



# The benefits of dog ownership on people as an undervalued resource in urban environments

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**Abstract:** In countries with a developed economy, life confined in built environment has generated a new need for contact with nature and non-human beings. Nowadays, there are many studies that investigate the possible outcomes of the human-animal bond on people's health. Nevertheless, few studies have been carried out to assess the benefits of human-animal bond as an innovative resource to enhance people's health and wellbeing. In this regard, the In-Habit (INclusive Health And wellBeing In small and medium size ciTies) project is a good example of a framework that proposes an innovative approach to the topic of human-animal interactions in the urban environment. The aim of this scoping review was to summarize and discuss the literature dealing with beneficial effects of dog ownership while introducing the INHABIT project as a mean to promote the integration of pets into society through the implementation of adequate pet policies based on multidisciplinary approaches like "One health". A literature search was conducted in June-September 2021, and articles were selected using a 4-step screening process that allowed us to include 51 articles in the review. According to some of these studies, dog ownership seemed to have a positive effect on the owner's cardiovascular activity, blood pressure and overall levels of physical activity. Other benefits are related to mental health, like the reduction of depression and loneliness in various categories of people.

**Key Words:** dog ownership; Human-Animal Interaction; dog owners; zooeiyia; pet friendly policies; urban environment.

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## Introduction

According to AVMA (The American Veterinary Medical Association), "Human-Animal Interaction (HAI) encompasses any situation where there is interchange between human(s) and animal(s) at an individual or cultural level. These interactions are diverse and idiosyncratic, and they may be fleeting or profound. The human-animal bond (HAB) can be defined as a mutually beneficial and dynamic relationship between people and animals that is influenced by behaviours considered essential to the health and well-being of both. The bond includes, but is not limited to, the emotional, psychological, and physical interactions of people, animals, and the environment" (AVMA, American Veterinary Medical Association).

According to Beck (2014), there are three major hypotheses that can be regarded as the evolutionary and psychological bases for human's predisposition to bonding with animals: the biophilia hypothesis, the attachment theory, and the social support theory.

Biophilia is a scientific term proposed by Wilson (1984) identifying "the innate tendency to focus on life and lifelike processes". According to Wilson, the human brain is predisposed to be attracted by animals and other forms of life.

The attachment theory was initially developed by Bowlby in the 1950s; attachment is defined as a particular kind of affectional bond that ties a subject (person or animal) to another specific individual, binding them together in space and enduring over time (Ainsworth & Bell, 1970). It is

characterized by specific features: contact maintenance, which is maintaining contact and proximity with the attachment figure; searching response (or protest at separation) when involuntarily separated from the attachment figure; secure base effect, which refers to the fact that the attachment figure represents a base from which to explore the world (Ainsworth, 1969; Ainsworth & Bell, 1970; Bowlby, 1988); safe haven effect, i.e. the attachment figure provides a sense of safety in times of threat or distress (Kerns et al., 2015). The attachment bond is widely studied in the dog-owner relationship. It has been found that both parties can be attached to the other: e.g. dogs can establish an attachment bond to their owner (Mariti et al., 2013, 2018; Payne et al., 2015; Topál et al., 1998), but pets can also play a role as attachment figures for people (Kurdek, 2009; Meehan et al., 2017; Sable, 1995). In fact, the human-dog attachment is likely to have characteristics that are a mix of child-mother and peer-to-peer attachment bond (Savalli & Mariti, 2020).

The theory of social support refers to the possibility to turn to an individual in times of crisis or need (Cohen, 2004). Quality of life is enhanced if social support is found, as it usually provides a buffer from stress (Cohen, 1988; Cohen & Wills, 1985). Social support has three different forms (Jacobson, 2009):

- Emotional support: it refers to that behaviour that has the goal to comfort others and make them feel admired, respected, and loved. It provides caring and security;
- Cognitive support: it refers to all that information or advice that can be provided to a person and that can help them adjust to situations;
- Material support: it refers to services that can resolve practical problems.

Social support can be provided also by dogs (Friedmann & Thomas, 1995) and this may probably be another reason that makes people bond with them. In fact, people often perceive their pets as members of their family able to provide them with a unique source of social support that buffers their stress (Albert et al., 1988; Melson, 2003; Staats et al., 2008; Stambach & Turner, 2016). Moreover, dogs can provide a particular kind of support that is unconditional and non-judgemental (Pachana et al., 2011).

The first pioneering study that showed the beneficial effect of dogs, on humans was published in 1980 by Friedmann et al. (Friedmann et al., 1980). They investigated the correlation between owning a pet and the survival of patients who were discharged from a coronary care unit after myocardial infarction. Results showed how subjects who owned a pet, compared to patients who did not, had higher probability of survival one year after hospitalisation. This effect was found both with people who owned a dog and those who owned another pet species (Friedmann et al., 1980). Later in 1991, Serpell et al. (Serpell, 1991) investigated the effects of pet acquisition on human health and behaviour and found out that pet owners are more likely to have a reduction in minor health problems and that these effects persist for months. Moreover, dog owners displayed an increase in the number and duration of recreational walks taken after the adoption of the dog (Serpell, 1991). In both studies the beneficial effects might be attributed to an increase in physical activity, in fact, owning a dog requires to take him out more than once a day.

