



# Separation-related problems in dogs: Influence of caregiver characteristics and fear/anxiety

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## ARTICLE INFO

### Keywords:

Behavioral problems  
Caregiver characteristics  
Companion dogs  
Dog-caregiver relationship  
Fear/anxiety  
Separation related problems

## ABSTRACT

Separation-related problems (SRPs) are among the most prevalent behavioral disorders in companion dogs, with negative consequences for the welfare of both dogs and their caregivers. This cross-sectional study focused primarily on caregiver-related characteristics influencing SRPs, followed by the role of fear/anxiety behaviors in dogs. Initial correlation analyses were conducted, and variables significantly associated with SRPs were included in multiple linear regression models to identify the most relevant predictors from a broad set of factors. The results underscore the role of interpersonal dynamics and fear/anxiety. Caregiver stress, emotional closeness to the dog, more positive attitudes towards aversive training methods, and co-sleeping emerged as risk factors, collectively explaining 8.7% of the variance in SRPs. When fear/anxiety was added to the model, the explained variance increased, with the final model accounting for 15% of the variability in this behavioral disorder. In contrast to previous notions that an inadequate dog-caregiver relationship stems from avoidant attachment, the findings suggest that excessive emotional closeness on the part of the caregiver may be a more relevant factor. Future studies should aim to include additional variables in the model (e.g., unpredictable routines, previous kennel stays) to increase its explanatory power.

## Introduction

Over the past few decades, dogs have transitioned from working animals to members of multispecies families, assuming increasingly significant emotional roles (Bradshaw, 2017; GfK Metris, 2018). This rapid shift has not always been matched by adequate adaptation on the part of humans, which may contribute to dysfunctional interactions and behavioral problems (Bradshaw, 2017). When left unaddressed, these issues can develop into behavioral disorders that compromise the well-being of both species (Barcelos et al., 2023). Among these, separation-related problems (SRPs) stand out due to their high prevalence, treatment challenges and consequences for caregivers. In the present study, the term SRPs refers to a range of behaviors that occur in the caregiver's absence or in anticipation of separation - such as vocalization, destruction, elimination, or agitation - regardless of whether

these reach the diagnostic threshold of separation anxiety.

Despite variations in methodology, it is estimated that between 17.2% and 47.4% of dogs display behaviors consistent with separation anxiety (Tiira et al., 2016; Salonen et al., 2020; Beaver, 2024), with 85.9% of dogs showing at least one separation- or attachment-related behavior at a moderate to severe level (Beaver, 2024).

These behaviors can severely affect caregivers, with emotional, social, and financial consequences (Horwitz, 2008; Sherman and Mills, 2008; Soares et al., 2010; Overall, 2013; Enders-Slegers and Hediger, 2019; Kogan et al., 2019; Buller and Ballantyne, 2020; Barrios et al., 2022; Barcelos et al., 2023; Kuntz et al., 2023).

Current evidence suggests that SRPs arise from a combination of emotional states—such as frustration, social distress, boredom, and heightened anxiety—rather than being solely due to hyper-attachment or conditioned fear (Amat et al., 2014; de Assis et al., 2020; Harvey

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<https://doi.org/10.1016/j.jveb.2025.12.013>

Received 21 July 2025; Received in revised form 11 November 2025; Accepted 30 December 2025

Available online 31 December 2025

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et al., 2022; Pierantoni et al., 2022; Hargrave, 2023). In this context, these emotional states are understood as affective responses influencing behavior, rather than formal clinical diagnoses. Recent reviews (Meneses et al., 2021a) further emphasize that separation anxiety and related behaviors are multifactorial in origin, influenced by genetic, developmental, environmental, and caregiver-related variables. Still, fear/anxiety (F/A) remain central to canine mental health and may be strongly implicated in SRPs (Lindley, 2012; Mills et al., 2020; McAuliffe et al., 2022).

In addition to F/A, several etiological factors have been associated with the development of SRPs. Among the most common are: a history of prolonged periods of solitude (Sherman and Mills, 2008); continuous and prolonged proximity to the caregiver without separation intervals (Sherman and Mills, 2008); early separation from the mother, before eight weeks of age (Tiira and Lohi, 2015); extended stays in kennels; having lived in shelters (McCrave, 1991; Jagoe and Serpell, 1996); moving to a new home with the family (Wright and Nesselrote, 1987; Flannigan and Dodman, 2001); sleeping in the caregiver's bedroom (Sherman and Mills, 2008) has also been linked to SRPs.

Environmental and social contexts play a role as well. Living in urban environments (Wright and Nesselrote, 1987); the loss of an animal companion with whom a strong bond existed (Wright and Nesselrote, 1987); having only one caregiver (Perry et al., 2005); a lack of consistency and predictability in daily routines (de Assis et al., 2020; Dale et al., 2024). In this context, predictability refers to stable and coherent routines that help dogs anticipate events, rather than rigid schedules, as excessive rigidity may itself increase frustration or stress. Lack of independence training (de Assis et al., 2020), meaning insufficient habituation to being alone or separated from caregivers in a gradual and positive way, has also been identified as a risk factor for SRPs. Aging and cognitive decline (Chapman and Voith, 1990) are additional contributing factors.

Chronic pain, such as that associated with osteoarthritis (Mills et al., 2020) and a caregiver's failure to recognize this pain may further exacerbate SRPs (Batista et al., 2025).

Certain caregiver-related variables and dog management have been linked to SRPs. Caregiver stress has been associated with SRPs (Hunt et al., 2015; González-Ramírez et al., 2018; Clarke and Loftus, 2023), as has an avoidant attachment style (Konok et al., 2015). Personality traits such as low conscientiousness and high neuroticism have also been implicated (Dodman et al., 2018).

