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Jane Kinkus Yacilla
Purdue University, janeyat@purdue.edu

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**A Panorama of Human-Animal Interactions Research: Bibliometric Analysis of
HAI Articles 1982-2018**

Jane Kinkus Yacilla

Libraries & School of Information Studies, Purdue University, West Lafayette, IN, USA

Address for correspondence: Professor Jane Kinkus Yacilla, Purdue University Libraries
and School of Information Studies, Veterinary Medical Library, 625 Harrison Street,
West Lafayette, IN 47907, USA. E-mail: janeyat@purdue.edu

Abstract

What can we know about human-animal interactions (HAI) research by looking at information about its research articles, such as publication information, text of abstracts or author keywords, or citation patterns? Bibliometric analysis, the quantification of information *about* published articles, is a tool we can use to gain a perspective of the status of research in a particular field. In this study, information about four decades of HAI research publications was obtained from the multidisciplinary research database *Web of Science Core Collection*, and analyzed to look for informative patterns about this body of research using Microsoft Excel and VantagePoint text mining software. The data set of 1715 articles included first reports of research and review articles published between 1982 and 2018. Analyses reveal that there has been steady growth of HAI research publication, both in terms of annual number of articles published and distinct journal titles publishing these articles, with these numbers climbing more sharply in recent years. HAI research is very collaborative, and many countries are represented through author affiliations, although most of the research is written in English. Veterinary medicine/science and psychology/psychiatry were the top departments found in author affiliations. The animals mentioned in the research cover house pets, horses, livestock, and wild animals. Moreover, there is evidence that external funding for HAI research is slowly increasing. In short, a bibliometric analysis of HAI publications found through *Web of Science Core Collection* provides a panorama of this growing field of research.

Conflict of interest

The authors report no conflict of interest, financial or otherwise.

Keywords

bibliometrics, bibliometric analysis, text analytics, human-animal interaction, human-animal interactions

Ethical approval:

Ethical approval was not required for this study.

PREPRINT

Introduction

Bibliometrics

Bibliometrics is the analysis of information about journal articles (also known as article meta-data), including citation information; the text of abstracts, keywords, or indexing terms; and citation patterns; and is used to provide an overview of a research field based on its publications. While techniques such as in-depth narrative literature reviews, systematic reviews, and meta-analyses can be used to assess, and possibly critique, specific areas of a research field, bibliometric analysis is a method that can be used for more descriptive purposes. I.e., bibliometrics is another tool that researchers can use to more clearly see the current status of and evolving trends in research in a particular field.

Pritchard (1969) first coined the term “bibliometrics” as an alternative to “statistical bibliography,” which had been used since the 1920s to describe the process of learning about science essentially “by counting documents” (Pritchard, 1969). Contemporary researchers use bibliometric analyses of journal article citations and abstracts in diverse ways. Bibliometrics can identify publication trends in a body of research literature, such as the yearly publication volume of relevant articles, the number of journals publishing the articles, and even gender trends among the authors (Sing et al., 2017). Bibliometrics can establish the key journals of a research discipline, both in terms of which journals publish the greatest volume of articles in question, as well as which journals are most heavily referenced by researchers publishing in the field (Crawley-Low, 2006).

Bibliometrics can describe the productivity of researchers from one country or institution

(Kimball et al., 2013) or worldwide productivity in the field of research (Hohmann et al., 2017). Identifying themes across a body of research can inform researchers, administrators, and policymakers (Hosey and Melfi, 2014). Citation analysis, a type of bibliometrics in which attention is paid to the number of times articles are cited by other articles, can further validate an author's or journal's influence. Identification of journals that publish highly cited articles, including consideration of the corresponding Journal Impact Factors, can inform author decision about where to send manuscripts for publication (Slutsky & Aytac, 2016). Highly cited articles, known as "citation classics," are often acknowledged as highly influential in the field (Garfield, 1977). Categorizing the journals that cite an article can reveal whether the article's influence extends only to its own discipline or has had a broader impact (Marceau et al., 2019). Bibliometrics can be used in a purely descriptive manner, to quantify the characteristics of a body of literature (Andrés, 2009), or to provide a basis for evaluation, for example of a research program, based on output (i.e., published articles) or influence (as measured through citations) and other factors (Moed, 2017). In short, bibliometric analyses can provide a heuristic view of a field through examination of information *about* its research publications, rather than through examination of the *contents* of its publications (as in review articles, for example).

