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Posthumanist critique and human health: how nonhumans (could) figure in public health research

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Posthumanist critique and human health: How nonhumans (could) figure in public health research

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Abstract: This paper uses bibliometric analysis and critical discourse analysis to explore the rise in research involving nonhumans in public health, and the potential contribution of posthumanist social theory to this growing body of public health scholarship. There has been a sudden and rather marked increase in research and writing on animals, zoonoses and/or the 'One-health' paradigm within public health journals since 2006. Indeed 'One-health' rather than 'posthumanism' holds together research involving nonhumans of various kinds – from viruses to animals - within the discipline. Advocates of the 'One-health' paradigm argue that human and animal health must be integrated through joining the research, training and care practices of human and animal medicine. By mapping the terrain of public health research involving nonhuman species, we consider how and where posthumanist theory could be productively drawn upon to contribute to both critical and applied research involving nonhumans within public health. We specifically ask how the posthumanist insight to 'follow the nonhumans' would raise new questions and analytics for this research area.

Keywords: posthumanism, nonhumans, animals, One-health, bibliometric analysis

Introduction

There is a growing literature in the social sciences and humanities that explores the salience of nonhumans of various kinds for social life, as this special issue on posthumanism attests to. Posthumanism is a broad and even conflicting area of social theory that seeks to understand how humans are made in tandem with nonhumans of varying kinds, such that separating out humans from the world is problematized. However, public health research has not engaged with the posthumanist scholarship to date. We conducted a search of the terms 'posthuman' and 'public health' in Web of Science, and found only two entries; both articles were published in *Critical Public Health* and were written by the same lead author (Rock, 2013; Rock, Degeling, & Blue, 2014). As a point of comparison, a search in Web of Science for 'posthuman' within the social sciences and humanities resulted in 587 articles published between 2010 and 2014. That said public health *is* researching the ways in which nonhuman animals and other kinds of nonhuman agents (such as microbes or viruses) are embroiled in human health. So there is at least some overlap between posthumanism in the social sciences and humanities and public health research concerned with nonhumans. To consider these spaces of shared interest and the potential for productive dialogue, this article starts with reviewing the literature at the intersection of nonhuman species and public health using bibliometric analysis and critical discourse analysis. We ask where and how nonhumans

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3 figure within public health research today and historically. The aim of this review is to
4 provide an overview to the themes or topics addressed within the public health literature
5 focused on nonhumans. Based on this analysis we consider how posthumanist theory could
6 productively contribute to these areas of public health research into the future.
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9 This paper builds directly upon Melanie Rock, Chris Degeling and Gwendolyn Blue's
10 (2014) argument that posthumanist theory is relevant for public health. Toward that end,
11 Rock, Degeling and Blue have provided a synthetic review of the posthumanist literature,
12 tracing it through post-structuralism generally and science and technology studies (STS) in
13 particular. Their goal is to introduce public health to this theory, as they argue it is relevant to
14 research regarding zoonotic infectious diseases, toxins and other environmental contaminants
15 as well as the healthy and unhealthy consequences of pet populations.
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19 The goal of this paper is the inverse. We map how nonhumans currently figure within
20 public health research. Through this mapping we ask if, where and how posthumanist theory
21 could productively contribute to existing research agendas within public health. We start with
22 a brief review of the posthumanist literature as it relates to this article. We then discuss our
23 use of bibliometric analysis in combination with critical discourse analysis, and present our
24 findings based upon this analysis. We demonstrate that the 'One-health' paradigm is providing
25 the theoretical basis for research involving nonhumans in public health research today. One-
26 health is a term that is used to reorganize the relationships between human medicine and
27 animal veterinary medicine, so that these two medical fields speak more to one another in
28 both knowledge and practice. We conclude by considering why public health is turning to
29 One-health, and what posthumanist theory could contribute in this context. We argue that the
30 posthumanist injunction to 'follow the nonhumans around' would raise new questions and
31 analytics for this research area. In particular, this could be productively entwined with
32 existing practices in both critical public health that explores power relationships and social
33 epidemiology that explores relationalities between humans and things, such that
34 posthumanism could extend not only critique in public health but also more applied practices.
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40 **Background to posthumanism**