To this day, many other articles have been published on the benefits of positive human-animal interactions, including some aimed at assessing the effects of animal-assisted interventions. However, little research has been carried out on the basis of a multidisciplinary, integrated and wide viewing approach able to integrate the knowledge from different professionals (veterinarians, psychologists, doctors etc., as well as professionals from very diverse fields such as urban planners and politicians). In this regard, IN-HABIT (INclusive Health And wellBeing In small and medium size ciTies) is a research project representing a good example of a framework that proposes an innovative approach to the topic of human-animal bond in the urban environment whose effects will be monitored and evaluated. IN-HABIT is a Horizon 2020 project (GA 869227), funded by European Commission, that aims at implementing visionary and integrated solutions to foster inclusive health and wellbeing in small and medium size cities with a focus on gender and diversity. The project involves 4 European cities (Cordoba, Spain; Riga, Latvia; Lucca, Italy and Nitra,

Slovakia) where the mobilization of existing undervalued resources will increase people's health and wellbeing. Each city will work with a different resource, namely: culture in the case of Cordoba, food for the city of Riga, human-animal bond in Lucca, and finally, environment in Nitra. Specifically, Lucca's case study looks at the human-animal relationship as a resource to improve the well-being and the quality of life of both parties in the urban environment. As far as we know, the potential of human-animal relationship to improve the quality of urban life has never been evaluated. Planning and building a city that is tailored to the human-animal relationship brings several implications: i.e., for urban planning, in the organization and management of spaces, on operational and management methods, on the rules of citizens' behaviour, on the development and protection of animal citizenship, on the provision of innovative social services and supports for less empowered people etc. Among other goals, IN-HABIT will further investigate the human-animal bond to fully understand benefits and drawbacks of adopting a companion animal, as well as deepening the knowledge regarding the specific activities that bring positive effects on health and wellbeing, since not all benefits are strictly linked to just owning a pet (as we highlighted throughout the text of this scoping review). Through a bottom-up participative process (Granai et al., 2022), so far the project has designed infrastructures to facilitate positive interactions between people and animals, and it is working on innovative services involving pets (dogs and cats as well as other companion animals) to improve tourism, animal-assisted interventions (carried out in public and in dedicated spaces), activities in schools, and more proposals that will come from the on-going participative process. All these solutions will be implemented through the identification and codification of experimental actions, and then evaluated (through surveys, focus groups, physiological measurements etc.) to assess their effectiveness and transfer them to other cities.

Although the IN-HABIT project is not only focused on the benefits of pets, the relationship established with animals in the household is the most widespread and the one that this kind of project is aimed at valorising the most.

The purpose of the present scoping review was to summarise scientific literature that focuses on the benefits arising from dog ownership, while introducing the IN-HABIT project as a mean to promote the integration of pets into society through the implementation of adequate pet policies based on multidisciplinary approaches like "One health"; we did not consider studies focused on AAIs (assisted animal interventions), as they do not belong to the sphere of pet ownership.

## Materials and Methods

### *Inclusion and exclusion criteria*

Scientific papers were eligible if they were written in English, available in full text form, focused on dog ownership and its possible benefits. Articles about AAIs were not included as these interventions are out of scope. In fact, AAIs are a particular form of interaction between people and animals that takes place in specific contexts and with specific goals (IAHAIO (International Association of Human-Animal Interaction Organization), 2014); animals involved in AAIs, who are not linked to the beneficiaries by an ownership, usually receive a training to work with specific categories of persons, and the benefits are usually clearly defined in the design of the project as desired outcome.

### *Search strategy*

Searches were conducted from June 2021 to September 2021, using primarily the database of Web of Science and PubMed, although additional searches were conducted using Scopus and Google scholar.

The main query asked about the beneficial effects of pets (particularly dogs). Key words used in the search were: pet, pet ownership, pet companionship, pet owner, dog, dog owner, relationship,

human animal relationship, human animal interaction, human animal bond, zoeyia (from the Greek root words for animal “zoion” and health “Hygeia”).

### Selection process

Results from searches were pooled, and duplicate results were excluded.

Articles were then selected based on a 4-step screening process:

Phase 1: Titles of the articles were scanned to filter out irrelevant results.

Phase 2: Abstract were evaluated to identify articles relevant to the topic of HAI and its benefits. Papers that were focused on AAIs were excluded.