Human-animal interactions research

Human-animal interactions (HAI) research is a relatively young field, and as such the body of HAI research itself has been the topic of review articles and systematic reviews. In a review of the history of the human-animal bond, Hines (2003) found that the earliest

research emerged from veterinary medicine in the early 1970s, and that veterinary colleges were among the first organizations to establish centers devoted to this subject. In 1981 a group of interested veterinarians and doctors “aligned through shared observations that pets were having a positive impact on their human clients’ health and happiness,” but they felt that that scientific research about human-animal interactions was lacking. They subsequently formed the Delta Society (Pet Partners, n.d.). In 1984 the Delta Society started a newsletter to publish scholarship about humans and animals, and in 1987 formally launched *Anthrozoös: A Multidisciplinary Journal of the Interactions of People, Animals, and Environment*, the first journal dedicated to commentaries, reviews, research articles, and book reviews on HAI and related topics. Since the 1980s a few more journals focusing on human-animal interactions/bond have started, including *Society & Animals* (1993 -) and *Human-Animal Interaction Bulletin* (2013 -), as well as other journals that focus more broadly on animal welfare or behavior, such as *Animal Welfare* (1992-), *Journal of Applied Animal Welfare Science* (1998 -), and *Journal of Animal Ethics* (2011 -).

Since the early 1990s, HAI researchers have scrutinized the body of literature produced by themselves and their colleagues. Rajecki and Beck (1993) published a commentary that examined the first five years of research articles in *Anthrozoös*. They categorized the articles according to research methodology or article type (questionnaire/survey/interview, experiment, direct observation, diagnostic scheme/taxonomy, scale development, program evaluation, history, position paper, case study, or review), and reported on author demographics, including numbers of authors,

authors' geographic location, and type of institutional affiliation. Their analyses led to a discussion of a perceived gap in the HAI literature, a lack of case studies, which had been recommended by *Anthrozoös* editor Andrew Rowan as a methodology important in the development of new theories and as a tool to support or refute existing theories (Rowan, 1990). Barba (1995) conducted a qualitative analysis of a convenience sample of 52 research reports about human-animal relationships, most of which were nonexperimental. She found that a few articles had errors in how results were reported, and authors of 25% of articles using nongeneralizable samples inappropriately generalized their results. Barba ultimately called for improving sample sizes, more use of theoretical frameworks, and further testing of existing measurement instruments (Barba, 1995). Beck and Katcher (2003) reviewed articles about research on the health benefits of animals. They recommended that subsequent research should include healthy populations in addition to subjects with the physiological or psychological conditions being studied. They also called for more research on the human-animal bond with children and older adults, and that researchers should determine if human-animal interactions are as beneficial for the animals as for the humans (Beck & Katcher, 2003). Wilson and Barker (2003) conducted a review of review articles about human-animal interactions research. They found that a commonality of the reviews was the call for well-designed research. These authors recommended improving both qualitative approaches, which can lead to hypothesis *building*, and as well as quantitative approaches, which can lead to hypothesis *testing*, and for researchers to improve other aspects of study designs, such as sample selection, intervention development, and interpretation of results (Wilson & Barker, 2003).

With regard to a bibliometric treatment of HAI topics, the aforementioned article by Rajecki and Beck touched upon some variables often included in bibliometric studies, such as author demographics and institutional or national affiliation (Rajecki & Beck, 1993). Gerbasi et al. (2002) analyzed a set of HAI-related doctoral dissertations according to many characteristics, including several that were based on the dissertations' publication metadata, although these authors did not use the term "bibliometrics" in their article. Hosey and Melfi (2014) also collected and characterized a group of HAI-related articles, including a few bibliometrics-style analyses, but most of their article is based on thematic analyses derived by reading the full text of articles rather than by examining only the article metadata. To date, the author has identified no other studies that combine bibliometrics methods with HAI research publications.

Objectives

Bibliometric studies are often exploratory in nature, and therefore are conducted without the development of a specific research question. The current study has been designed to describe a panorama of existing HAI research literature by identifying patterns or trends in information about the research articles, including author affiliations, the publishing journals, citation patterns, and words or phrases extracted from the article abstracts or author-supplied keywords.

