





# 1 Introduction

2

3 Mental health problems are one of the main disease burdens of society and are growing  
4 worldwide [1]. In the United Kingdom, mental health problems represent the largest  
5 single cause of disability, with estimated costs of £105 billion a year; one in four adults  
6 in the country suffers at least one diagnosable mental health problem in any given year  
7 [2]. Psychological changes led by pet ownership may have an important impact on  
8 mental health, with associated economic savings (£2.5 billion/year – UK) [3]. However,  
9 studies in this field are inconsistent, and how pet ownership might impact on human  
10 well-being has not been explored systematically. Heterogeneity within important  
11 aspects of pet ownership (e.g. amount of exercise undertaken, level of disclosure of  
12 personal emotional information with their dogs) may explain why some individuals may  
13 benefit while others do not [4, 5, 6]. It is therefore not surprising that investigations on  
14 depression have shown pet ownership improves [7, 8, 9], as well as makes no difference  
15 [10, 11, 12] and even worsens the condition [13, 14]. Similar contradictions extend to  
16 other aspects of well-being, such as loneliness [8, 15], stress [13, 16], anxiety [13, 17],  
17 human functioning [11, 18] and life satisfaction [19, 20].

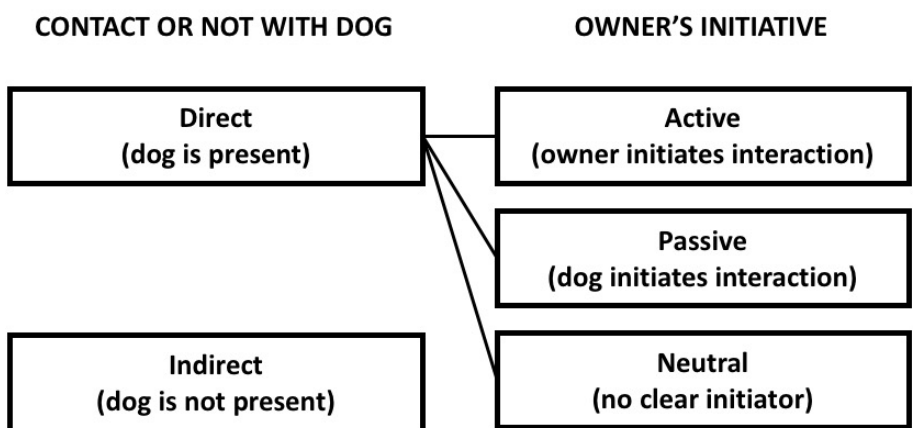
18

19 The tendency to compare ‘pet owners’ versus ‘non-owners’ in cross-sectional research  
20 [21] is a gross oversimplification of a complex relationship. Clearly, the specific activities  
21 owners engage with, rather than the simple act of ownership is important. 35% of dog  
22 owners, for example, do not walk their dogs [22, 23], and so benefits associated with  
23 increased exercise cannot be expected in this subpopulation; likewise, variations in time  
24 spent with the pet are likely to change life satisfaction and anxiety in owners [17]. Where  
25 dog-ownership related activities have been considered, the research approach has  
26 tended to be top-down (i.e. dictated by the preconceived ideas of the researcher),  
27 focusing on the impact of a few specific activities. Dog walking, for example, has been  
28 extensively investigated and linked with several changes in well-being, such as increase  
29 in social interactions [15, 24, 25, 26, 27], social support [24, 26, 27, 28], human  
30 functioning [29, 30], feelings of happiness [31], relaxation, anxiety, stress [24],  
31 annoyance [26]. However, it should be recognised that owners may attribute a wider  
32 range of beneficial outcomes to these activities, and it is only by questioning them that  
33 the breadth of potentially important activities is likely to be identified (i.e. using a  
34 bottom-up approach).

35

36 There appears to be a lack of systematic consideration of *the full spectrum of specific*  
37 *activities/events that occur due to the dog’s existence in the person’s life which may be*  
38 *of relevance*. We define these activities as *dog human related activities (DHRA)*, also  
39 referred to simply as ‘activities’ within the article (Fig. 1). This definition guided the  
40 design of this study and may direct future studies in dog-human interaction. Here, we  
41 propose classifying activities as either direct (occurring in the presence of the dog), such  
42 as walking the dog, petting it, the mere company of the dog; or indirect (do not require  
43 the presence of the animal), e.g. buying food for the dog, meeting dog friends, studying  
44 dog-related topics. Direct activities are not restricted to events initiated by the owner  
45 (active activities, e.g. grooming, feeding), but also include interactions started by the pet  
46 (passive activities, e.g. jumping up, licking the owner, barking) and neutral events, in  
47 which it is not clear who initiates the interaction (neutral activities, e.g. the

1 company/presence of the dog, sleeping next to each other, watching tv together). Only  
 2 with a comprehensive list of these activities, can we hope to identify the important  
 3 relationships that might improve human well-being.  
 4



5  
 6 **Figure 1.** [legend after the references]  
 7

8 Well-being is frequently examined using a hedonic and eudaimonic perspective.  
 9 Hedonia is a focus on the experience of pleasant events, while eudaimonia focuses on a  
 10 fulfilling life aimed at achieving one's potential [32]. Hedonic well-being is composed of  
 11 positive and negative affect but is frequently operationalised as subjective well-being  
 12 (SWB), a broader term comprising affect and life satisfaction [33]. Affect (or core affect)  
 13 is the manifestation of moods and emotions [34], and life satisfaction is the judgment  
 14 of one's own life, e.g. feeling delighted or terrible about life [35]. In contrast, eudaimonic  
 15 well-being, also referred to as psychological well-being (PWB), is typically composed of  
 16 six elements or areas of functioning: (1) autonomy, one's independence and freedom  
 17 from others' approval, (2) environmental mastery, one's fit and mastery on surrounding  
 18 environment, (3) personal growth, one's self-realization and achievement of one's  
 19 potential, (4) positive relations with others, one's feelings of empathy and affection for  
 20 others and good social relations, (5) purpose in life, one's meaning in life and  
 21 comprehension of one's purpose, (6) self-acceptance, one's positive self-regard with  
 22 acceptance of past life and good and bad qualities [36].  
 23

24 In this study, we used dog owner-generated data from focus group sessions to  
 25 systematically identify the most important dog human related activities (both direct and  
 26 indirect activities) impacting on self-perceived human well-being (hedonia, life  
 27 satisfaction and eudaimonia) in order to develop a comprehensive framework, which  
 28 lays the groundwork for future quantitative studies.  
 29

30 **Results**  
 31

32 A framework of dog human related activities and their reported well-being outcomes in  
 33 hedonia, life satisfaction and eudaimonia has been generated from the focus group  
 34 sessions with an heterogenous sample of dog owners representing owners of different  
 35 ages, genders, dog-related expertise, having dogs of various sizes, ages and with varying  
 36 durations of dog ownership. A general overview of the framework is provided in the

1 section below, while more details of the framework are provided in the subsequent  
 2 sections in the following order: first, activities related to the four main aspects of  
 3 hedonic well-being, second, activities related to life satisfaction and, third, activities  
 4 related to the six elements of eudaimonic well-being. Percentages provided within the  
 5 Results section are purely a description of the data generated and should not be used  
 6 for quantitative analysis.

7  
 8 **Dog human related activities and well-being outcomes**

9 A total of fifty-eight activities were reported as important for participants' well-being.  
 10 They were divided into 15 themes (Fig. 2). The most commonly mentioned themes were:  
 11 'exercise with dog' (count: 127, 14.9%), especially walking; 'non-specific ownership,  
 12 routines' (120, 14.1%), mainly having a dog and looking after it; 'tactile interactions'  
 13 (100, 11.7%), notably cuddling/snuggling with dog; 'social interactions' (91, 10.7%), such  
 14 as the contact with other people/dog while out with dog; 'shared activity in the house'  
 15 (75, 8.8%), mainly being greeted by dog; 'shared activity outside the house' (75, 8.8%),  
 16 especially the presence/company of the dog; and 'teaching or learning' (66, 7.7%),  
 17 mainly training the dog.

18  
 19 Eighteen well-being outcome themes also emerged for the framework (Fig. 2). Aspects  
 20 of hedonia most frequently associated with dog human related activities were an  
 21 increase in 'positive valence-high arousal' states (195 mentions, 22.9%), such as  
 22 excitement, happiness, and an increase in 'positive-valence-low arousal' states (136,  
 23 16.0%), e.g. calmness, relaxation. For eudaimonia, 'positive relations with others' (93,  
 24 10.9%), such as social interactions, and 'purpose in life' (57, 6.7%) prevailed.

