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ARTICLES

Ethical Decision-Making in Zoonotic Disease Control

How Do One Health Strategies Function in the Netherlands?

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Abstract
To tackle zoonotic disease threats, a One Health approach is currently commonplace and generally understood as an integrated effort of multiple disciplines to promote the health of humans, animals and the environment. To implement One Health strategies in zoonotic disease control, many countries set up early warning systems, in which human and veterinary health professionals cooperate. These systems, like the Dutch Zoonoses Structure, can be successful to detect emerging disease threats. However, these systems are not well equipped to handle moral dilemmas that can arise in zoonotic disease control, like the culling of healthy animals. This research studies the role of normative presuppositions of professionals involved in zoonotic disease control policies in the Netherlands. We found that these professionals in general adhered to a holistic view of the One Health concept, however, in practice an anthropocentric approach was dominant. Public health was identified as the trumping moral value, which reveals an inherent field of tension with the core of One Health thinking. The lack of ethical expertise in control systems for zoonotic diseases can lead to misconception of ethical principles, like the precautionary principle which is frequently evoked to justify disease control measures.

Keywords Zoonotic disease control · One Health · Decision-making · Ethics

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Introduction

No recent zoonotic disease outbreak has caused more public and political debate in the Netherlands than the Q-fever epidemic of 2007–2011. During this period, more than 4000 people became ill and eventually 95 Q-fever patients died due to the *Coxiella Burnetii* infection. Besides human victims, over 50,000 healthy and pregnant goats were culled to stop the disease. Because of its major societal impact and the extensive course of this epidemic, the corresponding process of zoonotic disease control was extensively reviewed and evaluated.

The overall criticism was that a lack of political thoroughness and defective cooperation between human and veterinary health professionals hampered an effective approach to stop the epidemic. The evaluation committee concluded that this was partly due to underlying differences in opinion between the involved ministries of Health, Welfare and Sports and Agriculture, Nature and Food Quality (Van Dijk et al. 2010). To address these issues and to be better prepared for future zoonotic disease threats, the Dutch government introduced a national Zoonoses Structure in 2011 (see Fig. 1).

Following a systematic One Health approach, the purpose of this new institution was to establish a formal collaboration between veterinary and medical professionals to share, assess and respond to signals of new and re-emerging zoonotic infections (National Institute for Public Health and the Environment 2019). In this model the final decision-making authority in case of zoonotic disease outbreaks is shared between the minister of Agriculture and the minister of Health, in a kind of collegial

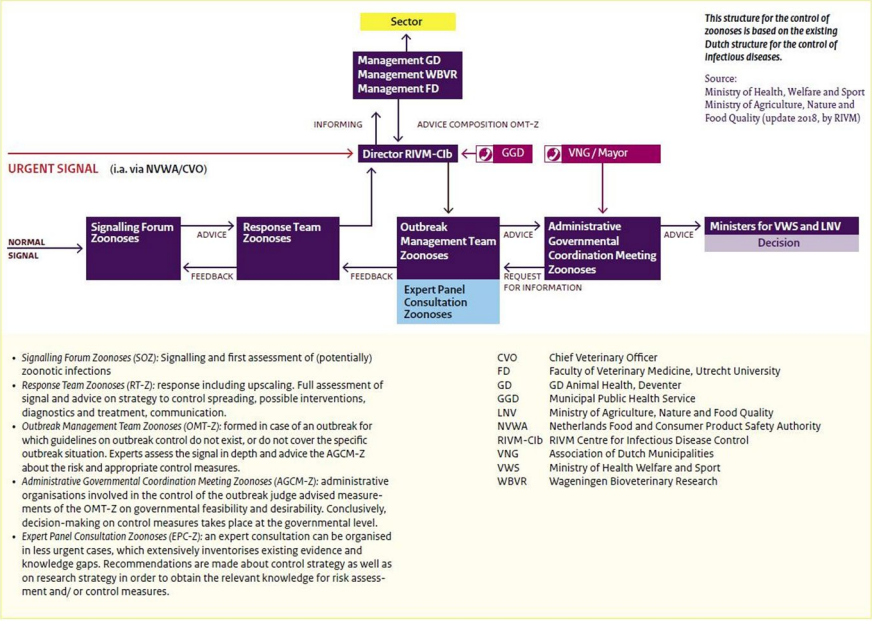

Fig. 1 Dutch Zoonoses Structure. *Source*: NIPHE 2019

governance body (Minister of Health, Welfare and Sports 2012). Since its introduction, the Zoonoses Structure has indeed proven its value in early recognition of zoonotic signals (Waegemaekers and van den Kerkhof 2013). At the same time, One Health strategies in zoonotic disease control are becoming the international standard as well (Kelly et al. 2017).

However, as Haalboom points out in her historic analysis of zoonotic disease control in the Netherlands, it can be questioned whether a procedural solution, like the Dutch Zoonotic Structure, will also solve conflicts of interest between, for instance, public health and the economic interests of the agricultural sector (Haalboom 2017). It is known from previous outbreaks that zoonotic disease control can raise moral dilemmas, like the culling of healthy animals to protect public health, which call for ethical reflection and political decisions (Lederman 2016). Framing zoonotic disease control as a One Health approach does not automatically alleviate these dilemmas (Degeling et al. 2015; Lysaght et al. 2017; van Herten et al. 2019).

