegiline (a monoamine oxidase inhibitor). As with individualized medicine in humans, looking beyond superficial diagnostic categories allows one to be more specific with interventions,[9] especially in the case of an acute response. This intervention eases treatment for clients (which makes

Fig. 1. It is important for clients to recognize the subtle signs of discomfort, such as a head turn, rather than force the animal into stressful situations that may provoke a more overt response. (*Courtesy of* P. Baumber, Lincoln, United Kingdom.)

compliance more likely), because redundant measures can be identified and excluded more effectively. If left untreated or treated inappropriately, the chronic arousal associated with long-term stress can also have serious physical health impacts, once again emphasizing the importance of accurate assessment and appropriate interventions (**Box 1**).

THE IMPACT OF STRESS ON PHYSICAL HEALTH

Stress has been shown to directly shorten an animal's lifespan,[10] but it is also associated with various detrimental changes in physical health (eg, through its impact on the immune system, gastrointestinal function, and the urogenital system), which affect the animal's quality of life. Several well-documented associations in the companion animal veterinary literature are reviewed briefly below in this section, but it should be noted that associations do not necessarily indicate causality and indeed the 2 will interact, because disease is by definition stressful (it is a state of changed or "dis" ease). In some situations the relationship may be unclear. For example, hyperthyroidism in cats is more common in cats kept indoors (increasing the odds by

Box 1
Assessing the specific stress response

- A single measure of stress such as cortisol is inadequate when assessing a patient because these general measures may simply indicate a level of arousal with no regard to the underlying emotional state of the individual.
- Assessing emotion through triangulation of features is critical for the implementation of a plan to manage or treat stress.
- Emotional states are not mutually exclusive and the emotion(s) elicited in a specific situation can undergo alteration over time.

a factor of 4 to 11.2)[11] and although this might be associated with increased stress, recent data suggest the coincident increased exposure to fire retardants, which are widely used to treat home furnishings and have been shown to affect thyroid function, may be very important in this increased risk.[12]

Urinary System

An increased risk of interstitial cystitis in cats is associated with a range of stressors (eg, moving to a new home, dogs or other cats in the house, and especially, conflict between cats and difficulty accessing a litter tray).[13,14] Three different studies have also shown an increased risk for cystitis correlated with the time that cats spent indoors.[15–17] In addition, this condition is associated with increased plasma norepinephrine.[18] A possible pathophysiological mechanism for these associations might relate to a change in bladder permeability associated with stress.[19]

A recent study found that behaviorally normal and problematic cats from households including a urine sprayer had elevated fecal glucocorticoids (an indicator of chronic arousal), compared with individuals from homes with a cat that was failing to use the litter tray,[20] suggesting that urine spraying is a more common behavioral outcome of chronic stress than failure to use the litter tray. It is worth noting that in this study, 7/18 (39%) of the spraying cats who seemed otherwise physically normal to their owners had signs of physical disease on clinical examination. By comparison, 11/23 (48%) of the toileting cats were subsequently found to have physical problems, suggesting that failure to use the litter tray often has medical complications, but these do not seem to be associated with ongoing chronic stress.

This finding demonstrates the importance of careful evaluation of health and behavioral indicators when a sign such as house soiling is presented because there is no simple means of determining the influence of stress on the presenting signs.

Reproductive System

In dogs, decreased sperm quality, azoospermia, has been associated with an anxious temperament.[21] Fear and anxiety may also inhibit complete erection and ejaculation in the dog[22] and reduce proceptive and receptive behaviors. On the other hand, environmental stress in bitches may result in a failure to breed.[23] In young bitches, stress may play a role in the development of "split cycles," an estrous cycle that begins with normal follicular development and estrogen secretion but fails to progress to ovulation or can be a contributory factor for delayed puberty.[23]

