This is the published version of a paper published in *Infection Ecology & Epidemiology*.

Citation for the original published paper (version of record):

Reference values and the problem of health as normality: a veterinary attempt in the light of a one health approach.
*Infection Ecology & Epidemiology*, 4: 24270
http://dx.doi.org/10.3402/iee.v4.24270

Access to the published version may require subscription.

N.B. When citing this work, cite the original published paper.

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Reference values have been used to measure whether an individual is healthy or not since 1969, both in veterinary (1, 2) and human medicine (3). Reference values also refer to the concept of statistical normality or to statistically normal individuals. The concept of normality has been widely discussed within human medicine but much less within veterinary medicine (4).

Today, there is an ongoing discussion within veterinary medicine on the use of reference values and how they are defined (1, 2, 5, 6). The discussion surrounding the concept of reference values in human medicine has been going on for several decades, yet there seems to be no consensus on how to understand the theory behind them (7).

Nevertheless, despite these issues, reference values are used and new attempts arise to try to solve this problem of not having a proper theoretical foundation. Here, we want to analyze the linkage between the definition of reference values and the underlying definition of health, especially in the veterinary medicine paper written by Geffré et al. (2). We will here argue that the attempt to get rid of the ‘problematic’ concept of normality by replacing it with reference values fails, and we will show the circularity of the argument as well as the wider problem of referring to health as normality.

Method

Through a literature survey in the database Thomson Reuter Web of Science™ (performed November 24, 2011) papers were selected that analyzed the definition of reference values within veterinary medicine. Used keywords were ‘normality’ and ‘veterinar*’. The titles and abstracts were scanned for theoretical papers that dealt with the definition. Among these, a key paper (2) was identified and analyzed in depth through philosophical concept analysis.

Results and discussion

The importance of reference values has become more and more apparent. The reason appears to be that this concept is seemingly more specific and/or more easily defined than the concept of health or the concept of normality. Reference values have been used as a means to avoid the term ‘normality’ due to its many different connotations (2, 4, 6).

Geffré et al.’s (2) solution to avoid the concepts of health or normality is to state that exclusion and inclusion criteria can be more properly defined than whether an individual is healthy or not. Geffré et al.’s (2) solution unfortunately does not prove to be more adequate than earlier ones and we will here pinpoint their mistake.

Geffré et al. (2) define reference individuals in the following words:

Reference individuals are generally assumed to be ‘healthy’; however, health is relative and lacks a precise and quantifiable definition. Therefore, reference individuals are selected using ‘well-defined criteria,’ ie,
inclusion and exclusion criteria, which approximate health. Inclusion and exclusion criteria should be defined precisely, according to the aims of the study, and may differ from one study to another. The RI [reference interval] determined from the individuals selected according to the given criteria will be applicable only to similar individuals, i.e., only to individuals fulfilling the same criteria. (2, p. 289)

The well-defined criteria mentioned, inclusion and exclusion, are defined in these words:

These criteria are chosen so that only healthy individuals are included; individuals that are diseased, or do not belong to the reference population for whom an RI is being established, are excluded. (2, p. 291)

This means that the authors, in order to avoid the concept of health (which is relative and imprecise), instead connect reference values to inclusion and exclusion criteria which are based on healthy individuals, as if these were easier to define. The argument is circular because in the attempt to avoid the use of the term ‘health’ the notion of reference values is introduced, although this notion is based on the fact that we can have reference individuals/groups who must be healthy.

Lumsden (1) states that for a single disease and a single value, identifying inclusion and exclusion criteria might be an easy task to do. Further, Lumsden argues that for a single value there might be a possibility to use individuals that might have other diseases but not the particular disease state which is under consideration. This gives us several options to identify the individuals for the reference sample group.

1. The reference sample group needs to be healthy.
2. The reference sample group needs to have proper exclusion and inclusion criteria.
3. The reference sample group needs to be healthy with regard to a particular disease.

All three options seem to share similar types of problems. If we are unable to conclude that an individual is healthy, we still risk there being some disease that the individual has that could influence the reference value in a detrimental way.

‘Being healthy’ in this context does not refer to the status of an individual in its entirety, but rather to that individual being healthy in one specific aspect. Reference values are used only to determine whether someone is showing abnormal or normal values in respect to one quality. This entails that the ‘healthy’ individuals used as a reference group, only need to be considered healthy in this one respect, that is, having normal values on one scale.

Therefore, reference values cannot stand alone. They need to be based on a definition of health (2, p. 291). To consider an individual suitable as a reference individual, one needs to know whether it is healthy or not (3). Once again, it is important to point out that being healthy is still only in regard to one value. Once the reference values are established, other individuals can be compared to these values to see whether they are healthy or not. Still, one has to bear in mind that even healthy individuals can deviate from the stated reference values. Due to statistical procedures, 5% of the population, as Geffré et al. (2) puts it, shows ‘abnormal results’.

Therefore, before we decide what is healthy (or normal, or a reference value), we already must have identified a population of healthy individuals. This is problematic for veterinary medicine (as well as human medicine). Health can within veterinary medicine have different meanings, normality being one of them (4, 8). There is no consensus on which definition of health to use within veterinary medicine (2, 9), and the same holds for human medicine (2, 10).

The mere use of reference values implies that we are talking of health as normalcy, since without the idea of health as normalcy, one would not have anything to compare a clinical examination with (5). Even so, the attempts to replace ‘healthy’ or ‘normal’ with a reference value, really only confirm the image that veterinary medicine is based on the idea that being healthy equals being statistically normal. Only when deviating from the reference value, an individual is considered to be of ill health. The notion of equating health with statistical normality is problematic and has also been questioned in the field of human medicine (11, 12).

In order to deal with these issues, one needs either to avoid the talk of normality all together, aiming for other definitions of health, or to develop the idea of normality. In Gunnarsson’s study, normality (or abnormality) is referred to statistical normality (or abnormality) (8). Lerner and Hoffman (4) clarify that normality has been shown to have other interpretations within veterinary science and that there are even more meanings present within human medicine. It is suggested that:

Important distinctions [still] to make within veterinary medicine would, for example, be between normal as ‘normal distribution,’ as ‘most representative of its class,’ and as ‘most suited to survival.’ (4, p. 411)

To be able to solve this dilemma, one has to bring together the theoretical analysis of both human and veterinary medicine. This can be done in a one health approach, where both human and veterinary medicine are included and can share similar definitions.
Conclusion
At the moment there is no clear-cut definition of what a healthy, normal individual is. To have a clear-cut definition seems to be crucial for the understanding of reference values and their proper diagnostic use. There are two solutions: either to aim for a definition of health that does not rely on the notion of normality or to develop the idea of normality away from statistical normality. This may be done by using a one health approach, since one could argue that such an approach could provide a more stable theoretical foundation, having the same definition for both human and veterinary medicine.

Conflict of interest and funding
The authors have not received any funding or benefits from industry or elsewhere to conduct this study.

References