Methodology

The design of this study was a retrospective, descriptive bibliometric review. A data set of journal article information was generated from the database *Web of Science: Core*

Collection (WOSCC) (formerly known as ISI Science Citation Index) on the topic of human-animal interactions (HAI) research. *WOSCC* was selected because it covers a broad range of academic disciplines, its records can be uploaded into many other analytics software with little additional processing, and because its records include some fields that other databases do not, including the references cited by the article, the number of times an article has been cited, and information about research funding. The search used was TS=("human animal interactions" or "human animal interaction" or "human animal relationships" or "human animal relationship" or "human animal relations" or "human animal bond" or "human animal studies" or anthrozoology), and hereafter HAI will refer to these terms in aggregate. The search was refined to cover full publication years through 2018, and to include only items likely to contain primary reports of research, i.e., including articles, reviews, and proceedings papers, while excluding editorials, letters, books or book chapters, book reviews, or abstracts. The data set contained 1715 records. Data cleanup, for example merging multiple versions of an author's name into one or sorting keywords into categories, was conducted using VantagePoint text mining software (thevantagepoint.com). Additional analyses and graphics were created using a combination of Web of Science Core Collection, Microsoft Excel, and VantagePoint.

Results

The earliest articles in the data set were published in 1982. One contained the phrase "human animal bond" and was published in *International Journal for the Study of Animal Problems*, while "human-animal relationship" appeared in *Zeitschrift fur Ethnologie*.

There has been steady growth since 1982 of both articles containing at least one of the search phrases, as well as the journals publishing these articles, with both the number of articles and journal titles peaking in 2018. See Figure 1 for the publication trends over time.

Publications

The 1715 articles were published in 648 distinct publications, including journals and conference proceedings. The most productive journals in HAI research, in terms of numbers of articles published over time, were *Anthrozoös* and *Applied Animal Behaviour Science (AABS)*, publishing 238 (13.9%) and 190 (11.1%) of the articles respectively. These two journals far out-published the next few top journals, including *Society & Animals* (66, 3.8%), *Animal Welfare* (47, 2.7%), *Journal of Veterinary Behavior—Clinical Applications and Research* (24, 1.4%), and *Journal of Veterinary Medical Education* (20, 1.2%). While the number of articles published by *Anthrozoös* and *AABS* differs by a few percent of the total, the 238 *Anthrozoös* articles represent nearly a third (33.2%) of its total research articles published between 1982 and 2018, while the 190 articles from *AABS* constitute only 4.3% of its research articles over the same period.

Looking at the journals heavily *referenced* by the articles in a field can provide insight into the researchers' reading habits and therefore their information needs. In this case, the top journals that were referenced by the articles had a moderate degree of overlap with the top journals that published the articles (10 of 25 journals). Several of the referenced

journals that do not specifically focus on publishing HAI research include *Science*, *Nature*, and *Proceedings of the National Academy of Sciences of the United States*; several veterinary journals (*Veterinary Record*, *Veterinary Journal*, *Journal of Veterinary Behavior*); an animal science title (*Livestock Production Science*); psychology journals (*Journal of Personal and Social Psychology*, *Psychological Reports*, *Journal of Comparative Psychology*, *Behaviour*, *Psychological Bulletin*), and others (*Physiology & Behavior*, *Hormones & Behavior*). Information about which journals publish articles in a research discipline, as well as which journals are referenced by those research articles, can inform which journal subscriptions are purchased and other collection development decisions made by information specialists and librarians.

Another way to assess the most influential journals in a field is by examining how frequently their articles are *cited* by other publications. According to a citation analysis computed by WOSCC (June 13, 2019), the sum of times cited for all 1715 articles was 22,930, with an average number of citations per article of 13.37. Journals whose articles' rates of citations were higher than this average are presented in Table 1. *Anthrozoös* articles were cited slightly less frequently than the average, with an average citation rate of 12.44. Another citation-based metric, the h-index, was presented by Hirsch (2005) as an easily computable number that gives a general estimate of an author's or journal's overall influence based on citation information. The h-index of the entire data set was 64, which means that out of the 1715 articles being analyzed, 64 had been cited at least 64 times. *Applied Animal Behaviour Science* had an h-index of 47, and *Anthrozoös* had an h-index of 28. The next highest h-index was *Animal Welfare* at 14, which suggests that

AABS and *Anthrozoös* published relatively more articles with higher citation rates than the other journals. Among the top citing journals, 18 of 25 coincide with the top publishing journals; outliers include *Veterinary Record*, *Zoo Biology*, *Veterinary Journal*, *Frontiers in Psychology*, *Poultry Science*, *Animal Cognition*, and *Scientific Reports*. This is not to say that these journals did not publish articles on HAI topics, only that they were not among the top 25. See Table 2 for a comparison of the top journals in terms of publication rates, being referenced by articles in the data set, and citing articles in the data set.