Societal debates about zoonotic disease control often focus on the easily polarised conflict between safeguarding public health versus serving the economic interests of livestock farming. Although this conflict cannot be ignored, such a conceptualization easily obscures other dimensions of zoonotic diseases. There are several other values at stake too. Think of values like animal welfare and -integrity, autonomy, sustainability or biodiversity. Moreover, a highly polarized debate may create obstacles to finding policies that are reasonable and fair to all stakeholders: consumers, food producers, NGOs, the government and animals.

Speranza et al. rightly argue that: “One Health is grounded in achieving sustainable outcomes” and “even when public health interventions are humanist in orientation, efforts to sustain the health of our ecological communities might require the prioritisation of non-human interests”. To evaluate the social sustainability of One Health initiatives, Speranza et al. suggest that; “at the minimum it does not undermine individual needs and capabilities, fosters emancipation, environmental justice, solidarity and social cohesion, and thereby improves human well-being” (Speranza et al. 2018). The question is when and to which extent animal welfare and environmental health are prioritized? And how responsibilities are shaped in the practice of zoonotic disease control? Especially when it is taken into account that culture, religion and economic considerations determine human–animal–ecosystem relationships (cf. Zinsstag et al. 2015).

In 2015 the Dutch Council on Animal Affairs issued a policy assessment framework for a One Health approach in health issues at the human–animal–ecosystem interface (Council on Animal Affairs 2016). The goal of this tool was to: “give an insight into the elements which, in the Council’s view, constitute the One Health assessment framework and the values that have to be taken into account” (pp. 2). However: “the weight that is ultimately assigned to those values remains outside the set of criteria, checks and balances here because the choice has to be made by those who are responsible for the policy” (pp. 2). This makes the Council’s’ assessment framework a useful instrument to make an inventory of all values at play and to systematically discuss them. It does not offer a guideline on how this evaluation should take place, what could be regarded as a reasonable and socially acceptable outcome and how to make this process transparent to society.

The aim of this paper is to examine ethical decision-making in zoonotic disease control in the Netherlands. Our hypothesis is that moral presuppositions of veterinary and human health professionals play an important role in this process. Therefore, we have studied how these professionals balance certain values in case of moral dilemmas in zoonotic disease control and which role ethical theory plays.

Methodology

In our research we used an interpretive empirical research method consisting of semi-structured in-depth interviews with relevant health professionals: experts, policy- and decision makers involved in zoonotic disease control in the Netherlands. Interpretive research aims to understand how particular humans in particular times makes sense of their world. Interpretative researchers study (inter)subjective experiences and patterns therein by interpreting communicative behavior, in the context in which they are (co-)constructed (Yanow and Schwartz-Shea 2014). Our study is descriptive as well as explanatory. On the one hand we aim to describe what these professionals consider a One Health strategy in zoonotic disease control, which moral dilemmas they encounter and which moral values and ethical principles they find relevant. On the other hand, we examine how they balance the different values that play a role in zoonotic disease control and how ethical theory is applied. Finally, we explore if and how moral presuppositions of health professionals influence ethical decision making in zoonotic disease control. The empirical data we gathered with the interviews were analysed qualitatively.

Literature Research

To construct a questionnaire for the interviews, we searched the literature for conceptions of One Health and of moral values and ethical principles that could play a role in zoonotic disease control. The One Health concept is described in the literature in various ways (Gibbs 2014), the core of which can be summarized as improving the health of humans, animals and the environment through interdisciplinary cooperation. We used the definition of the American Veterinary Medical Association (2008) as a point of reference to test our respondents' conception of One Health.

Moral values can be defined as characteristics of persons, organizations or of society as a whole that are in themselves worth pursuing and reflect people's opinion on what construes their version of a good life, for example autonomy. Moral norms or principles are concrete rules of conduct that prescribe what we should do, for instance to have respect for autonomy of humans (Bolt et al. 2003).

Our basic selection of values was derived from the assessment framework of the Dutch Council on Animal Affairs (2016), who categorized the most relevant values for evaluation of One Health interventions spread across the human–animal–ecosystem domain (see Fig. 2). It is debatable whether some of the terms (like contamination) could be classified as (moral) values. However, the majority