Anthropomorphism may intensify the emotional bond and heighten stress during separation (Mota-Rojas et al., 2021), while patterns of hyper-attachment and emotional dependence may exacerbate SRP symptoms (Sherman and Mills, 2008). Finally, favorable attitudes towards aversive training have been linked to behaviors like persistent vocalization and inappropriate elimination in the caregiver's absence (Dodman et al., 2018). These findings align with the multifactorial model proposed by Meneses et al. (2021b), which highlighted the influence of caregiver-related and management factors on the development and expression of separation anxiety - many of which may also contribute to broader separation-related problems.

Previous research has typically examined predictors of SRPs in isolation, which limits understanding of their relative importance. This study addresses this gap by adopting an integrative approach. The primary objective is to identify caregiver-related predictors—covering intrapersonal, interpersonal, and caregiving/management factors—while controlling for dog-related variables. A secondary objective is to assess the specific contribution of fear and anxiety to SRPs. A cross-sectional questionnaire design was chosen as it allows the simultaneous assessment of a wide range of caregiver- and dog-related variables in a large sample, providing a cost-effective and replicable approach.

## Materials and methods

### Participants

The sample, which was non-probabilistic and based on convenience, included 730 caregivers (95.2% women), with a mean age of 35.5 years (SD = 9.8; range = 18–82 years). This sampling strategy, along with the predominance of female caregivers, may limit generalizability and should be considered when interpreting the results.

### Instruments

The questionnaire comprised four sections: 1) control questions; 2) companion dog questionnaire; 3) caregiver characteristics; and 4) socio-demographic data. In the control section, caregivers were asked about their legal age, whether they were the dog's primary carer, and if they had lived with their dog for at least one year. The Companion Dog Questionnaire (based on the behavior questionnaire of the British Small Animal Veterinary Association, Horwitz and Mills, 2012) followed, asking about the dog's age, how long the dog had lived with their caregiver, where it usually stays during the day, where it sleeps at night, how many hours it spends without human company, walk frequency, veterinary visits, health issues, osteoarthritis diagnosis, radiography with sedation, professional training, basic behaviors, ability to perform tricks, and how disobedience was handled (open-ended). To assess F/A, we used four items: "Is fearful, and it is difficult to be with them in certain environments"; "Is very anxious"; "Is constantly alert when outside"; and "Is constantly alert at home". To assess SRPs, we used six items: "Follows the caregivers around the house like a shadow to avoid being left alone"; "Becomes highly agitated as soon as it realizes it will be left alone"; "Barks and/or destroys items in the house when left alone"; "Urines and/or defecates in inappropriate places when left alone"; "Whines and/or howls when left alone"; "Scratches the front door when left alone". Responses were rated on a scale from 0 = not at all to 10 = very much. The caregiver characteristics section assessed empathy, attitudes toward animals, the caregiver-dog bond, anthropomorphism, emotional comfort provided by the dog, attitudes toward aversive training, ability to perceive chronic pain, personality, attachment style and mental health.<sup>2</sup> Last, participants provided information on gender, age, residence, level of education, and household income.

### Procedure

The study was approved by the Ethics Committee (Ref.: 22170). Data were collected through a Portuguese-language online questionnaire (Google Forms), distributed via social media and veterinary medical centers between 16 October 2023 and 24 March 2024.

Scale scores were calculated as the mean of the items, after reverse-

<sup>2</sup> Empathy: The Animal Empathy Scale (AES) was used to assess empathy towards pets (Emauz et al., 2016). Attitudes: The Portuguese version of the Pet Attitude Scale was employed (Templer et al., 1981; Varela, 2021). Dog-Caregiver Bond: The Portuguese version of the Monash Dog-Owner Relationship Scale (MDORS) assessed the dog-caregiver bond through three sub-scales: perceived costs, perceived emotional closeness, and dog-owner interaction (Dwyer et al., 2006; Guimarães, 2017). Anthropomorphism: The Anthropomorphism Scale was translated and back translated to measure the tendency to anthropomorphize (Antonacopoulos and Pychyl, 2008). Emotional Comfort: The Comfort from Companion Animals Scale assessed the emotional comfort provided by the companion dog (Guimarães, 2017; Zasloff and Kidd, 1994). Attitudes Towards Aversive Training: The Attitude to Training Questionnaire was translated and back translated (Dodman et al., 2018). Chronic Pain Perception Scale (Batista et al., in press). Personality, Attachment, and Mental Health: Participants also completed the Big Five Personality Inventory (Rodrigues and Gomes, 2022), the Adult Attachment Scale (Canavarro et al., 2006), and the Depression Anxiety and Stress Scale (Pais-Ribeiro et al., 2004).

coded items were recoded. All measures showed acceptable values for standardized Cronbach's alpha ( $\alpha$ ) (see Table S1 of the supplementary material).

Qualitative variables were recoded into dummy variables. In all dummy variables, the reference group was coded as 0, the comparison category as 1, and all remaining categories as 0 (Marôco, 2014), (Table S1).

To identify the variables most strongly associated with the behavioral disorder index — and thus potential candidates for multiple linear regression models (MLRM) — Pearson correlations were first calculated between all variables (questions/scales), and the SRPs index (Table S1). Following the guidelines of Marôco (2014), only variables significantly correlated with SRPs were included in the MLRM.<sup>3</sup> To avoid multicollinearity, the subscales were used without including the total scale score simultaneously (e.g., stress, anxiety, and depression subscales from the Depression, Anxiety and Stress Scale).