At the time the data set was generated, *WOSCC* indicated that 22 articles, published between 1994 and 2012, had been cited over 100 times (*WOSCC* citation counts are based on citations occurring within other journals it indexes, and so therefore may differ from citation counts offered by Scopus or Google Scholar, for example). A cursory examination of these articles reveals that nine of them reported on HAI research related to livestock or farm animals; eight specifically to dogs, cats, or pets; two addressed wildlife; and one related to human-animal interactions without specifying animal(s). Of course many articles in the data set were cited dozens or scores of times while not reaching the arbitrary benchmark of 100 citations; perhaps of greater interest is the fact that 19% (328) of the articles had never been cited. Factors that can affect how frequently an article is cited include where the publishing journal is indexed (how easy is the article for other researchers to find?), and whether the article is published in an Open Access journal (free access) as opposed to a subscription-based journal. However, nearly 75% of the uncited articles were published in years 2014-2018, which is consistent with Lariviere

and Gingras's (2014) finding that, while many articles are cited in journals within their own disciplines within two years, for interdisciplinary topics it takes around five years for citations to emerge in publications across disciplinary boundaries.

Authors

In this data set, 34% (584) of the articles have a single author, followed by two authors at 19% (330). As has been the trend in many other disciplines, the number of co-authors of HAI-related research articles has increased over time, along with the total article output, which is illustrated by Figure 2. Nevertheless, the degree of collaboration represented by the articles, computed as the annual average number of authors per article, indicates that the degree of collaboration has remained relatively steady between two and three since the late 1990s, with a peak of slightly more than three in 2017.

A vast majority (1629, 95%) of articles were written in English. A small number of articles (26, 1.5%) were written in German or French (9, .5%). Based on information from author affiliations, researchers from 71 countries were represented, with the largest numbers coming from USA (483 articles, 28%), United Kingdom (362, 21%), and Australia (16%). Table 3 shows the top 25 institutions affiliated with HAI research based on the number of articles published. Researchers from l'Institut National de la Recherche Agronomique (INRA) in Saint Genes Champanelle, France published 38 articles (2.2% of the total), followed by University of Melbourne, Australia (36 articles, 2%), and University of Veterinary Medicine in Vienna, Austria (33, 1.9%). Purdue University in Indiana, USA ranked highest in terms of number of instances; i.e., Purdue was listed as

an author's address 41 times among 27 articles, followed by INRA with 39 listings among 38 articles, and University of Melbourne, with 39 listings among 36 articles. The international aspect of HAI research is quite evident in this group, with 9 countries represented among these 25 institutions: Australia (6), Austria (2), Canada (3) England (2), France (2), Italy (1), Netherlands (1) and Sweden (1).

Disciplines

The articles in the data set were written by 3407 distinct authors who listed 2862 distinct affiliations (i.e., affiliations that were identical for multiple authors were counted as one affiliation). A vast majority (2449, 85.6%) of authors came from academic institutions. Among the academic authors, 336 (11.7%) came from departments of veterinary medicine or veterinary science, followed by 229 (8%) from departments of psychology or psychiatry, and 222 (7.8%) from departments of biological, life, or earth sciences. The term “anthrozoology” or “human-animal” was included in 159 (6.6%) of author addresses, and 134 (4.7%) included “animal health” or “animal welfare,” while “ethology” or “animal behavior” appeared in 78 (2.7%) of author addresses. Small numbers of departments were combined into “Other social sciences or humanities” to form a plurality (360, 12.5%), while 213 (7.4 %) of academic affiliations did not indicate a specific department or unit. Non-academic institutions, including research institutes, governmental agencies, non-governmental agencies, zoos, and museums, among others, were represented in 555 (19.2%) of author affiliations. Table 4 presents more information about author affiliations represented in the data set. In this table, the percentages total more than 100% because a majority of articles had at least two authors.

Topics

The author conducted two types of analyses with regard to the topics represented by the articles in the data set. First, the animal(s) of interest were extracted by first processing the article abstracts with VantagePoint's Natural Language Processing algorithm (NLP) to generate a list of topic words and phrases. Then the list was hand coded according to animal (e.g., words or phrases that included cat, cats, feline, kittens were coded to "cats," and so on). The most prevalent animal represented by the data set was dogs, with mentions in 367 articles (21.4%), followed by pets or companion animals in 339 articles (19.77%), exotic or wild animals in 205 articles (11.95%), cows, oxen, water buffalo, or bison in 196 (11.43%), and horses, donkeys, or mules in 123 articles (7.17%). Figure 3 provides additional information about animal representation in the data set. Here the percentages add up to over 100% because multiple phrases were extracted from some abstracts (i.e., some articles coded to goats were also coded to livestock/farm animals, some articles about rats were also coded to laboratory animals, etc.).