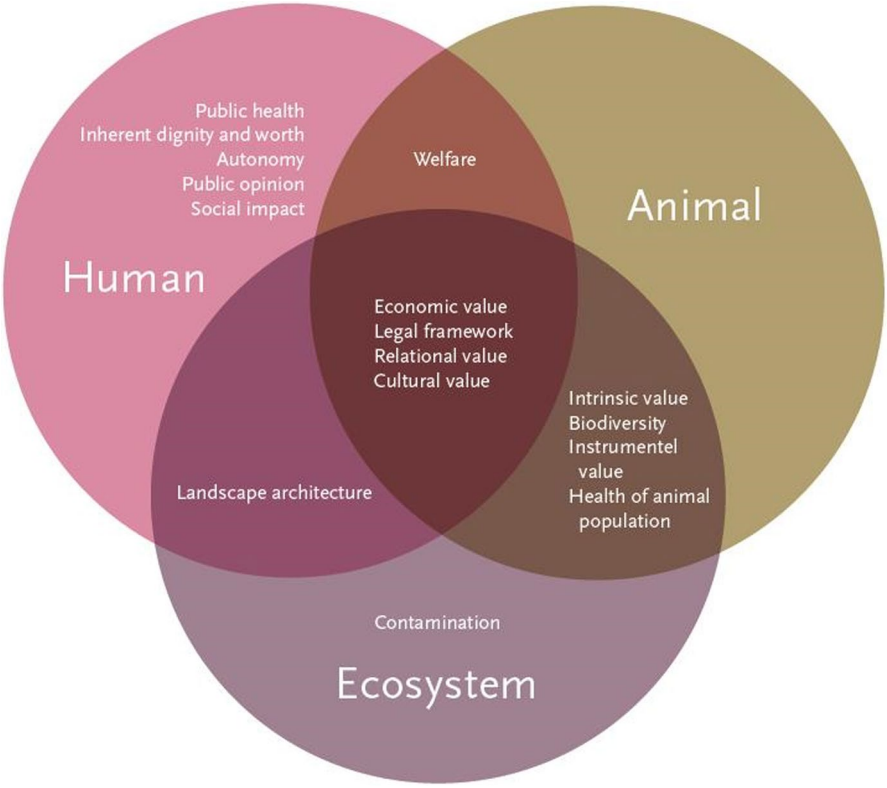

Fig. 2 Overview of values. *Source*: Dutch Council on Animal Affairs (2016)

of these values can also be found in other ethical analyses of zoonotic disease control (Cohen et al. 2012; Degeling et al. 2017; Johnson et al. 2019).

For the selection of relevant ethical principles, we primarily used the principles of Beauchamp and Childress: *respect for autonomy*, *non-maleficence*, *beneficence* and *respect for justice* (Beauchamp and Childress 2013). These mid-level principles mediate between different high-level ethical theories and low-level common morality. They are considered as *prima facie* action guiding and are used to reflect on particular cases, especially in human and veterinary medicine (Mullan and Main 2001; Spike 2018).

In his 'ethical matrix', which was designed to structure ethical dialogue, Mepham has adapted these principles to apply them to animals. He introduced the principle of *wellbeing*, a combination of the principles of non-maleficence and beneficence, that implies: to avoid harm and promote benefits. In his view the principle of *autonomy* means that animals should be able to perform natural behaviour. And finally, he suggested a principle of *fairness,* meaning respect for justice and respect for the intrinsic value of animals (Mepham et al. 2006).

Another important ethical principle often invoked in zoonotic disease control is the precautionary principle: when scientific evidence about the consequences is not yet available, but it is likely that a zoonotic disease will cause harm to the health of people, animals or the environment, measures shall be taken to diminish that harm (European Commission 2000). For this reason, we added this principle to our list. An overview of the ethical principles as presented during the interviews is given in Fig. 3.

Semi-structured In-Depth Interviews

We used a semi-structured list of open questions to guide the interviews. The questions were divided into six items: the concept of One Health, zoonotic disease control policies, values, principles, ethical decision making in practice and human–animal relations. Apart from questions about the respondents' moral presuppositions towards the One Health concept and zoonotic disease control, we also used questions on the respondents' view on the human–animal bond, to reveal their basic moral attitude towards animals. To identify which moral values the respondents think are important in zoonotic disease control, we first asked this in an open question. Additionally, we presented them the list of values we derived from literature and asked them to choose the five most important values. We also prompted for ethical principles via an open question. Subsequently, we offered them our matrix of ethical principles and asked the respondents to point out the three most important ones and to rank them.

Autonomy	**Non-maleficence**
• *Respect for the autonomy of humans*: To repect decisions of autonomous humans/ informed consent. • *Respect for the autonomy of animals*: To respect the intrinsic value /natural behavior of animals.	• *Do no harm principle*: Not to harm humans/animals. • *Precautionary principle*: To take measures to prevent expected harm to humans/animals in case of scientific uncertainty.
Justice	**Beneficence**
• *Principle of justice*: To treat like cases alike.	• *Principle of utility:* To promote overall welfare of humans/animals

Fig. 3 Matrix of ethical principles

Selection of Respondents

The respondents were either policymakers or -advisors, all involved in the Dutch Zoonoses Structure. They were pre-selected, based on their professional involvement in zoonotic disease control. Despite the fact that our research concerns a relatively small group of people, these professionals all play a key role in Dutch zoonotic disease policies. Of the thirteen respondents we interviewed, six (three male and three female) worked in the human domain and seven (five male and two female) in the veterinary domain. The length of the interviews was on average 1.5 h. The interviews were done by the first two authors from December 2018–March 2019 on a location preferred by the respondent, often their own work environment.

Data Processing and Analysis

The interviews were recorded and transcribed verbatim. Subsequently, the transcripts were processed and analyzed using the three cycle coding method described in Miles et al. (2013). During the coding process Word, Excel and the qualitative data analysis program ATLAS.ti were used. Coding was done by the first two authors separately to improve reliability of data processing and the outcome was discussed with the other authors, to finally end up with a uniform list of labels. First cycle coding was descriptive, which means that relevant fragments in the text received a label, mostly a short summary that characterizes the fragment. During second cycle coding trends and patterns within the data set were identified. Labels were classified in sub-themes based on their interrelationship (pattern coding). In the third cycle coding phase we searched for relations and consistency between the sub-themes. Eventually, this resulted in five main themes: (1) One Health, (2) zoonotic disease control, (3) moral dilemmas, (4) values and (5) principles and decision making. Thereafter, we applied the results of the coding process to answer our research questions.

Results

What is a One Health Strategy in Zoonotic Disease Control?