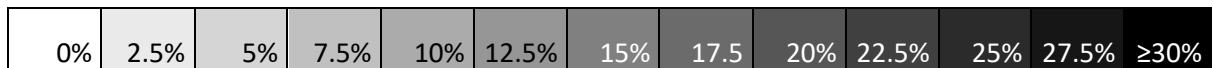
25  
 26 Details of all well-being outcomes and the dog human related activities reported to lead  
 27 to them are given in the heat map in Fig. 2. The darker the cell in the map, the higher  
 28 the percentage of mentions (up to ≥30%) of the relevant activity within the well-being  
 29 outcome column.  
 30

| ACTIVITIES<br>(THEMES AND CODES)                    | HEDONIA     |      |      |      |             |      | EUDAIMONIA  |     |     |     |     |     |             |     |     |     |     | LIFE SAT.   |  |
|---|-------------|------|------|------|-------------|------|-------------|-----|-----|-----|-----|-----|-------------|-----|-----|-----|-----|-------------|--|
|   | Increase in |      |      |      | Decrease in |      | Increase in |     |     |     |     |     | Decrease in |     |     |     |     | Increase in |  |
|   | NvHa        | NvLa | PvHa | PvLa | NvHa        | NvLa | Aut         | Env | Per | Pur | Pos | Sel | Aut         | Env | Pur | Pos | Sel | LS          |  |
| <b>1. Aging and end of life of dog</b>              |             |      |      |      |             |      |             |     |     |     |     |     |             |     |     |     |     |             |  |
| Euthanasia, end of life - dog                       |             |      |      |      |             |      |             |     |     |     |     |     |             |     |     |     |     |             |  |
| Old dog - having it                                 |             |      |      |      |             |      |             |     |     |     |     |     |             |     |     |     |     |             |  |
| <b>2. Exercise with dog</b>                         |             |      |      |      |             |      |             |     |     |     |     |     |             |     |     |     |     |             |  |
| Cycling   |             |      |      |      |             |      |             |     |     |     |     |     |             |     |     |     |     |             |  |
| Hiking  |             |      |      |      |             |      |             |     |     |     |     |     |             |     |     |     |     |             |  |
| Running   |             |      |      |      |             |      |             |     |     |     |     |     |             |     |     |     |     |             |  |
| Sledging  |             |      |      |      |             |      |             |     |     |     |     |     |             |     |     |     |     |             |  |
| Swimming  |             |      |      |      |             |      |             |     |     |     |     |     |             |     |     |     |     |             |  |
| Walking   |             |      |      |      |             |      |             |     |     |     |     |     |             |     |     |     |     |             |  |
| <b>3. Failing to meet dog's needs, expectations</b> |             |      |      |      |             |      |             |     |     |     |     |     |             |     |     |     |     |             |  |
| Leave dog alone, behind                             |             |      |      |      |             |      |             |     |     |     |     |     |             |     |     |     |     |             |  |
| Not fulfil dog's needs, e.g. walking                |             |      |      |      |             |      |             |     |     |     |     |     |             |     |     |     |     |             |  |
| <b>4. Grooming (theme)</b>                          |             |      |      |      |             |      |             |     |     |     |     |     |             |     |     |     |     |             |  |
| Bath the dog  |             |      |      |      |             |      |             |     |     |     |     |     |             |     |     |     |     |             |  |
| Clean dog's teeth                                   |             |      |      |      |             |      |             |     |     |     |     |     |             |     |     |     |     |             |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| Grooming (non-specific)  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| The result of grooming   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>5. Non-specific ownership routines</b>                          |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Having the dog, being a dog owner                                  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Look after the dog, routine  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Look after a puppy   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>6. Picture-related</b>  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Posting pictures, videos of dog on social media                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Take photos of dog   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>7. Playing with dog (theme and activity)</b>                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>8. Providing for the dog</b>                                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Buy snacks, treats for dog   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Buy toys, objects to dog   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Cook for dog   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Feed the dog   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Take dog to the vet  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>9. Shared activity in the house</b>                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Being followed by the dog  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Being greeted by dog   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Dog waiting for owner to do something                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Dog's presence in the house  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>10. Shared activity outside the house</b>                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Dog's company at work  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Dog's presence while outside the house                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Pet therapy with own dog   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Trip with dog  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>11. Social interactions</b>                                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Contact with other people, dog while out with your dog             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Meeting with other dog lovers with or without dogs                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Talk about dog   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Talk to dog  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Inappropriate interaction with your dog - from other person or dog |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>12. Tactile interactions - theme</b>                            |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Being licked, kissed by dog  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Cuddle, snuggle with dog   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Pet the dog  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Sleep, lie on bed with dog   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Tactile interactions (non-specific)                                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>13. Teaching or learning</b>                                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Agility  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Learn dog-related things   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Training, showing dog's skills                                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>14. Unwanted behaviours</b>                                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Aggression   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Barking  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Biting, trying to bite, lunging                                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Chewing, destroying objects  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Farting  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Growling   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

|   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|---|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| Poo related, e.g. roll on it, eat it, defecate in the house   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Snoring - dog   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Stealing, e.g. food, objects  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>15. Watch dog's behaviour</b>  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| See dog in a situation (not described as positive or negative for the dog) that pleases the owner, e.g. funny noise |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| See dog in a situation it dislikes  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| See dog in a situation it enjoys  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

1



2

3 **Figure 2.** [legend after the references]

4

5 ***'Negative valence–high arousal' and dog human related activities***

6 In this aspect of hedonic well-being negative feelings such as 'annoyed', 'angry',  
7 'stressed', 'worried', and 'frustrated' emerged. Increase in feelings of this aspect were  
8 mainly occasioned by unwanted dog behaviours, such as barking; but also more benign  
9 social interactions with dog/people, especially negative encounters while out with their  
10 own dog. For example, participant 15:

11

12 *It is quite annoying when people don't ask if a dog is friendly first, you shouldn't*  
13 *just go straight and stroke the dog, you shouldn't be touching a dog if he has an*  
14 *owner.*

15

16 Also, teaching or learning dog-related things, particularly training the dog; and non-  
17 specific ownership routines, such as looking after a puppy, had a negative impact on this  
18 aspect of well-being. Some activities, however, were reported as protective against  
19 these negative feelings, especially shared activities with the dog outside and inside the  
20 house, simply due to the dog's presence/company in these contexts. Tactile interactions  
21 with the dog, such as cuddling and sleeping together, and exercises with the dog,  
22 notably walking, also played a key role in decreasing feelings of negative valence-high  
23 arousal. For example, participant 4:

24

25 *It is very hot in [name of the country] so I jog at night, like at midnight, so I take*  
26 *her with me, it makes me feel protected, it is quite nice. She gives me company,*  
27 *like someone is with me, so I don't have to be afraid, it reduces my fear.*

28

29

30 ***'Negative valence–low arousal' and dog human related activities***

31 This aspect of hedonic well-being included states such as 'sad', 'tired', 'unhappy',  
32 'lonely', 'depressed'. Elements of this aspect increased in dog owners mostly when they  
33 felt they failed to meet their dog's expectations/needs, especially for leaving the dog

1 alone/behind, and when their dogs performed an unwanted behaviour, notably the  
2 destruction of objects. For example, participant 25 said:

3  
4 *If it [destruction of object] is in the middle of the day it is very tiring, it is not even anger,*  
5 *you are exhausted.*

6  
7 Additionally, having an old dog and coping with the end of life of the animal, such as  
8 euthanasia, was associated with negative feelings within this aspect. Negative emotions  
9 of low arousal were nevertheless improved by tactile interactions with the dog, such as  
10 cuddling, and by sharing activities with the dog both inside the house, especially by  
11 being greeted by the animal, and outside the house, in particular, the dog's  
12 presence/company. Also, exercising together, mainly walking, was frequently reported  
13 to decrease these negative feelings. For example participant 16, explained:

14  
15 *It was difficult at times to walk him, but I was determined, me and him. For me,*  
16 *walking is on the higher top of my list, it helped in my recovery [from depression]*

#### 17 18 **'Positive valence-high arousal' and dog human related activities**

19 This includes states such as 'happiness', 'joy', 'fun', 'excitement', 'activation'. Owners  
20 reported improvements in feelings of this aspect from exercising with their dogs,  
21 especially walking; from watching their dog, mainly when the dog is happy in a situation;  
22 and from teaching the dog, such as training exercises. For example, participant 7:

23  
24 *It makes me happy to see how happy she [the dog] is, how excited she is.*

25  
26 Positive feelings of high arousal also arose from tactile interactions with the dog, such  
27 as cuddling and lying next to each other, playing with the dog, e.g. tug and ball games;  
28 and shared activities inside the house, notably being greeted by the dog. No activity was  
29 identified to directly decrease this element of well-being.