Immune System

Although small bouts of stress can enhance the immune response toward a pathogen, chronic stress can dampen immune responses to invasive pathogens.[24] In humans, chronic stress seems to result in suppression of the immune response[25] and 2 studies in shelter dogs support a similar association.[26,27] In catteries, it has been found that cats exhibiting high levels of stress are about 5 times more likely to develop upper respiratory tract infection compared with cats exhibiting lower levels.[28] Stress during pregnancy in both human and nonhuman animals can also reduce immunocompetence in the offspring.[29,30]

Gastrointestinal System

Stress has been associated with various gastrointestinal diseases in humans, including functional bowel disorders, inflammatory bowel disease, peptic ulcers, and gastroesophageal reflux.[31] In both cats and dogs it has been associated with intermittent diarrhea, vomiting, or decreased appetite, especially when the stressor

is associated with isolation or confinement.[32,33] Cats faced with unexpected changes to their management may decrease appetite and water intake, avoid elimination for 24 hours (potentially increasing the risk of constipation), and defecate outside the litter tray.[34] In general, food intake and stress seem to be negatively correlated in cats,[28] whereas in dogs, associations have been made between increased stress and coprophagia[35] and inflammatory bowel disease.[36]

The Integument

The skin and nervous system are both derived from embryonic ectoderm[37] and so it is not surprising that they share functional relationships through a substantial number of common hormones, neuropeptides, and receptors.[38] Thus, under stressful conditions, these common factors might play a role in the pathogenesis of dermatoses, such as atopic dermatitis,[39] or lead to the expression of pruritus.[40] The management of identifiable environmental stressors or concurrent behavioral problems in dogs with recurrent pyoderma can be an important part of the long-term treatment of these conditions.[41] An increased severity and frequency of dermatologic conditions has been reported among dogs with fears and anxieties,[10] and the importance of multimodal treatment addressing concurrent psychological conditions in dogs with pruritus, such as anxiety, fearfulness, or aggressive behavior, is increasingly being recognized.[42] Indeed it has been suggested that behavioral therapy in combination with psychopharmacology can be important in achieving an improvement of 50% or more in dermatologic expressions of repetitive behaviors in cats and dogs.[43]

In cats, self-grooming and scratching are often immediate responses to conflict without any pathologic impact.[44] However, within repeatedly stressful situations over which the cat has very limited control, maladaptive over-grooming may develop.[45] Although a range of environmental and social stressors have been associated with this disorder,[43] others suggest that psychogenic alopecia is overdiagnosed and that in most cases the cause is primarily an underlying medical factor.[46] In reality, attention should be given to both physical and psychological elements because the former probably increases the risk of the latter even if they are not specifically causal (**Fig. 2**).

THE IMPACT OF STRESS ON MENTAL HEALTH

Not only is anxiety a mental health problem in its own right and a risk factor for the development of a range of physical health problems as described in the previous

Fig. 2. Stress may not only trigger bouts of over-grooming but also play an important role in maintaining chronic dermatopathies. Multimodal management of such cases is essential. (*Courtesy of* S. Stariha Pipan, Lincoln, United Kingdom.)

section, it can also increase the risk of other psychological problems. In humans, it has been reported that generalized anxiety increases the risk of separation anxiety in children, social phobias in adults, and more generally, the risk of obsessive-compulsive behavior and posttraumatic stress disorders, all of which may have companion animal analogues.[43]

Unavoidable and unpredictable fear-eliciting stressors may result in more general disturbances to mental health if the animal is unable to find an appropriate way to cope. For example, a dog with a sound aversion may become more generally anxious during fireworks season, necessitating the use of combination psychopharmacological therapy to control both the emotional response to specific noises (benzodiazepines) and the more general change in mood (specific or nonspecific serotonergic agents).