In the MLRM, as this was an exploratory analysis without a predefined theoretical model, the Stepwise method was initially used to identify the model that best fit the data. After identifying the model, statistical assumptions were assessed, and variables showing signs of multicollinearity were removed.

The predictor variables were then organized into five blocks, and new MLRM were estimated using the Enter method with sequential entry: first, variables related to the dog; second, sociodemographic variables; third, intrapersonal variables; fourth, interpersonal variables; and fifth, variables related to caregiving and management. This approach aimed to identify which group of variables contributed most to explaining SRPs.

A new MLRM was then estimated, introducing F/A as an additional predictor. To reduce potential endogeneity due to simultaneity—that is, overlap between variables influencing both F/A and SRPs—predictors of F/A identified in our previous work (Batista et al., submitted) were excluded from the final model. These included the dog's age, caregiver stress, perceived caregiving costs, attitudes towards aversive training, annual average number of veterinary consultations, knowledge of four basic training behaviors, and being on medication.

## Results

Table S1 (supplementary material) presents the correlations between the variables under study and SRPs, as well as the internal consistency (Cronbach's alpha) of each scale.

Contrary to expectations, the dummy variable for osteoarthritis showed negative correlations with SRPs ( $r = -0.062$ ,  $N = 729$ , one-tailed  $P = 0.047$ ), suggesting that dogs with this condition tend to exhibit fewer SRPs. A similar pattern was observed for the “health problems” variable. A more detailed analysis revealed that most of these dogs were medicated (83%;  $\chi^2_1 = 86.720$ ,  $P < 0.001$ ), suggesting that the observed effect may be due to medication rather than the clinical condition itself. Nevertheless, given that osteoarthritis is inherently painful, it is also possible that pain or pain management may have influenced the expression of separation-related behaviors, either through reduced overall activity or the sedative effects of analgesic treatment. Additionally, dogs with osteoarthritis may simply exhibit lower mobility due to pain or joint stiffness, which could reduce destructive behavior or agitation and, consequently, appear as fewer SRPs. For this reason, both variables were excluded from the final analysis.

<sup>3</sup> Except for the dummy variables “intact male”, “spayed female”, and “neutered male”, which were excluded because the number of cases was considerably lower than for the other variables, significantly reducing the sample size in the MLRM.

## Correlations

Among the intrapersonal variables, caregivers with higher levels of anxiety, depression, and stress reported more SRPs ( $r = 0.171$ ,  $r = 0.147$ ,  $r = 0.189$ , respectively,  $N = 730$ ,  $P < 0.001$ ). Avoidant attachment style was associated with higher SRPs ( $r = -0.085$ ,<sup>4</sup>  $N = 730$ ,  $P = 0.021$ ). Secure attachment was found to be associated with fewer SRPs ( $r = -0.076$ ,  $N = 730$ ,  $P = 0.041$ ), while anxious attachment was linked to more SRPs ( $r = 0.127$ ,  $N = 730$ ,  $P = 0.021$ ). Higher levels of neuroticism ( $r = -0.117$ ,<sup>5</sup>  $N = 730$ ,  $P = 0.001$ ) and lower openness to new experiences ( $r = -0.072$ ,  $N = 730$ ,  $P = 0.026$ ) were also associated with more SRPs.

Among the interpersonal variables, caregivers who anthropomorphized their dogs more reported higher levels of SRPs ( $r = 0.114$ ,  $N = 730$ ,  $P = 0.002$ ). Stronger emotional closeness ( $r = 0.136$ ,  $N = 730$ ,  $P < 0.001$ ), higher perceived costs ( $r = 0.180$ ,  $N = 730$ ,  $P < 0.001$ ), and greater caregiver–dog interaction ( $r = 0.090$ ,  $N = 730$ ,  $P = 0.015$ ), were also associated with more SRPs. More favorable attitudes toward aversive training methods were correlated with higher levels of SRPs ( $r = 0.171$ ,  $N = 730$ ,  $P < 0.001$ ).

Dogs that spend less time alone ( $r = -0.124$ ,  $N = 672$ ,  $P = 0.001$ ) and those that sleep in the caregiver's bedroom showed higher levels of SRPs ( $r = -0.121$ ,  $N = 730$ ,  $P = 0.001$ ), compared to dogs sleeping in another place at home. Dogs that go for walks only once a day ( $r = 0.101$ ,  $N = 730$ ,  $P = 0.006$ ), are disciplined using punishment ( $r = -0.116$ ,  $N = 730$ ,  $P = 0.002$ ), or know only one basic behavior ( $r = -0.112$ ,  $N = 730$ ,  $P = 0.002$ ) also exhibited more intense SRPs, compared to those that are not walked, are corrected with the word “no,” or know four behaviors, respectively.

Dogs that had been living with their caregivers for a shorter period ( $r = -0.104$ ,  $N = 729$ ,  $P = 0.005$ ) and intact females showed higher levels of SRPs ( $r = -0.162$ ,  $N = 364$ ,  $P = 0.002$ ). Younger dogs also exhibited more SRPs ( $r = -0.134$ ,  $N = 730$ ,  $P < 0.001$ ). The age of separation from the mother was not related to SRPs ( $r = -0.010$ ,  $N = 574$ ,  $P = 0.810$ ).

Among sociodemographic variables, caregivers with a master's degree reported more SRPs in their dogs compared to those who had completed only middle school ( $r = -0.073$ ,  $N = 615$ ,  $P = 0.048$ ). Perception of chronic pain hypothesis was not supported ( $r = -0.036$ ,  $N = 730$ ,  $P = 0.328$ ).