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42 Rock, Degeling and Blue (2014) have provided an excellent discussion of the
43 posthumanist literature for a public health audience. They note that humanism posited an
44 intrinsic value for human life, and a universal capacity amongst people to be moral and
45 rational. Humanism is therefore an important achievement in many respects. But Rock,
46 Degeling and Blue contend that our imbrication with technologies in particular has required
47 critiquing some aspects of humanism today, which they do through post-structuralism
48 specifically. Rock, Degeling and Blue contend that Pierre Bourdieu was a post-structuralist
49 who revitalised humanism, while Michel Foucault was a post-structuralist who showed how
50 the notion of the human is itself historically contingent. Rock, Degeling and Blue then trace
51 how post-structuralism has been taken up in some uniquely posthumanist ways since. This
52 includes non-representational theories in geography, which allow us to understand meaning-
53 making in ways that take a more-than-human and more-than-textual world seriously. This
54 also includes actor network theory in STS, which has (in)famously argued that nonhumans
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3 must also be understood as agentic. Rock, Degeling and Blue then provide an introduction to
4 other concepts from these fields which may be useful to public health researchers. This
5 includes the idea that purportedly natural things like diseases need to be socially and
6 materially "enacted" (Mol, 2002) and that agency is relationally distributed across humans
7 and nonhumans through "meshwork" (Ingold, 2011). Rock, Degeling and Blue conclude that
8 there is space for productive dialogue between public health and anthrozoology, which
9 focuses on the interactions between humans and nonhumans through primatology and
10 ethological perspectives.
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14 Building upon the review of posthumanism offered by Rock, Degeling and Blue, the
15 background section of this article has more modest goals. It is meant to provide necessary
16 context for understanding how and why we selected the search terms that we did in
17 conducting our bibliometric analysis, and what is left out as a consequence of these choices.
18 This background also allows us to discuss the specifics of how posthumanism could
19 contribute to existing public health research agendas in the Conclusion, which is based on our
20 analysis of how nonhumans are currently situated in public health research.
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24 The term 'posthumanism' carries some rather different and even conflicting
25 meanings, informed by various strands of thought including post-structuralism, humanism
26 and cybernetics (Wolfe, 2010). On the one hand, posthumanist thought argues that we need to
27 look at the ways in which humans are embroiled, and thereby develop, or "become"
28 (Haraway, 2008), with other species as well as other nonhuman things. For example, physical
29 anthropologists are contributing to posthumanist thought by showing that domestication is
30 not something that we humans simply do to other species; humans also show all the physical
31 traits used to demarcate domesticated species, and so we humans have also changed through
32 our interactions with other animal species over time (Cassidy & Mullin, 2007; Leach, 2003).
33 As such, posthumanist critique is, to some extent, part of the "materialist turn" in the social
34 sciences and humanities, in that it seeks to recoup the animality of humans as embodied and
35 embedded (Wolfe, 2010: xv). This strand of posthumanist thought argues that humanism is a
36 discourse that needs to be troubled, despite the important ways in which it has facilitated
37 rights for various oppressed groups of people (Wolfe, 2010). Specifically, it is argued that
38 humanism is based upon an inadequate division between humans and nonhumans (Cubukcu,
39 Forthcoming, 2017), one that we need to problematize in order to appreciate human
40 interactions with animals, plants and all the other things that we live with on this planet
41 (Wolfe, 2010). It is a divide that we also need to challenge because, in being based on a
42 hierarchy, humanism risks perpetuating rather than ameliorating differences between humans
43 that can in turn perpetuate rather than ameliorate oppression (Cubukcu, Forthcoming, 2017).
44 Posthumanism has thus sought to intervene in the anthropocentrism of the social sciences and
45 humanities by emphasizing how we as humans socialize with a variety of nonhumans,
46 including other animal species, plants and inanimate objects. We believe that this strand of
47 posthumanist thought has the most relevance to public health.
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55 But there is a different use of the term posthuman, seen particularly within bioethics
56 but also sociology. Here 'posthumanism' or 'transhumanism' is used as part of an argument
57 that humans can and should develop and use biotechnologies in order to improve human
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bodies (Fuller, 2011; Savulescu & Bostrom, 2009). There is a glorification of science, choice and consumption here that has been consistently silent on issues of power, refusing to consider how fantasies of biological control risk reproducing hierarchies, including gender, sexuality, race, ethnicity, class, nation, citizenship, age and (dis)ability. This version of posthumanism has therefore been critiqued as an extension of humanism (Wolfe, 2010). Largely developing in bioethics, these posthumanists tend to take, as their counter-argument, those who see biotechnologies as eroding an a priori, unified and fundamental human essence, such as Jurgen Habermas (2003) or Francis Fukuyama (2002). We do not believe that this more speculative and futurist area of thought is particularly relevant to public health at present, or to the goals of critique.

Given that there were only two references to ‘posthuman’ and ‘public health’ while also knowing that public health research is considering the implications of human-nonhuman species relations for health, we decided to search for specific topics in public health research where a posthumanist insight could be relevant. This included zoonotic diseases, animals generally and the ‘One-health’ paradigm. We asked how research in public health is organised, which is topically compatible with posthumanism but that does not reference this term. We were also interested in considering the relationship, if any, between these areas of research. The animality of humans is therefore our focus in this paper, and we do not engage in the more cybernetic aspects of posthumanism.

Methods

This paper combines bibliometric methods with critical discourse analysis. To start, bibliometric methods have been adopted in this paper to review the public health literature that addresses nonhuman species in order to provide insights into what main topics are addressed, and how those topics are addressed. The particular method used in this paper - bibliographic coupling in combination with clustering - has been found to be a valid tool for identifying research themes within a large field (Jarneving, 2007).

The bibliometric data for this paper were gathered from the Web of Science Core Collection database. Within the titles, abstracts and keywords of the publications indexed in this database, a search was executed to select out all articles between 1995 and 2014 that used the terms ‘zoonosis’ OR ‘zoonotic’ OR ‘animal’ OR ‘one health’ AND ‘public health’. The search criterion ‘one health’ selected articles that fit within the ‘One-health’ paradigm as well as publications discussing, for example, ‘one health care practice’. Therefore, all the publications selected through this criterion were manually cleaned, keeping only those publications that dealt with the ‘One-health’ paradigm specifically. In total, the search resulted in 7294 publications, which were analysed by means of bibliographic coupling and cluster analysis.

Bibliographic coupling was used to build a visual map based on the overlap in the references cited by the publications. In other words, distance on this map represents the amount of overlap between the references in the bibliographies of the publications. The more similar the topics of texts are, the closer the articles are located in relationship to one another

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3 on the map. The analysis was executed in VoS-viewer, a program developed for the
4 construction and visualisation of bibliometric networks, which uses a mapping technique
5 closely related to multidimensional scaling (van Eck, Waltman, Dekker, & van den Berg,
6 2010). After the bibliographic coupling, the publications were further assigned to exactly one
7 cluster, or a set of closely related nodes (Waltman, van Eck, & Noyons, 2010). Within
8 clusters, co-citation analysis of the bibliographic references shows the most frequently shared
9 texts. These documents are the foundational references for the topical area. Foundational
10 texts were analysed using critical discourse analysis (Jager & Maier, 2009; Wodak & Meyer,
11 2009).