Different interpretations of One Health can lead to divergence of objectives in zoonotic disease control and can complicate cooperation (Kingsley and Taylor 2017). To understand how policymakers and advisors in the Netherlands interpret the concept in the context of zoonotic disease control, we have asked the respondents about their own definition, their ideas on One Health policies and cooperation with other professionals. Furthermore, we have discussed what zoonotic disease control according One Health principles would ideally look like. Finally, we asked whether the respondents think more preventive measures are needed to avert

zoonotic diseases. This provided information to answer our first research question: what is a One Health strategy in zoonotic disease control according to health professionals?

When asked about their definition, nearly all respondents indicated that they understand One Health as a call for multidisciplinary collaboration to combat zoonotic diseases (n = 11). The majority endorsed the holistic starting point of One Health that the health of humans, animals and the environment is promoted (n = 8). One respondent adhered a strictly anthropocentric view and states that: "*It's really all about human health"*. Subsequently, when confronted with the definition of the American Veterinary Medical Association: "One Health is defined as the collaborative effort of multiple disciplines—working locally, nationally and globally—to attain optimal health for people, animals and the environment" (American Veterinary Medical Association 2008), all respondents subscribed this statement. Although one respondent noticed that: "*Optimal for animals is not always the same as optimal for humans or the environment*".

Regarding cooperation: veterinary as well as human health professionals appreciated working together in the Zoonoses Structure and acknowledged that much progress is made since the Q-fever epidemic. Several respondents pointed out that mutual trust (n = 2) and careful handling of data (n = 3) are important conditions in this respect. Both human and veterinary professionals admitted that in the current system there is too little involvement of other professionals, like ecologists (n = 6). To further improve zoonotic disease control, they indicated that more funding was necessary for research and early detection (n = 4).

Contrary to their support for a holistic conception of One Health, zoonotic disease control policies in practice seem overwhelmingly anthropocentric, or in other words human health driven. According to several respondents (n = 4), keeping animals healthy is mainly important for public health reasons. Both human- and veterinary professionals stated that only when disease control measures contribute to public health or when it is economically interesting, public authorities will invest in animal health. Moreover, they indicate that human disease burden must be substantial to make such an investment. Zoonotic disease policies are therefore dominated by public health and economic considerations. Although, these interests can sometimes conflict, as we have seen in the Q-fever case, they are both anthropocentric in nature. Veterinary professionals are sometimes frustrated that there seems no willingness to improve animal health without clear human benefits (n = 4). On the other hand, as one of them pointed out: "*We are not going to invest in animal health at the cost of humans*". This can also imply that, for the sake of public health, animal health and welfare can be infringed. For instance, one respondent mentioned that: "*For public health reasons it would be better to keep all animals indoors*".

In answer to our question about preventive measures against zoonotic diseases, several respondents emphasized that early detection is the most effective strategy (n = 7). Although one respondent emphasized it is in fact difficult to predict what the next zoonotic disease outbreak will be. To protect farm animals and humans, a high level of biosecurity on farms was considered essential. Two respondents, both human health professionals, argued that, to decrease the risk of zoonotic diseases, biosecurity is more important than reducing the number of farm animals.

Vaccination of animals and/or humans can sometimes be an option but must be cost-effective and proportional in comparison with the health risks (n = 2).

Although our research did not reveal a definitive answer to what according to our respondents a One Health strategy in zoonotic disease control exactly entails, there is a discrepancy between theory and practice. In theory, most respondents adhered to a holistic view on One Health. In practice, the drivers for zoonotic disease control were predominantly anthropocentric. The main objective for One Health strategy in zoonotic disease control seems to be a better multi-disciplinary collaboration to promote public health. No differences between veterinary and human health professionals were found.

What are the Moral Dilemmas of One Health Strategies in Zoonotic Disease Control?

Zoonotic disease control can raise moral dilemmas, like the culling of healthy animals to protect public health (Cohen et al. 2012; Degeling et al. 2016; van Herten et al. 2019). To examine their source and nature, we asked the respondents which moral dilemmas and ethical questions they encountered during zoonotic disease control. We inquired whether they had experienced difficult professional or societal debates about certain zoonotic disease control measures and how they look at measures like the culling of healthy animals. Finally, we inquired about possible friction between personal and professional views in decision making or advising during a zoonotic disease outbreak.

Especially veterinary respondents acknowledged that zoonotic disease control can impair animal welfare, for instance by culling or keeping animals indoors to stop the spread of a disease (n = 8). Another dilemma that was mentioned concerned the confidentiality of data (n = 6). In the Netherlands, certain laboratories and research institutes are private companies used by veterinarians and farmers to diagnose animal diseases. Although they are legally bound to provide data of notifiable diseases, this sometimes leads to tensions. For instance, in case of a (new) zoonotic disease it is not mandatory to report, as was the case at the start of the Dutch Q-fever epidemic in 2007. Certainly, in times where public health risks are not clear yet, a conflict of interests can arise, for instance between economics or privacy and public health.

Several respondents pointed out that a response to zoonotic disease signals was only initiated when it led to serious illness in human patients (n = 4). When a zoonotic disease mainly affects animals and there is little disease burden in humans, the Dutch Zoonoses Structure will not advice action. A respondent illustrated this by posing the question: *"How many humans must become sick before action is taken against the animal disease source?"*. This has primarily to do with reasons of cost-effectiveness. The question when to interfere in the animal production chain with stringent measures is also problematic from a legal and economic point of view. It was argued that farmers run business enterprises and there is a threat of legal liability procedures when there appears not enough scientific proof for certain disease control measures. This touches upon the issue of responsibility and bearing the costs

of zoonotic disease control. One respondent mentioned that: "*Farmers are paying the price for zoonotic disease control while the benefits are on the human side"*.