The second topic analysis compared the key terms used in the search strategy against the topic list generated by the NLP algorithm. Variations of "human-animal relationships" (namely, human-animal relationships, human-animal relationship, human animal relationships, human animal relationship, human-animal relations, human animal relation, HAR, HARs) were found in 484 articles (28.22%), followed by variations on "human-animal interactions," which were found in 300 articles (17.49%). "Human-animal bond"

variations occurred in 139 articles (8.10%). Table 5 provides more information about how these and a few additional related topics were represented. In this case the percentages add up to less than 100%, because these numbers are based on data found only in the *abstracts* of the articles, while the database search strategy found articles that included at least one of the search terms in *any* field, such as the title or author's keywords.

Funding

WOSCC began presenting research funding information extracted from indexed articles in 2008, so funding patterns from before 2008 generally cannot be determined from this dataset (although three articles from 2006-2007 contained funding information, indicating they were likely added to WOSCC in or after 2008). Of the 1715 articles, 485 contained information in the WOSCC "funding text" field. From these data, over 600 funding acknowledgements were extracted, describing funding that came from across the funding spectrum: universities, governmental entities, non-governmental organizations, corporate sponsors, research foundations, and others. The most frequently mentioned funder was the National Institutes of Health (USA), all institutes, with 39 acknowledgements, followed by the Economic and Social Research Council (UK) with 24 acknowledgements, the National Science Foundation (USA) with 23 acknowledgements, and the Waltham Foundation (UK) with 22 acknowledgements. Table 6 provides for a list of funders acknowledged at least five times. The rate at which articles included funding text steadily increased from 4.3% in 2006 to 51.9% in 2018, which is especially

impressive considering that there was a nearly five-fold increase in the annual number of articles published during the same interval.

Discussion

This bibliometric analysis of HAI-related articles provides a panoramic view of this field of research. The fact that HAI is a growing field of research is evidenced by the increasing number of articles published per year, the increasing number of journals that are publishing them, and the range of disciplines represented by these journals. In addition, HAI is a highly collaborative field, which is reflected by the increasing number of articles written by multiple authors. There is further evidence that HAI research is both international in nature, as well as multidisciplinary. HAI research pertains to all sorts of animals, from common household pets, to livestock and farm animals, to wildlife and marine animals, and is illustrative of the many ways, and in the many contexts, that humans and non-human animals interact. Finally, while it seems that HAI research is not yet richly funded, the rate at which HAI articles acknowledged external funding agencies has significantly increased.

Limitations of this type of study include the omission of desired data from the database records; inconsistent or incorrect information in the data; and errors made by authors, journal publishers, or the database creator. The search strategy used to generate the data set used in this study itself was far from exhaustive, and used only a few terms that could be used to describe the entire arena of human-animal studies research. Use of these

search terms certainly could have omitted relevant articles; for example, the highly cited work by Friedmann et al. (1980) on pet ownership and one-year survival rates of coronary care patients, while included in *WOSCC*, was not included in the data set simply because none of the search terms were found in the article title, abstract, or keywords. Use of *WOSCC* itself may also be limiting because, while this database's coverage is very broad, journals must be well established before they are selected for inclusion, so pertinent articles from early volumes of selected journals or from journals that otherwise have not been included, were excluded from this study. Bibliometric analyses are not an exact science, but still are useful for gaining a perspective on a field's research landscape based on a set of its publications.