Chronic frustration may similarly evoke more general behavioral changes, especially when the animal is faced with an insoluble problem.[5] Depending on the individual and the circumstances, the pet might respond passively with depressed behavior, or actively with a state of heightened arousal and possibly chronic displacement behaviors that may ultimately become stereotypic (eg, tail chasing).[47] Genetic factors inevitably play a role in the expression of specific displacement activities, for example, flank-sucking is often associated with Dobermans,[48] tail chasing and spinning with German shepherds and bull terriers,[49] and wool sucking with Oriental cat breeds.[50] However, it important to note that although genetic factors constitute a heightened risk for the development of the behavior, a stressor still needs to be present to trigger its expression.

Mental health problems may arise not only from the prolonged effects of specific emotions but also from the emotional consequences of motivational conflict. For example, a dog that is inconsistently treated by a member of the family may suffer from such conflict anxiety. This conflict anxiety is distinguished from the anxiety that arises from the anticipation of an aversive event, because it is associated with uncertainty about the current state, rather than a concern about the future and may be evident from a greater prevalence of ambivalent behaviors such as approach-avoidance and hesitancy. Treatment of such a problem needs to focus on resolving the conflict; accordingly desensitization regimes are of less value than respondent counterconditioning of the emotion, for example, with powerful rewards to encourage approach.

Finally, it is worth noting again that the increased arousal associated with stress is normally mediated through the endogenous glucocorticoid system. In addition to mobilizing energy reserves, these chemicals seem to have significant effects on cognitive processing, resulting in greater sensitivity to aversive events, which may be of mental health significance, in both normal animals and those already suffering some degree of dementia. Stress responses may increase cerebral metabolic demand and so have the potential to increase the rate of cognitive decline in animals with cognitive dysfunction. Concern over the deleterious psychological effects of raised levels of glucocorticoids has also caused some[51] to recently recommend using caution in the chronic administration of related chemicals for therapeutic reasons. An initial survey by these authors indicated that around 30% of dogs treated with glucocorticoids showed increased sensitivity to aversive events (eg, nervousness and/or restlessness, increased startle responses, food guarding, increased avoidance responses including irritable aggression, and increased barking).[51] Obviously these drugs have many beneficial effects, but, given the precautionary principle, these data suggest a cost-benefit analysis should be performed before they are prescribed, noting the potential increased risk of behavior problems related to an increased

sensitivity to aversive stimuli and also the significance of possible negative psychological effects on welfare.

THE IMPACT OF STRESS ON SOCIAL HEALTH

Social health includes a wide range of interactions with others, both con-specifics and hetero-specifics. Perhaps the most widely recognized problems in this domain include the "social phobias,"[39] but conditions like agoraphobia also impact on normal social interactions, albeit indirectly. In a study of 1040 dogs with aggressive behavior problems, more than a third of them involved family members and around 12% involved dogs living in the same household,[52] indicating poor social relationships likely to result in stress with an associated risk to health (**Box 2**). Fear and frustration are commonly cited as the most common reason for these problems[53] and this may result from chronically inconsistent interactions that give rise to stress. Thus it can be seen that where relationship problems occur, stress can be a cause and/or a consequence (**Table 1**).

Behavior problems (and especially aggressive behavior) are among the most common reasons given for the relinquishment of dogs and cats,[54] and this abandonment may also be considered another social health cost associated with chronic stress. Accordingly, as the veterinary profession increasingly takes on a responsibility for the total health care of pets, it is essential that techniques aimed at managing and preventing these problems are embraced. These interventions form the focus of the second part of this article.

PRINCIPLES OF STRESS AUDITING AND INTERVENTION MANAGEMENT

Behavior problems arise as a result of the accumulation of risk factors of varying importance and are rarely entirely related to a single cause. Accordingly, management should focus on addressing relevant factors based on both their significance and also the ease with which they can be addressed. Although many behavior problems may have a clear trigger that may be considered a stressor, these are not the focus of this article, because this embraces much of veterinary behavioral medicine. Instead, the focus here is on the management of factors that increase the risk of a problem, which may provide the tipping point for the expression of a problematic behavior or exacerbate its intensity to an unacceptable level. In some situations focusing on these may resolve the problem and be easier for clients to address.