Most respondents (n = 11) did not experience any issues of cognitive dissonance, here interpreted as an internal conflict between their professional- and their personal opinion. They indicated that it is their job to provide professional advice based on available scientific evidence. They refrain from actual political decision making, because this is seen as a governmental responsibility. Many of the respondents recognized that zoonotic disease control can lead to public debate (n = 9). However, some of them (n = 3) regret the fact that in general many people form opinions without sufficient knowledge about zoonotic disease control. They observe a lack of mutual understanding between opposing parties in the societal debate and insufficient trust in expert opinions. One respondent indicated that: *"Public opinion influences the answer to the question whether interference is necessary but has no impact on how the disease is controlled"*. Whether or not zoonotic disease control leads to public debate is also dependent on the species that is involved, some respondents (n = 6) suggested.

Part of the respondents expected that problems could arise with killing horses or companion animals in zoonotic disease control because of the human–animal bond (n = 3), although others did not experience this as an issue (n = 3). Several respondents (n = 4) found killing of healthy food producing animals less problematic because these animals would be killed anyway. However, nearly all claimed that killing animals can only be justified when there is a serious public health threat and no alternatives are available (n = 12). Some of the respondents (n = 5) held the opinion that killing healthy animals does not affect their wellbeing. Arguments for this were that they believed animals do not have any awareness of future welfare and if the killing is performed '*lege artis*' these animals will not feel any pain or discomfort. Others (n = 4) do think that killing affects animal wellbeing because we take away their future life and happiness. There was no difference in professionals from the human or veterinary domain in this respect, nor between men and women. However, we did note some discrepancies in the answers. Respondents who earlier stated that culling healthy animals was an animal welfare issue, had no problems with killing animals when this is done in a proper way and with a good reason.

What Moral Values are Related to a One Health Strategy in Zoonotic Disease Control?

Our hypothesis is that moral presuppositions influence ethical decision making in zoonotic disease control. We were specifically interested in the effect of One Health in this context. Did the One Health concept add non-anthropocentric values in the decision-making process? Prior to our questions, we explained to our respondents that we defined values as situations worth pursuing or desirable characteristics of people, organizations or the society as a whole. Honesty and independence were mentioned as examples. We started with inquiring which values our respondents spontaneously associated with One Health strategies in zoonotic disease control. Thereafter, we confronted them with our list of values

(see Fig. 2). We asked them to choose the five most important values and rank them. Finally, we included questions about human–animal hierarchy, dietary patterns and keeping animals, to study their general attitude towards animals and the human–animal relationship.

Almost all respondents pointed out public health and/or human welfare as the most important value in zoonotic disease control (n = 12). As one respondent described it: "*If we are not healthy […] nothing else is important*". Only one respondent thought public health was not necessarily an absolute trumping value in this context. In practice, economics appeared an important factor too. Many of the respondents (n = 7) acknowledged that financial consequences always bear a heavy weight in the decision-making process. Several respondents (n = 4) emphasized that honesty and transparency are important values. They stated that these values are necessary to give insight in all risk factors and to make the right considerations. Honesty and transparency also generate (interprofessional) trust and support from society for difficult decisions in zoonotic disease control. A favourable public opinion was mentioned several times as an important value to consider (n = 7). Part of the respondents (n = 5) expected that being more open about risks and consequences would contribute to a more socially acceptable zoonotic disease control.

During the interviews we did not encounter respondents with divergent views on the meaning of the values we presented. Values like animal health, animal welfare, the intrinsic value of animals, human–animal relations and environmental health were all mentioned by the respondents. However, most of them acknowledged that these values were not decisive. For some (n = 2), animal and environmental health were merely instrumental to public health and economy, as can be derived from this statement: *"Healthy food of animal origin is a prerequisite for public health"*. Values associated with the ecosystem were sometimes (n = 4) interpreted as landscaping to minimize public health risks, for instance by moving animal production away from urban areas.

To reflect on moral presuppositions, we have also added questions about human–animal relations. All respondents placed humans hierarchically above animals. At the same time, they concluded that this does not imply that people could treat animals in any way they would like. Society should take good care of farm animals and respect animal welfare. The arguments that our respondents brought forward to underpin this hierarchy varied from: "*We humans decide everything", "Humans have a life expectancy and a self-image, animals do not", "As long as we use animals for food we are not equal", "If we have to choose whose life to protect we decide for humans"* and *"I have stronger emotional relations with other humans than with animals"* to *"I cannot explain this, it is just my feeling"*.

When asked for a definition of health, all the respondents adhered to a holistic view. This implies that for humans, as well as for animals, health is more than just absence of disease. Wellbeing and social interactions are considered as constituent factors of health too. They did not feel there is a distinction between humans and animals in this respect. Many respondents, for instance, argued that besides good health the ability to perform natural behaviour is an important criterion for animal welfare. Only one respondent referred to a more instrumental version of animal health and stated that: *"An animal is in good health if it grows and produces well"*.

All but one respondent ate meat and other animal products. Many of them indicated that nowadays they try to eat less animal products because of the impact on the environment. For this reason, but also for animal welfare, these respondents buy organic products. Nearly all respondents have or have had companion animals. Only one respondent keeps animals for production purposes.