#### 30 31 **'Positive valence-low arousal' and dog human related activities**

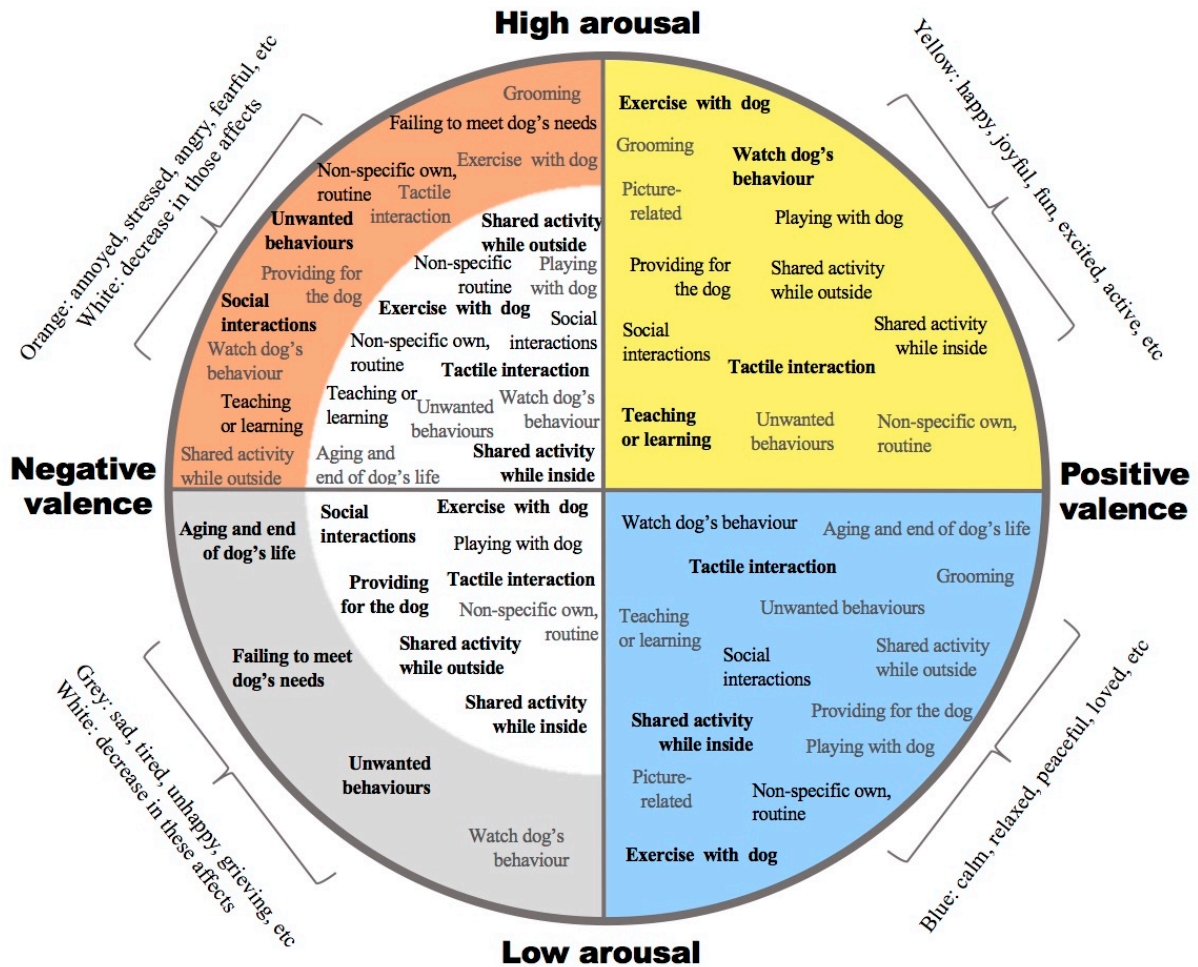
32 In this aspect of well-being, feelings of calmness, relaxation, peace, and love emerged.  
33 They reported growth in feelings of 'positive valence-low arousal' when they were  
34 involved in tactile interactions with their dogs, such as cuddling, sleeping together and  
35 lying next to each other. For example, participant 1:

36  
37 *Snuggling with the dog, on the sofa or on the bed, they just come up and flop on*  
38 *you, you can just relax and forget how busy it is and things like that, it is really*  
39 *calming.*

40  
41 Additionally, exercising with the dog, mainly walking, and sharing activities in the house,  
42 notably being greeted by the dog, were also associated with increases in feelings of this  
43 aspect. No activity was reported to directly decrease this element of well-being.

44  
45 The results relating to dog human related activities effects on the valence-arousal  
46 (hedonic well-being) are summarised in Figure 3.





1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22

**Figure 3.** [legend after the references]

***‘Life satisfaction’ and dog human related activities***

There were not many mentions of life satisfaction as an outcome of dog human related activities. The few mentions that did occur tended to be related to exercising with the dog, such as walking, running and cycling, dog ownership *per se*, general routine with the dog and taking the animal to animal-assisted interventions. For example, participant 16:

*He [the dog] was life changing, he improved my life and the life of my family, he has a positive impact on the whole family.*

***‘Autonomy’ and dog human related activities***

In this element of eudaimonic well-being, ‘non-specific ownership routines’, such as being a dog owner and being able to look after an animal were frequently mentioned by owners as activities that make them feel more autonomous. For example, participant 8:

*As a pet parent I do feel protective of him and I have that sense that I can go out and take care of him, so I feel independent.*

1 Increases in this element were also associated with shared activities with the dog  
2 (outside and inside the house), especially having the dog's presence/company; and with  
3 exercises with the dog, such as walking, running, hiking. In contrast, owners' autonomy  
4 decreased when they struggled to leave their dog behind/alone. For example,  
5 participant 5:

6  
7 *Sometimes dogs restrict that [autonomy, independence], you don't always have*  
8 *the opportunity to take dogs somewhere, we have a family in [another country*  
9 *far away] and to go and travel there means you have to leave the dog*  
10 *somewhere, and sometimes there is no place to leave the dog.*

### 11 12 **'Environmental mastery' and dog human related activities**

13 In this element, owners reported their ability to fit or cope with their surrounding  
14 environment, including the performance of tasks relating to daily living. Improvements  
15 in environmental mastery were associated with dog ownership and looking after the  
16 animal on a regular basis, which is part of the theme 'non-specific ownership routines'.  
17 Also, performing exercises with the dog, mainly walking, and providing for the animal,  
18 particularly feeding it, were reported to increase the sense of environmental mastery of  
19 owners. For example, participant 10:

20  
21 *It [feeding the dog] gives me something to do, otherwise I would skip a few meals.*  
22 *They have their own dinner, they have their own routines so I need to keep my*  
23 *routines as well. They have routine in the morning, it is good, it reminds me of*  
24 *doing things. One of the dogs has tablets, so it reminds me of my tablets as well.*

25  
26 However, owners also mentioned that having an old dog and giving support to this old  
27 animal hindered their own environmental mastery. For example, participant 31:

28  
29 *The negative side of dog ownership is when they get old, you need to adjust your*  
30 *life to help your dog, [...] you need to adjust loads of your routine.*

### 31 32 **'Personal growth' and dog human related activities**

33 Personal growth was reported as a sense of self-achievement in particular aspects of the  
34 owner's life (or life as a whole). The activities that mainly contributed to this element of  
35 well-being were being a dog owner and being capable of looking after a dog. Also,  
36 teaching and learning were associated with personal growth, especially learning dog-  
37 related things, such as dog behaviour and dog travel regulations, and training the dog  
38 successfully, e.g. to perform a new skill. For example, participant 35:

39  
40 *He is the first dog I have had as an adult so I had to learn something about dog*  
41 *behaviour, how to look after them, about visas, how to get a [nationality of dog]*  
42 *dog into this country, that helped my personal growth.*

43  
44 No activity was reported to decrease this element of well-being.