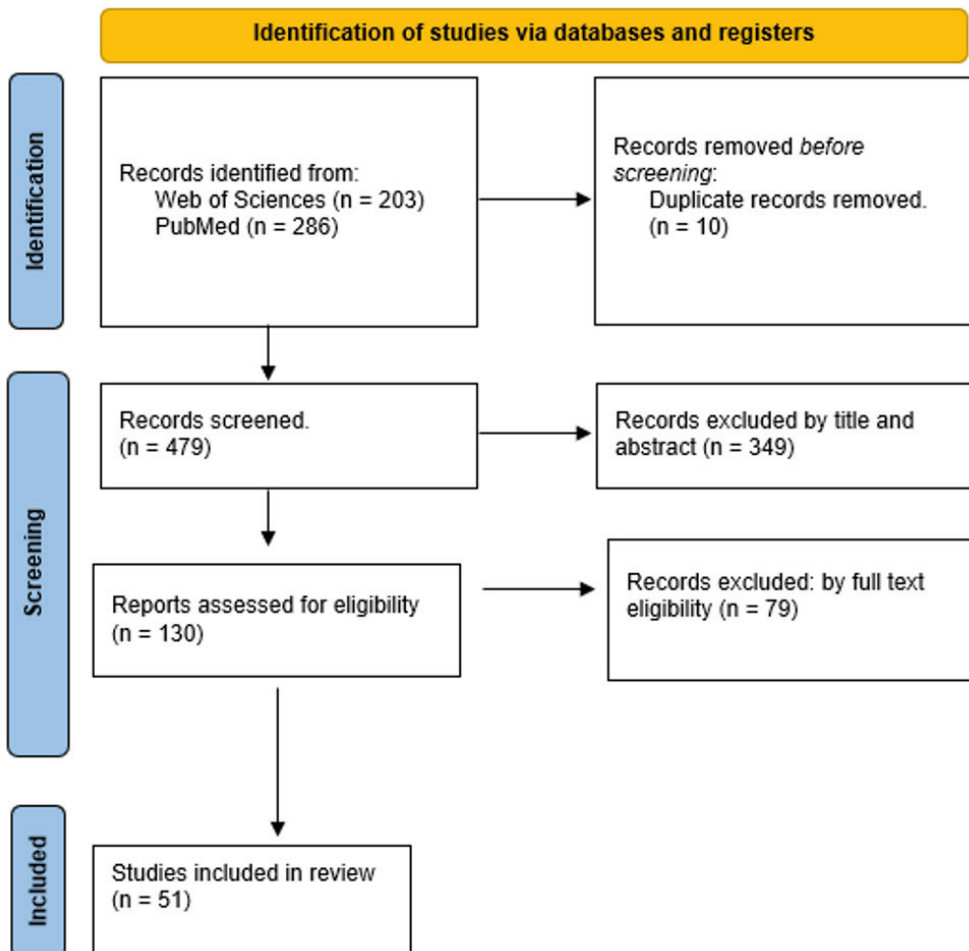
Phase 3: Reference lists were mined for additional relevant papers.

Phase 4: Review articles were removed, and full texts of the remaining papers were read in detail.

The articles remaining at this stage were included in the current review.

### Results and Discussion

The selection process is summarized in Figure 1. A total of 51 articles were included in this review.



**Figure 1.** Flow chart of the selection process of articles for this review.

Based on the different thematic areas of the articles, we decided to divide the results into 4 topics namely:

- Benefits on physical health and wellbeing
- Benefits on mental health and psychology
- Benefits of companion animal during COVID 19 pandemic
- Benefits on social life

The articles organized into the 4 topics are included in tables 1 to 4.

### *Benefits on physical health and wellbeing*

Social affiliations with and companionship of pets have important effects on human health (Table 1). In fact, a study that investigated the correlation between owning a pet and the survival of patients who were discharged from a coronary care unit after myocardial infarction, showed that pet owners had higher probability of survival one year after hospitalisation compared to non-pet owners (Friedmann et al., 1980). Of the 39 patients analysed that did not own a pet, 11 (28.2%) died a year after hospitalization, compared with only 3 out of the 53 pet owners (5.7%). Authors hypothesized that pet ownership (being them dogs or pets other than dogs) may measure the physical status of a patient, considering that companion animals provide to their owners an important amount of daily exercise (feeding, toileting, walking and petting animals are indeed, regular daily events). However, this hypothesis cannot be generalized to a larger population due to the small sample that participated in the study. Since dogs require a considerable amount of daily care compared with other pets, researchers also compared non-pet owners with patients that owned pets other than dogs. The results showed that the correlation between pet ownership and survival was significant even for those who owned pets other than dogs (Friedmann et al., 1980). These results highlight that the effects found by the authors are not only due to the increased physical activity provided by walking a dog.

Further investigations by Friedmann et al. (1995) were conducted on the effect of dog ownership on one year survival among a group of post-myocardial infarction patients in 1995. Results support and increase the generalizability of the previous study in 1980, showing that dog ownership contributed to survival of patients. Furthermore, authors proved that owning a dog and social support from either the pet or other people were independent predictors of survival. Having a dog produced a complementary effect on health and did not substitute other sources of social support: this effect is not dependent of social support received by other people and of the physiologic severity of the illness.

Dog ownership also have an impact on blood pressure (BP), as proved by a study conducted to evaluate the effect of the presence of a pet on BP (Friedmann et al., 2013). Dogs were associated with lower systolic and diastolic BP. It is not clear if dogs directly influence BP or if they are able to improve one's mood than in turn reduces BP. Regardless, these findings suggest that the presence of a dog is related to BP and that companion animals may be effective as an additional intervention to reduce BP in their owners' daily lives (Friedmann et al., 2013).

Many studies also focused on the beneficial effects of companion animals on elderly people and on the possible outcomes on aging population. Siegel (1990) found pet ownership to be associated with fewer doctor visits. Indeed, several studies proved that dog ownership may be associated with physical health during aging. For instance, a study by Mueller et al. (2018) showed that more than 60% of dog owners regularly walked their dogs, thus maintaining a physically active and healthy lifestyle. A similar study suggests that owning a dog leads to a potentially health improving effect: in fact, elderly dog owners would walk for 20 additional minutes compared with people of the same age who did not own a dog. Moreover, dog owners would make 2700 additional steps per day at a moderate cadence (>100 step/min), meaning that they were more likely to meet physical activity guidelines (150 minutes of moderate to vigorous physical activity) (Dall et al., 2017).

