

Noah's Syndrome: Systematic Review of Animal Hoarding Disorder

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Animal Hoarding Disorder (AHD) is a recently acknowledged psychiatric syndrome regarded as a form of Hoarding Disorder. Despite its great complexity, AHD has been underestimated both within and outside the academic community. This systematic review of the literature will assess some features to give a description of the syndrome. We have selected 26 empirical investigations which have been analyzed for such purpose. Moreover, we have estimated the mean values of some variables such as age (55.6 years old), gender (74.9% women), households (51.8% single-person), unemployment (53.6%), number of animals per case (64.1), presence of dead animals (32.9%) and object hoarding co-morbidity (59.5%). Results will be discussed to highlight AHD particular features, the need for an integrated view around the One Welfare concept and the need for an interdisciplinary approach. Given its complexity, we recommend acknowledging AHD as a separate nosographic entity.

Key words: animal abuse, anthrozoology, companion animals, hoarding disorder, Noah's syndrome.

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Collecting objects is a common human activity. From the evolutionary point of view, the tendency to accumulate possessions could be considered adaptive, as it ensures resources when they are scarce (Leckman et al., 2005). Nevertheless, accumulative behaviors can become a pathological pattern which could jeopardize a person's health, that of their family and surrounding environment (Kim et al., 2001). Object hoarding has been embraced by public health, medical, psychiatric, and criminal justice authorities in the United States only since the mid-1990s (Svanberg & Arluke, 2016).

In the fourth version of DSM (APA, 1994) hoarding was defined as a likely symptom for Obsessive-Compulsive Disorder (OCD) or obsessive-compulsive personality disorder (OCPD). In the next edition, DSM-5, Hoarding Disorder (HD) became a separate nosographic category in the new chapter for Obsessive Compulsive and Related Disorders. HD is characterized by the persistent difficulty in discarding or parting with possessions, the significant distress associated and the consequent excessive clutter of functional areas, all of which interfere in daily activities and lead to considerable deterioration of living conditions and social life (APA, 2013; Frost & Steketee, 1998).

HD or Diogenes Syndrome, therefore, entails a behavioral disorder characterized by problematic behaviors of accumulation, squalor, personal neglect and poor insight of such disruptive behavior (Irvine & Nwachukwu, 2014).

There are a few obstacles to carry out an epidemiology, such as some discrepancies when outlining HD casuistry or the ego syntonic nature of the disorder (Frost et al., 2000). Notwithstanding, HD behaviors have been observed in 2% to 6% of the population (Nordsletten et al., 2013). Some studies have linked HD to interpersonal conflicts, occupational disability and several health issues (Tolin et al., 2008), high rates in anxiety, depression, family and social disabilities, progressive functional deficit (Grisham et al., 2008), social isolation (Samuels et al., 2002) and difficulties in bonding with other people (Grisham et al., 2018).

The cognitive behavioral model hypothesis is that hoarders tend to have an excessive emotional attachment to possessions (hyper sentimentality), so they deem objects as extensions of themselves (Frost & Harlt, 1996) and develop strong feelings for such things the same way it might occur with people, to the extent of calling it "love" (Frost & Gross, 1993). Likewise, some research suggests that individuals might ascribe human personal qualities to their possessions (Neave et al., 2015) and even suffer their loss with the same intensity as if losing a close friend (Frost & Harlt, 1996).

DSM-5 includes a variation of HD known as Animal Hoarding Disorder (AHD), also named by some authors as Noah's Syndrome (e.g. Saldarriaga-Cantillo & Rivas Nieto, 2015). Despite the lack of general agreement to operationalize such disorder, works and research have adopted the diagnostic criteria proposed by Patronek (1999) for his categorization of Animal Hoarders (Joffe et al., 2014; Ockenden et al., 2014; Reinisch, 2009).

Patronek (1999) presented this disorder as a public health issue and described hoarders as people who: 1) persistently accumulate a large number of animals; 2) fail to provide minimum necessary conditions for nutrition, sanitation, and veterinary care; 3) fail to act on damaged animals or on the negative effect of hoarding on their own well-being and the health of other family members. He also pointed out that the phenomenon is not defined by the number of animals in a household but by the inability to provide adequate care. Towards the end of the 1990s, Patronek signed the Hoarding of Animals Research Consortium, added denial of one's inability to provide care to animals and urges to accumulate animals as further criteria, which emphasizes the ego syntonic nature of AHD symptoms (Hoarding of Animals Research Consortium, 2002).

He also proposed a classification of hoarders in five categories: (1) Overwhelmed caregivers, related to problems in caring for animals, triggered by a change in circumstances or resources (social, economic or medical) and/or as a result of over-accumulation of animals

from uncontrolled breeding, donation or other means. Hoarders provide adequate care at first but eventually get overwhelmed. (2) Rescuer hoarders, who have a strong sense of mission to save animals, which leads to compulsive hoarding. This type of hoarders fear death of their animals and believe they are the only ones who can provide adequate care. (3) Incipient hoarders, for whom hoarding begins within the idea of “loving animals”. They usually achieve minimum standards of care under the law, although care is deteriorating. They are more likely to be aware of problematic conditions and actively attempt to provide care. (4) Exploiter hoarders, who acquire animals purely to serve their own needs. They lack empathy for animals or people and acquire animals actively but then they show indifference to their suffering. (5) Breeder hoarders, who initially breed animals for show or sale (i.e. for gain in prestige or money). Over time they have increasing difficulties to keep proper care. The first three types are incapable of providing proper care because the amount of hoarded animals exceeds their resources, whereas the other two types do not attend to the needs of animals because of indifference to animal suffering (Patronek & Nathanson, 2006; Elliot et al., 2019). Although these criteria and classification have not yet been studied by APA or WHO, they have been extensively used to study AHD.