45

1 **'Purpose in life' and dog human related activities**

2 Having a dog, looking after the animal and having a routine because of the dogs' needs  
3 were associated with improvements in their purpose in life. Additionally, exercising with  
4 the dog, primarily through walks, increased this element as well, as did some non-  
5 specific activities; for example participant 23:

6  
7 *Because I got a dog I got quite a good routine now. I need to make sure she walks,*  
8 *she is fed, all the needs are met, so that gives me purpose in life.*

9  
10 Some activities, however, decreased or hindered owners' sense of purpose in life, such  
11 as the responsibilities linked to dog ownership and not being able to leave the dog  
12 behind/alone. For example, participant 33:

13  
14 *If I didn't have my dogs I would travel more and be more free, I would do more*  
15 *things, it is more negative to purpose in life, not autonomy, because I think in a*  
16 *big picture.*

17  
18 **'Positive relation with others' and dog human related activities**

19 Dog owners reported changes in their social relations and empathy for others. Increases  
20 were attributed to having more interactions with other people, especially when out with  
21 the dog, and explicitly meeting other dog lovers on purpose. Exercising with the dog,  
22 particularly walking, and being accompanied by the dog while outside the house  
23 improved owners' relations with others as well. For example, participant 20:

24  
25 *When you go out for a walk you meet different people, it seems okay to talk to*  
26 *them because you have a dog, the dog is an introducer. If you are just walking by*  
27 *yourself it is different, the dog is the connector.*

28  
29 Several owners also said that simply having a dog was beneficial to their social relations.  
30 In contrast, contact with others was also detrimental to their social relations, especially  
31 when having disruptive encounters, such as inappropriate interactions from others  
32 towards their dogs. Unwanted behaviours, particularly those related to aggression, such  
33 as when their dogs bark, bite or lunge towards others, were also detrimental to their  
34 social relations. For example, participant 25:

35  
36 *Sometimes it is annoying meeting other people. Yesterday, for example, there*  
37 *was a guy sitting with three dogs, and then a woman approached and tried to pet*  
38 *them, then all dogs started barking, and the guy was trying to calm the three*  
39 *dogs. Sometimes I think 'please don't interact with my dogs, just leave me'*

40  
41 **'Self-acceptance' and dog human related activities**

42 Self-acceptance included owners' self-esteem and acceptance of their good and bad  
43 qualities. This element improved through the simple fact of having a dog and being able  
44 to look after the animal successfully, as well as due to activities shared with the dog in  
45 the house, particularly being greeted by the dog. For example, participant 2:

1 *Being licked, being cuddled, greeted [by dog] helps with self-esteem and self-*  
 2 *acceptance because you can feel that you are loved, like when you feel sad, they*  
 3 *pick up that and they try to cheer you up, it helps you accept who you are.*

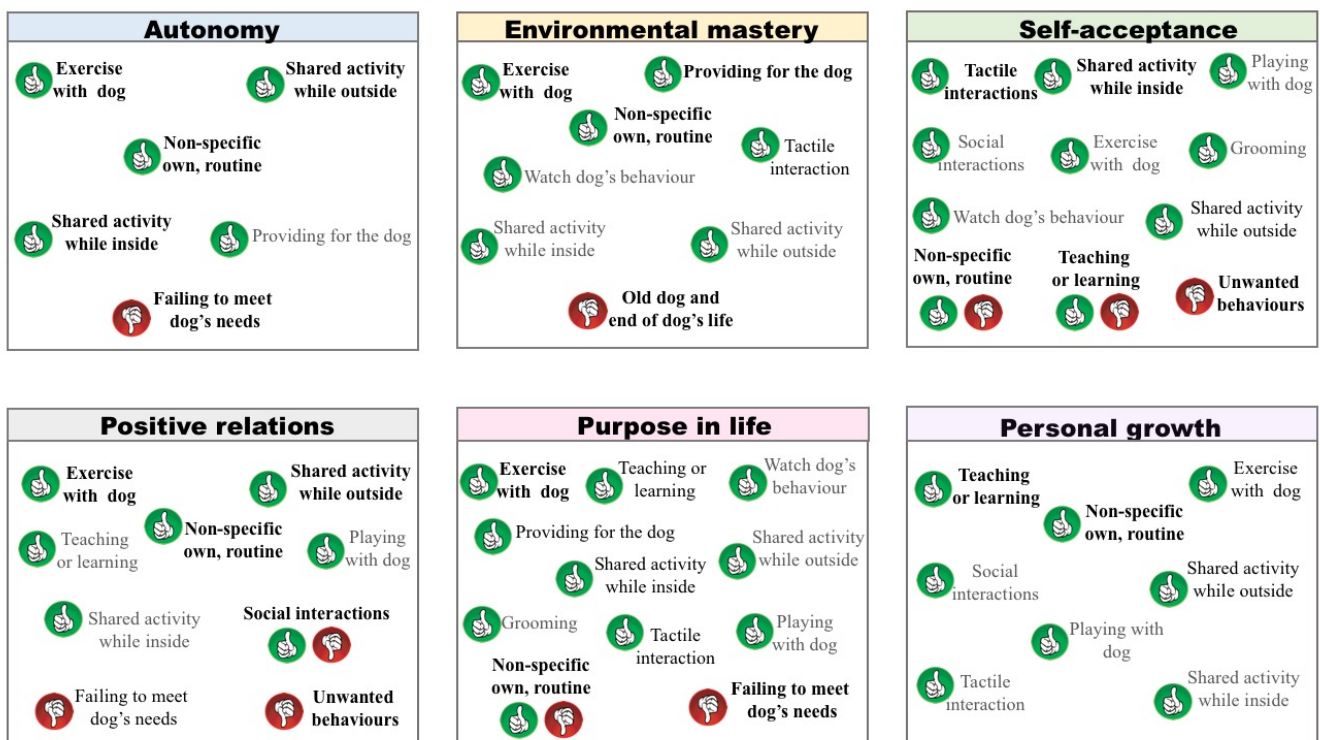
4  
 5 Tactile interactions with the dog, such as cuddling and being licked/kissed by the dog,  
 6 and teaching or learning dog related things, such as dog training and learning about dog  
 7 behaviour, had a beneficial impact on this element as well.

8 By contrast, owners' self-acceptance was hindered by dog's unwanted behaviours,  
 9 especially due to the feeling of not being able to control their animal's behaviour, such  
 10 as when the dog was acting aggressively or getting a recall when it was needed. For  
 11 example, participant 27:

12  
 13 *On training she is great but on public she won't come back to me when I call her,*  
 14 *then suddenly she starts to bark to someone with no reason, and I can't control*  
 15 *her, it makes me feel completely useless.*

16  
 17 Training the dog and looking after a puppy also decreased owner's self-esteem,  
 18 particularly due to the frustration they felt for not being able to train a specific skill or  
 19 manage their puppy.

20  
 21 These results relating to the themes of dog human related activities associated with  
 22 eudaimonic well-being are summarised in Fig. 4.



26  
 27 **Figure 4.** [legend after the references]

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47

**Discussion**

The recurrent inconsistencies observed across studies investigating dog ownership and human well-being, without taking into consideration the individuality of each dog-human relationship, drove the use of a new investigative approach in this study. A framework based on the full spectrum of activities/events dog owners could be involved with, due to the existence of a dog in their lives (defined by us as dog human related activities – see Introduction) was created. The use of the activities (or themes of activities) of our framework in future investigative studies is likely to increase consistency across studies, as patterns of well-being outcomes are expected to be observed for each particular identified activity. We believe this is the first systematic attempt to identify the most important specific dog human related activities that have an impact on the perceived well-being of owners. The framework is comprised of 58 dog human related activities and 15 themes of activities, which emerged as the most important dog human related events to dog owners’ hedonic well-being, life satisfaction and eudaimonic well-being. Importantly we considered not only positive but also negative impacts, since the balance between these may be critical in the final well-being outcome.

As might be expected, the majority of dog human related activities were associated with positive well-being outcomes but three important groups of activities had a predominantly negative impact on owners’ well-being: (1) aging and end of dog’s life, such as euthanasia, (2) failure to meet dog’s needs/expectations, such as leaving the dog alone at home, and (3) unwanted behaviours, such as problematic tendencies and poor obedience. The richness of the framework revealed in this study reinforces the problem with oversimplified dichotic comparisons based purely on ownership or not frequently observed in studies of the “pet effect” [21, 37]. Our data support the need for better mapping of activity to outcome: for example, being greeted by a dog, physical interactions with the animal and dog training, were repeatedly referred to as boosters for owner’s self-acceptance, by contrast walking the dog had a stronger impact on owner’s social interactions, autonomy and purpose in life. It should also be noted that having to leave the dog alone at home, which may be related to owner work status, or looking after an old dog was related to important negative feelings of low arousal, such as sadness, and to decrease in autonomy or environmental mastery. In contrast, the occurrence of unwanted behaviours and obedience issues were predominantly linked with negative feelings of high arousal, such as anger, and worsening on positive relation with others and self-acceptance.