## Regression analysis

Four variables correlated with SRPs were included in the regression models<sup>6</sup> (Table 1) (Maroco, 2021). The final model (Model 5) explained 8.7% of the variance. No dog-related or sociodemographic variables emerged as predictors. In Model 3 only caregiver stress was included. In Model 4, emotional closeness and attitudes toward aversive training were added — the latter being the strongest predictor. In Model 5, when the dog's sleeping location was included, the explained variance ( $R^2$ ) increased to 8.7%. In the regression models, attitudes toward aversive training, caregiver stress, emotional closeness, and the dog's sleeping location emerged as significant predictors of SRPs (see Table 1). Attitudes toward aversive training showed the strongest association, followed by caregiver stress and emotional closeness. Interpersonal variables were the most relevant group.

The model including F/A (Table 2) also incorporated emotional closeness and the dummy variables for where the dog sleeps (indoors and outdoors). The remaining predictors were excluded due to their influence on F/A (Caregiver stress and attitudes towards aversive

<sup>4</sup> Interpretation: the less trust in others, the more SRPs.

<sup>5</sup> Interpretation: the lower the emotional stability, the higher the levels of SRPs.

<sup>6</sup> The multiple categories represented by the dummy variables are considered a single variable.

**Table 1**  
Predictors of separation-related problems.

	Model 1 Dog characteristics $\beta$ std	Model 2 Sociodemo-graphic variables $\beta$ std	Model 3 Intrapersonal variables $\beta$ std	Model 4 Interpersonal variables $\beta$ std	Model 5 caregiving and management $\beta$ std
DASS: Stress	$\beta$ -	-	0.189*** (0.539)	0.153*** (0.436)	0.159*** (0.452)
	std -	-			
	( $\beta$ i)				
MDORS: Emotional closeness	$\beta$ -	-		0.144*** (0.583)	0.113*** (0.458)
	std -	-			
	( $\beta$ i)				
Attitudes to Training (aversive)	$\beta$ -	-		0.157*** (0.419)	0.171*** (0.458)
	std -	-			
	( $\beta$ i)				
Dummy Sleeps inside the house.	$\beta$ -	-			-0.133*** (-0.501)
	std -	-			
	( $\beta$ i)				
Dummy Sleeps outside the house.	$\beta$ -	-			-0.080** (-0.627)
	std -	-			
	( $\beta$ i)				
Dummy Sleeps elsewhere.	$\beta$ -	-			-0.036 (-0.666)
	std -	-			
	( $\beta$ i)				
Intercept $\beta_0$	-		1.180	-1.934	- 1.284
Explained variance ( $R^2_{adj}$ )	-	-	0.034	0.072	0.087
$R^2$ change	-	-	0.036***	0.040***	0.019**
Model significance	-	-	$F_{1, 728} = 26.996$ , $P < 0.001$	$F_{3, 726} = 19.726$ , $P < 0.001$	$F_{6, 723} = 12.580$ , $P < 0.001$

Note. \*  $P < 0.05$ , \*\*  $P < 0.01$ , \*\*\*  $P < 0.001$ . Criterion variable = separation-related problems (minimum = 0; maximum = 10). Sleeping indoors coded as a dummy variable: sleeps in the bedroom = 0; sleeps in another indoor room = 1.

Variance Inflation Factor (VIF) in Model 5: Stress = 1.043; Emotional closeness = 1.066; Attitudes to Training = 1.062; Dummy Sleeps inside the house = 1.098; Dummy Sleeps outside the house = 1.071; Dummy Sleeps elsewhere = 1.012.

**Table 2**  
Predictors of separation-related problems including fear/anxiety as a predictor.

	Model 5 Including Fear/Anxiety	
MDORS: Emotional closeness	$\beta$ std	0.099** (0.398)
	( $\beta$ i)	
Dummy Sleeps inside the house.	$\beta$ std	-0.102** (-0.384)
	( $\beta$ i)	
Dummy Sleeps outside the house.	$\beta$ std	-0.040 (-0.312)
	( $\beta$ i)	
Dummy Sleeps elsewhere.	$\beta$ std	-0.002 (-0.039)
	( $\beta$ i)	
Fear/anxiety	$\beta$ std	0.354*** (0.269)
	( $\beta$ i)	
Intercept $\beta_0$		-0.366
Explained variance ( $R^2_a$ )		0.150
Model significance		$F_{5, 724} = 26,674$ , $P < 0.001$

Note. \*\*  $P < 0.01$ , \*\*\*  $P < 0.001$ . Criterion variable = separation-related problems (minimum = 0; maximum = 10). Sleeping indoors coded as a dummy variable: sleeps in the bedroom = 0; in other rooms or outdoors = 1.

Variance Inflation Factor (VIF): Emotional closeness = 1.056; Dummy Sleeps inside the house = 1.092; Dummy Sleeps outside the house = 1.062; Dummy Sleeps elsewhere = 1.010; Fear/anxiety = 1.006.

training, Batista et al., submitted). The model was significant but explained only 15% of the variance in SRPs.

## Discussion

From a broad set of variables related to caregiver characteristics and F/A, we sought to identify those most relevant for predicting SRPs in companion dogs. The results were consistent with this focus, suggesting that caregiver intrapersonal and interpersonal characteristics, along

with caregiving and management practices, may contribute to the occurrence of SRPs. The final model, which included caregiver stress, emotional closeness to the dog, attitudes toward aversive training methods, and the dog's sleeping location, explained 8.7% of the variance in SRPs. When F/A was added, the explained variance increased to 15%, suggesting a partial overlap or comorbidity between certain types of SRPs and fear/anxiety. This exploratory finding highlights the need for more refined measures and study designs to clarify the nature of this relationship. The final model explained only up to 15% of the variance, indicating that many relevant factors remain unaccounted for.