Animal hoarding disorder is a complex problem existing in almost every community which damages human and animal welfare (Polak et al, 2014). An American association for animal control informed that feeding and bathing each animal in a shelter takes a minimum of 15 minutes of care time per day (9 minutes for bathing and 6 minutes for feeding). If a person had 10 animals placed in their care, the minimum time required for basic care would be 2.5 hours a day; if there were 20 animals, then more than 5 hours a day would be needed (ASV, 2010).

Because of such difficulties and other factors, animals in hoarding situations tend to be deprived from adequate veterinary care, food, and water. Comparably, intervention strategies for these cases are usually expensive and time-consuming, as they entail a variety of services such as veterinary, sanitation and legal aids (Patronek, 1999; Polak et al, 2014).

Animal hoarding is an under-reported problem and few studies are available in the scientific literature, particularly outside the USA (Calvo et al, 2014). Many cases go undetected due to the reserved nature of animal hoarders and the resources available in intervening organizations. Consequently, prevalence for AHD is greatly underestimated (Joffe et al, 2014). Moreover, the high rate of recidivism reported in the studies indicates that current interventions turn out to be inefficient (Ockenden et al, 2014).

This paper is intended to make a revision of empirical studies which directly or indirectly assess the characteristics of AHD people, and a meta-analysis on their demographic characteristics, establishing connections among the data to reach an updated and comprehensive depiction of the disorder.

Method

A revision of empirical studies having as variable the behavior of animal hoarding was carried out, following the procedure proposed by The PRISMA Group (Moher et al., 2009). This process was achieved through the reference manager Mendeley. Initially the terms “*animal hoarding*”, “*Noah's syndrome*” and “*hoarding disorder*” were included. This procedure provided 807 results. Abstracts were scanned and only papers mentioning animal hoarding were sorted. This procedure provided 132 results. From them, 24 were empirical and deemed relevant. Finally, a manual search of investigations mentioned in these articles led to the addition of two papers which had not been included (Vaca-Guzman & Arluke, 2005; Svanberg & Arluke, 2016). Thus, the procedure resulted in a total of 26 articles with original empirical investigations.

Then we conducted an analysis considering the 15 quantitative investigations about the characteristics of animal accumulators. The data was uploaded to *IBM SPSS Statistics 25* for Windows, where we estimated the weighted averages of the demographic characteristics linked to people with AHD.

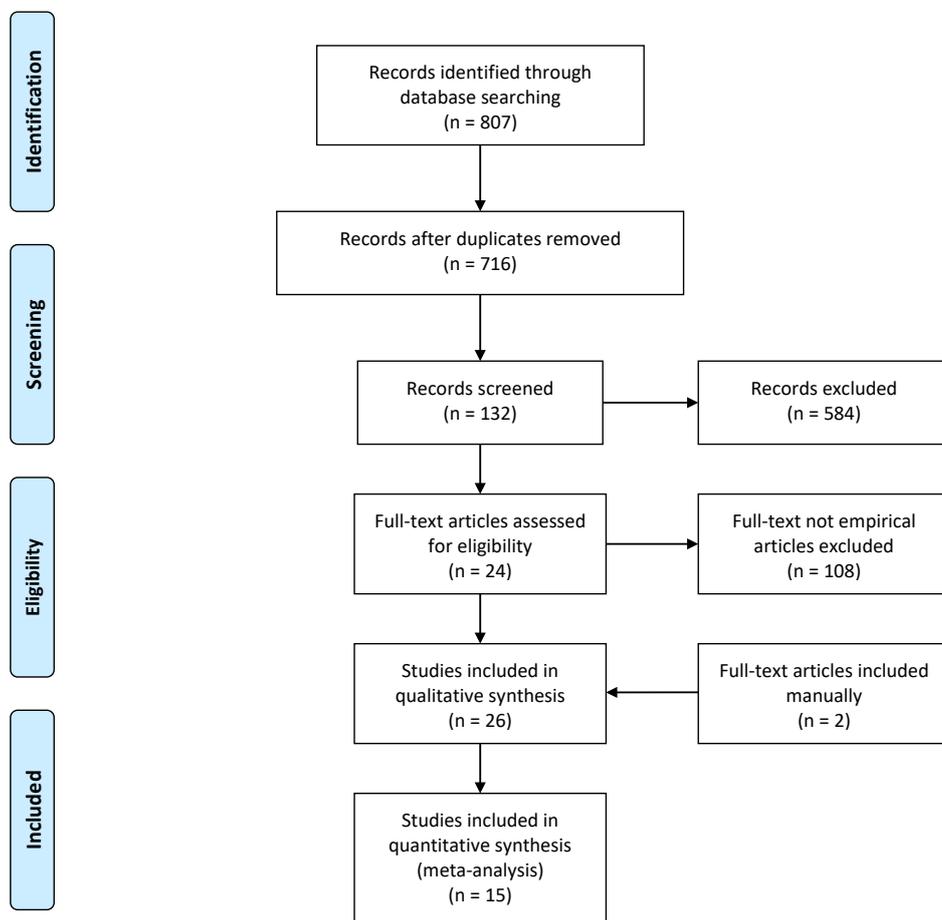


Figure 1
Review procedure on a flow diagram

Results

All the investigations considered in this review are presented on [Table 1](#) where the main results regarding our aims are accounted for. [Table 2](#) and [Table 3](#) show quantitative studies and their results on certain variables related to the description of individuals who suffer from AHD. Additionally, it presents their weighted mean.