It is not surprising that the most frequently reported activities to impact on well-being in this study, have also been reported to be important in previous investigations. Physical interactions with dogs, for example, have been shown to decrease stress [38, 39, 40, 41], anxiety [42, 43, 44] and fear [45], and increase feelings of positive valence [15]. Being greeted by the dog is suggested to provide comfort and positive feelings for owners [46]. Dog walking often catalyses owners’ social interactions [15, 47], improves owner’s emotional state [24] and gives them purpose in life [15]. In contrast, unwanted behaviours may hinder owners’ social interactions [46] and generate feelings of negative

1 valence [48]. The loss of a pet [46] and the care of an old animal [49] have also been  
2 linked to negative feelings of low arousal, such as sadness and depression, as has a sense  
3 of failure to fulfil the dog's expectations, e.g. when owners fail to walk them [26] or  
4 leave them alone at home. However, our study extends this list and systematically  
5 integrates this more comprehensive inventory of activities into a coherent framework  
6 for the first time (Figs 2, 3 & 4).

7  
8 Changes in affect (hedonia) were mainly reported to be caused by specific events, such  
9 as playing, training, being greeted by the dog, while changes in eudaimonic well-being  
10 (eudaimonia) were mainly linked to more general events, such as being a dog owner and  
11 looking after the dog. This difference is not surprising since hedonia (represented by  
12 affect) amounts to the pursuit of pleasure through the experience of discrete life events,  
13 responsible for changes in feelings [32, 50]; by contrast, eudaimonia, represents a  
14 lifestyle, ("eudaimonic living") [51], in which intrinsic values and long-enduring outputs  
15 are aimed for [36], making eudaimonia more stable over time than hedonic well-being  
16 [33, 52]. Thus, it seems likely that either a set of activities or a high  
17 intensity/frequency/duration of activities is required to yield transformations in  
18 eudaimonia, rather than the experience of a single event. For example, walking a dog  
19 once a year may suffice to increase one's momentary happiness and be identified as an  
20 activity that improves this affect. However, this same event may not be enough to  
21 change the meaning or quality of one's life (aspects of eudaimonia).

22  
23 Changes in life satisfaction, one of the components of subjective well-being, was not  
24 linked to dog human related activities by the majority of participants. This might be a  
25 product of the study design, which required participants to focus on the four most  
26 important dog human related activities for their affect and/or life satisfaction in the  
27 same exercise. This might have encouraged them to focus more on specific events and  
28 thus subjective feelings. Another possible limitation is the lack of males in the sample,  
29 even though an effort was made to increase their representation in the selection phase.  
30 Women are believed to have higher psychological openness than men [53, 54], thus,  
31 future studies may need to minimise the disclosure of information about the nature of  
32 the research to recruit more men. Nonetheless, the activities and changes in well-being  
33 reported by male participants in the focus group sessions were not noticeably different  
34 to those reported by their female counterparts, and sessions were continued until  
35 redundancy of the information provided by all participants was achieved, but this does  
36 not negate the possibility of a selection bias limiting the information provided.

37  
38 To increase the consistency across future studies, we recommend the selection of  
39 individual activities provided in our framework or combinations of them to test  
40 associations with the potential well-being outcomes as identified here. For example,  
41 testing if a higher frequency (or duration) of tactile interactions with dogs is positively  
42 associated with self-esteem. However, if our list of activities does not mirror a specific  
43 targeted population (e.g. dog owners with physical disability; dog owners who live on  
44 farms), new specific activities (or themes) could be added to the existing framework to  
45 make it even more comprehensive or a new framework specific for this group could be  
46 created based on the specific dog human related activities of interest. By assessing  
47 individual activities, rather than dog ownership *per se* (or even dog-assisted intervention

1 *per se*), future investigations are likely to identify patterns of increase or decrease in  
2 particular well-being outcomes in relation to specific activities, especially if  
3 representative sampling of their targeted population and control for potential  
4 mediators (e.g. demographics, closeness to pet) are applied. Thus, it might be evidenced  
5 that dog ownership *per se* is not the key to change elements of well-being but dog-  
6 related activities.

7  
8 Future studies by the authors will quantitatively assess the relationship between dog  
9 human related activities and changes in well-being identified here, through a survey, as  
10 a prelude to more comprehensive investigations of causality. It should also be noted  
11 that there may be cultural differences, particularly between countries, and so these  
12 results should not be thought to be globally comprehensive. Likewise, the relationship  
13 with other pets could be explored, since the activities reported are likely to differ from  
14 one species to another. Even though our framework has a good representability of dog  
15 owners (different ages, genders, dog-related expertise, dog sizes, dog ages and dog  
16 ownership duration) and saturation of themes has been reached in our thematic  
17 analysis, the framework cannot encompass all possible activities existent in all dog-  
18 owner dyads. More activities are expected to be found in studies targeting specific types  
19 of dog owners, i.e. those who have a particular goal associated with their relationship,  
20 such as a form of work or a specific hobby or interest. Any new activities might be rare  
21 at a general population level and/or not likely to change the well-being of dog owners  
22 at a population level. For example, even though some owners might be happy while  
23 dressing their dogs with different clothes and that might be a very important activity in  
24 their lives, this activity is not likely to have a strong effect on the well-being at a  
25 population level but could still be added into our framework to make it even more  
26 complete.

27  
28 The creation of a definition for dog human related activities and the framework of  
29 activities and their well-being outcomes provided in this qualitative study provides a  
30 more robust basis for future research in the field examining the mental health of dog  
31 owners (or even in the field of dog-assisted interventions), which should help to resolve  
32 current inconsistencies. This new, more specific approach opens the door to the  
33 investigation of changes in human well-being which acknowledges the individuality of  
34 each dog-owner dyad. This framework also provides the foundation for the  
35 development of more robust study designs and treatment plans for patients with mental  
36 health issues, which might be helped by dog-assisted interventions or dog owners simply  
37 hoping to improve their mental health.

## 38 39 **Methods**

### 40 41 ***Participants***

42 Initially, convenience and voluntary samplings were used to recruit self-identified dog  
43 owners via the University of Lincoln's Petscando database (volunteer owners), social  
44 media, in person leaflet distribution and leaflets placed at pet shops, food markets and  
45 buildings of the university. 91 dog owners filled a recruitment form to volunteer to the  
46 study. Some of them were selected through purpose sampling to generate greater  
47 sample diversity with regards to owners' age, gender, dog-related expertise or not (e.g.

1 dog trainer, veterinarian of small animals, volunteer in dog-assisted interventions) size  
2 of their dogs, age of their dogs and duration of the dog ownership. Diagnosable mental  
3 health problems were not directly investigated in the study (e.g. as a selection  
4 criterium), owners with and without diagnosable mental health conditions were  
5 welcome to participate and, during the focus group, they were free to disclose as much  
6 or as little of their mental health status as they wanted. The population was thus mental  
7 health stigma-free, and accordingly honest and unbiased by such issues.

8  
9 Based on the 91 registrations, a total of 45 participants were selected. Ten of them were  
10 not included as they either did not attend or arrived too late for the focus group  
11 meeting. The 35 dog owners who comprised the final sample, were aged from 18-24  
12 years to 65-74 years old (median 25-34 years), 26 were female (74.3%), 15 owners had  
13 some dog-related expertise (42.9%), eight owners had small dogs (23%), 14 medium  
14 dogs (40%), 13 large dogs (37%), their dogs' age ranged from a few months old to up to  
15 more than 15 years old (median 1-3 years old) and dog ownership lasted from a few  
16 months to more than 15 years (median 1-3 years). Finally, allocation to one focus group  
17 or another was performed according to participants' time availability.