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15 Based on the bibliographic analysis, we then conducted a closer analysis of the most
16 frequently cited text in one key cluster using critical discourse analysis (Jager & Maier, 2009;
17 Wodak & Meyer, 2009). The One-health cluster bridges the different substantive areas of
18 focus in the map, and so we wanted to better understand how nonhumans were discussed in
19 these texts. The question we asked when reading these texts was: how are nonhuman species
20 represented generally and in relationship to public health specifically in this document? In
21 addition, we also conducted a close reading and critical discourse analysis of the other article
22 published in *Critical Public Health* that addresses nonhuman species but that does not
23 reference posthumanism. We selected this text because the only references to posthumanism
24 and public health within our sample were published in *Critical Public Health*. The question
25 we asked when reading this text was: how might posthumanism provide a different
26 theoretical insight? Combining bibliometric analysis with critical discourse analysis in this
27 way allowed us to ask where and how there are synergies between posthumanist theory and
28 public health research.

33 34 35 **Findings**

36 The spread of the 7294 articles published in the past 20 years on zoonosis, animals or
37 'One-health' within the public health literature is unevenly distributed over time (see
38 Supplementary Material, Graph 1). In the first 10 years – between 1995 and 2005 – a small
39 but steady rise is visible. From 2006 onwards, the number of publications per year increases
40 rapidly.

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43 The rise of research regarding zoonosis, animals and/or 'One-health' within the public
44 health literature can be compared with the rise in the general public health literature. Graph 2
45 (see Supplementary Material) plots the growth of this research and compares it to the growth
46 of the general public health literature. In this graph, the number of publications in 1995 is
47 taken as the baseline. For each year it calculates how much the number of articles has risen in
48 comparison to 1995. For example, a growth of two would mean that the number of
49 publications in that year is double the number of publications in 1995. In Graph 2, we see that
50 the two literatures are increasing at a similar rate from 1995 to 2005. However, research on
51 zoonotic diseases, animals or 'One-health' begins to escalate rapidly relative to the general
52 public health research in 2006. In other words, the research on zoonotic diseases, animals or
53 'One-health' has become a greater proportion of the total public health research since 2006.