The studies tend to outline AHD as a chronic disorder which progressively deteriorates (Calvo et al., 2014; Ockenden et al., 2014). It initiates around middle-age (Arrienti et al., 2017) and the highest incidence rate of the disorder is around 55 years old, with the severest symptoms. According to research, the average age for animal hoarders is between 50 and 60 (Min: 49.7; Max: 61.4) with a weighted mean of 55.6 ($SD = 3.4$)

This disorder primarily affects women on a rate of 3 to 1 (Women: $WM = 74.9\%$, $SD = 8.9$). Studies did not show significant gender differences regarding the seriousness of symptoms or hoarding styles.

The available data contributes only partially to the stereotype of animal hoarders deemed as socially isolated, unemployed, and living alone or with dependent people. Cases referred by Irvine & Nwachukwu (2014), Svanberg & Arluke (2016), and Saldarriaga-Cantillo & Rivas Nieto (2015) describe women with such features. However, only half animal hoarders live in single-person households ($WM = 51.8$, $SD = 8.7$) and a third have a partner. Cohabitation frequently refers to dependent people (e.g. children, disabled or confined people) or individuals with similar hoarding behavior (HARC, 2002; Reinisch, 2009).

Financial status was bad or borderline (Calvo et al., 2014). Unemployment (i.e., retired, pensioners and unemployed people) is featured in half of the cases (Min: 33, Max: 66.6) with a WM of 53.6% ($SD = 8.7\%$). The most frequent hoarders' occupation is animal protection. Cases described by Vučinić & Dimitrijević (2007) and Polak et al. (2014) highlight the presence of animal shelters and sanctuaries or rescue networks, where individuals revealed behaviors of the overwhelmed and rescuer types of hoarder.

Impairment of activities of everyday life (e.g. sleep, nutrition, hygiene) is common (Arriente Ferreira et al., 2017; HARC, 2002; Reinisch, 2009). Moreover, there is little or no insight about the disorder in half of the cases (Dozier et al., 2019; Patronek, 1999). Animal hoarders tend to justify their actions minimizing or denying their consequences, or to make excuses for their actions such as disguising an ill act on something noble (Vaca Guzmán & Arluke, 2005) and claiming to be animal rescuers or saviors (Berry et al., 2005; Strong et al., 2018).

Recidivism has proved frequent after interventions, although studies show wide differences in their rates: 12.5% (Calvo et al., 2014), 25.3% (HARC, 2002), 50% (Reinisch, 2009) and 64% (Ockenden et al., 2014). Object hoarding occurs in half the cases. Despite a relative average of 59.5% ($SD = 24.2$), it is a result conditioned by HARC findings which estimated that 100% of people with AHD also hoarded objects, a fact that is significantly different from the rest of the investigations (Min: 35.8; Max: 56.7). People with AHD and object hoarding show similar sociodemographic features. However, studies with object hoarding samples highlighted that animal hoarding was not common among these people (Cunha et al., 2017; Ung et al., 2017). In addition, animal hoarding in people with OCD is highly infrequent (0.47%; Campos Lima et al., 2015).

The number of animals accumulated by AHD individuals is extremely broad, with a registered minimum of 6 and a maximum of 918. The findings displayed a wide range (Min: 16.6; Max: 118.9) of average numbers. The relative mean was 64.1 ($SD = 32.8$) animals per case. Cats and dogs are by far the most hoarded species for which their primary source of acquisition was uncontrolled breeding, estimated in 2 out of 3 cases ($WM = 68.1$, $SD = 8.9$).

Animal welfare conditions entail malnutrition and health care needs in 9 out of 10 cases which means that good health conditions are rare (Calvo et al., 2014; Reinisch, 2009; Strong et al., 2018). Even in such cases, there are commonly behavioral problems among animals due to fearfulness (Boat & Knight, 2001; McMillan et al., 2016) which is the main reason for euthanasia after interventions (Ockenden et al., 2014). Moreover, the presence of animals which were not removed from households occurs in 1 out of 3 cases ($WM = 32.9$, $SD = 19.3$).

Hoarding cases are located in urban as well as rural areas, mostly in middle or working class neighborhoods. The type of housing tends to be single-family houses, in a proportion just a little above flats and others (Calvo et al. 2014, Frost et al. 2000; Patronek, 1999). All such households are seriously neglected, where access and facilities are compromised and they are usually described as unsanitary (Frost et al., 2000; HARC, 2002). Almost all cases reported the presence of feces on the floor and unbearable urine odor whose levels of toxic ammonia were dangerous for humans and animals (Calvo 2014; Reinisch, 2009; Strong et al., 2018).

Complaints from neighbors are common and usually justified on the grounds of the unsanitary conditions as well as animal cruelty (Berry et al., 2005; Joffe et al., 2014; Ockenden

et al., 2014; Patronek, 1999). It has been informed that animals were frequently confined in cages, makeshift crates or specific rooms inside the property (Arrienti Ferreira et al., 2017; Elliott et al., 2019), although acts of aggravated cruelty upon animals were not as frequent (Joffe et al., 2014; Ockenden, 2014).

Interventions tend to be cumbersome as several agencies are involved and because animal hoarders are often reluctant to cooperate (Frost et al., 2000). Furthermore, the involvement of justice and the media has been somewhat disregarded (Arluke et al., 2002; HARC, 2002). Consequently, any monitoring tends to appear insufficient and ineffective (Berry et al., 2005), a fact that promotes high rates of recidivism.