Several findings from the present study support results from previous research, strengthening the validity of previously identified associations between caregiver characteristics and SRPs. Higher levels of stress were associated with more SRPs, confirming the relationship reported by Clarke and Loftus (2023) and González-Ramírez et al. (2018). Avoidant attachment style was also linked to higher levels of SRPs, in line with the findings of Konok et al. (2015). The personality trait of neuroticism was positively associated with SRPs, consistent with Dodman et al. (2018). Neuroticism, often defined as the opposite of emotional stability, refers to a tendency toward anxiety, irritability, and mood instability (Neves, 2001). Caregivers high in neuroticism may interact inconsistently with their dogs (O'Farrell, 1997) or display overprotective behaviors that may hinder adequate socialization (Podbersek and Serpell, 1997), mechanisms that can contribute to SRPs. As described in literature, the practice of allowing dogs to sleep in the caregiver's bedroom was also correlated with increased SRPs. Finally, the number of hours spent in contact with humans per day was positively associated with SRPs, in line with the suggestion made by Sherman and Mills (2008). These are correlational, not causal associations and latter are likely far more complex than the outline of possible patterns identified here.

Discrepancies were also identified when compared to previous



studies, which may reflect methodological, contextual, or sample-related differences and warrant further investigation. Contrary to expectations, caregivers' ability to perceive chronic pain (Batista et al., 2025) was not associated with SRPs, suggesting that pain may play a smaller role. However, this finding should be interpreted with caution, as pain in dogs is frequently underrecognized or underestimated by caregivers and professionals (Mills et al., 2020; Batista et al., 2025), which may have obscured its relationship with behavioral manifestations. Chronic pain conditions such as osteoarthritis may therefore contribute to SRPs in ways that were not fully captured by the present methodology.

Some unanticipated associations were also identified. Although exploratory, these findings raise relevant questions and pave the way for future research. Older dogs and those that had lived longer with their caregivers exhibited fewer SRPs, possibly due to better adaptation to routines. Given that this was a non-representative sample composed of current caregivers, it is also possible that more severe cases—such as dogs that were relinquished or euthanized due to separation-related issues—were not captured. Therefore, the present results may underestimate the true impact or severity of SRPs in the general dog population. Dogs walked once per day showed more SRPs than those never walked, but not more than dogs walked more frequently. This unexpected pattern may reflect frustration arising from insufficient stimulation, inconsistent caregiver routines, or some other unidentified pattern or association. The use of the word “no” was associated with fewer SRPs compared to the use of positive punishment, suggesting that clear verbal corrections may help set boundaries without compromising welfare. Finally, the number of basic behaviors learned was negatively associated with SRPs, which may indicate that effective communication between dog and caregiver acts as a protective factor.

Higher levels of caregiver anxiety and depressive symptoms, anxious attachment style, anthropomorphic beliefs, greater perceived costs, increased interaction, and emotional closeness were found to be associated with higher levels of SRPs. In contrast, a secure attachment style and the personality trait openness to experience were associated with lower levels of SRPs. These findings further illustrate that SRPs are not solely driven by dogs, but that caregivers' emotional dependence also appears to contribute to the problem. Inappropriate relationships may arise not only in caregivers with an avoidant attachment style (Konok et al., 2015), but also in those with a high need for emotional closeness. We lack discrete measures to truly assess such effects.

Although the regression models provided some insight into which caregiver- and dog-related variables may contribute to SRPs, all associations are correlational, and the explanatory power of the models was modest. Interpersonal variables accounted for more variance in SRPs than other groups of variables. Attitudes toward aversive training emerged as the most influential predictor. These attitudes shape how caregivers interact with their dogs—impacting training, corrections, and responses to stress—and may create an unstable environment that worsens SRP symptoms. Caregiver stress was the second most important predictor, supporting the idea that dogs are sensitive to their caregivers' emotional state and may “absorb” their stress (Andics et al., 2014; 2016; Wilson et al., 2022), potentially creating cycles of mutual reinforcement. These results also suggest the possibility of reciprocal influences, whereby caregiver stress affects dog behavior, and, in turn, the dog's behavior may increase caregiver stress. Emotional closeness, which evaluates the caregiver's emotional bond with the dog through items such as ‘My dog helps me get through tough times’ and ‘I would like to have my dog near me all the time’ (Dwyer et al., 2006), also explained SRPs, likely due to increased dependence. However, this variable should be interpreted as one factor among several interacting variables rather than a sole driver. Dogs that sleep in their caregivers' bedroom—a marker of high proximity—showed more SRPs, suggesting lower emotional self-regulation capacity.

Yet the variance explained by the models was small. When F/A was added to the regression model, the variance explained in SRPs increased

from 8.7% to 15%. This modest increase suggests that fear and anxiety may share common emotional mechanisms with some types of SRPs, consistent with the view that separation anxiety represents one form within a broader spectrum of anxiety-related behaviors (Tiira et al., 2016; de Assis et al., 2020). Nevertheless, as 85% of the variance remains unexplained, these results should be regarded as exploratory and interpreted with caution regarding their biological significance.

Regarding limitations, overall, weak correlations were observed, but this is consistent with the existing literature in this field (e.g., Dodman et al., 2018; Barcelos et al., 2023). This may be due to the use of subjective and indirect measures, as well as the fact that all data were based on caregiver self-reports without direct observation of the dogs' responses. The proportion of explained variance remains relatively low, indicating that other factors play a relevant role. It is important to emphasize that these results reflect associations rather than causation, given the cross-sectional design of the study. Additionally, the use of a convenience sample with a strong predominance of female caregivers (95 %) may limit the generalizability of the findings and should be considered a major weakness.