Box 2
The impact of stress on health

- Several organ systems have been shown to be susceptible to developing pathologic abnormality as a result of stress, for example, the urinary, gastrointestinal, reproductive, and immune systems as well as the integument.
- For these reasons, where the underlying cause of a disease process is unclear and especially in the case of recurrent problems, stress should be investigated as a contributory cause.
- There is now evidence that corticosteroids may give rise to changes in behavior; therefore, their use needs to be even more carefully scrutinized, especially their long-term use or use in patients already at risk of developing certain behavior problems related to negative affect.
- Stress can lead to alterations in behavior that impact on relationships between individuals and vice versa.

Table 1
Stress' impact on dogs' and cats' health

	Species	Impact
Physical health		
General	Dog	Shortened lifespan
Urinary system	Cat	Increased risk of interstitial cystitis Increased risk for cystitis Association between spraying and medical complications
Reproductive system	Dog	Decreased sperm quality (azoospermia) Inhibit complete erection and ejaculation Failure to breed in bitches "Split cycles" Delayed puberty in female animals
Immune system	Dog Cat	Suppression of the immune system Increased risk to develop upper respiratory tract infection
Gastrointestinal system	Dog, cat Cat Dog	Intermittent diarrhea, vomiting, or decreased appetite Decreased appetite and water intake, avoiding elimination for 24 h, defecation out of the litter tray Coprophagia Inflammatory bowel disease
Integument	Dog Dog, cat Cat	Pyoderma Pruritus Increased severity and frequency of dermatologic conditions Repetitive behaviors Repetitive behaviors, eg, over-grooming
Mental health	Dog, cat Dog Cat	Chronic frustration Deleterious psychological effects of raised levels of glucocorticoids Nervousness and/or restlessness, increased startle responses, food guarding, increased avoidance responses including irritable aggression, and increased barking Tail chasing Flank sucking in Dobermans Tail chasing and spinning in German shepherds and bull terriers Wool sucking in Oriental cat breeds
Social health	Dog, cat Dog	"Social phobias" Aggressive behavior toward family members or toward dogs living in the same household

Data from Refs.[5,10–18,20–23,26–28,32–36,39–45,47–53]

As with specific stress responses, this background stress may have a predominant quality, which alters the likelihood of an overt emotional reaction in a given circumstance. For example, if the home is relaxed, the animal may be less likely to show a specific fear response, but if there is an undercurrent of anxiety, these responses may be more likely to occur. In clinical practice, increased levels of background stress in the home have been found to be one of the most pervasive risk factors for aggression by cats toward humans.[55] To address this issue, it is essential to first recognize the background context of the problem. A framework for this systematic evaluation of circumstances requiring intervention is provided by the stress audit process, which aims to identify these nonovert risk factors.[5] Each of a series of contexts is systematically evaluated for the predominant affective responses (as detailed above) with which they are associated. These stresses are listed in **Box 3**, together with indicators

Box 3
Stress audit

- Husbandry
  - Daily management
  - Rules and regulations
    - Training given to enable the pet to understand them
    - Consistency of enforcement by all spending time with the pet
  - Level of routine
  - General environment quality both physical and social
- Expectations placed on the animal by its owner
  - Animal's role and whether it is the same for all family members
  - Clarity and consistency of expectations by all family members
  - Provision of resources needed by the animal to achieve these expectations
- Ongoing change
  - Amount and type of change
  - Predictability within changing situations
  - Preparation for change and communication of ability to cope
  - Availability of coping strategies
- Specific stressors in the home affecting the client's family
  - Changes in behavior or circumstance that might impact on the animal
    - Associated changes in expectations of animal's behavior (see specific stressors affecting the pet, below)
    - Associated changes in animal's management
- Specific stressors in the home affecting the pet
  - Physical characteristics of the stressor
    - Affective quality
    - Intensity
    - Magnitude
    - Duration
    - Predictability
  - Expectation of animal's behavior in relation to this stressor
    - Preparation given to enable coping
    - Appropriateness of response to the pet's behavior including variants of it
  - Opportunities for control over the stressor by the pet
  - Supportive or conflicting social relationships in the home (see also support for the pet, below)
- Support for the pet
  - Communication
    - Clarity: instruction provided or animal expected to initiate appropriate behavior
    - Provision made for the animal to succeed in the above
  - Feedback
  - Consistency