Discussion

The description presented in this review raises awareness about AHD complexity compared to Hoarding Disorder. Firstly, the environment could be more seriously affected in AHD, setting the conditions for a number of infections (Joffe et al., 2014), toxic levels of ammonia in the atmosphere (Reinisch, 2009; Ockenden et al., 2014; Strong et al., 2018) and problematic behavior in animals (Arrienti Ferreira et al., 2017), issues that can affect not only the animals concerned but also hoarders, relatives and neighbors. In addition to this, caring for animals entails a few expenses which may aggravate the already precarious situation of hoarders and make access to hygiene more difficult for both people and animals.

HD people are often described as having a deep emotional bond with their possessions (Frost & Gross, 1993, Frost & Harlt, 1996) comprising a one-sided truth. Unlike objects, cats and dogs trigger enduring emotional bonds (Sanders, 1993) with humans in the same way as attachment figures (Zilcha-Mano et al., 2011) and this represents a two-way relationship. Evidence of this has been observed in animal behavioral (Palmer & Custance, 2008) and neuroendocrine responses (Nagasawa et al., 2015). In non-clinical samples, it has been shown that more than 90% of people consider their animal companions to be members of the family, so they tend to make considerable efforts to keep them, even if they jeopardize their own safety to avoid separation (Díaz Videla, 2017).

Based on these premises it can be assumed a greater reluctance in AHD people to part with their animals than in HD people to part with their possessions. This is reinforced by a strong fear of animal helplessness and risk of euthanasia. Moreover, for ethical reasons animals cannot be disposed of the same way objects can, and their relocation requires collaboration from different agencies, which in turn means a greater investment of time and money resources.

Besides sanitation hazards, AHD cases tend to involve animal cruelty. This is one of the main reasons for complaint among neighbors and it is key to identify AHD situations. Cruelty is normally defined as neglect in basic care, decay of living conditions, absence of attention to basic needs in nutrition and hygiene, overcrowding and poor health, lack of veterinary care or even cohabitation with dead animals, all typical settings for animals in cases of AHD. The relationship with hoarded animals can be defined as a direct form of abuse when it is purposefully injured, not simply by failure to act, but also through physical abuse (Cajal et al., 2018). An example of this can be observed where animals are forced to live inside crates or locked in bathrooms.

The great complexity of AHD in terms of symptoms, intervention and risks justifies being considered as a psychiatric disorder separate from HD. Furthermore, it should mobilize scientists and researchers to work on treatment strategies specifically designed for AHD.

In this framework, AHD represents a clear model of the One Welfare approach, which proposes that strategies for medical conditions can only be effective if the human-animal-environment interconnection is taken into account (Centers for Disease Control and Prevention, 2018). Logically, AHD interventions need to treat human health as well as animal and environment welfare.

Among such actions, we highlight the need for cat and dog sterilization. Uncontrolled reproduction has been outlined as the most frequent way of animal accumulation, present in two out of three cases (68.1%). It demands veterinarians to educate clients about early sterilization of their animals and the implementation of public awareness campaigns to ensure universal access to neutering and, eventually, public regulation for these measures.

On the other hand, the accumulation of animals could work as a detector for a wide range of medical, social, and economic problems as well as cases of abuse on people who depend on hoarders. Such individuals can be forced to face dire conditions in exchange for care and company from the hoarder (HARC, 2002)

Another element that contributes to the severity of the disorder and the difficulty of an intervention is the lack of an adequate social support network (Arrienti Ferreira et al., 2017). It is yet unclear to what extent social isolation is a cause, rather than an effect, of animal hoarding, or to what extent expanding hoarders' social network might reduce their craving for animals (HARC, 2002). In any event, it is evident that such need makes them prone to look for rescue networks and get close to people who encourage the acquisition of new animals, which in turn enhances the problem.

Thereby, a key challenge for any intervention would be to reduce isolation and avert enabling factors. Several authors (Boat & Knight 2001; HARC, 2002; Ockenden et al., 2014; Patronek, 1999; Strong et al., 2018) have stated the need of specialized training for the agencies involved so as to understand the human-animal bond and recognize both signs of AHD and the extent of its psychological deterioration. Due to the isolation and the reckless behavior typical of hoarders, it is difficult to create a cooperative alliance with them. In some cases, a valuable strategy would be to negotiate keeping a small number of their favorite animals as long as they can commit to both monitoring and improvement of living conditions.

Strategies should be integrative, coordinated and guided by the characteristics of each case. It might be useful to consider the different types of hoarders, in connection with beliefs, level of defiance and types of bond established with their animals (Elliott et al., 2019; Strong et al., 2018). Coordination means that those cases set in motion by certain instruments (e.g. legal prosecution) should not be disregarded by other means (e.g. for psychiatric reasons), or else avoid overlapping interventions and sentences that could turn out in conflicting and fleeting results (Joffe et al., 2014).

For all these reasons, the "One-Welfare" perspective has been proposed. It promotes holistic approaches to help reduce recidivism in AHD through the creation of a task force aimed at law enforcement training, mental health services for the psychological components, involvement of crisis counseling services, and meetings to inform district attorneys about animal hoarding prior to appearing in court (Strong et al., 2018).

Limitations

It should be noted that the current review may not be considered a formal meta-analysis. The purpose was to link data and to describe emerging patterns from the studies about an outline of people suffering from AHD. A formal meta-analysis should be based on a greater number of investigations directly comparable. While this disorder has been formally described in the last two decades, little empirical research has been carried out on the subject. Some investigations tend to use samples which are not comparable in a direct way and in some cases fail to inform key data. Despite this, we managed to comprise substantial information. Nevertheless, such data should be considered as preliminary descriptions rather than accomplished conclusions.

Conclusions

Noah's Syndrome is a psychopathological condition described only recently in scientific literature. It has been acknowledged as a variant of Hoarding Disorder because of its special features. However, its complexity has been underestimated both by the media and the agencies involved in its treatment. Such difficulty is highly represented by the concept of One-Welfare because it demands the need of an integrated approach of the relationship individual-animal-environment for the sake of an adequate strategy design to deal with it.