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3 The 7294 publications within the subset of public health, used in this paper, come
4 from 1777 different journals. The top ten journals, in which most articles are published, are
5 shown in Table 2 (see Supplementary Material). Based on the titles of the most occurring
6 journals, it appears that public health research involving nonhuman animals is primarily
7 applied research that is focused on zoonotic diseases. *Zoonoses and Public Health* publishes
8 the majority of this research by far. Also both the second (*Revue Scientifique et Technique -*
9 *Office International des Epizooties*) and the tenth journal (*Vector-borne and Zoonotic*
10 *Diseases*) in our sample focus explicitly on zoonotic diseases. The other journals are either
11 medical (e.g., *Plos One*, *Epidemiology and Infection*, *Emerging Infectious Diseases* and *Plos*
12 *Neglected Tropical Diseases*) or veterinary (e.g., *Veterinary Parasitology*, *Preventive*
13 *Veterinary Medicine* and *Veterinary Microbiology*) journals.
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18 To further investigate the content of our sample, and consider where posthumanist
19 critique could contribute, the publications were mapped by means of bibliographic coupling
20 and then divided into clusters. The analysis comprises 6986 of the 7294 documents. 308
21 documents were excluded from the analysis because they were unconnected to any other
22 document (i.e., they either did not share any bibliographic references or there was not any
23 information about the references available). In total 39 clusters were found, ranging in size
24 from 2 to 1125 publications. The discussion of the results that follows only addresses the ten
25 largest clusters, which comprises 72% of the articles in the sample. Table 1 shows the
26 number of publications for the ten largest clusters in our dataset.
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36 To interpret the clusters, a word analysis of the titles, keywords and abstracts of the
37 articles was executed for each cluster. After removing stop words (such as ‘the’, ‘is’, ‘at’,
38 ‘which’ and ‘on’) and punctuation, and transforming all upper case letters to lower case
39 letters, the words were “stemmed”. This refers to an automated process, which reduces the
40 inflectional forms of a word to a common base form. An example is reducing ‘humans’ to
41 ‘human’. After completing these automated preparations, the frequencies of each word were
42 counted. Since the clusters are homogeneous subsets within the sample, the main topic of the
43 publications in a cluster can be derived by examining the most frequently used words.
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47 The biggest cluster, with 1125 publications, addresses foodborne bacterial infections
48 such as *Salmonella*, *Escherichia coli* and *Campylobacter jejuni*. The second cluster focuses
49 on nutrition-related public health problems, such as obesity and diabetes. Many of the
50 publications in this cluster used nonhuman animals as models for human disease. We note
51 this because one of the frequently used words in this cluster is ‘model’ (mentioned 548 times
52 in this cluster), and was used in specific reference to animal models. The third largest cluster
53 comprises of more critical and reflective publications within public health, dealing for
54 instance with policy and health protection programmes. It is within this cluster that a large
55 number of publications can be found that conceptually reflect upon or empirically apply the
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3 'One-health' paradigm. The two publications that explicitly use the terminology of
4 posthumanism can also be found in this cluster (Rock, 2013; Rock, et al., 2014).
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6 Clusters four, five and six in Table 1 focus on specific zoonotic diseases: diseases
7 brought forward by helminths such as *Echinococcosis*, vector-borne diseases (for example
8 through ticks or mosquitos), and influenza/viral pandemics (for example avian influenza
9 H5N1). In addition, the final three clusters in Table 1 (clusters eight, nine and ten) also deal
10 with zoonotic diseases. Specifically, these clusters focus on rabies, waterborne parasites (such
11 as *Cryptosporidium* and *Giardia lamblia*) and toxoplasmosis. Finally, the seventh cluster
12 addresses environmental pollution and toxicology. Nonhuman animals are present in this
13 cluster in two different ways: as experimental models for human diseases and as a site for
14 assessing the exposure of both humans and animals to environmental pollution.
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18 Figure 1 (see Supplementary Material) shows the bibliographic coupling map, in
19 which publications are spatially positioned depending upon the amount of overlap in the
20 references that the publications cite. Publications positioned close together will have a larger
21 amount of overlap in their bibliographies than publications positioned further away from each
22 other. The colours on the map show the different clusters. The ten main clusters discussed
23 above are marked with the corresponding labels on the map.
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27 On the left hand side, we find the clusters that are focused on zoonotic diseases, or the
28 ways in which human and animal health is interconnected. On the right hand side of the
29 figure, two clusters are found: Environmental pollution and toxicology as well as Obesity and
30 diabetes. These two clusters are spatially rather separate from the other clusters, and differ in
31 content from the other clusters. These two areas of research tend to use animals as models of
32 human disease, or in the case of environmental pollution as co-sufferers. The 'One-
33 health/general' cluster sits right in the middle of our map. This cluster links the public health
34 literature that addresses zoonotic diseases with the research that uses animals as models of
35 human diseases.
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39 Due to the central location of the 'One-health' cluster, we see it as the point of
40 departure for asking if and how posthumanist theory could contribute to public health. 'One-
41 health' is a call for interdisciplinary research and practice regarding the global and
42 interspecies aspects of health and illness in the context of travel as well as declining habitats
43 for nonhuman, non-domesticated animal species (Craddock & Hinchliffe, 2015; Wolf, 2015);
44 it is embedded in the history of comparative medicine. The most frequently shared references
45 in this cluster (see Supplementary Material, Table 3) give insight into the key publications
46 within this paradigm, and highlight its orientation toward medical science (that includes
47 veterinary medicine). The results presented in Table 3 (see Supplementary Material) are
48 based on a subset of the whole dataset which only includes the 591 publications of cluster 3.
49 From these publications, the most commonly shared publications are listed, which were
50 determined through co-citation analysis. The first column of Supplementary Material Table 3
51 indicates how many of the 591 publications cite the publication. The first two most frequently
52 cited texts are general public health publications. However, the subsequent publications all
53 focus on the link between human and animal health and human and animal medicine. The
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3 articles were published in medical and veterinary journals in the early years of the 2000s. An
4 exception is the seventh publication, the 1984 book by Calvin Schwabe entitled *Veterinary*
5 *medicine and human health*. The concept ‘one medicine’ was coined in this book, which has
6 been further developed and extended into the ‘One-health’ paradigm in more recent years.
7 We also see from Supplementary Material Table 3 just how important the work of Jakob
8 Zinsstag has been for this cluster, as he is a co-author on three of the ten articles. Further,
9 Zinsstag's work has played a crucial role in raising the importance of Calvin Schwabe's book.
10 The centrality of Schwabe’s book could be seen as a critical juncture in the development of
11 One-health, informing its distinctly medical approach today.ⁱ
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15 Table 4 (see Supplementary Material) shows the publications found within the 'One-
16 health' cluster that have been most cited. We conducted a closer analysis of these articles
17 using critical discourse analysis as these texts have been taken up by other scholars and used
18 in other research programmes the most extensively. These texts are primarily focused on the
19 consequences of nonhuman agents for human health, such as the species of zoonotic
20 pathogens most likely to be associated with emerging diseases in humans (Taylor, Latham, &
21 Woolhouse, 2001), the factors associated with emerging infectious disease outbreaks in
22 humans (Jones et al., 2008), the problem of antibiotic resistant microbes for human health
23 (Spellberg et al., 2008) and the distribution of ticks and Lyme disease risk (Nicholson &
24 Mather, 1996). One article viewed animals as surrogates for humans in assessing the health
25 effects of chemicals in the environment, in a manner that extends the use of animal models to
26 include animals as sentinels (van der Schalie et al., 1999). The discourse analysis thus
27 mapped onto the bibliometric analysis, wherein One-health links public health research on
28 zoonotic diseases with research using animal models. The former set of articles could be
29 subdivided in terms of focus, where characterising and classifying pathogens was the goal of
30 some (Cleaveland, Laurenson, & Taylor, 2001; Taylor, et al., 2001), understanding the
31 transmission of diseases and its contexts the focus of others (Epstein, 2001; Jones, et al.,
32 2008; Mangili & Gendreau, 2005; Nicholson & Mather, 1996), while a third subset of articles
33 were more programmatic or calls to action (Jackson, 2003; Spellberg, et al., 2008; Zinsstag,
34 Schelling, Waltner-Toews, & Tanner, 2011).
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42 Nonhuman species were largely represented as objects for analysis in these texts.
43 There were, however, some instances wherein nonhuman species were discussed in more
44 agentic terms. For example, microbes were represented as having “incredible power” that
45 requires “respect” given their ability to “inhabit literally every possible climate and
46 environment on the planet” such that “human beings are nothing more than walking
47 microbial planets” (Spellberg, et al., 2008: 156). The agency of microbes makes the metaphor
48 of ‘war’ absurd according to the authors, as it is one that humans could never win. Indeed the
49 authors credit microbes with “inventing” the primary “weapon” that humans have in fighting
50 microbes; microbes “invented” antibiotics over two billion years ago while humans simply
51 “discovered” antibiotics in the first half of the twentieth century (Spellberg, et al., 2008: 157).
52 Antimicrobial effectiveness is thus considered a precious resource, one that requires constant
53 stewardship and renewal on the part of humans in order to keep pace with microbial
54 adaptations.
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3 In turn, humans in general and human health specifically were the predominant
4 subjects of these texts. In general, the bifurcation of subjects/objects, culture/nature and
5 human/nonhuman was implicitly sustained, in a manner that stands in contradiction to
6 posthumanism. However, the animality of humans was nonetheless also at times expressed
7 with statements like: “Modern society is increasingly aware that humans and culture are
8 components of the natural environment” (Jackson, 2003: 191). And the animality of humans
9 presumably makes possible the “inextricable interconnection of humans, pet animals,
10 livestock and wildlife” that undergirds calls to integrate the medicine and health of humans
11 and animals through One-health (Zinsstag, et al., 2011: 148). Interestingly, Zinsstag et al.
12 contend that public health has been particular slow to collaborate and cooperate in addressing
13 zoonotic diseases through a One-health programme because of its focus on human subjects
14 (Zinsstag, et al., 2011: 151).
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19 To better understand how posthumanism might be integrated into public health
20 research, we looked at the one article in our sample that was published in *Critical Public*
21 *Health* but that did not use the term posthuman. This article was also located within the
22 “General/One-Health” cluster.
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25 Kennedy Kapala Mwcalimba's (2012) article in *Critical Public Health* was clustered
26 within the 'One-health' grouping in our analysis. Mwcalimba explored avian influenza
27 preparedness in Zambia. The article does not engage with the term posthuman or any of the
28 posthumanist social theory. It does, however, show the limits of the ‘One-health’ paradigm
29 by showing how humans and animals are entwined through agriculture and culture. The
30 focus, however, is on understanding how Western concerns regarding avian flu and
31 corresponding international standards overdetermined the preparedness strategies developed
32 in Zambia. This meant that pressing, local human and animal health needs went unaddressed
33 (see also Giles-Vernick, Owona-Ntsama, Landier, & Eyangoh, 2015). Critique here is thus
34 focused on the political economic as opposed to the posthuman. But in the process, the
35 political and economic difficulties associated with integrating human and animal health
36 through the ‘One-health’ paradigm become increasingly clear. Mwcalimba’s article therefore
37 serves as an important lesson for advocates of the ‘One-health’ paradigm, as avian flu
38 preparedness in Zambia came to be largely controlled by agricultural groups rather than
39 medical or public health groups in a manner that stymied integration. Mwcalimba thus
40 provides an important critique of ‘One-health’ by following the policy. A posthumanist
41 intervention would ask: what might avian influenza preparedness in Zambia look like by now
42 following the birds as well?
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49 Discussion