of some more specific characteristics to be explored. Elements are then discussed further in the following sections. With practice, the assessment of these in the clinical setting can be made from questions framed into a conversation of just a few minutes, alongside a written history.

Demands and Expectations

The first goal of the stress audit process is to examine the demands being made of the animal in terms of its daily management, including its level of routine (predictability), the quality of the general environment, and the support given to the animal to ensure it is able to adapt to these expectations. For example, a dog that is home alone for an extended period of time may be more prone to certain forms of separation-related problems if it has not been trained to cope with either the frustration of being confined or separation from an attachment figure. By way of further example, if a family expects a dog not to jump on the sofa, but he has never been consistently taught this, there is likely to be frustration as the animal is sometimes punished for jumping on the sofa but is at other times allowed up (without it being clearly cued that this is acceptable) when members of the family want company (**Fig. 3**).

Second, the stress audit considers the physical characterization of specific demands and the preparation and available resources given to the animal to help it cope (**Box 4**). An animal may be able to cope with stressors individually, but together, especially if the stressors are of the same emotional quality, these events may overwhelm the individual. In this regard, predictability and control may be particularly important considerations. If an animal is able to cope, predictability may reduce the impact of the stressor, but if not, both predictable and unpredictable stressors will lead to a significant stress response—in predictable situations anxiety may develop from the time the animal can predict the triggering event; however, in the case of unpredictable stressors, the animal may generalize its state of anxiety to many extraneous stimuli.

Control implies that the animal has acceptable choices available to it that it can use to reduce the impact of the stressor for itself; for example, a dog that is not at ease with unfamiliar people and does not have anywhere to retreat to when visitors arrive has no

Fig. 3. Dogs need to learn frustration control, so they do not get over-aroused when denied the opportunity to engage in a pleasurable activity. (*Courtesy of* P. Baumber, Lincoln, United Kingdom.)

Box 4
The stress audit

- Stressors are cumulative and therefore all aspects of an animal's life need to be assessed when planning an intervention to manage stress.
- Both the physical and the social environment, as well as changes in both, need to be assessed as part of the stress audit.
- Control and predictability are important for stress reduction.
- Owners who offer support (rather than consolation) to help their pet's coping ability in the face of the pet reacting to stressors can reduce their pet's stress, whereas a punitive owner response will exacerbate this.

control over the situation and may respond aggressively as a consequence. The provision of an area of safe and secure retreat, however, puts it in control (**Fig. 4**). Provision of such a safe haven is extremely important in the effective and safe management of a dog and is described further in **Box 5**.

When an animal faces a demand, it will cope best if those around it are supportive rather than indifferent or in conflict with it. Often, owners feel the urge to punish their pets when they do not behave as they would like (**Fig. 5**). Punishment not only potentially exacerbates an animal's anxiety and/or frustration, but also impacts on the dog's perception of the individual as a consistent source of security (secure base; see below, **Box 5**), affecting its wider coping capacity. It is therefore not surprising that physical punishment is significantly associated with all forms of dog-related aggression (ie, toward owner, unfamiliar people, and other dogs).[56]

INTERVENTION MEASURES FOR MANAGING STRESS

As already mentioned, specific problems may require specific interventions, but this falls outside the scope of this article and the reader is referred to other texts for advice

Fig. 4. A safe haven is not the same as a bolt hole, and the association with safety, security, and control needs to be made, away from stressful situations. (*Courtesy of* P. Baumber, Lincoln, United Kingdom.)