### 18 19 ***Pilot study and focus group sessions***

20 Focus groups consist of an organised discussion with a selected group of people to  
21 gather information on a topic [55], and are recommended for exploratory research [56],  
22 such as to the development of theoretical frameworks [57], justifying their use in this  
23 work. This study was approved by the ethical review committee at the University of  
24 Lincoln (reference 2019-Jul-0503), and all methods were carried out in accordance with  
25 the university Research Ethics Policy and with the BPS Code of Ethics and Conduct.  
26 Written informed consent was obtained from all participants. A pilot session, with four  
27 volunteers, was conducted to assess the quality of the moderator guide and time  
28 management before the main focus groups. All focus groups took place at the University  
29 of Lincoln, UK and were focused on dog human related activities and their impact on  
30 well-being. They were moderated by the first author, who had been trained in focus  
31 group moderation and supported by an assistant. Two audio devices were used  
32 simultaneously for recording: Homder Digital Audio Recorder and iPhone 8 (Apple®). In  
33 line with Guest *et al.* [58], which reports that 90% of themes in focus groups are usually  
34 discovered within three to six sessions, a total of six sessions (besides the pilot) were  
35 performed in this study, and saturation of themes was achieved. Each of the 35  
36 participants could take part in one session only. Group sizes ranged from four to eight  
37 dog owners, and session duration varied from 80-103 minutes (mean 91 minutes).

38  
39 Based on a pre-defined semi-structured moderator guide, dog owners were first  
40 introduced to the concepts of dog human related activities, hedonic well-being, life  
41 satisfaction and eudaimonic well-being in a similar way they have been defined in the  
42 Introduction of this paper but with simpler words (e.g. instead of using the word affect  
43 in hedonic well-being, the moderator referred to it as emotions and moods) and through  
44 a PowerPoint presentation aimed to facilitate the comprehension of the concepts.  
45 Examples of dog human related activities during this explanation were minimal so as  
46 not to influence owners' replies in the next step.



1 Second, owners were asked about the four most important activities for their own  
2 subjective well-being (positive and negative affect plus life satisfaction), and the four  
3 most crucial activities linked to their eudaimonic well-being. In order to prevent inter-  
4 participant bias and to generate a greater diversity of activities, dog owners were  
5 initially instructed to individually write these activities on a piece of paper provided.  
6 Participants were free to write more than one well-being outcome for each activity and  
7 it was made clear that they could also write less than four dog human related activities  
8 for each aspect of well-being if they wished. When asked about activities important to  
9 their life satisfaction and hedonic well-being, life satisfaction itself or any aspect of affect  
10 (e.g. happiness, sadness, calm) was a potential outcome. No predetermined fixed-  
11 options of affect was used to help participants characterise freely, with any word, the  
12 nature of the affect they experience from each activity reported, as recommended by  
13 Scherer [59]. In contrast, when participants wrote the activities essential for their  
14 eudaimonic well-being, they were asked to use the theory of the six elements of this  
15 well-being (e.g. autonomy, self-acceptance) as a guide for their reply, as these elements  
16 are part of the core concept of eudaimonic well-being.

17

18 Third, once all owners had finished writing, they shared out loud their list of dog human  
19 related activities and provided some background to justify their connection with the  
20 well-being outcome mentioned. At this point, dog owners had the opportunity to  
21 interact with each other, for example, discussing and elaborating on each other's points.  
22 Several new dog human related activities emerged from that discussion and participants  
23 had the opportunity to agree or disagree with each other's perceptions, which was  
24 important to evidence both positive and negative well-being outcomes of the same  
25 activity. In that discussion, probes and prompts were used by the moderator to clarify  
26 and gather further information from participants.

27

### 28 ***Transcription and data analysis***

29 Word-for-word transcription of the audio records and data analysis were performed on  
30 Microsoft Word® and NVivo 11, respectively. Thematic analysis of the transcripts was  
31 conducted in three steps. First, dog owner related activities and elements of hedonic  
32 well-being, life satisfaction and eudaimonic well-being were coded. Second, activity  
33 codes were grouped according to their similarity in order to generate themes, e.g.  
34 'hiking' and 'running' with the dog were grouped within the theme 'exercise'. Affect  
35 elements were grouped based on the dimensional models presented by Russel [60],  
36 Scherer [59] and Yik *et al* [61], and eudaimonic elements were grouped according to  
37 Ryff's [36] classification. For example, the feelings 'calm' and 'relaxed' were grouped  
38 together as a hedonic aspect of positive valence-low arousal. At this stage, the final  
39 codes and themes were decided following discussion and consensus reached among the  
40 authors. Third, activities and themes were linked with their well-being outcomes  
41 through matrix coding (cross-tabulation of the frequency of references to each  
42 component). For example, the number of times the theme 'tactile interactions' was  
43 mentioned as beneficial to self-esteem (eudaimonic well-being) was calculated, as well  
44 as all other themes in relation to this well-being outcome. In order to have a better view  
45 of this cross-tabulation, a heat map was created (Figure 2).

46

## 1 Data availability

2  
3 Data used for analysis are included in the supplementary information.  
4

## 5 References

- 6  
7 1. Vos, T., Barber, R.M., Bell, B., Bertozzi-Villa, A., Biryukov, S., Bolliger, I., Charlson, F.,  
8 Davis, A., Degenhardt, L., Dicker, D., & Duan, L. Global, regional, and national  
9 incidence, prevalence, and years lived with disability for 301 acute and chronic  
10 diseases and injuries in 188 countries, 1990–2013: a systematic analysis for the  
11 Global Burden of Disease Study 2013. *Lancet*, **386**, 743-800;  
12 [https://doi.org/10.1016/S0140-6736\(15\)60692-4](https://doi.org/10.1016/S0140-6736(15)60692-4) (2015).  
13 2. Mental Health Taskforce. The five year forward view for mental health – a report  
14 from the independent Mental Health Taskforce to the NHS in England;  
15 [https://www.england.nhs.uk/wp-content/uploads/2016/02/Mental-Health-](https://www.england.nhs.uk/wp-content/uploads/2016/02/Mental-Health-Taskforce-FYFV-final.pdf)  
16 [Taskforce-FYFV-final.pdf](https://www.england.nhs.uk/wp-content/uploads/2016/02/Mental-Health-Taskforce-FYFV-final.pdf) (2016).  
17 3. Hall, S., Dolling, L., Bristow, K., Fuller, T., & Mills, D.S. *Companion animal*  
18 *economics: the economic impact of companion animals in the UK* (CABI, 2017).  
19 4. Degeling, C., Burton, L., & McCormack, G. R. An investigation of the association  
20 between socio-demographic factors, dog-exercise requirements, and the amount  
21 of walking dogs receive. *Can. J. Vet. Res.*, **76**, 235-240;  
22 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3384289/> (2012).  
23 5. Evans-Wilday, A. S., Hall, S. S., Hogue, T. E., & Mills, D. S. Self-disclosure with dogs:  
24 dog owners' and non-dog owners' willingness to disclose emotional  
25 topics. *Anthrozoös*, **31**, 353-366; <https://doi.org/10.1080/08927936.2018.1455467>  
26 (2018).  
27 6. Pickup, E., German, A.J., Blackwell, E., Evans, M., & Westgarth, C. Variation in  
28 activity levels amongst dogs of different breeds: results of a large online survey of  
29 dog owners from the UK. *J. Nutr. Sci.*, **6**, e10; <https://doi.org/10.1017/jns.2017.7>  
30 (2017).  
31 7. Allen, K., Blascovich, J., & Mendes, W. B. Cardiovascular reactivity and the presence  
32 of pets, friends, and spouses: the truth about cats and dogs. *Psychosom. Med.*, **64**,  
33 727–739; <https://doi.org/10.1097/01.PSY.0000024236.11538.41> (2002).  
34 8. Carr, E. C. J., Wallace, J. E., Pater, R., & Gross, D. P. Evaluating the relationship  
35 between well-being and living with a dog for people with chronic low back pain: a  
36 feasibility study. *Int. J. Environ. Res. Public Health*, **16**, 1472;  
37 <https://doi.org/10.3390/ijerph16081472> (2019).  
38 9. Pereira, J. M. & Fonte, D. Pets enhance antidepressant pharmacotherapy effects in  
39 patients with treatment resistant major depressive disorder. *J. Psychiatr. Res.*, **104**,  
40 108–113; <https://doi.org/10.1016/j.jpsychires.2018.07.004> (2018).  
41 10. Batty, G. D., Zaninotto, P., Watt, R. G., & Bell, S. Associations of pet ownership with  
42 biomarkers of ageing: population based cohort study. *Br. Med. J.*, **359**, j5558;  
43 <https://doi.org/10.1136/bmj.j5558> (2017).  
44 11. Branson, S., Boss, L., Cron, S., & Kang, D. H. Examining Differences between  
45 Homebound Older Adult Pet Owners and Non-pet Owners in Depression, Systemic  
46 Inflammation, and Executive Function. *Anthrozoös*, **29**, 323–334;  
47 <https://doi.org/10.1080/08927936.2016.1152764> (2016).