Dog walking in community dwelling elderly is generally positively correlated with better health practices and improved mobility, not only for those who currently have a companion dog (Curl et al., 2017; Friedmann et al., 2020; Motooka et al., 2006; Taniguchi et al., 2018; Thorpe, Kreisle et al., 2006), but also for those who had experience of it (Taniguchi et al., 2019).

Owning a pet contributes to many beneficial effects and these benefits may arise also from newly adopted pets that can bring positive changes in people's behavior and health. In a study that compares non pet owners with people who recently acquired a new companion animal (dogs among them), Serpell and colleagues (1991) found that the latter are more likely to register a reduction in minor health problems compared to the former and that the effects persist for months. Furthermore, in the same study, they found that dog owners reported a further increase in physical exercise, especially in the form of walking, compared to other pet owners (Ham & Epping, 2006; Raina et al., 1999; Serpell, 1991; Thorpe, Kreisle et al., 2006).

Indeed, one of the factors that proved to be more predictive for improved physical health in dog owners is the involvement of the owners in taking care, and specifically in walking the dog. In a study that investigated whether dog owners were more active than non-dog owners, Bauman et al. (Bauman et al., 2001) proved that in general the former are not more fit than the latter, unless they practise regular, sustained dog walking. Other studies demonstrates that dog ownership by itself is not associated with better physical health, while walking the dog is correlated with better health, less sedentary behaviour and a greater probability of meeting official medical recommendations for physical activity (Coleman et al., 2008; Curl et al., 2017; Ham & Epping, 2006; Mc-Connell et al., 2011; Thorpe, Simonsick et al., 2006). All these studies showed that owning a dog is not sufficient to improve ones' physical health, on the contrary the main effect is due to taking care of dogs, specifically walking them out. Consequentially, it might be that people living in the same household will benefit from owning a dog in a different way depending on the activity they share with the dog. At the same time, it would also be possible that some people don't have physical benefits at all, because they don't take care of their dog. Nevertheless, we should still consider other possible effects of companionship.

**Table 1.** Articles on the beneficial effects on physical health.

Authors	Title	Year
Bauman et al.	The epidemiology of dog walking: An unmet need for human and canine health	2001
Coleman et al.	Characteristics of Dog Walkers	2008
Curl et al.	Dog Walking, the Human-Animal Bond and Older Adults' Physical Health	2017
Dall et al.	The influence of dog ownership on objective measures of free-living physical activity and sedentary behaviour in community-dwelling older adults: A longitudinal case-controlled study	2017
Friedmann et al.	Animal companions and one-year survival of patients after discharge from a coronary care unit	1980
Friedmann et al.	Pet ownership, social support, and one-year survival after acute myocardial infarction in the Cardiac Arrhythmia Suppression Trial (CAST)	1995

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Friedmann et al.	Pet's presence and owner's blood pressures during the daily lives of pet owners with pre- to mild hypertension	2013
Friedmann et al.	Pet Ownership Patterns and Successful Aging Outcomes in Community Dwelling Older Adults	2020
Ham and Epping	Dog walking and physical activity in the United States	2006
McConnel et al.	Friends with benefits: On the positive consequences of pet ownership	2011
Motooka et al.	Effect of dog-walking on autonomic nervous activity in senior citizens	2006
Mueller et al.	Human-animal interaction as a social determinant of health: Descriptive findings from the health and retirement study	2018
Raina et al.	Influence of companion animals on the physical and psychological health of older people: An analysis of a one-year longitudinal study	1999
Serpell et al.	Beneficial effects of pet ownership on some aspects of human health and behaviour	1991
Siegel et al.	Stressful Life Events and Use of Physician Services Among the Elderly: The Moderating Role of Pet Ownership	1990
Taniguchi et al.	characteristics of community-dwelling elderly Japanese dog and cat owners	2018
Taniguchi et al.	Association of Dog and Cat Ownership with Incident Frailty among Community-Dwelling Elderly Japanese	2019
Thorpe et al.	Physical Activity and Pet Ownership in Year 3 of the Health ABC Study	2006
Thorpe et al.	Dog ownership, walking behavior, and maintained mobility in late life	2006

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### *Benefits on mental health and psychology*