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51 It is interesting to note the rise in public health research involving nonhuman animals
52 since the 1990s, which from 2006 onwards is even stronger than the rise in the general public
53 health literature. The increased interest in zoonotic diseases accounts for some of the rise in
54 research regarding nonhuman species within public health. High profile zoonotic diseases
55 such as SARS or H1N1 have been a stimulus for this area of research (see also Craddock &
56 Hinchliffe, 2015; Porter, 2015). The heightened concern with zoonotic diseases is
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3 exemplified by the change in the name and scope of the *Journal of Veterinary Medicine,*
4 *Series B* to *Zoonoses and Public Health* in 2007. The focus in this strand of the literature is to
5 understand the pathways through which diseases cross species. But this research agenda also
6 goes beyond nonhuman animals to consider how other-than-animal entities, such as
7 chemicals, also shape human health (see Washburn, 2013 for a discussion). The porosity of
8 individual and species bodies is of key *concern* within this body of research.
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11 The public health literature engages with nonhuman animals in another, distinct way,
12 however. While an extensive part of the literature focuses on zoonotic diseases, public health
13 research also engages in standard biomedical research involving animal models. Biomedical
14 research has long used nonhuman animals as surrogates for humans in research, and public
15 health does this as well (Friese & Clarke, 2012; Lewis, Atkinson, Harrington, &
16 Featherstone, 2013). The animal model paradigm presumes that species retain certain
17 biological forms and processes through evolution, making it possible for one species to stand
18 as a surrogate for another. This is why Rachel Ankeny (2007) argues that comparison is
19 always part of the modelling process, even if it is implicit in the case of 'exemplary' (Bolker,
20 2009) models. Here the porosity of species bodies is a key *resource* for public health
21 research.
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26 What links these two discrete areas of scholarship is the 'One-health' paradigm. This
27 is clearly demonstrated in Figure 1 (see Supplementary Material), where the 'General/One-
28 health' cluster lies in the middle, between these two literatures in the bibliographic coupling
29 map. The rise in research regarding nonhuman animals in public health is therefore also
30 accounted for by the publication of key articles on the 'One-health' paradigm in the
31 beginning of the 2000s. These articles were frequently cited in later years. As such, the
32 development and further expansion of the 'One-health' literature within the field of public
33 health has boosted the number of publications addressing nonhuman species from the late
34 2000s onwards. It serves as a link between public health research on zoonotic diseases and
35 public health research that uses animals as models.
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40 The 'One-health' literature is medical in its orientation, and has not engaged with the
41 social sciences (Craddock & Hinchliffe, 2015; Wolf, 2015). This is confirmed in the analysis
42 of the key cited publications within this cluster, which are all published in medical and
43 veterinary journals. From our analysis it can be concluded that the concern with nonhuman
44 animals within public health is based upon the discourse of the 'One-health' paradigm. The
45 critical posthumanist theory from within the social sciences was only present in an extremely
46 limited number of publications. The neglect of the critical posthumanist literature within
47 public health is not surprising, given the concerns of the 'One-health' paradigm and its
48 perceptions of the social sciences. For example, the 'One-health' paradigm has been critiqued
49 for its reliance upon the deficit model, wherein the role of the social sciences is limited to
50 helping to communicate scientific and medical truths to an uninformed public (Craddock &
51 Hinchliffe, 2015).
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56 Conclusion