It should also be noted that the questionnaire did not provide explicit definitions of SRPs to caregivers and focused on overt behaviors (e.g., vocalization, pacing, elimination, or property damage). Covert manifestations such as behavioral inhibition were not considered, which represents a limitation and may have led to underestimation of some forms of SRPs.

Future studies should incorporate additional variables into explanatory models of SRPs—such as previous abandonment, shelter history, environmental enrichment, unreported pain, frustration, or boredom—to deepen understanding of underlying mechanisms, increase explained variance, and guide more effective interventions. Moreover, research should aim for more diverse and representative samples. Variables influencing both issues—such as caregiver stress and attitudes toward aversive training—are particularly relevant, as fear/anxiety may mediate the relationship between these variables and SRPs.

## Conclusion

This study identified several caregiver- and dog-related variables associated with SRPs, including attitudes toward aversive training, caregiver stress, emotional closeness, sleeping in the caregiver's bedroom, and fear/anxiety. These findings suggest that caregiver-related factors play a meaningful, though limited, role in the occurrence of SRPs, underscoring the relevance of human-dog emotional dynamics.

However, the modest proportion of variance explained indicates that this approach captured only part of the complexity underlying SRPs. Future studies should refine the design by combining caregiver self-reports with behavioral and physiological measures, employing longitudinal approaches, and recruiting more representative samples. Such improvements will help clarify causal mechanisms and enhance the translational value of findings for clinical and welfare-oriented interventions.

## CRedit authorship contribution statement

**Catarina Lavrador:** Writing – review & editing, Conceptualization. **Gonçalo da Graça-Pereira:** Writing – review & editing, Resources, Conceptualization. **Maria Toscano Batista:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

## Ethical note

The study was approved by the Ethics Committee (Ref.: 22170). Informed consent was obtained from all participating caregivers prior to data collection. Participants were assured of the voluntary nature of

their involvement, their right to withdraw at any time, and the anonymity and confidentiality of their responses.

## Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the authors used DeepL Translate to translate from Portuguese to English. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

## Declaration of Competing Interest

The authors declare no conflict of interest.

## Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.jveb.2025.12.013](https://doi.org/10.1016/j.jveb.2025.12.013).

## Data availability statement

Research data and syntax are shared. Data\_RSP. sav. Sintaxe\_SRP. sav. DOI 10.5281/zenodo.16282483.