The research carried out with the revision of investigations brings forth a depiction of AHD that not only favors a more comprehensive understanding of the problem but also allows for a better identification of people prone to develop AHD, which in turns allows for early interventions.

Furthermore, such description stresses some underlying problems in AHD which demand a closer liaison between mental health services and animal welfare organizations. At present, this human-animal bridge is virtually non-existent for public health sectors.

Thus, AHD is demanding new integrated approaches steering to an interdisciplinary management and a more systemic and complex mind. Acknowledging AHD as a separate disorder will promote the development of more holistic visions and more comprehensive approaches to human-animal-environmental health.

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Table 1
Summary of empirical research that evaluated animal hoarding as a mental disorder

Author	Year	Country	Cases / Sample	Design
Patronek	1999	USA	TPAA cases ($n = 54$) reported from animal control agencies.	Qualitative descriptive study
<p>Results: 46% of hoarders were 60 years of age or older, and half of the total lived alone. 37% were between 40 and 59 years old, and 11.1% were under 40 years old. In 76% of the cases, they were women. Cats were involved in 65% of cases, dogs in 60%. In addition, 11% accumulated birds, and another 11% farm animals. The hoarding motivation was the love for the animals, animals as a substitute for children, the feeling that no one else would take care of them, and the fear that they would be slaughtered. Dead animals and animals in unhealthy conditions were found in 80% of cases. In half of the cases the accumulators did not recognize the existence of a problem. The most frequent reason for reporting was sanitary conditions. 90% of the cases lacked bathroom, kitchen, electricity, or heating services. At least a quarter of the accumulators were then institutionalized or to a residence under supervision. The annual prevalence estimated on the US was between 700 and 2000 cases.</p>				
Frost et al.	2000	Massachusetts, USA	Health officers listed by the Massachusetts Health Officers Association ($n = 88$) who received hoarding complaints.	Qualitative descriptive study
<p>Results: 64% of the officers reported at least one accumulation claim, which was more frequently reported by neighbors (52%) or by the police (47%). 32% of accumulation cases included animal hoarding. In these cases, housing conditions were less healthy, there were greater risks to public health and they were more difficult to address. These cases tended to involve more public agencies and achieve less effectiveness in the interventions.</p>				
Boat & Knight	2001	USA	Six Adult Protective Services case managers report of clients who had pets ($n = 525$).	Qualitative descriptive study
<p>Results: 90% were older than 60 years. Among the main themes that emerged from the interviews with the volunteers, the authors highlighted: (1) attachment and loss of animals, (2) the aggressiveness of many of these poorly socialized animals, (3) neglect of oneself and towards animals, (4) animal abuse, and (5) animal accumulation. The intervention involved removing the animals, which generated a lot of discomfort for their holders. It is emphasized that the accumulation of animals can be a sign of mental disorder or dementia and that the return of animals is not convenient.</p>				
Arluke et al.	2002	USA and UK	Articles press reports ($n = 100$) of animal hoarding and hoarders from 1995 to 2001.	Qualitative descriptive study
<p>Results: Content analysis revealed five main emotional themes: drama, revulsion, sympathy, outrage, and humor (not mutually exclusive). The message transmitted is largely inconsistent, generating confusion and failing to clarify the criminality of accumulation behavior in relation to animal abuse and / or the psychopathology associated with this condition.</p>				

HARC	2002	Canada	TPAA cases ($n = 71$) reported from a broad spectrum of agencies: animal control officers, police officers, Health Departments, human law enforcement, veterinarians.	Qualitative descriptive study
<p>Results: 83.1% were women ($n = 59$). The average age was 55 years for women and 53 years for men. The total number of animals involved per case ranged from 10 to 918, with an average of 55.8 for men and 90.1 for women. 71.8% of the reported were single, widowed, or divorced. All of them had object hoarding disorder too. Hoarders between 50 and 64 years were the group that accumulated the most animals. There was no obvious association between the type of animal involved and the gender of the hoarder, whether the hoarder lived alone, age of the hoarder, or the ability to move around the home.</p>				
Vaca-Guzman & Arluke	2005	No data	TPAA cases ($n = 118$) reported in 163 articles press between 2000 and 2003	Qualitative descriptive study
<p>Results: Accumulators justified themselves in 51 of the cases analyzed and excused themselves in the other 65 cases. The justifications included denying that their actions are incorrect, defining themselves as "good Samaritans" and victims of the system. Excuses included attributing their dysfunction to external events, appealing for lack of information, considering themselves scapegoats, or referring to their own disabilities.</p>				
Berry et al.	2005	USA	TPAA cases ($n = 56$), identified in press reports.	Qualitative descriptive study
<p>Results: 73.2% were women. Half of these, and a third of the men, were between 50 and 59 years old. Cats and dogs were the animals present in most homes (71.4% and 9.6% respectively). The number of animals per case ranged from 8 to 560 ($M = 118.9$). The cases generally lacked follow-up, and compliance with psychological evaluations and court-ordered counseling was difficult to determine. The loathsome judicial treatment of the hoarders seemed to contribute to the recurrences.</p>				
Vučinić & Dimitrijević	2007	Belgrade, Serbia	TPAA cases ($n = 3$) who managed dogs Refugees	Qualitative descriptive study
<p>Results: All the reports were about women who managed dog shelters with non-euthanasia policies. All three exhibited characteristics that could be classified as both surpassed caregivers and rescue accumulators. The health status of the animals was evaluated. In the first, there were 220 dogs, and their status was: limit for 150, poor for 62, and terrible for 8. In the second case, there were 157 dogs, and their status was: limit for 123 and poor for 34. In the third case there were 52 dogs, and their status was: limit for 34 and poor for 18.</p>				
Reinisch	2009	Manitoba, Canada	Animal Hoarding cases ($n = 6$) review of the enforcement and investigation files of the Manitoba Chief Veterinary Officer between July 2005 and July 2007	Qualitative Descriptive study
<p>Results: only one case involved a man, the rest cases were women. In four of the cases, the animals were in terrible condition, which led to euthanasia procedures. Cats were the most frequently animal hoarded although there was an exclusive case of rabbits and another of horses. One case was not classified</p>				