- 1 12. Garrity, T. F., Stallones, L., Marx, M. B., & Johnson, T. P. Pet ownership and  
2 attachment as supportive factors in the health of the elderly. *Anthrozoös*, **3**, 35–44;  
3 <https://doi.org/10.2752/089279390787057829> (1989).
- 4 13. Bradley, L. & Bennett, P. C. Companion-animals' effectiveness in managing chronic  
5 pain in adult community members. *Anthrozoös*, **28**, 635–647;  
6 <https://doi.org/10.1080/08927936.2015.1070006> (2015).
- 7 14. Barker, S. B., Schubert, C. M., Barker, R. T., Kuo, S. I. C., Kendler, K. S., & Dick, D. M.  
8 The relationship between pet ownership, social support, and internalizing  
9 symptoms in students from the first to fourth year of college. *Appl. Dev. Sci.*;  
10 <https://doi.org/10.1080/10888691.2018.1476148> (2018).
- 11 15. Carr, E. C. J., Wallace, J. E., Onyewuchi, C., Hellyer, P. W., & Kogan, L. Exploring the  
12 meaning and experience of chronic pain with people who live with a dog: a  
13 qualitative study. *Anthrozoös*, **31**, 551–565;  
14 <https://doi.org/10.1080/08927936.2018.1505267> (2018b).
- 15 16. Albert, A. & Anderson, M. Dogs, cats, and morale maintenance: some preliminary  
16 data. *Anthrozoös*, **10**, 121–123; <https://doi.org/10.2752/089279397787001193>  
17 (1997).
- 18 17. Bennett, P. C., Trigg, J. L., Godber, T., & Brown, C. An experience sampling  
19 approach to investigating associations between pet presence and indicators of  
20 psychological wellbeing and mood in older Australians. *Anthrozoös*, **28**, 403–420;  
21 <https://doi.org/10.1080/08927936.2015.1052266> (2015).
- 22 18. Carr, D. C., Taylor, M. G., Gee, N. R., & Sachs-Ericsson, N. J. Typologies of older  
23 adult companion animal owners and non-owners: moving beyond the dichotomy.  
24 *Aging Ment. Health*, **23**, 1452-1466;  
25 <https://doi.org/10.1080/13607863.2018.1503999> (2018a).
- 26 19. Bao, K. J. & Schreer, G. Pets and happiness: examining the association between pet  
27 ownership and wellbeing. *Anthrozoos*, **29**, 283–296;  
28 <https://doi.org/10.1080/08927936.2016.1152721> (2016).
- 29 20. Crowley-Robinson, P. & Blackshaw, J. K. Pet ownership and health status of elderly  
30 in the community. *Anthrozoös*, **11**, 168–171;  
31 <https://doi.org/10.2752/089279398787000643> (1998).
- 32 21. Friedman, E. & Krause-Parello, C.A. Companion animals and human health:  
33 benefits, challenges, and the road ahead for human-animal interaction. *Rev. Sci.*  
34 *Tech. OIE*, **37**, 71-82; <https://doi.org/10.20506/rst.37.1.2741> (2018).
- 35 22. Oka, K. & Shibata, A. Prevalence and correlates of dog walking among Japanese  
36 dog owners. *J. Phys. Act. Health*, **9**, 786-793; <https://doi.org/10.1123/jpah.9.6.786>  
37 (2012).
- 38 23. Slater, M.R., Robinson, L.E., Zoran, D.L., Wallace, K.A., & Scarlett, J.M. Diet and  
39 exercise patterns in pet dogs. *J. Am. Vet. Med. A.*, **207**, 186-190 (1995).
- 40 24. Campbell, K., Smith, C. M., Tumilty, S., Cameron, C., & Treharne, G. J. How does  
41 dog-walking influence perceptions of health and wellbeing in healthy adults? A  
42 qualitative dog-walk-along study. *Anthrozoös*, **29**, 181–192;  
43 <https://doi.org/10.1080/08927936.2015.1082770> (2016).
- 44 25. Christian, H., Giles-Corti, B., & Knuiaman, M. "I'm Just a' - Walking the Dog"  
45 Correlates of Regular Dog Walking. *Fam. Community Health*, **33**, 44–52;  
46 <https://doi.org/10.1097/FCH.0b013e3181c4e208> (2010).

- 1 26. Cutt, H. E., Giles-Corti, B., Wood, L. J., Knuiiman, M. W., & Burke, V. Barriers and  
2 motivators for owners walking their dog: results from qualitative research. *Health*  
3 *Promot. J. Austr.*, 19, 118–124; <https://doi.org/10.1071/HE08118> (2008).
- 4 27. Graham, T. M., & Glover, T. D. On the fence: dog parks in the (un)leashing of  
5 community and social capital. *Leis. Sci.*, 36, 217–234;  
6 <https://doi.org/10.1080/01490400.2014.888020> (2014).
- 7 28. Richards, E. A., McDonough, M. H., Edwards, N. E., Lyle, R. M., & Troped, P. J.  
8 Psychosocial and environmental factors associated with dog-walking, *Int. J. Health*  
9 *Promot. Educ.*, 51, 198-211; <https://doi.org/10.1080/14635240.2013.802546>  
10 (2013).
- 11 29. Curl, A. L., Bibbo, J., & Johnson, R. A. Dog walking, the human-animal bond and  
12 older adults' physical health. *Gerontologist*, 57, 930–939;  
13 <https://doi.org/10.1093/geront/gnw051> (2017).
- 14 30. Gretebeck, K. A., Radius, K., Black, D. R., Gretebeck, R. J., Ziemba, R., & Glickman, L.  
15 T. Dog ownership, functional ability, and walking in community-dwelling older  
16 adults. *J. Phys. Act. Health*, 10, 646–655; <https://doi.org/10.1123/jpah.10.5.646>  
17 (2013).
- 18 31. Westgarth, C., Christley, R. M., Marvin, G., & Perkins, E. I walk my dog because it  
19 makes me happy: a qualitative study to understand why dogs motivate walking and  
20 improved health. *Int. J. Environ. Res. Public Health*, 14, 936-954;  
21 <https://doi.org/10.3390/ijerph14080936> (2017).
- 22 32. Ryan, R.M. & Deci, E.L. On happiness and human potentials: A review of research  
23 on hedonic and eudaimonic well-being. *Annu. Rev. Psychol.*, 52, 141-166;  
24 <https://doi.org/10.1146/annurev.psych.52.1.141> (2001).
- 25 33. Joshanloo, M. Investigating the relationships between subjective well-being and  
26 psychological well-being over two decades. *Emotion*, 19, 183-187;  
27 <https://psycnet.apa.org/doi/10.1037/emo0000414> (2019).
- 28 34. Mendl, M., Burman, O.H. & Paul, E.S. An integrative and functional framework for  
29 the study of animal emotion and mood. *P. Roy. Soc. B-Biol. Sci.*, 277, 2895-2904;  
30 <https://doi.org/10.1098/rspb.2010.0303> (2010)
- 31 35. Diener, E. Subjective well-being: the science of happiness and a proposal for a  
32 national index. *Am. Psychol.*, 55, 34; <https://doi.org/10.1037/0003-066X.55.1.34>  
33 (2000).
- 34 36. Ryff, C.D. Happiness is everything, or is it? Explorations on the meaning of  
35 psychological well-being. *J. Pers. Soc. Psychol.*, 57, 1069-1081 (1989).
- 36 37. Allen, K. Are pets a healthy pleasure? The influence of pets on blood pressure. *Curr.*  
37 *Dir. Psychol. Sci.*, 12, 236–239; [https://doi.org/10.1046%2Fj.0963-  
38 7214.2003.01269.x](https://doi.org/10.1046%2Fj.0963-7214.2003.01269.x) (2003).
- 39 38. Abrahamson, K., Cai, Y., Richards, E., Cline, K., & O'Haire, M. E. Perceptions of a  
40 hospital-based animal assisted intervention program: an exploratory study.  
41 *Complement. Ther. Clin. Pract.*, 25, 150–154;  
42 <https://doi.org/10.1016/j.ctcp.2016.10.003> (2016).
- 43 39. Barker, S. B., Barker, R. T., McCain, N. L., & Schubert, C. M. A randomized cross-  
44 over exploratory study of the effect of visiting therapy dogs on college student  
45 stress before final exams. *Anthrozoös*, 29, 35–46.  
46 <https://doi.org/10.1080/08927936.2015.1069988> (2016).