## References

- Amat, M., Camps, T., Le Brech, S., Manteca, X., 2014. Separation anxiety in dogs: the implications of predictability and contextual fear for behavioural treatment. *Anim. Welf.* 23, 263–266. <https://doi.org/10.7120/09627286.23.3.263>.
- Andics, A., Faragó, T., Kis, A., Miklósi, Á., Gácsi, M., 2016. Neural mechanisms for lexical processing in dogs. *Science* 353, 1030–1032. <https://doi.org/10.1126/science.aaf3777>.
- Antonacopoulos, N.M.D., Pychyl, T.A., 2008. An examination of the relations between social support, anthropomorphism and stress among dog owners. *Anthrozoös* 21, 139–152. <https://doi.org/10.2752/175303708X305783>.
- de Assis, L.S., Matos, R., Pike, T.W., Burman, O.H.P., Mills, D.S., 2020. Developing diagnostic frameworks in veterinary behavioral medicine: disambiguating separation related problems in dogs. *Front. Vet. Sci.* 6, 499. <https://doi.org/10.3389/fvets.2019.00499>.
- Barcelos, A.M., Kargas, N., Assheton, P., Fawcett, A., Shoesmith, E., Mills, D.S., 2023. Dog owner mental health is associated with dog behavioural problems, dog care and dog-facilitated social interaction: a prospective cohort study. *Sci. Rep.* 13, 21734. <https://doi.org/10.1038/s41598-023-48827-y>.
- Barrios, C.L., Gornall, V., Bustos-López, C., Cirac, R., Calvo, P., 2022. Creation and validation of a tool for evaluating caregiver burnout syndrome in owners of dogs (*Canis lupus familiaris*) diagnosed with behavior disorders. *Animals* 12, 1185. <https://doi.org/10.3390/ani12091185>.
- Batista, M.T., Lavrador, C., da Graça-Pereira, G., 2025. Development and validation of a chronic pain perception scale for dogs: structural validity and reliability. *Vet. Rec.* e5664 <https://doi.org/10.1002/vetr.5664>.
- Beaver, B.V., 2024. The prevalence of behavior problems in dogs in the United States. *J. Vet. Behav.* 76, 34–39. <https://doi.org/10.1016/j.jveb.2024.11.001>.
- Bradshaw, J., 2017. *The Animals among Us*. Penguin Books, St Ives.
- Buller, H., Ballantyne, K.C., 2020. Living with and loving animals with behavior problems: an exploratory study of the experiences of companion animal guardians. *J. Vet. Behav.* 40, 47–56. <https://doi.org/10.1016/j.jveb.2020.01.002>.
- Canavarro, M.C., Dias, P., Lima, V., 2006. A avaliação da vinculação do adulto: Uma revisão crítica a propósito da aplicação da Adult Attachment Scale-R (ASS-R) na população portuguesa. *Psicol.* 20, 156–186. <https://doi.org/10.17575/rpsicol.v20i1.381>.
- Chapman, B.L., Voith, V.L., 1990. Behavioral problems in old dogs: 26 cases (1984–1987). *J. Am. Vet. Med. Assoc.* 196, 944–946.
- Clarke, H., Loftus, L., 2023. Owner psychological characteristics predict dog behavioural traits. *Res. Sq. [Prepr.]*. <https://doi.org/10.21203/rs.3.rs-2657563/v1>.
- Dale, F., Burn, C., Murray, J., Casey, R., 2024. Canine separation-related behavior at 6 months of age: dog, owner and early-life risk factors identified using the 'Generation Pup' longitudinal study. *Anim. Welf.* 33, 1–16. <https://doi.org/10.1017/awf.2024.56>.
- Dodman, N.H., Brown, D.C., Serpell, J.A., 2018. Associations between owner personality and psychological status and the prevalence of canine behavior problems. *PLOS ONE* 13, e0192846.
- Dwyer, F., Bennett, P.C., Coleman, G.J., 2006. Development of the Monash Dog Owner Relationship Scale (MDORS). *Anthrozoös* 19, 243–256.
- Emauz, A., Gaspar, A., Esteves, F., Carvalhosa, S.F., 2016. Adaptação da Escala de Empatia com Animais (EEA) para a população portuguesa. *ál. Psicol.* 2, 189–201.
- Enders-Slegers, M.-J., Hediger, K., 2019. Pet ownership and human–animal interaction in an aging population: rewards and challenges. *Anthrozoös* 32, 255–265. <https://doi.org/10.1080/08927936.2019.1569907>.
- Flannigan, G., Dodman, N.H., 2001. Risk factors and behaviors associated with separation anxiety in dogs. *J. Am. Vet. Med. Assoc.* 219, 460–466.
- GfK Metris, 2018. Estudo GfKTrack.2PETS. GfK, Lisboa.
- González-Ramírez, M.T., Vanegas-Farfano, M., Landero-Hernández, R., 2018. Differences in stress and happiness between owners who perceive their dogs as well behaved or poorly behaved when they are left alone. *J. Vet. Behav.* 28, 1–6. <https://doi.org/10.1016/j.jveb.2018.07.010>.
- Guimarães, D., 2017. Alterações de comportamento nos cães decorrentes da ansiedade dos tutores. Tese de Mestrado em Medicina Veterinária. Universidade do Porto.
- Hargrave, C., 2023. Canine separation-related problem behaviours – part 1: social living and owner absence. *Companion Anim.* 28 (9). <https://doi.org/10.12968/coan.2023.0023>.
- Harvey, N.D., Christley, R.M., Giragosian, K., Mead, R., Murray, J.K., Samet, L., Upjohn, M.M., Casey, R.A., 2022. Impact of changes in time left alone on separation-related behavior in UK pet dogs. *Animals* 12, 482. <https://doi.org/10.3390/ani12040482>.
- Horwitz, D.F., 2008. Practical approach to the treatment of separation anxiety in dogs. *NAVC Conf.* 142–145.
- Hunt, M., Otto, C.M., Serpell, J.A., Alvarez, J., 2015. Interactions between handler well-being and canine health and behavior in search and rescue teams. *Anthrozoös* 25, 323–335. <https://doi.org/10.2752/175303712X13403555186253>.
- Horwitz, D.F., Mills, D.S. (Eds.), 2012. *BSAVA Manual of Canine and Feline Behavioral Medicine*, 2nd ed. BSAVA, Gloucester.
- Jagoe, A., Serpell, J.A., 1996. Owner characteristics and interactions and the prevalence of canine behavior problems. *Appl. Anim. Behav. Sci.* 47, 31–42. [https://doi.org/10.1016/0168-1591\(95\)01008-4](https://doi.org/10.1016/0168-1591(95)01008-4).
- Kogan, L.R., Schoenfeld-Tacher, R., Hellyer, P.W., 2019. Veterinary behaviorists and trainers: client perceptions and experiences. *J. Vet. Behav.* 32, 11–17.
- Konok, V., Kosztolányi, A., Rainer, W., Mutschler, B., Halsband, U., Miklósi, Á., 2015. Influence of owners' attachment style and personality on their dogs' (*Canis familiaris*) separation-related disorder. *PLOS ONE* 10, e0118375. <https://doi.org/10.1371/journal.pone.0118375>.
- Kuntz, L., Montrose, V.T., Kobelt, A.J., 2023. Development and validation of a caregiver burden scale for owners of companion animals with behavior problems. *Front. Vet. Sci.* 10, 1141861. <https://doi.org/10.3389/fvets.2023.1141861>.
- Lindley, S., 2012. The effects of pain on behaviour and behavioural problems. Part 2: fear and anxiety. *Companion Anim.* 17, 55–58. <https://doi.org/10.1111/j.2044-3862.2011.00115.x>.
- Marôco, J., 2021. Análise estatística com o SPSS Statistics, 8.ª ed. ReportNumber, Pêro Pinheiro.
- McAuliffe, L., Koch, C.S., Serpell, J.A., Campbell, K.J., 2022. Associations between atopic dermatitis and anxiety, aggression, and fear-based behaviors in dogs. *J. Am. Anim. Hosp. Assoc.* 58, 167–177. <https://doi.org/10.5326/JAAHA-MS-7210>.
- McCrave, E.A., 1991. Diagnostic criteria for separation anxiety in the dog. *Vet. Clin. North Am. Small Anim. Pract.* 21, 247–255.
- Meneses, T.F., Ochoa, J., Tiira, K., Broach, D., Hatfield, B., Overall, K.L., 2021b. Development of and pharmacological treatment options and future research opportunities for separation anxiety in dogs. *J. Am. Vet. Med. Assoc.* 259, 1130–1139. <https://doi.org/10.2460/javma.20.08.0463>.
- Meneses, T.F., Ochoa, J., Tiira, K., Broach, D., Hatfield, B., Overall, K.L., 2021a. Review of epidemiological, pathological, genetic, and epigenetic factors that may contribute to the development of separation anxiety in dogs. *J. Am. Vet. Med. Assoc.* 259, 1118–1129. <https://doi.org/10.2460/javma.20.08.0462>.
- Mills, D.S., Demontigny-Bédard, I., Gruen, M., Klinck, M.P., McPeake, K.J., Barcelos, A.M., Hewison, L., Van Haevermaet, H., Denenberg, S., Hauser, H., Koch, C., 2020. Pain and problem behavior in cats and dogs. *Animals* 10, 318.
- Mota-Rojas, D., Mariti, C., Zdeinert, A., Riggio, G., Mora-Medina, P., Reyes, A.D.M., Gazzano, A., Domínguez-Oliva, A., Lezama-García, K., José-Pérez, N., 2021. Anthropomorphism and its adverse effects on the distress and welfare of companion animals, 1–24. *Animals* 11, 3263. <https://doi.org/10.3390/ani11113263>.
- Neves, J., 2001. Personalidade, percepção e aprendizagem. In: Ferreira, J.M.C., Neves, J., Caetano, A. (Eds.), *Manual de Psicossociologia das Organizações*. McGraw-Hill, Lisboa, pp. 221–357.
- O'Farrell, V., 1997. Owner attitudes and dog behaviour problems. *Appl. Anim. Behav. Sci.* 52 (3–4), 205–213. [https://doi.org/10.1016/S0168-1591\(96\)01123-9](https://doi.org/10.1016/S0168-1591(96)01123-9).
- Overall, K.L., 2013. *Manual of Clinical Behavioral Medicine for Dogs and Cats*. Elsevier Health Sciences, St. Louis.
- Pais-Ribeiro, J.L., Honrado, A., Leal, I., 2004. Contribuição para o estudo da adaptação portuguesa das escalas de ansiedade, depressão e stress (EADS) de 21 itens de Lovibond e Lovibond. *Psicol. Saúde.* 5, 229–239.
- Perry, G., Seksel, K., Beer, L., et al., 2005. Separation anxiety: a summary of some of the characteristics of 61 cases seen at Sydney, Australia, behaviour practice. In: Mills, D., Levine, E., Landsberg, G.M., et al. (Eds.), *Current Issues and Research in Veterinary Behavioral Medicine*. Purdue University Press, West Lafayette, IN, pp. 203–206.
- Pierantoni, L., Albertini, M., Pirrone, F., Burioli, V., Valsecchi, P., 2022. Complex emotional responses in separation-related problems in dogs: the role of anxiety, frustration, and fear. *J. Vet. Behav.* 54, 22–30. <https://doi.org/10.1016/j.jveb.2022.01.005>.
- Podberscek, A.L., Serpell, J.A., 1997. Aggressive behaviour in English cocker spaniels and the personality of their owners. *Vet. Rec.* 141, 73–76.
- Rodrigues, R.I., Gomes, C., 2022. Desenvolvimento e validação de uma versão portuguesa do Inventário de Personalidade Big Five. *Rev. Iberoam. Diagn. Eval. Psicol.* 2 (63), 163–176.