Box 5
A note on safe havens and secure bases

A safe haven is an area where the animal is in control and which has become a conditioned place of safety outside of times when there are significant stressors. Consequently, when the animal is faced with potential stressors, it can retreat to this place and feel relatively safe. This safe place is not the same as a "bolt hole," which is a place to which the animal goes hoping that the aversive event will pass (ie, the animal is not confident of a desirable outcome). When establishing a safe haven, it is important that training takes place when the animal is calm and not anxious and that the philosophy of this area is respected by all family members (ie, the animal should not be forced to come out of the safe haven); no one forces their attention on the animal when it is in its safe haven, and there are only ever positive associations with the place (eg, tasty treats or toys can be placed when the animal is not there for it to find). Pheromonatherapy may provide unconditioned chemical safety signals to help enable the creation of this area, especially in an otherwise chaotic home environment.[5]

A secure base is a place or individual that allows an animal to explore uncertainty with confidence. Accordingly, a safe base cannot be associated with aversives and in the case of the person there may be an expectation that the individual will recognize and intervene to abort situations in which the animal is expressing discomfort.[62]

on these matters (eg, Refs.[5,39]). Nonetheless, it should be remembered that support measures need to be tailored to the individual patient, their family, and circumstances, because there is no point overwhelming a client with tasks beyond their competence or resources.[5] Therefore, simple management and environmental changes, such as avoidance of exacerbating stressful circumstances and the use of pheromonatherapy where relevant, are often preferable as initial interventions, although specific behavioral intervention may be required.[5] Where possible, training and learning exercises should be framed within the context of normal daily interactions, because time is often the most limited resource for many clients, impacting on their compliance with training.[57]

Interventions to manage stress will always be important, but minimizing the stress response in the first place would be ideal. To this end, early life experiences can be manipulated to help pets cope with stimuli that may put them at risk for arousal and negative emotion. A review of the literature of puppy and kitten development is outside the scope of this article, but there is extensive evidence of correlations between certain early life events and the expression of problem behavior later in life.[58,59] Although

Fig. 5. Encouraging inappropriate play can not only lead to problematic behaviors like biting, but also become part of a stressful cycle as the owners try to punish what they see as inappropriate behavior by the cat. (*Courtesy of* Daniel Mills, Lincoln, United Kingdom.)

causal relationships are often difficult to prove and scientific assessment of early life interventions is scant (see Seksel and colleagues[60] as an example of such a study), appropriate puppy training, habituation, and socialization are generally advised. More specific to developing coping strategies for stressors, Zulch and Mills[61] postulate that owners should take a more proactive role in creating resilience through educating puppies in life skills. Examples of the type of skills that puppies can learn to assist them in coping with everyday life include an ability to experience novelty with confidence, not immediately take fright at startling stimuli, tolerate frustration, and understand the boundaries. Hand in hand with this go owner skills of responding appropriately to the communicative behavior of their pets so that they can serve as a secure base.[62]

SUMMARY

Stressors impact on all areas of a pet's life, potentially to the detriment of their well-being. In addition, should this lead to behavior change, it is likely to cause strain in the owner-pet relationship with an increased risk of relinquishment. Understanding why events may be perceived as stressful to a given individual is essential in remedying their effect. Clinicians need to be skilled in recognizing and categorizing potential stressors as well as auditing the background stress in the animal's environment as only once this has been accomplished can measures be implemented to reduce the effects of specific stimuli. In addition, a thorough understanding of both the features of a stimulus that elicit a stress response and the cumulative effect of stressors allows the clinician to structure interventions that are tailored to the individual. An individualized approach is likely to be more effective of itself and because it will reduce the resource commitment and skill set required by owners, which through increased compliance is beneficial to the overall outcome of sometimes challenging behavior problems.

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