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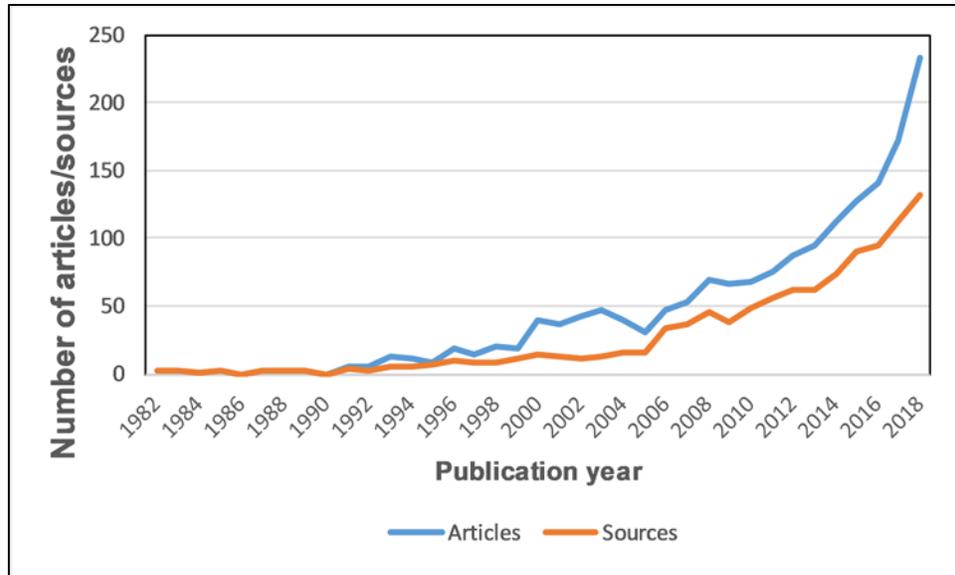


Figure 1. Yearly publication rates for both HAI articles, and the sources (e.g., journals, conference proceedings) publishing them, have increased steadily over time.

Table 1. Top journals based on the highest number of citations per article

Rank	Journal title	Number of articles	Average citations/article
1	Journal of Animal Science	7	46.7
2	Applied Animal Behaviour Science	190	33.0
3	Social & Cultural Geography	8	27.4
4	Veterinary Clinics of North America: Small Animal Practice	10	23.7
5	Frontiers in Psychology	16	19.9
6	Preventive Veterinary Medicine	11	19.6
7	Behavioural Processes	13	18.4
8	Animal Welfare	47	17.9
9	Journal of Dairy Science	15	17.5
10	Journal of Veterinary Behavior - Clinical Applications and Research	24	13.8

Table 2. Top journals based on the total number of HAI articles published in the data set, the number of times they were referenced by articles in the data set, and the number of times they cited the articles in the data set

Rank	Top publishing journals	Heavily referenced journals	Top citing journals
1	Applied Animal Behaviour Science	Applied Animal Behaviour Science	Applied Animal Behaviour Science
2	Anthrozoos	Anthrozoos	Anthrozoos
3	Animal Welfare	Animal Welfare	PLOS One
4	Society & Animals	Society & Animals	Journal of Veterinary Behavior - Clinical Applications and Research
5	Journal of Veterinary Behavior - Clinical Applications and Research	Journal of Animal Science	Animal Welfare
6	Frontiers in Psychology	Journal of the American Veterinary Medical Association	Society & Animals
7	PLOS One	Animal Behavior	Animals
8	Behavioural Processes	Journal of Dairy Science	Journal of Dairy Science
9	Journal of Dairy Science	Physiology & Behavior	Journal of Applied Animal Welfare Science
10	Journal of Animal Science	PLOS One	Animal
11	Preventive Veterinary Medicine	Journal of Personality & Social Psychology	Journal of the American Veterinary Medical Association
12	Journal of Veterinary Medical Education	Zoo Biology	Journal of Animal Science
13	Social & Cultural Geography	Veterinary Record	Behavioural Processes

14	Journal of the American Veterinary Medical Association	Science	Livestock Science
15	Animal	Journal of Applied Animal Welfare Science	Physiology & Behavior
16	Journal of Agricultural & Environmental Ethics	Behavioural Processes	Veterinary Record
17	Veterinary Clinics of N. America- Small Animal Practice	Psychological Reports	Preventive Veterinary Medicine
18	Italian Journal of Animal Science	Journal of Archaeological Science	Frontiers in Veterinary Science
19	Zoo Biology	Journal of Veterinary Behavior	Journal of Veterinary Medical Education
20	Livestock Science	Veterinary Journal	Zoo Biology
21	International Journal of Environmental Research and Public Health	Proceedings of the National Academy of Sciences of the USA	Veterinary Journal
22	Journal of Applied Animal Welfare Science	Animal Cognition	Frontiers in Psychology
23	Animals	Environment & Planning D	Poultry Science
24	Frontiers in Veterinary Science	Journal of Comparative Psychology	Animal Cognition
25	Canadian Veterinary Journal	Nature	Scientific Reports

Table 3. Top institutions based on number of times mentioned in individual author addresses