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3 Interest in nonhuman animals within public health has been informed by the
4 discursive practices of the 'One-health' paradigm, as opposed to the discursive practices of
5 'posthumanism'. Many of the contributions that Rock, Degeling and Blue (2014) contend
6 posthumanism can make to public health are arguably also already being made by One-
7 health, such as foregrounding: 1) the importance of nonhuman entities for improving human
8 health and subjective well-being (Rock, et al., 2014: 337; Zinsstag, et al., 2011), as evidenced
9 by infectious disease (Jones, et al., 2008; Rock, et al., 2014: 338; Taylor, et al., 2001), 2) the
10 use of animals as sentinels (Rock, et al., 2014: 338; van der Schalie, et al., 1999); and 3) the
11 range of nonhuman substances (e.g., microbes, carcinogens) that shape human health (Rock,
12 et al., 2014: 338; Spellberg, et al., 2008). Both posthumanism and One-health also challenge
13 the sharp delineation between physical and social environments (Jackson, 2003; Rock, et al.,
14 2014: 339).

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19 As such, for posthumanist theory to influence public health research, the differences
20 between 'One-health' and 'posthumanism' need to be discussed as well. Both posthumanist
21 social theory and 'One-health' emphasize the mutual dependence of humans, other species
22 and other things. But where posthumanist thought is rooted in a philosophical problem, 'One-
23 health' is rooted in an organizational problem. The agency of nonhumans is in turn a focal
24 point and site of potentiality in the more philosophically-oriented, posthumanist literature,
25 whereas nonhuman agency is either not considered or considered a problem in the One-health
26 literature. Further, where posthumanism argues that we need to better understand human
27 interactions with other species and things in historically, culturally and politically contingent
28 ways, 'One-health' starts with a biomedical model to argue for a greater integration of human
29 and animal medicine. Finally, and as Judith Green (2012) has pointed out, there is still the
30 assumption of a hierarchy in terms of whose health matters most in the 'One-health'
31 paradigm; it privileges the securitization of human populations in the global North (see also
32 Craddock, 2015; Craddock & Hinchliffe, 2015; Hinchliffe, 2015). The prioritization of
33 certain humans over other humans and other species is contrary to posthumanism. The critical
34 edge of posthumanism could therefore be particularly useful to public health research.

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41 There is a growing social science literature that seeks to critique the 'One-health'
42 paradigm, and these critiques are therefore relevant to current public health research
43 addressing nonhuman species as well. A recent special issue of *Social Science & Medicine*,
44 for example, critiqued One-health for failing to address power relations (Craddock, 2015;
45 Craddock & Hinchliffe, 2015; Giles-Vernick, et al., 2015), which has in turn meant that the
46 social, political and economic embeddedness of human-animal interactions is not addressed
47 by 'One-health' advocates (Coffin, Monje, Asiimwe-Karimu, Amuguni, & Odoch, 2015;
48 Woldehanna & Zimicki, 2015; Wolf, 2015). Posthumanist theory can help public health
49 researchers address these concerns, which are certainly shared by critical public health
50 scholars.

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Social scientists have begun to put forward other analytic approaches to the 'One-
health' paradigm. This includes cultural anthropology (Wolf, 2015), ethno-ecological history
(Giles-Vernick, et al., 2015) and participatory epidemiology (Coffin, et al., 2015; Paige,
Malave, Mbabazi, Mayer, & Goldberg, 2015). We suggest that posthumanist theories and