in any category, the rest were considered as rescuers accumulators (1 case), surpassed caregivers (2 cases), exploiters (2 cases). About the exploiters, one looked for personal monetary satisfaction and the other emotional. Relapses were recorded or suspected in 50% of cases.

Steketee et al.	2011	USA	Animal Hoarding cases (n = 16) and owners of a lot of animals but without the disease (n = 11)	Descriptive study
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Results: 44% of the participants with Animal Hoarding Disease, against 9% of the other group, showed poor care of the animals. They found the presence of vital stressors (in childhood and adulthood), strong emotional reactions to the death of animals, a marked tendency to caretaker roles, to rescue animals and strong attachment to animals stood out in both groups. In the case of people with TPAA, they found early attachment problems, chaotic environments in childhood, mental health problems, greater anthropomorphism in relation to animals, and more dysfunctional relationships.

Slyne et al.	2013	USA	People self-identified as having hoarding symptoms or people near somebody with these symptoms (N = 1639). From this measure, 550 defined themselves as hoarders: 153 without animals, 383 with 1 to 9 animals, and 14 with 10 or more animals.	Qualitative descriptive study
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Results: those who defined themselves as hoarders had a mean age of 52 and were 95% women. 26% were single, 42% married, 5.6% lived as a couple, 20% were divorced and 3.6% widowed. There were no differences between the subgroups regarding these variables, as well as the severity of the tendency to accumulate objects. Those with more animals were more likely to make sacrifices for money, work, social life, and housekeeping, but no differences were found between groups in overall household conditions.

Calvo et al.	2014	Spain	Animal Hoarding cases (n = 24), reported by rescue organizations between 2002 and 2011	Qualitative descriptive study
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Results: people with Animal Hoarding were both men (n = 13) and women (n = 14), who tended to be socially isolated, and to accumulate animals of a single species (dog or cat). The course of the disorder was rather chronic, mostly from more than five years of hoarding. In 83% of cases, the hoarders lived alone. In all cases, the financial situation was precarious. In only one case the animals' deterioration was recognized by the hoarder where animals were kept in poor condition in 95.8% of these homes. In more than 90% the animals had parasites and/or lesions and/or diseases. Fear in animals was the most reported behavior problem (96% of cases). 80% of the animals found were dogs and 19% cats. The average number of animals per case was 50. In 44% of the cases, they also hoarded objects. A large number of animals in poor condition were explained by a collection of abandoned animals (69%) and uncontrolled reproduction (78%).

Irvine & Nwachukwu	2014	Canada	A single case of a 61 year female with Animal Hoarding characteristic (n = 1) admitted involuntarily because she presented maniac symptoms and bipolar disorder.	Single case report
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Results: Animal hoarding diagnosis could be established while, after hospitalization, the patient requested someone to go to her home to feed her animals. It is recommended to evaluate possible TPAA when patients appear neglected and smelly, with personality traits of being hostile, detached, and suspicious.

Joffe et al.	2014	New South Wales, Australia	Animal Hoarding cases ($n = 29$) in records of finalized persecutions for offenses relating to animal hoarding between 2005 and 2011.	Qualitative descriptive study
<p>Results: 72.4% were women, the mean age was 54.8, and 45% of the cases corresponded to rural areas. The most referred occupation was that of breeders, followed by retired and unemployed. The most common animals were dogs, cats, farm animals, and horses. More than half were acquired from reproduction (intentional or not). The average number of animals was 41 per case. The most common legal charges were for negligence in feeding and physical health of the animal; the sentence was jail, payment of veterinary and legal costs, and the prohibition of owning animals. Unlike in Australia, psychiatric hospitalization is the most widely adopted measure in the United States.</p>				
Ockenden et al.	2014	Victoria, Australia	Animal hoarding case reports ($n = 22$), sourced from the Royal Society for the Prevention of Cruelty to Animals between 2000 and 2014.	Qualitative descriptive study
<p>Results: 63% were women and 45% were between 50-59 years; 25% percent had formally established psychiatric diagnoses, without gender differences. Two hoarders, both men, had multiple criminal records. The number of accumulated animals ranged between 10 and 180, without gender differences. Cats were accumulated in 50% of cases, and dogs in 22.7%. Hoarders younger than 40 years old had fewer animals than those in other groups. Two of them had animal refugees and took in abandoned animals. After the intervention, the main reason for animals' euthanasia was behavioral problems. Recurrences were estimated in 64% of cases and objects hoarding in 55.5%. Most of the hoarders' stories involved some traumatic event in their lives.</p>				
Polak et al.	2014	USA	Cases of cat sanctuaries consistent with animal hoarding ($n = 4$) reported for negligence and animal mistreatment.	Qualitative descriptive study
<p>Results: the average of animals per sanctuary was 593.5. The animals suffered from infectious, respiratory, dermatological, and serological diseases, in a higher proportion than those typically found in shelter cats.</p>				
Campos Lima et al.	2015	Río de Janeiro, Brazil	Cases of animal hoarding among patients attending a university OCD clinic ($n = 420$) between 1998 and 2013.	Qualitative descriptive study
<p>Results: only 0.47% ($n = 2$) presented animal hoarding. Both cases also hoarded objects and showed low adherence to therapy.</p>				
Saldarriaga-Cantillo & Rivas Nieto	2015	Colombia	A single case report of an 83 years old female with animal hoarding symptoms ($n = 1$), was initially assessed in her home after a fall.	Single case report
<p>Results: the woman was malnourished, showed poor personal hygiene, hostility, and suspicion, and refused to receive medical help. At home she lived with 16 cats and 15 dogs. Neighbors reported an abrupt behavioral change in the woman, 15 years ago, after suffering a stroke. The neuropsychological evaluation showed moderate cognitive impairment that affected higher functions, especially the frontal-subcortical organization. Additionally, the woman was diagnosed with hypertension, diabetes, major depressive disorder.</p>				
McMillan et al.	2016	USA	Dogs rescued from hoarding situations ($n = 408$)	Correlacional