- 1 40. Crump, C., & Derting, T. L. Effects of pet therapy on the psychological and  
2 physiological stress levels of first-year female undergraduates. *N. Am. J. Psychol.*,  
3 **17**, 575–590 (2015).
- 4 41. Wilson, C. C. The pet as an anxiolytic intervention. *J. Nerv. Ment. Dis.*, **179**, 482–  
5 489; <https://doi.org/10.1097/00005053-199108000-00006> (1991).
- 6 42. Buttelmann, D., & Roempke, A. K. Anxiety-reducing effect: dog, fish and plant in  
7 direct comparison. *Anthrozoös*, **27**, 267–277;  
8 <https://doi.org/10.2752/175303714X13903827487647> (2014).
- 9 43. Cole, K. M., Gawlinski, A., Steers, N., & Kotlerman, J. Animal-assisted therapy in  
10 patients hospitalized with heart failure. *Am. J. Crit. Care*, **16**, 575–585. (2007).
- 11 44. Shiloh, S., Sorek, G., & Terkel, J., Reduction of state-anxiety by petting animals in a  
12 controlled laboratory experiment. *Anxiety, Stress, and Coping: an International*  
13 *Journal*, **16**, 387-395; <https://doi.org/10.1080/1061580031000091582> (2003).
- 14 45. Barker, S. B., Pandurangi, A. K., & Best, A. M. Effects of animal-assisted therapy on  
15 patients' anxiety, fear, and depression before ECT. *The Journal of ECT*, **19**, 38–44;  
16 <https://doi.org/10.1097/00124509-200303000-00008> (2003).
- 17 46. Chandler, C. K., Fernando, D. M., Minton, C. A. B., & Portrie-Bethke, T. L. Eight  
18 domains of pet-owner wellness: valuing the owner-pet relationship in the  
19 counseling process. *J. Ment. Health Couns.*, **37**, 268–282;  
20 <https://doi.org/10.17744/mehc.37.3.06> (2015).
- 21 47. McNicholas, J. & Collis, G.M. Dogs as catalysts for social interactions: robustness of  
22 the effect. *Br. J. Psychol.*, **91**,61-70; <https://doi.org/10.1348/000712600161673>  
23 (2000).
- 24 48. Ben-Michael, J., Korzilius, H., Felling, A., & Vossen, J. An exploratory model of dog  
25 disciplining. *Anthrozoös*, **13**, 150–163;  
26 <https://doi.org/10.2752/089279300786999798> (2000).
- 27 49. Christiansen, S. B., Kristensen, A. T., Sandøe, P., & Lassen, J. Looking after  
28 chronically ill dogs: impacts on the caregiver's life. *Anthrozoös*, **26**, 519–533;  
29 <https://doi.org/10.2752/175303713X13795775536174> (2013).
- 30 50. Huta, V. An overview of hedonic and eudaimonic well-being concepts in *The*  
31 *Routledge handbook of media use and well-being: International perspectives on*  
32 *theory and research on positive media effects* (eds. Reinecke, L. & Oliver, M. B.) 14–  
33 33 (Routledge, 2017).
- 34 51. Ryan, R.M., Huta, V., & Deci, E.L. Living well: a self-determination theory  
35 perspective on eudaimonia. *J. Happiness Stud.*, **9**, 139-170;  
36 <https://doi.org/10.1007/s10902-006-9023-4> (2008).
- 37 52. Steger, M. F. Hedonia, eudaimonia, and meaning: me versus us, fleeting versus  
38 enduring in *Handbook of eudaimonic well-being*. (ed. Vittersø, J.) 175–182;  
39 [http://dx.doi.org/10.1007/978-3-319-42445-3\\_11](http://dx.doi.org/10.1007/978-3-319-42445-3_11) (Springer International  
40 Publishing, 2016).
- 41 53. Mackenzie, C.S., Gekoski, W.L., & Knox, V.J. Age, gender, and the underutilization  
42 of mental health services: the influence of help-seeking attitudes. *Aging Ment.*  
43 *Health*, **10**, 574-582; <https://doi.org/10.1080/13607860600641200> (2006).
- 44 54. Rubin, Z., Hill, C.T., Peplau, L.A., & Dunkel-Schetter, C. Self-disclosure in dating  
45 couples: sex roles and the ethic of openness. *J. Marriage Fam.*, **42**, 305-317;  
46 <https://doi.org/10.2307/351228> (1980).
- 47 55. Gibbs, A. Focus groups. *Social Research Update*, **19**, 1-8 (1997).

- 1 56. Wilkinson, S. Focus group methodology: a review. *International Journal of Social*  
2 *Research Methodology*, **1**, 181-203;  
3 <https://doi.org/10.1080/13645579.1998.10846874> (1998).  
4 57. Bourgeault, I., Dingwall, R. & De Vries, R. (ed.). *The SAGE handbook of qualitative*  
5 *methods in health research* (SAGE Publications, 2010).  
6 58. Guest, G., Namey, E., & McKenna, K. How many focus groups are enough? Building  
7 an evidence base for nonprobability sample sizes. *Field Methods*, **29**, 3-22;  
8 <https://doi.org/10.1177%2F1525822X16639015> (2017).  
9 59. Scherer, K.R. What are emotions? And how can they be measured? *Soc. Sci.*  
10 *Inf.*, **44**, 695-729; <https://doi.org/10.1177%2F0539018405058216> (2005).  
11 60. Russell, J.A. Core affect and the psychological construction of emotion. *Psychol.*  
12 *Rev.*, **110**, 145; <https://doi.org/10.1037/0033-295x.110.1.145> (2003).  
13 61. Yik, M., Russell, J.A. and Steiger, J.H. A 12-point circumplex structure of core  
14 affect. *Emotion*, **11**, 705; <https://doi.org/10.1037/a0023980> (2011).

15

## 16 **Figure legends**

17 **1.** Dog human related activities classification scheme

18 **2.** Heat map of all dog human related activities and their respective well-being  
19 outcomes. The darker the colour in the cell higher is the relative frequency of mentions  
20 of the activity (rows) in relation to the well-being outcome in the column. E.g. 'looking  
21 after the dog' (dark cell) was mentioned to increase purpose in life more times than  
22 'running with the dog' (light cell). **Nv** and **Pv** (negative and positive valence,  
23 respectively), **Ha** and **La** (high and low arousal, respectively), **Aut** (autonomy), **Env**  
24 (environmental mastery), **Per** (personal growth), **Pur** (purpose in life), **Pos** (positive  
25 relations), **Sel** (self-acceptance), **LF** (life satisfaction).

26 **3.** Model of impact on affect (valence and arousal) for all themes of dog human related  
27 activities. Each coloured quadrant contains themes of activities that increase an aspect  
28 of affect, while white areas contain themes that were reported to cause reduction of  
29 that aspect of affect. The spatial position of items within quadrants is not related to any  
30 difference in intensity. Themes in **bold**: had a high frequency of mentions in the well-  
31 being element reported (10% or more). Black: moderate frequency of the mentions (5.0-  
32 9.9%). Grey: low frequency of the mentions (0.01-4.9%).

33 **4.** All themes of dog human related activities reported to impact on eudaimonic well-  
34 being. Themes in **bold**: high frequency of the mentions in the element of well-being  
35 reported (10% or more). Black: moderate frequency of the mentions (5.0-9.9%). Grey:  
36 low frequency of the mentions (0.01-4.9%). A green 'thumbs-up' indicates that the  
37 activity is beneficial to the referred well-being, while a red 'thumbs-down' shows the  
38 activity hinders that well-being. A few activities can be both beneficial and detrimental  
39 depending on the specific context of the interaction.

40

## 41 **Acknowledgements**

42 This study was funded by the PEARL Activity Grant Scheme 2019-20. The authors thank  
43 all dog owners who took part in the study, Simon Lunt for his assistance through the  
44 focus group sessions and Phil Assheton for his support in the construction of a figure.

1

2 **Authors' contributions**

3 AMB designed the study, collected and analysed the data, and wrote the manuscript.

4 NK contributed to the study design, data analysis and writing of the manuscript. JM

5 designed the study, contributed to the data analysis and wrote the manuscript. SH

6 contributed to the design of the study, data analysis and writing of the manuscript. DM

7 designed the study, analysed the data and wrote the manuscript.

8

9 **Additional information**

10 Competing interests: the authors declare no competing interests.