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3 methods could similarly move forward research concerns with nonhuman species in public
4 health, particularly critical public health but also more applied public health approaches
5 rooted in social epidemiology.
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8 What would happen if public health research involving nonhuman animals started
9 with a posthumanist injunction, as opposed to a 'One-health' injunction? If 'One-health' calls
10 for the integration of medical and veterinary expertise, posthumanism would call upon
11 researchers to 'follow the nonhuman.' Here the nonhuman agent that is of interest – the
12 animal, the virus, the microbe – is traced as it interacts with humans and other nonhumans. It
13 is a very micro-level approach to seeing how more meso- and macro-level entities, such as
14 networks or structures or meshworks of agency, are produced and/or how diseases are
15 enacted at material and symbolic levels. What would happen if public health research took
16 this up, and began to follow around the nonhuman species of interest and concern for human
17 health? How might that change our analyses? Couldn't public health extend such an approach
18 in the process, by also showing where these relations can be transformed in order to improve
19 the health and wellbeing of humans and other species as well?
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24 Donna Haraway (2008: 3) developed her notion of 'becoming with' by asking "what
25 do I touch when I touch my dog." Haraway shows that, to answer this question, she needs to
26 tell the natural, social, cultural, political and economic history of her dog's breed through
27 colonialism alongside the natural, social, cultural, political and economic processes shaping
28 her interactions with her dog today. As such, a posthumanist theory that starts with the
29 nonhuman species that is of interest must describe things like local, national and international
30 laws and policies, the history of social relationships between different people and other
31 species and things, the symbolic meaning of nonhuman species within a particular context
32 and the kinds of opportunities and problems these present. But in telling the natural histories
33 of animals or other things as political and economic and cultural and symbolic, the key
34 posthumanist insight could be combined with existing epidemiological practices in a manner
35 that could produce both better knowledge and better policies.ⁱ As Rock and her colleagues
36 point out, posthumanist approaches are useful to public health because they shift the analysis
37 of infectious diseases from a chain of causation toward a greater understanding of the
38 relationships that drive the incidence of zoonoses (Rock, et al., 2014: 338). Starting with the
39 nonhuman, tracing its relations and applying critical social theory seems to us to be a
40 necessary next step in public health research involving nonhuman agents.
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46 It is important to emphasize that, while the injunction to 'follow the actor' is more
47 often aligned with actor network theory, we are advocating for a posthumanist approach that
48 is more consistent with Donna Haraway's (1989, 1991, 2008) scholarship than Bruno Latour
49 (2005). This is because Haraway uses critical social theory in following nonhuman actors,
50 while Latour does not on the basis of his commitment to a flat ontology. This flat ontology
51 cannot, however, address many of the limitations of the 'One-health' paradigm, as described
52 by the emerging social science literature.ⁱⁱ We advocate for a posthumanism that engages
53 with history, culture and politics – the stuff of critical public health – in pursuing alternatives
54 to One-health. Such a posthumanist approach has the capacity to both critique and intervene
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in the processes through which human and nonhuman health alike is "enacted" (Mol, 2002), ways that may currently be illness producing.

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35 and comments at the conference helped tremendously in revising and refining our arguments
36 here. We would also like to thank Angela Cassidy for her comments and suggestions on our
37 handling of One-health in an earlier version of this paper, and Juan Pablo Pardo Guerra for
38 his comments on the bibliometric analysis. The comments from two anonymous reviewers
39 helped us to improve the paper tremendously, for which we are very grateful.

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45 Table 1. Overview of clusters with corresponding number of publications

Cluster	Size
Foodborne infections	1125
Obesity and diabetes	665
One-Health and general	591
Helminths	457

Vector-borne diseases	450
Influenza and viral pandemics	444
Environmental pollution and toxicology	411
Rabies	337
Waterborne parasites	309
Toxoplasmosis	206

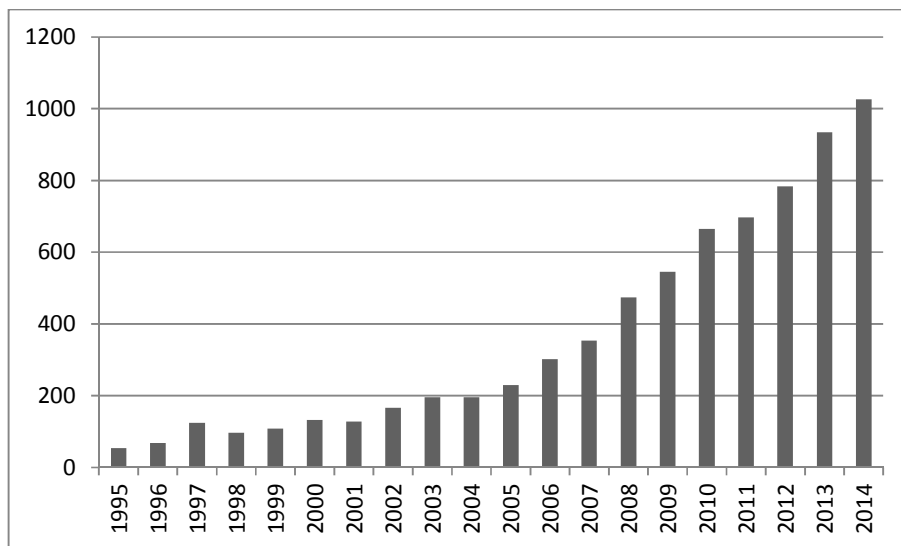
Endnotes

ⁱ We would like to thank one of the anonymous reviewers for their comments on this point.

ⁱⁱ That said, Francisco Tirado, Andres Gomez and Veronica Rocamora (2015) have analysed influenza using Actor Network Theory and so provide a crucial insight into how the injunction to follow the nonhuman can be put to good use in the context of public health.

Supplementary material

Graph 1. Number of publications per year.



Graph 2. Growth curve for the public health literature in general and the subset used in this paper.