Rank	Institution (from author address)	Times mentioned	Number of records
1	INRA, St Genes Champanelle, France	39	38
2	Univ Melbourne, Vic, Australia	39	36
3	Univ Vet Med, Vienna, Austria	39	33
4	Purdue Univ, W Lafayette, IN USA	41	27
5	Monash Univ, Vic, Australia	27	27
6	Univ Calif Davis, Davis, CA USA	36	23
7	Univ Sydney, NSW, Australia	26	22
8	Univ Vienna, Vienna, Austria	25	21
9	Univ Cambridge, Cambridge, England	24	20
10	La Trobe Univ, VIC, Australia	21	20
11	Univ Calgary, Calgary AB, Canada	26	16
12	Tufts Univ, North Grafton, MA USA	22	15
13	Univ Guelph, Guelph ON, Canada	20	15
14	Colorado State Univ, Ft Collins, CO USA	19	15
15	Univ British Columbia, Vancouver BC, Canada	19	15
16	Univ Missouri, Columbia, MO USA	34	14
17	Virginia Commonwealth Univ, Richmond, VA USA	23	14
18	Washington State Univ, Pullman, WA USA	23	14
19	Univ Adelaide, SA, Australia	18	14
20	Wageningen Univ, Wageningen, Netherlands	20	13
21	Univ Queensland, Qld, Australia	18	13
22	Swedish Univ Agr Sci, Uppsala, Sweden	16	13
23	Univ Milan, Milan, Italy	13	13

24	Univ Rennes, Rennes, France	13	13
25	Waltham Ctr Pet Nutr, Leics, England	13	13

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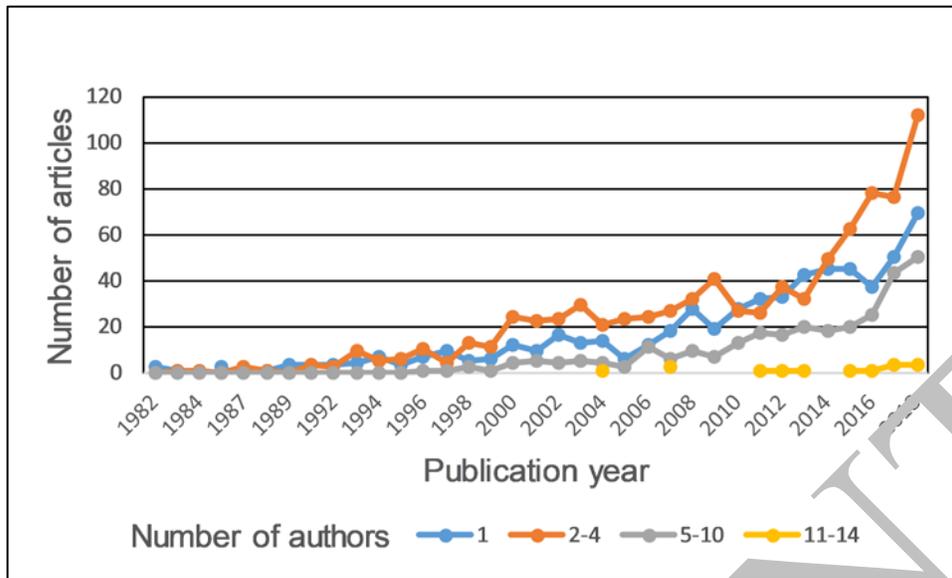


Figure 2. The average number of co-authors of HAI articles has increased over time.

Table 4. Types of author affiliations, based on number of articles in the data set

Type of institution	Department or organization type	Number of articles	Percentage of total
Academic affiliations	Other social sciences or humanities	360	21.0%
	Veterinary medicine/sciences	336	19.6%
	Psychology or psychiatry	229	13.4%
	Biological, life sciences, geological sciences	222	12.9%
	No department listed	213	12.4%
	Human-animal/anthrozoology	159	9.3%
	Animal science, husbandry	157	9.2%
	Human health/medicine/nursing	143	8.3%
	Animal health/welfare	134	7.8%
	Anthropology, archaeology	120	7.0%
	Sociology or social work	89	5.2%
	Agriculture	88	5.1%
	Ethology, animal behavior	78	4.5%
	Education	68	4.0%
	Computation/technology	53	3.1%
Non-academic affiliations	Research institutes	162	9.4%
	Governmental agencies	146	8.5%
	NGOs, non-profits, .orgs, associations	64	3.7%
	Company, commercial entity	51	3.0%
	Hospital, medical center	47	2.7%
	Other	23	1.3%
	Zoos, animal reserves/preserves	23	1.3%
	Museums	21	1.2%
	Veterinary clinic or hospital	18	1.0%