Regarding mental health and psychological benefits (summarized in table 2), some early research found that owning companion animals was associated with less depression and loneliness in specific groups of owners, like elder people, women living alone, vulnerable, and homebound people (Garrity et al., 1989; Krause-Parello, 2008; McConnell et al., 2011; Stallones et al., 1990; Zasloff & Kidd, 1994). A study that investigated the association between pet ownership and loneliness among older adult primary care patients, found that people who were owning a pet at that moment were 36% less likely to report loneliness compared with people who did not own a pet (Stanley et al., 2014). Thus, companion animals may attenuate feelings of loneliness for older adults living alone, representing a source of social connectedness for their owners. Although social connectedness usually refers to a strong connection with other people, pets may also satisfy elders' need for connectedness. In fact, depending on the owners for survival, they give them a sense of worth and responsibility for another living being (Stanley et al., 2014), providing them with a daily motivation and routine that may increase self-esteem and positively affect their mental health (Hui Gan et al., 2020). Nevertheless, we should also consider that owning a dog might

facilitate interaction with other people (McNicholas & Collis, 2000a; Rossbach & Wilson, 1992) and this is a possible explanation to the decreased feeling of loneliness. Attachment to pets provide a unique and accessible source of social support (McNicholas et al., 2005) that plays a key role in individuals who experienced a major social loss, buffering their depressive symptoms (Carr et al., 2020). Korean research investigated the association between symptoms of depression in companion dog owners and their attitudes toward their dogs to explore whether the strength of the human-animal bond can modify the mental health benefits of dog ownership. Results showed that the owners with favourable attitudes toward their dogs had fewer depression symptoms (Min et al., 2019). However, people experiencing depression might feel a low level of intimacy with their dog (Carr et al., 2020), thus influencing their attitude towards the pet. Other papers show that pet ownership (mainly dog ownership) is negatively correlated with depression in a population of people aged more than 13 years in Dhaka (Chakma et al., 2021), as well as in homeless youth (Lem et al., 2016), and among unmarried women who live with a pet (Tower & Nokota, 2006). However, a study by Miltiades et al. found that older adults who were attached to their dogs had higher levels of depression than older adults who were less attached (Miltiades & Shearer, 2011). These results seem to be in contrast with those reported by Garrity et al. (Garrity et al., 1989), who found that older adults with high pet attachment had lower levels of depression. However, Miltiades et al. pointed out that their sample was recruited from veterinary clinics and dog grooming salons, so for the authors it is reasonable to think that these subjects have a strong desire to meet their pets needs and not being able to do so creates a psychological burden. Still, in our opinion this might be questionable, in fact, while veterinary clinics responds to scientifically proven needs, grooming saloon reflect more an owner's whim.

Another important effect of owning a pet is the one found by Siegel et al., i.e. that pets provides a buffer against stress (Siegel, 1990). In fact, from the results emerged that the accumulation of stress was positively correlated with an increase of doctor's visit in participants without pets, while this effect did not manifest itself for pet owners. In a Japanese study (Motooka et al., 2006), researchers investigated the correlation between dog walking and autonomic nervous activity in senior citizens. Authors hypothesized (and then verified) that dog walking is not only good for health in terms of increased physical activity, but that walking with a dog provides greater health benefits than walking without it, thus increasing the parasympathetic neural activity, which is generally associated with a reduction in stress. Human autonomic nervous activity for parasympathetic oscillation was analyzed while volunteers were walking with and without a dog. Results showed that walking a dog shifts a person's autonomic nervous activity in favour of the parasympathetic one meaning that merely spending time with a companion animal may have a stabilising effect that buffers human stress (Motooka et al., 2006).

Pets play an important role in children and preadolescent psychosocial development. For instance, in a study conducted in USA, young pet owners (children between 8 and 11 years) were found to have greater autonomy compared to non-pet owners (owned pets were mostly dogs and cats, but also other pets ownership were investigated), meaning that companion animals may be used to foster development of autonomous characteristics like responsibility and self-reliance (especially considering that the subjects were also in charge of taking care of the pet) (Van Houtte & Jarvis, 1995). Moreover, pets were found to significantly influence self-concept and self-esteem in preadolescents (Van Houtte & Jarvis, 1995). Similar results were found by Bratko et al. (2015), who showed that children (age range: 9-10 years) taking care for the well-being of their pet learn to be more responsible and empathetic. Generally, children who owned a pet reported a greater well-being than non-owners. A large study by McConnel et al. provides evidence that pet owners had greater self-esteem, were more physically fit, tended to be less lonely, were more conscientious, were more extraverted, tended to be less fearful and less preoccupied than non-owners (McConnell et al., 2011).

Regarding homeless people, some recent studies investigated the beneficial effects of dog own-



ership on them, reporting psychological benefits, as well as some perceived limitations and disadvantages. In an interview investigating the perceived costs and benefits of dog ownership for homeless people in the UK, participants reported a sense of companionship and love as one of the primary benefits that arise from owning a pet (Howe & Easterbrook, 2018). Moreover, dogs can provide relief from everyday stressors that come with being homeless and from loneliness (Lem et al., 2016; Rew, 1996; Wolch & Rowe, 1992). Interviewees also reported that their dogs gave them the motivation to regulate their destructive behavior (substance abuse). Since owners are responsible for their pets, homeless people are motivated to control their behavior to effectively take care of their companion animals (Howe & Easterbrook, 2018). In a similar study conducted in the UK, results showed that dog ownership provided to participants a sense of protection, security and even warmth (Scanlon et al., 2021). However, both studies highlight the significant difficulties that homeless people with dogs experienced in accessing services and accommodations (Howe & Easterbrook, 2018; Scanlon et al., 2021). In fact, owning a dog hinders the possibility to access general support services, as well as accommodations, since many providers are reluctant to accept pets. The main concerns are hygiene maintenance, and possible noises or behavior that would be a nuisance to other guests (Scanlon et al., 2021).