How are These Moral Values Balanced in Case of Moral Dilemmas Related to One Health Strategies in Zoonotic Disease Control?

To understand ethical decision-making? in the practice of zoonotic disease control, we asked our respondents about balancing different values and the use of ethical principles. We first explained that ethical principles are derived from ethical theories and can be helpful in solving moral dilemmas and conflicts of interests. Then we asked them if they could spontaneously recall any examples of ethical principles. None of the respondents could clearly answer this. Thereafter, our overview of relevant ethical principles was presented (see Fig. 3).

Of these principles, most respondents appointed the precautionary principle as the most important action guiding principle in zoonotic disease control (n = 10). One respondent explained: *"With a zoonotic disease outbreak there are always knowledge gaps, that is why the precautionary principle is important"*. Another respondent noted that: *"By appealing to the precautionary principle we don't waste precious time discussing whether we know enough to take action"*.

Other principles mentioned were the "do no harm"-principle (n = 10), respect for autonomy (n = 9), the principle of justice (n = 4) and the utility-principle (n = 2). Since the "do not harm"-principle and the precautionary principle are strongly related, it is clear that the notion of non-maleficence for humans is viewed as most important. No distinct ranking of the other principles could be derived from the answers. Some respondents considered that the "do no harm"-principle should be applied to humans as well as animals. This would imply that animals should not be harmed unnecessarily? by zoonotic disease control measures. However, most respondents use ethical principles purely from an anthropocentric perspective. One respondent, for instance, declared that: *"The "do no harm"-principle applies to animals as long as there is no human suffering"*.

Although some respondents claim that most of the principles on our list were implicitly used in the decision-making process, others hold the opinion that the use of ethics in zoonotic disease control is underdeveloped. From the way our respondents reflected on ethical principles, we question a uniform use of ethical principles in general and of the precautionary principle more particularly. Some respondents frame this last principle as taking precautions to prevent a zoonotic disease outbreak. This interpretation can be understood as the principle of prevention, which entails that it is generally preferable and cheaper in the long term, to prevent social impacts and ecological damage than having to restore and rectify damage after an event (Vanclay 2003).

Others specifically refer to precautionary actions to mitigate public health risk in times of scientific uncertainty. This view is derived from a general definition of the

precautionary principle: when an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically (Wingspread 1998).

These differences in interpretation call for further research on the role and meaning of the precautionary principle in zoonotic disease control. For other principles we also found differences in interpretation. The principle of utility was sometimes used as a simple cost–benefit analysis. In other interviews it was explained as promoting overall (human) wellbeing. By some, the principle of justice was a substantiated outcome when balancing conflicting human and animal values. Others indicated that justice requires treating certain categories of animals the same as others. In case of *Avian Influenza*, for example, the question is whether it is justified to apply different rules for commercial and backyard poultry.

When asked about trade-offs in zoonotic disease control, six respondents point out public health as the most important and decisive value in zoonotic disease control. One (human health) respondent regarded loss of animal health and welfare as purely economic. Another (veterinary) respondent pointed out that: *"No concessions are made to human interests in order to improve animal or environmental health"*. According to most respondents, human morbidity or mortality is an indispensable driver to start zoonotic disease control measures. Animal interests are taken into account, as far as the effect of disease control measures on animal welfare is concerned. These control measures must be proportional in relation to the risk for public health. One respondent argued: *"You have to have good reasons to cull healthy animals in case of a zoonotic disease outbreak"*.

Discussion

Professional Background and Gender

Our research population represents policymakers and advisors from both the human and the veterinary domain involved in the Dutch Zoonoses Structure. Beforehand, we expected to find differences in responses between these two groups. Professionals from the veterinary domain were thought to value animal interests more than their human counterparts. However, our research did not reveal much difference in this respect. Only when asked about moral dilemmas, human professionals mentioned a field of tension between economics and public health more often, frequently referring to the Q-fever case. The same goes for gender differences. Only in case of the "do no harm"-principle, most of the respondents, considering it should apply to humans as well as animals, were male (six out of the seven). This is inconsistent with literature, that finds that women, on average, show higher levels of positive attitudes towards animals (Herzog 2007). Otherwise, no difference in response was noted between human and veterinary health professionals, nor between male and female respondents. This can partly be explained because our respondents are a selective group involved in One Health policymaking. The context in which our respondents operate probably influences their balancing of values related to humans

and animals (van Asselt et al. 2019). The answers of our respondents are therefore not representative for the view of the general public.

Is-ought Distinction

In certain cases, it was not clear if the respondents answered the questions from the perspective of the actual or the desired situation. For instance, when a respondent states that: "*No concessions are made to human interests to improve animal or environmental health*". Sometimes the context or further questioning revealed the respondents real position. Because this situation occurred more than once, we think this could imply that some health professionals struggle with a so-called "is-ought" distinction. In other words, how is the present situation related to what—in their view—ought to be the case? In ethics descriptive and normative statements are considered independent, which means that no "ought" can be derived from an "is" (Spielthenner 2017). A possible explanation for the conflation of is and ought, that we sometimes encountered, is that health professionals do not think they can change the present situation and therefore accept this as a given fact. Furthermore, the role of our respondents as health professionals and experts might limit them in expressing normative opinions.