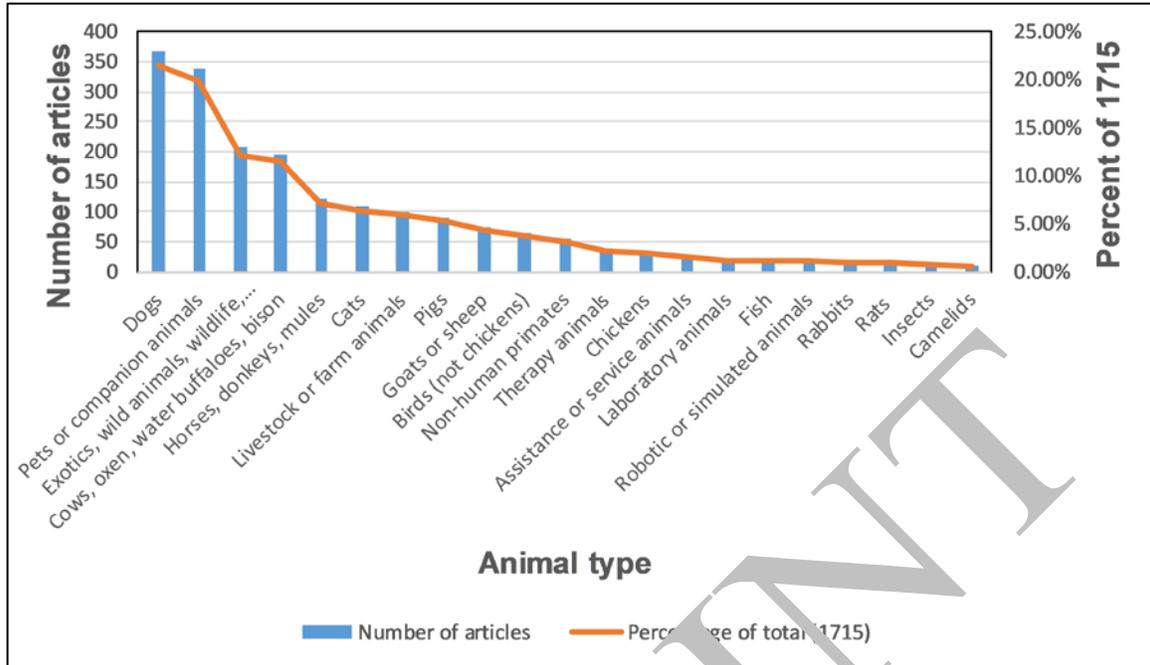


Figure 3. Popular animals in HAI articles based on number of articles mentioning them

Table 5. Topic analysis based on the search terms used to generate the data set, as well as some additional terms of interest

Type of term	Keywords or phrases	Number of articles	Percentage of total
Search terms	human-animal relationship(s)	484	28.2%
	human-animal interaction(s)	300	17.5%
	human-animal bond	139	8.1%
	human-animal studies	45	2.6%
	anthrozoology	18	1.0%
Additional terms of interest	animal-assisted intervention(s)	33	1.9%
	animal welfare	175	10.2%
	animal-assisted therapy(ies)	44	2.6%
	bereavement/grief	29	1.7%
	animal-assisted activity(ies)	20	1.2%

Table 6. Top funding organizations based on the number of times mentioned in articles in the data set

Rank	Funding Organization	Times mentioned	Number of Records
1	National Institutes of Health (USA)	39	34
2	Economic and Social Research Council (UK)	24	20
3	National Science Foundation (USA)	23	20
4	Waltham Foundation (UK)	22	21
5	Social Sciences and Humanities Research Council (Canada)	12	12
6	European Union	11	11
7	Australian Research Council	10	10
8	European Commission	10	10
9	Conselho Nacional de Desenvolvimento Científico e Tecnológico (Brazil)	8	8
10	Human-Animal Bond Research Initiative Foundation (USA)	7	7
11	Natural Sciences and Engineering Research Council (Canada)	7	7
12	Arts and Humanities Research Council (UK)	6	5
13	Australian Government	6	5
14	CONACyT (National Council for Science and Technology, Mexico)	6	4
15	Coordination for the Improvement of Higher Education Personnel (Brazil)	6	6
16	Medical Research Council (UK)	6	4
17	Research Council of Norway	6	6
18	Agence Nationale de la Recherche (France)	5	4
19	Wellcome Trust (UK)	5	5