Results: the evaluations of rescue dogs were compared with a database of behavioral records of 11,277 control dogs. Those who came from hoarders homes showed: greater fearfulness (towards strangers and dogs), sensitivity to touch, attachment, and attention-seeking (even after spending 2.5 years in the new home), urination and defecation when left alone and repetitive behaviors (even in posterior adoptions with other dogs). These dogs showed less aggressiveness towards strangers (if they are adopted in a home without other dogs) when they were more than 2 years old, also towards other dogs. They showed increased training capacity, a tendency to chase small animals, increased excitability (only for the first 2.5 years in the new home), energy, competitiveness with other dogs, and persistent barking (if they were adopted in a home without other dogs). Overcrowding, chronic stress, and the need to compete with other animals for resources would encourage these behaviors.

Svanberg & Arluke	2016	Stockholm, Sweden	A single case report of a 68 years old female with hoarding animal disorder ($n = 1$) reported in press articles between 2001 and 2007, and the legal reports of the case.	Single case report
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Results: the woman lived with 11 swans in bad condition in a very dirty 25 m² apartment. She indicated that she had captured them for treatment because they were injured, and would then release them. Like other hoarders, she considered herself an animal lover, she believed that she had done her job well, and denied that she had attempted to harm animals. The unhealthy conditions of the house also showed that he suffered from Animal Hoarding Disorder. Psychiatric evaluation was not performed.

Cunha et al.	2017	Curitiba, Brazil	Hoarding Disorder cases ($n = 113$) reported as complaints received in the City Secretaries of Health, Environment, and Social Assistance between September 2013 and April 2015.	Correlational
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Results: 42.5% of the reported cases involved objects hoarders, 36.3% animal hoarders, and 21.2% both things. In Curitiba, Animal Hoarding was estimated in one for every 42,729 inhabitants, and 3.71 cases per 100,000 inhabitants. The average number of animals per case was 27.8. The Hoarding Disorder correlated positively with population density, and negatively with the economic level of the neighborhood.

Arriente Ferreira et al.	2017	Puerto Alegre, Brazil	Animal hoarders cases ($n = 33$).	Qualitative descriptive study
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Results: 73% were women and 60% older adults (average age: 61.39 years). The subjects had hoarded animals for 23.09 years on average. 56.7% also hoarded objects. The average number of animals per hoarder was approximately 41.

Ung et al.	2017	San Diego, USA	Hoarding severity scores in adults diagnosed with HD ($n = 65$).	Correlacional
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Results: half indicated having pets ($n = 35$), the average of pets per household was 2. No significant association was found between the current characteristics of keeping animals and the severity of TPA. The number of animals during childhood correlated with the severity of the symptoms of TPA.

Strong et al.	2018	Carolina del Norte, USA	Animal hoarders cases detected in different Social Services ($n = 6$).	Qualitative descriptive study
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Results: the intervention strategies used were described as varied and guided by the type of case. So-called overwhelmed keepers were more receptive to the offer of assistance and managed to reduce the number of animals, while exploiters tended to reject help and recommendations. If the accumulators refused aid, the authorities proceeded to remove the animals and take institute corrective measures in the house.

89% of the animals had a clinical condition that required veterinary attention, and 15% exhibited respiratory infections. The approaching model used achieved a 92% live release rate of the animals.

Dozier et al.	2019	USA	Cases of animal hoarding ($n = 17$), reviewed by masters-level clinicians and veterinarians in private practice.	Quantitative descriptive study
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Results: the average of hoarded animals was 94. The most frequent species were cats (65% of cases), dogs (59%), and rabbits (35%). (70%) of the cases showed low or absent awareness about the accumulation of animals. The most frequent reasons described were the desire to rescue them (29%) and to keep them as pets (18%). Veterinary assistance was required in 94% of cases, which was provided to 70% of the total animals. In 76% of the cases, all the animals had been withdrawn after the intervention. In a single case, no animals had been removed. They were only referred to mental health care in 2 cases (12%).

Elliott et al.	2019	New South Wales, Australia	Files of animal hoarding cases referred to RSPCA NSW ($n = 50$) between 2013 y 2015	Quantitative descriptive study
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Results: 78% were women. Most were over 50 years old and 40% lived alone. 30% had contact with mental health or community social services. The accumulators were categorized as: (1) breeders (30%), (2) outdated caregivers (24%), (3) rescuers (22%), (4) exploiters (10%), and (5) incipient accumulators (14%). The accumulation was mainly due to unplanned breeding (60%) and the collection of stray animals (38%). The median number of accumulated animals per case was 35, cats in 75% of the properties and dogs in 52%. In 75% of cases, the animals' living conditions were rated as "very unhealthy" or "unclean".