Despite the large body of research providing evidence of the beneficial effects of pet ownership on psychological and emotional wellbeing, some studies failed to find an association. For example, in a paper that investigated whether the presence of a pet (among them mostly dogs) was associated with multiple indicators of psychological wellbeing (Bennett et al., 2015), authors did not find any statistically significant differences between pet owners and non-pet owners, suggesting that pet ownership alone, may not be associated with substantial differences in indicators of wellbeing in elderly people. Nevertheless, they argued that frequency of contact should be taken into consideration when assessing the potential value of human-animal interactions as already stated in another study by Phelps et al., 2008. For example, results showed that frequency of pet presence was moderately negatively associated with depression, anxiety, stress, and loneliness scores, while for dog owners' frequency of dog presence was strongly negatively related to depression and moderately negatively related to anxiety and loneliness. Moreover, authors found a moderate positive relationship between frequency of dog presence and overall alertness, happiness, cheerfulness, activeness, sociability, relaxation, and self-efficacy (Bennett et al., 2015). Another study that examined the impact on the psychological health of individuals living alone, found that pet owners and non-owners did not have significantly different levels of loneliness or depression. When the authors decided to examine the influence of human social support, they found that dog owners with high levels of human social support were significantly less lonely than non-owners. Authors explained that dogs might be able to provide emotional support to their owners (Stammach & Turner, 2016) and, in individuals living alone with high level of human social support, this would mean having an additional source of social support that is not available for non-owners. At the same time, if we analyze the case of an individual with a low level of human social support, it is highly possible that the emotional support provided by a dog will not be sufficient to compensate for insufficient human social support (Duvall Antonacopoulos & Pychyl, 2010). Other factors that might influence these results are the different attitude and expectations of people, but in fact, these assessments are usually based on subjective factors which all depends on attitudes and expectations. Another possible reason why researchers fail to find a direct correlation between wellbeing and pet ownership is given by Bao et al. who argued that, in this kind of analyses, the period people owned their pet should be considered. It may be that at the beginning, adoption causes an increase of wellbeing that after a certain period will go back to a baseline level meaning that the owner might not be any more affected (or less affected) by the pet's presence (Bao & Schreer, 2016), as it happens in a phenomenon known as the hedonic adaptation (Frederick & Loewenstein, 1999). However, in our opinion, such hypothesis cannot be drawn this easily, considering all the existing literature about attachment bond which state that the longer the time

two subjects spent together the stronger their relationship should be (Ainsworth, 1969) (Bowlby, 1969). These articles show that the topic of HAB is wider than expected, and different factors must be considered when investigating this complex subject.

**Table 2.** Articles about mental health and psychological benefits.

Authors	Title	Year
Bennet et al.	An experience sampling approach to investigating associations between pet presence and indicators of psychological wellbeing and mood in older Australians.	2015
Bratko	Pet Ownership, Type of Pet and Socio-Emotional Development of School.	2015
Carr et al.	Psychological Health Benefits of Companion Animals Following a Social Loss.	2020
Chakma et al.	Depression among pet owners and non-pet owners: a comparative cross-sectional study in Dhaka, Bangladesh.	2021
Duvall Antonacopoulos	An examination of the potential role of pet ownership, human social support and pet attachment in the psychological health of individuals living alone.	2010
Garrity et al.	Pet Ownership and Attachment as Supportive Factors in the Health of the Elderly.	1989
Howe and Easterbrook	The perceived costs and benefits of pet ownership for homeless people in the UK: practical costs, psychological benefits and vulnerability.	2018
Hui Gan et al.	Pet ownership and its influence on mental health in older adults.	2020
Lem et al.	The protective association between pet ownership and depression among street-involved youth: A cross-sectional study.	2016
McConnel et al.	Friends with benefits: On the positive consequences of pet ownership.	2011
McNicholas et al.	Pet ownership and human health: A brief review of evidence and issues.	2005
Miltiades et al.	Attachment to pet dogs and depression in rural older adults.	2011
Min et al.	Owners' attitudes toward their companion dogs are associated with the owners' depression symptoms-an exploratory study in South Korea.	2019
Rew et al.	Coping With Loneliness Among Homeless Youth.	1996
Scanlon et al.	Homeless People and Their Dogs: Exploring the Nature and Impact of the Human-Companion Animal Bond.	2021
Stallones et al.	Pet Ownership and Attachment in Relation to the Health of U.S. Adults, 21 to 64 Years of Age.	1990
Stambach and Turner	Understanding the Human-Cat Relationship: Human Social Support or Attachment.	2016
Stanley et al	Pet ownership may attenuate loneliness among older adult primary care patients who live alone.	2014
Tower and Nokota	Pet companionship and depression: Results from a United States Internet sample.	2006
Van Houtte and Jarvis	The role of pets in preadolescent psychosocial development.	1995
Wolch and Rowe	On the Streets: Mobility Paths of the Urban Homeless.	1992
Zasloff et al.	Loneliness and pet ownership among single women.	1994