- Salonen, M., Sulkama, S., Mikkola, S., Puurunen, J., Hakanen, E., Tiira, K., Araujo, C., Lohi, H., 2020. Prevalence, comorbidity, and breed differences in canine anxiety in 13,700 Finnish pet dogs. *Sci. Rep.* 10, 2962. <https://doi.org/10.1038/s41598-020-59837-z>.
- Sherman, B.L., Mills, D.S., 2008. Canine anxieties and phobias: an update on separation anxiety and noise aversions. *Vet. Clin. North Am.: Small Anim. Pract.* 38, 1081–1106. <https://doi.org/10.1016/j.cvsm.2008.04.012>.
- Soares, G., Pereira, J.T., Paixão, R.L., 2010. Estudo exploratório da síndrome de ansiedade de separação em cães de apartamento. *Ciênc. Rural* 40, 631–636. <https://doi.org/10.1590/S0103-84782010000300008>.
- Templer, D.I., Salter, C.A., Dickey, S., Baldwin, R., Veleber, D.M., 1981. The construction of a Pet Attitude Scale. *Psychol. Rec.* 31, 343–348. <https://doi.org/10.1007/BF03394747>.
- Tiira, K., Lohi, H., 2015. Early life experiences and exercise associate with canine anxieties. *PLOS ONE* 10, e0141907. <https://doi.org/10.1371/journal.pone.0141907>.
- Tiira, K., Sulkama, S., Lohi, H., 2016. Prevalence, comorbidity, and behavioral variation in canine anxiety. *J. Vet. Behav.* 16, 36–44. <https://doi.org/10.1016/j.jveb.2016.06.008>.
- Varela, J., 2021. O papel das atitudes, do compromisso e das emoções nos maus-tratos animais. ISCTE – Instituto Universitário de Lisboa, Tese de Mestrado.
- Wilson, C., Campbell, K., Petzel, Z., Reeve, C., 2022. Dogs can discriminate between human baseline and psychological stress condition odours. *PLOS ONE* 17 (9), e0274143. <https://doi.org/10.1371/journal.pone.0274143>.
- Wright, J.C., Nesselrode, M.S., 1987. Classification of behavior problems in dogs: distributions of age, breed, sex, and reproductive status. *Appl. Anim. Behav. Sci.* 19, 169–178.
- Zasloff, R., Kidd, A.H., 1994. Attachment to feline companions. *Psychol. Rep.* 74, 747–752.