Table 2

Comparison of demographic data on people with AHD and weighted averages.

Study	Sample size	Age	Women (%)	Single (%)	Living alone (%)	Unemployed (%)	Animals per case	Homes with dead animals (%)	Household species (%)	Method of Acquisition (%)	Object hoarding (%)
Patronek (1999)	54	—	76	72	55.6	—	<i>Mdn</i> = 39*	59.3	Dogs 60 Cats 65 Birds 11 Won 11	—	—
HARC (2002)	71	<i>M</i> = 54.6	83	71.8	46.5	54.9	<i>M</i> = 84.3, average between 10 y 918	—	Dogs 54.9 Cats 81.7 Birds 16.9 Cattle 5.6 Small mammals 11.3 Horses 5.6 Reptiles 5.6	—	100
Berry et al. (2005)	56	—	73.2	—	—	—	<i>M</i> = 118.9, average between 8 y 560	33.9	Dogs 69.6 Cats 71.4	—	—
Reinisch (2009)	6	—	83	—	—	—	—	—	Dogs 33.3 Cats 66.6 Rabbits: 16.6 Horses 16.6	—	—
Steketee et al. (2011)	16	<i>M</i> = 49.7	94	—	56.3	33	<i>M</i> = 23.6	—	—	—	—

Slyne et al. (2013)	14	—	—	—	—	—	—	—	—	Collecting strays 71.4 Bought 21.4* Natural Reproduction 14.2*	—
Calvo et al. (2014)	27	—	52	—	83	—	$M = 50$	12.5	Dogs 79.1 Cats 41.6	Collecting strays 69.5 Unplanned breeding 72.2 Planned breeding 17.4	44
Jofee et al. (2014)	29	$M = 54.8$	72.4	—	—	41.3	$Mdn = 41$; average between 6- 500	41	Dogs 79 Cats 69 Birds 28 Cattle 66 Horses 41	—	—
Ockenden et al. (2014)	22	—	63	—	45.5	66.6	—	42.1	Dogs 22.7 Cats 50	Rescued 31.8 Unplanned breeding 81.8 Planned breeding 9	55.5
Cunha et al. (2017)	65	—	—	—	—	—	$M = 27,8$	—	—	—	36.8
Arrienti Ferreira et al. (2017)	33	$M = 61.4$	73	88	52	61	$M = 41$	—	Dogs 67.4 Cats 28.1 Ducks 3.7	—	56.7
Strong et al. (2019)	6	—	—	—	—	—	$M = 16.6$	—	Dogs 50 Cats 83.3 Birds 16.6	—	—
Dozier et al. (2019)	17	—	—	—	—	—	$M = 94$	—	Dogs 59 Cats 65 Birds 8 Cattle 12	—	53

									Rabbits 35 Guinea pigs 8 Reptiles 6 Raccoons 6 Ferrets 6		
Elliott et al. (2019)	50	—	78	46	40	55	$M = 53$; $Mdn = 35$; average between 6-300	6	Dogs 52 Cats 75 Birds 17 Cattle 8 horses 2 Reptiles 4 Poultry 10 Another 10	Collecting strays 38* Accepting animals from the public 32* Bought 6* Planned breeding 28 Unplanned breeding 60 Other sources (breeders, trapping feral animals, friends/family) 23* Animal rescue networks 9*	46
Weighted average values	$WM = 55.6$, $SD = 3.4$	$WM = 74.9$, $SD = 8.9$	$WM = 68.2$, $SD = 13.7$	$WM = 51.8$, $SD = 8.7$	$WM = 53.6$, $SD = 8.7$	$WM = 64.1$, $SD = 32.8$	$WM = 32.9$, $SD = 19.3$	Dogs: $WM = 61$, $SD = 13.3$ Cats: $WM = 65.2$, $SD = 15.9$	Collecting strays: $WM = 56.7$, $SD = 18.4$ Planned breeding: $WM = 20.8$, $SD = 7.8$ Unplanned breeding: $WM = 68.1$, $SD = 8.9$	$WM = 59.5$, $SD = 24.2$	

Note. Single case studies were not included, as well as those with sampling strategies that did not allow for diversity of people with Animal Hoarding (e.g., those who managed dog shelters, or samples of patients undergoing treatment for OCD). The *Mdn* value was not used to estimate the weighted average, although it was reported in the table; if the study did not provide the *M* value, and it could not be calculated with the data provided, this study was excluded from the calculation. Dogs and cats were the only species reported in all the studies, therefore, only the values on these were calculated. Not all studies reported the animals acquisition methods. The data reported with (*) were incompatible and were excluded from the calculation.

Table 3
 Comparison of values in each variable related to hoarding characteristics

	Max <i>M</i>	Min <i>M</i>	<i>WM</i>	<i>SD</i>
Age	61.4	49.7	55.6	3.4
Women (%)	94	52	74.9	8.9
Single (%)	88	46	68.2	13.7
Living alone (%)	83	40	51.8	8.7
Unemployed (%)	66.6	33	53.6	8.7
Animals per case	118.9	16.6	64.1	32.8
Homes with dead animals (%)	59.3	6	32.9	19.3
Cases with dogs (%)	79.1	22.7	61	13.3
Cases with cats (%)	83.3	28.1	65.2	15.9
Cases collecting strays (%)	71.4	31.8	56.7	18.4
Cases with planned breeding	28	9	20.8	7.8
Cases with unplanned breeding	81.8	60	68.1	8.9

Object hoarding	100	36.8	59.5	24.2
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Note. The table shows maximum and minimum average value reported considering all the studies in Table 2, and the weighted average values and its standard deviation calculated.