### *Benefits of pet during COVID 19 pandemic*

An important topic considered in this review is the human-animal bond during the Covid19 pandemic (Table 3). Some studies investigated both the role of companion animals (manly dog and cat ownership) for their owner and the concerns and difficulties that people with pet had to face. Companion animals constituted an important source of emotional and physical support to their owner during the Covid 19 lockdown (Bowen et al., 2020; Nieforth & O’Haire, 2020; Ratschen et al., 2020; Shoesmith et al., 2021). Although in the pre-lockdown period a study (Ratschen et al., 2020) found that stronger reported human-animal bonds were associated with poorer mental health, since lockdown the ownership (but not the strength of the bond) of companion animals was associated with less mental health deterioration and smaller increases in loneliness (Ratschen et al., 2020). Nevertheless, generalizability of these results is not possible, taking into consideration that the sample is not representative of the UK population (where the study was carried out); in fact, the sample was composed mainly by female owners and even the population of non-owners might not be representative considering that only 2% reported that they did not like animals, while the national average is thought to be around 10% (BMG). Emotional support provided from pets was also associated with an increase in emotional closeness and interactions with them (Bowen et al., 2020).

Studies also highlighted the specific challenges associated with caring for a companion animal during covid 19 pandemic. The most frequently reported concerns and worries were related to meeting the social and behavioral needs of pets, as well as to being able to adequately take care for animals when access to veterinary care, animal feed and adequate outdoor exercise spaces was limited (Applebaum et al., 2020; Ratschen et al., 2020; Shoesmith et al., 2021).

**Table 3.** Articles about companion animals in COVID19 pandemic.

<b>Authors</b>	<b>Title</b>	<b>Year</b>
Applebaum et al.	The concerns, difficulties, and stressors of caring for pets during covid-19: Results from a large survey of U.S. pet owners.	2020
Bowen et al.	The effects of the Spanish COVID-19 lockdown on people, their pets, and the human-animal bond.	2020
Nieforth and O’Haire	The role of pets in managing uncertainty from COVID-19.	2020
Ratschen et al.	Human-animal relationships and interactions during the Covid-19 lockdown phase in the UK: Investigating links with mental health and loneliness.	2020
Shoesmith et al.	The Influence of Human-Animal Interactions on Mental and Physical Health during the First COVID-19 Lockdown Phase in the U.K.: A Qualitative Exploration.	2021

### *Benefits on social life*

An interesting branch of HAI research focuses on the social benefits that could arise from pet ownership (Table 4), in particular the role of dogs as catalyst for human-human interactions. Early studies demonstrated that people experience a significantly higher probability of starting a conversation with a stranger when walking a dog compared to when they walk alone (Messent, 1983). Dogs work as an icebreaker providing an opening for conversation and approaching. Furthermore, the presence of a pet may increase ones’ likeability (Rossbach & Wilson, 1992).

The catalyst role of dogs in human social interactions was also investigated by McNicholas and

Collis (McNicholas & Collis, 2000b) with two different protocols. In the first one, they recorded through direct observation the number of interactions experienced by a female handler accompanied by her dog in routine movements. In this study, they decided to use a guide dog to avoid soliciting passers-by attention. In the second study, they analysed whether the catalysis effect was influenced by the appearance of the dog and/or the handler, manipulating their look. Results confirm that dogs can trigger human-human interactions and that this is a robust phenomenon that can be generalized beyond conventional dog walking areas. Moreover, appearance of either the dog or handler did not seem to influence this effect (McNicholas & Collis, 2000b). Later research showed that although people usually notice dogs, the features of the latter strongly influenced the effect they have on the former (Gazzano et al., 2013). In fact, the authors found out that people tend to feel and behave in a more positive way towards a puppy rather than towards adult dogs. Furthermore, people describe more negative feelings and behaviours when meeting Pit Bulls compared to other breeds (Gazzano et al., 2013). In a multinational study that explored the role of pets as a catalyst for social interaction, researchers not only proved that pet owners had more opportunities to get to know other people, but also found that these meetings were likely to lead to new friendships and, therefore, to new sources of human social support (Wood et al., 2015).

Dogs, besides facilitating social interactions between their owners and strangers, are also able to build a sense of community within neighbourhoods, as emerged in a qualitative and quantitative research conducted in three western Australian suburbs. Results showed that dog ownership was positively associated with attributions of friendship, social contact, and practical exchange of support (L. J. Wood et al., 2007). Moreover, the analysis suggested that the effects dogs provided to owners to walk and the presence of people walking their pets contributed to increase feelings of collective safety and had a positive effect on sense of community (Wood et al., 2007).

**Table 4.** Articles about social benefits.

Authors	Title	Year of publication
Gazzano et al.	Dogs' features strongly affect people's feelings and behavior toward them	2013
McNicholas and Collis	Dogs as catalysts for social interactions: Robustness of the effect	2000
Messent et al.	Animals and people: the tie between: social facilitation of contact with other people by pet dogs	1993
Rosbach	A multidisciplinary journal of the interactions of people and animals Does a Dog's Presence Make a Person Appear More Likable?: Two Studies	1992
Wood et al.	The pet factor - Companion animals as a conduit for getting to know people, friendship formation and social support	2015
Wood et al.	More than a furry companion: The ripple effect of companion animals on neighborhood interactions and sense of community	2007

#### *The IN-HABIT project as a mean to improve pet ownerships' benefits*

The IN-HABIT project in Lucca proposes an innovative framework that will consider all the benefits cited above to enhance people health and wellbeing as well as improving human animal bond in urban environments. For example, the infrastructures that have been designed so far (the so-called Animal Lines) will certainly increase the habit of people to take out their dogs since they have been thought to respond to the specific needs of human-dog dyads' interactions. Furthermore, the project aims also at organising specific activities that will further promote walking dogs

in public green spaces as well as to teach owners how to manage their pets in cities. At the same time the Animal Lines and all the activities promoted around them will enhance the possibility of social interactions between people and consequently improve the sense of community.