Public Health as Trumping Value

Considering a One Health approach in zoonotic disease control, the results indicate a strong focus on public instead of individual health. This is compliant with the overall aim of the Dutch Zoonoses Structure to protect public health rather than the health of individual animal keepers, veterinarians, consumers or animals. In theory, nearly all respondents endorsed a holistic idea of One Health: to promote the health of humans, animals and environment. However, in practice zoonotic disease control is predominantly aimed at protecting the health of humans. Animal and environmental health are only instrumental to safeguarding public health. As a result, the Netherlands operationalized One Health by structuring interdisciplinary collaboration in zoonotic disease control to protect public health.

This anthropocentric interpretation of One Health is also reflected in the moral presuppositions of human and veterinary health professionals involved in the Dutch Zoonoses Structure. The respondents convincingly point out public health as the most important value. Values related to animals or the environment do play a role in the decision-making process, but only a secondary one. At best, the effect of zoonotic disease control measures on animals and the environment is considered. However, in this approach public health is still the trumping value. These findings are consistent with reflections (Meijboom and Nieuwland 2018) and empirical research (Lysaght et al. 2017; Degeling et al. 2017) of other authors. Several scholars have promoted interspecies equity (Rüegg et al. 2017) or more-than-human solidarity (Rock and Degeling 2015) to emphasize the importance of including non-anthropocentric values in One Health strategies to combat zoonotic diseases. Our results show that apparently in practice this is not self-evident. The respondents

indicate that the most pressing conflict of interest in zoonotic disease control is that of public health versus the financial interests of the livestock industry, both human-directed values. These results are consistent with the findings of a historical analysis of dealings with zoonotic diseases of livestock in the Netherlands (Haalboom 2017).

We did not specify the meaning of the values that we presented in advance. Nevertheless, during the interviews we did not experience much difference in interpretation. Just a few times, we briefly discussed? the meaning of certain values, like autonomy. From this we conclude that interpretational differences did not affect the outcome of our results. In general, the values we presented were all considered as important factors in zoonotic disease control. For some values incorporated in the assessment framework of the Dutch Council on Animal Affairs, like social impact, contamination or landscape architecture, it is debatable whether these are actually moral values. In addition to our list of values, several respondents mentioned honesty, trust and transparency as core values in zoonotic disease control. On the one hand these values are regarded as a basic requirement for cooperation between different professional disciplines, on the other hand these notions are seen as necessary to establish societal support for difficult control measures. We therefore suggest adding these values to the assessment framework of the Dutch Animal Council to evaluate One Health strategies.

The Ambiguity of the Precautionary Principle

Regarding the use of ethical principles, the results illustrate that professionals in the current Dutch Zoonoses Disease Structure have little ethical knowledge. Just one ethical principle is dominantly present in the decision-making process: the precautionary principle. This principle is regularly invoked by policymakers to justify drastic zoonotic disease control measures, like culling of healthy animals (Mepham 2015; Bruschke et al. 2016). However, some respondents applied the precautionary principle to promote measures to prevent zoonotic diseases. Asked for the need and the nature of zoonotic disease prevention the answers differed. Many respondents (n = 7) said that improving farm biosecurity was important to prevent zoonoses. Vaccination of farm animals (n = 3) and early warning (n = 3) were mentioned less frequently. There was little attention for possible underlying causes of zoonotic disease outbreaks, although some respondents suggested drastic redesigning of animal production systems (n = 3), reducing the total amount of farm animals (n = 1) or separation of food production and residential areas (n = 1). Four respondents added that proportionality was an important prerequisite in the selection of disease control measures based on the precautionary principle.

The use of the precautionary principle is a much debated issue in public health ethics (Resnik 2004; Termeulen 2005). Although it is beyond the scope of this paper to fully analyze its application in zoonotic disease control, the respondents often present the precautionary principle as an objective tool to justify quick interventions in zoonotic disease control. However, as we can learn from the Q-fever outbreak in the Netherlands, in practice these interventions are often postponed for other reasons than lack of scientific evidence. For instance, the fact that the government needs to

underpin disease control measures to counter possible liability claims. Moral values like economy, privacy and animal welfare play a role in the decision-making process and therefore the precautionary principle is of course not morally neutral (cf. van den Belt 2003). Its use in zoonotic disease control confronts us with extra scientific value judgments and triggers questions like: which harm do we prevent, which measures do we apply if this (and the underlying causal relations) is not fully established? Therefore, in our opinion further research is needed to analyze the ethical implications of the use of the precautionary principle in zoonotic disease control.

Moral Status of Animals

To understand the respondents' basic attitude towards animals, we asked about their view on human–animal health and hierarchy. Moral convictions concerning animals influence people's judgements about disease control measures, like culling (Cohen et al. 2012). None of the respondents declared that humans and animals were equal. This differs remarkably with views of the general public, of which between 32% (Cohen et al. 2012) and 24% (Dutch Council on Animal Affairs 2018) consider humans and animal as equals because they think that humans and animals are both sentient beings and are all part of the natural world. Despite their preference, most respondents were convinced that in zoonotic disease control animal interests should be considered. In practice, the decision-making process is limited in this respect. Zoonotic disease control in the Netherlands is subject to strict EU regulations, in which human interests prevail. This can be explained from the fact that these regulations originate from the principle of liberal trade, one of the starting points of the European Union, and Dutch agriculture highly depends on its export position.