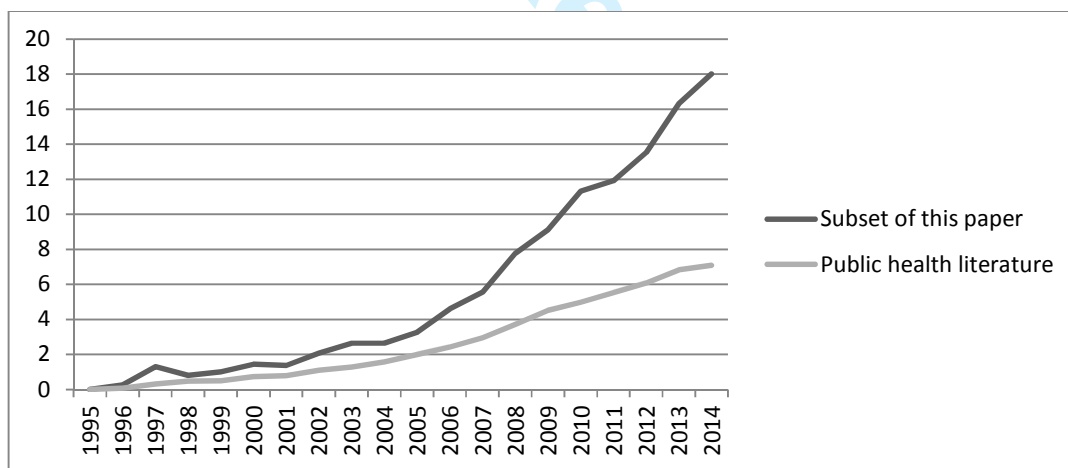


Table 2. Top-10 journals in our sample

Title of the journal	Number of publications in our sample
Zoonoses and Public Health	602
Revue Scientifique et Technique - Office International des	189

Epizooties	
Plos One	186
Veterinary Parasitology	129
Preventive Veterinary Medicine	78
Epidemiology and Infection	74
Veterinary Microbiology	74
Emerging Infectious Diseases	70
Plos Neglected Tropical Diseases	69
Vector-borne and Zoonotic Diseases	68

Table 3. Most frequently shared references within Cluster 3: One-Health

Number of times cited	Authors	Journal	Year	
60	Jones, KE; Patel, NG; Levy, MA; Storeygard, A; Balk, D; Gittleman, JL; Daszak, P	Nature	2008	Global trends in emerging infectious diseases
55	Taylor, LH; Latham, SM; Woolhouse, ME	Philosophical Transactions B	2001	Risk factors for human disease emergence.
32	Daszak, P; Cunningham, AA; Hyatt, AD	Science	2000	Emerging infectious diseases of wildlife-Threats to biodiversity and human health
30	Woolhouse, ME; Gowtage-Sequeria, S	Emerging Infectious Diseases	2005	Host range and emerging and Reemerging pathogens
29	Kahn, LH	Emerging Infectious Diseases	2006	Confronting zoonoses, linking human and veterinary medicine.
28	Zinsstag, J; Schelling, E; Wyss, K; Mahamat, MB	The Lancet	2005	Potential of cooperation between human and animal health to strengthen health systems
26	Schwabe, CW		1984	Veterinary medicine and human health
22	Cleaveland, S; Laurensonm MK; Taylor, LH	Philosophical Transactions B	2001	Diseases of humans and their domestic mammals: pathogen characteristics, host range and the risk of emergence

20	Zinsstag, J; Schelling, E; Waltner-Toews, D; Tanner, M	Preventive Veterinary Medicine	2011	From “one medicine” to “one health” and systemic approaches to health and well-being
18	Kahn, LH; Kaplan, B; Steel, JH	Veterinaria Italiana	2007	Confronting zoonoses through closer collaboration between medicine and veterinary medicine (as 'one medicine')
17	Roth, F; Zinsstag, J; Orkhon, D; Chimed-Ochir, G; Hutton, G; Cosivi, O; Carrin, G; Otte, J	Bulletin of the WHO	2003	Human health benefits from livestock vaccination for brucellosis: case study

Table 4. The most frequently cited publications from within the ‘One Health’/General cluster

Number of times cited	Authors	Journal	Year	Article title
1432	Jones, KE; Patel, NG; Levy, MA; Storeygard, A; Balk, D; Gittleman, JL; Daszak, P	<i>Nature</i>	2008	Global trends in emerging infectious diseases
690	Taylor, LH; Latham, SM; Woolhouse, ME	<i>Philosophical Transactions B</i>	2001	Risk factors for human disease emergence.
548	Spellberg, B. Guidos, R., Gilbert, D et al.	<i>Clinical Infectious Diseases</i>	2008	The epidemic of antibiotic-resistant infections: A call to action for the medical community from the Infectious Diseases Society of America
360	Cleaveland, S; Laurensonm MK; Taylor, LH	<i>Philosophical Transactions B</i>	2001	Diseases of humans and their domestic mammals: pathogen characteristics, host range and the risk of emergence
172	Mangili, A; Gendreau MA	<i>Lancet</i>	2005	Transmission of infectious diseases during commercial air travel
109	Jackson, LE	<i>Landscape and urban planning</i>	2003	The relationship of urban design to human health and condition
101	Nicholson, MC; Mather, TN	<i>Journal of Medical Entomology</i>	1996	Methods for evaluating Lyme disease risks using geographic information systems and geospatial analysis
100	Zinsstag, J; Schelling, E; Waltner-Toews, D;	<i>Preventive Veterinary</i>	2011	From “one medicine” to “one health” and systemic

	Tanner, M	<i>Medicine</i>		approaches to health and well-being
85	Van de Schalie, WH; Gardner, HS; Bantle, JA et al	<i>Environmental Health perspectives</i>	1999	Animals as sentinels of human health hazards of environmental chemicals
75	Epstein, PR	<i>Journal of urban health</i>	2001	West Nile virus and the climate

Figure 1. Map of publications after bibliographic coupling (colours represent clustering).

(See attachment.)

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