The IN-HABIT project will also bring new services thought for specific categories of people, like educational activities in schools (even through gamification) that will promote good values and practices towards pets and social services that can improve the lives of less empowered people.

Moreover, the IN-HABIT project will focus on human-animal bond through a multidisciplinary approach like the one used in the “One Health” framework. “One Health” is an integrated, unifying approach to balance and optimize the health of people, animals and the environment (WHO, World Health Organization). This approach is based on two main concepts. Firstly human, animal and the environment are all linked together, and secondly different disciplines should collaborate working locally, nationally and globally to attain optimal health for people, animals and the environment. The One Health initiative is dedicated to improving the health of all species through the integration of human health care and veterinary medicine. Although veterinarians and physicians have worked together mostly on the prevention of zoonoses, One Health is also aimed at improving the positive effects that arise from human-animal interactions, namely *zooeia* (Howden et al., 2009). *Zooeia* is a new approach that focuses on the relationship between companion animals and humans, and studies the health benefits that could arise from it. Future research should take into consideration the One Health program and its new concept of *zooeia* to improve humans and animals’ health with a multidisciplinary approach.

To conclude, the IN-HABIT project would add new value to the topic generating new understanding about the potential of the human-animal interactions and bond in innovative cities and creating new integrated pet policies able to support cities and municipalities, to activate and to valorise such resource and animal nature-based solutions by the way of an integrated human-animal city policy.

## Conclusions

The aim of this review was to summarise and discuss papers regarding the benefits that owning and taking care of a dog can provide, that can be regarded as a bases for the IN-HABIT project as a mean to improve human-animal relationship and, through that, to improve people’s health and wellbeing. Results from the literature search highlighted both benefits such as improved physical and psychological health and an increase in social interactions with other people, as well as some papers that failed to find any beneficial effect.

We must highlight that even though the focus of this scoping review was dog ownership, results reported that some beneficial effects does not come from simply owning a dog, but from taking care of it, walking it out etc... Therefore, the benefits of owning a dog are not the same for all family members but depends on the different activities each member does with its pet (in some cases, they may not have any benefits at all because perhaps one person does not go out and has a dog sitter).

This scoping review has some limitations. In fact, even though we used general and vague terms when searching the literature, for example we include in the key words terms like human animal relationship, interaction etc., we did not find papers that investigated specifically the risks of the human-dog relationship, even though they are well known (e.g. transmission of zoonoses (Overgaauw et al., 2020), potential allergic reactions (Ownby & Johnson, 2016), risks for injuries and bites (World Health Organization (WHO), n.d. etc.). Highlighting the potential risk of the human-pet relationship would be an interesting and important topic, however it was not the focus of this scoping review. Furthermore, the focus on negative effects probably needs other key words because the literature might be biased in itself.

Research should further investigate the beneficial effects of the relationship between humans and companion animals; this will allow professionals to recommend pet's adoption only when it may be positive for both the parties involved. It must be pointed out that there are a lot of factors to consider when doing such recommendations, for example people's ability to look after the animal (economically and physically), and criteria for selecting the right pet. In this regard, collaboration between different disciplines of the human and animal areas will be crucial. One Health program should focus on this aspect to promote the integration of pets into societies through the implementation of adequate pet policies.

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## I Benefici del possedere un cane sulle persone come risorsa sottovalutata in ambienti urbani

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### Sintesi

Nei paesi ad economia sviluppata, la vita confinata nelle città ha generato un nuovo bisogno di contatto con la natura e con gli animali non umani. Al giorno d'oggi, sono molti gli studi che indagano i possibili esiti del legame uomo-animale sulla salute delle persone. Tuttavia, sono stati condotti pochi studi per valutare i benefici del legame uomo-animale come risorsa innovativa per migliorare la salute e il benessere delle persone. A questo proposito, il progetto In-Habit (INclusive Health And wellBeing In small and medium size ciTies) è un buon esempio di framework che propone un approccio innovativo al tema delle interazioni uomo-animale in ambiente urbano. Lo scopo di questa scoping review è stato quello di riassumere e discutere la letteratura che si occupa degli effetti benefici del possedere un cane, introducendo il progetto INHABIT come mezzo per promuovere l'integrazione degli animali da compagnia nella società attraverso l'attuazione di adeguate politiche per gli animali domestici basate su approcci multidisciplinari come quello di "One health". Nel giugno-settembre 2021 è stata condotta una ricerca bibliografica e gli articoli sono stati selezionati utilizzando un processo di screening in 4 fasi che ci ha permesso di includere 51 articoli nella revisione. Secondo alcuni di questi studi, possedere un cane potrebbe avere un effetto positivo sull'attività cardiovascolare, sulla pressione sanguigna e sui livelli complessivi di attività fisica del proprietario. Altri benefici sono legati alla salute mentale, come la riduzione della depressione e della solitudine in varie categorie di persone.