Even when regulations leave room for selection in disease control measures, as was the case in the Q-fever epidemic, our research shows that human interests are overriding. This can partly be explained by our respondents' background. These professionals all work in zoonotic disease control, where public health takes a central place (National Institute for Public Health and the Environment 2019). This context plays a significant role in the decision-making process. From their reactions on questions about human–animal relations it appears that our respondents, just like the majority of the general public, do attribute animals moral status. This implies that their interests should be taken into account, in other words animals are morally considerable. However, health professionals experience zoonotic disease risks differently than laypeople. Although the question remains whether this is only a matter of knowledge or of different world views.

Other research has clarified that within the general public there is a significant heterogeneity concerning values related to One Health strategies in zoonotic disease control (Johnson et al. 2019). Johnson et al. found that food security, animal welfare and economic development are all considered important values by the general public. Furthermore, in case of value conflicts people were willing to accept trade-offs between these different values. In certain situations, part of the general public seemed to tolerate a somewhat higher morbidity and mortality in humans in favour of other values like food security. Their findings also suggest

some willingness to accept certain burdens in order to ensure the health of animals and the environment (Johnson et al. 2019).

Our respondents however, work within a regulatory framework that prioritizes public health and economics. This is probably why they eventually value these interests more than animal interests, when making decisions in zoonotic disease control. The suggestion that attitudes towards animal interests are context dependent is also described elsewhere in literature (Cohen 2010; Knight et al. 2010; van Asselt et al. 2016). Besides context, animal species can influence the decision-making process as well. For instance, several respondents (n = 6) foresee a societal debate around the culling of companion animals and horses. While culling of farm animals is considered less controversial because these animals are destined to be killed anyway.

The dominance of human interests is reflected by the method of prioritization of zoonotic diseases, which the National Institute of Public Health and Environment has developed (Fig. 4). This risk score was based on seven criteria, reflecting assessments of the epidemiology and the impact of zoonotic pathogens on society. Criteria are weighed, based on the preferences of a panel of judges with a background in infectious disease control (Havelaar et al. 2010). The following criteria are part of the assessment: (1) probability of introduction into the Netherlands, (2) transmission in animal reservoirs, (3) economic damage in animal reservoirs, (4) animal–human transmission, (5) transmission between humans, (6) morbidity in humans and (7) mortality in humans. None of these criteria include features that are intrinsically directed towards animals or the environment. In this method animal disease cases are only measured in term of economic loss (criterion 3), while human morbidity and mortality count as separate criteria. In other proposals to rank zoonotic diseases, like the One Health Zoonotic Disease Prioritization tool (Rist et al. 2014), the disease burden in animals is also translated into economic costs only. This demonstrates that in this context animal and environmental interests are of secondary importance.

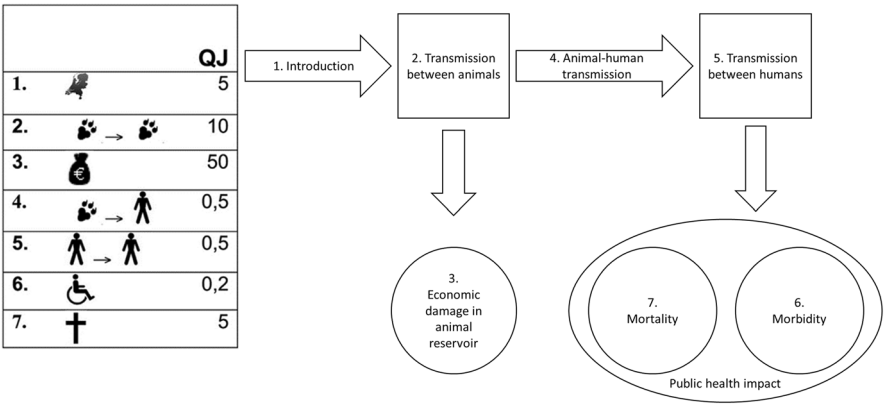

Fig. 4 Example of randomly created scenario used to determine relative weight (QJ) of zoonotic disease criteria. *Source*: NIPHE (2010)

Conclusions

In the Netherlands, One Health strategies in zoonotic disease control have translated into improvement of interdisciplinary cooperation to safeguard public health. This has resulted in a well-functioning system to detect zoonotic disease signals as soon as possible. However, the current Dutch Zoonoses Structure is not very well equipped to tackle the inevitable moral dilemmas that can arise in zoonotic disease control. It appears that in theory the holistic One Health paradigm is broadly supported amongst human and veterinary health professionals. In practice anthropocentric views are dominant. Public health and to a lesser extent economics are at the heart of current One Health strategies to combat zoonotic diseases. In general, animal- and environmental interests are subordinate to human interests. It is questionable whether society always shares this conception.

The assessment tool of the Dutch Council of Animals Affairs can be helpful to structure ethical decision-making but does not give guidance in ethical reflection. Moreover, values like honesty, trust and transparency which are at the core of interdisciplinary cooperation and societal acceptance, are not considered yet. Serious discussion of ethical issues should be an integral part of deliberations preceding decisions about measures to prevent and fight zoonoses. Although such discussions may not always make a difference to the final decisions reached, it is important in a democracy to ensure that the ethical assumptions underlying the decision-making process are transparent (cf. Wright et al. 2010). The role of ethicists includes identifying ethical dilemmas and corresponding moral values. Furthermore, they can facilitate ethical discussion by providing relevant ethical principles, analysis of arguments and considerations for action perspectives.

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Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethics Statement The study was carried out in accordance with the recommendations of the Social Sciences Ethics Committee of Wageningen University & Research, as confirmed by the chair of the Committee. All the respondents gave oral informed consent for anonymous use of the data for research purposes.

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