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An analysis of animal-based versus resource-based comments in official animal welfare inspection reports from organic and conventional farms in Sweden

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Abstract

This study analysed the free use of phrases related to animal-based and resource-based measures of animal welfare in Swedish state animal welfare inspection reports on conventional (C) and organic (O) farms. From 244 reports by 35 inspectors, 88 were analysed as matched pairs of C and O farms (same inspector, species and size of farm). They were analysed 'blind' for negative comments referring to the animals or to the resources (buildings and facilities). The most commonly reported deficiencies were poor body and hoof condition and dirty animals, accounting for a total of 79% of all animal-based remarks. Deficiencies in measures and equipment or excessively high stocking density together accounted for 78% of all resource-based remarks. The total number of general (non-compulsory) comments was similar for O and C farms. But the number of (compulsory) requirements for change to comply with legislation was almost twice as high for O than C. There were significantly more comments about body condition and hooves in C than O but a tendency for the opposite to be the case for animal health. Despite this, the number of requirements for change was greater for O-farms regarding their animals. There was no difference in number of comments on resources, but once more a tendency for more requirements for change was seen on O-farms. The study demonstrates that the analysis of inspection reports can be useful in terms of identifying where, in practice, animal welfare problems lie as well as further developing the methodology of animal welfare control.

Keywords: *animal welfare, control, farms, inspection, legislation, organic*

Introduction

In Sweden, as in other countries, concerns exist as to the practice and control of animal welfare. In 2006, new EU legislation came into effect that sought to standardise the control and enforcement of animal welfare legislation within the EU (EC 882/2004). This package of legislation is concerned with animal welfare, animal health, feed and food law. The emphasis is on risk-based control. At the same time, scientists are increasingly emphasising the importance of output measures (so-called animal-based measures) rather than input measures (resource-based or management-based measures) in the valid assessment of animal welfare in welfare assessment systems (Keeling & Veissier 2005; Main *et al* 2007). In Sweden, there is a nationwide network of state employed official animal welfare inspectors. The intention is that they should visit each inspection object (farm or animal facility) once every 3–5 years in order to check for compliance with animal welfare legislation. Following a visit, the inspector writes an official report and it is these that are analysed in this paper. In light of the move towards standardised systems of animal welfare control in Europe, this study, based on the analysis of these Swedish reports, tries to address some of the issues and potential problems that may arise in a wider European control system.

This project had three main aims. It was hoped an analysis of the topics or issues taken up in animal welfare reports would see the emergence of a clearer picture as to where the real animal welfare problems lie, ie where the deficiencies in satisfying animal welfare legislation tend to be found and whether or not these bear any relation to the research directed towards solving or reducing these problems. Secondly, by comparing the types of comments made in inspectors' reports from organic and conventional farms, it should be possible to determine if there are differences in areas of non-compliance with the animal welfare legislation across these styles of farming. Such a comparison would allow an exploration of the hypothesis that farmers in organic animal production tend to be more focused on their animals, whilst farmers with conventional animal production tend to focus on techniques, equipment and buildings (Segerdahl 2007). This hypothesis would lead us to predict fewer negative remarks by animal welfare inspectors relating to the animals on organic farms and fewer remarks

relating to the housing and facility maintenance on conventional farms. Thirdly, a further aim was to investigate any variation between what is written in inspectors' reports and, more importantly, how they express it: the relative proportions of negative remarks that could be termed animal-based, ie referring to the animal itself; its health, body condition, cleanliness etc, or resource-based, ie referring to features of the environment; space allowances, air quality etc or management-based, ie referring to management strategies or the handling of animals to be evaluated.

Materials and methods

Animal welfare inspectors in 26 rural communities in Sweden were contacted and asked to submit copies of their inspection reports from visits to organic (O) farms in the previous three years. A broad description of organic production was used, including farms that belonged to any of the registered national schemes. Once reports had been received from inspectors, lists of all non-organic farms in communities that had replied to our request were obtained from the Swedish Board of Agriculture. From these extensive lists of conventional (C) farms, we selected a short list of potential farms in each community of the same type (same species and number of animals) as the O-farm reported from that community. Organic poultry production is rare in Sweden and as we had not received reports from any of the organic broiler or egg production farms, poultry were excluded from this analysis. Inspectors who had contributed reports from O-farms were then sent a list with the names of the selected C-farms in their community, asking them if they had visited any of these farms in the previous three years. From the reports we received back regarding the C-farms, reports were matched to be a pair of farms (O and C) visited by the same inspector (in the same community) with the same type of production and approximately the same number of animals. The organic pig farms could not be matched sufficiently well, therefore the final analysis was of 68 beef farms, 12 dairy farms and 8 sheep farms.

The reports were then analysed in a semi-random order, 'blind', ie by an individual unaware which reports were from visits of O-farms and which were from C-farms. Although the writing style of the reports was known to vary considerably between inspectors (this being the reason behind our matched case control design) text referring to non-compliance with legislation was easy to identify, not least because it was usually associated with a date for a follow-up control visit. Thus, it was relatively easy to distinguish between negative general comments and statements referring to specific compulsory requirements for things to be corrected in each report. These 'General comments' in the text were analysed separately from the 'Specific requirements'.

Firstly, the report was read in order to identify and record any negative general comments referring to the animals': (i) body condition; (ii) overall health; (iii) hoof condition; (iv) coat, wool or fur condition; (vi) animals' cleanliness or (vi) any other comments negatively reflecting the welfare of the animal. These were referred to as animal-based measures. The same procedure was carried out for any comments referring negatively to the building and facilities where the animals were kept or could shelter, classified according to: (i) dimensions; (ii) hygiene; (iii) feeding equipment/facilities; (iv) fittings in the building; (v) density or (vi) ventilation/climate. These were called resource-based measures. Any comments referring to deficiencies in management or handling of animals which would have been called management-based measures were also noted, but these were rare and this category was not included further. As an example, a report saying that some animals were too thin and some light fittings were broken would result in one score in the general comments; animal-based measures, under the first sub-category (body condition) and one score in the general comments; resource-based measures, under the fourth sub-category (fittings in the building).

Secondly, the report was read to identify any specific requirements/actions that the farmer is required to take to correct a deficiency. The number of requirements, and whether they referred to something about the animals or something about the building were recorded. These were not divided into sub-categories. It is worth noting that a specific welfare problem could be referred to twice in the same report, ie the inspectors would write generally about the animals being dirty and then at the end demand that the farmer remove excess manure from the pens within the following two weeks. Such a report would result in one general comment; animal-based measure, in the sub-category cleanliness, and one specific requirement in the resource-based measure category. On the other hand, a simple specific requirement, such as the farmer must replace missing light bulbs, might result only in a specific resource-based requirement, but not be mentioned at all elsewhere and so have no associated general comment. For this reason, general comments were analysed separately from the specific requirements, within the same animal or resource category, since the total would not be meaningful. General comments regarding animals were, however, compared with general comments about resources, and specific requirements about animals were compared with specific requirements about resources.

Once the data was entered, it was re-coded in order to be anonymous. As might be expected, the majority of reports contained no general comments or specific requirements for change since the farm satisfied all the legislative requirements. For this reason, Wilcoxon signed rank, Chi-Square and Fisher's exact tests were used and total numbers of comments or requirements, rather than medians, are given in the text.

Results

Replies were received from 35 inspectors in 19 communities and a total of 244 reports from organic and conventional farms were received. However, this number was reduced when no sufficiently well-matched conventional farm had been visited by the inspector in question within the allotted timeperiod. Thus, a total of 88 reports, 44 matched pairs

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Table 1 Descriptive statistics of the total numbers of general comments and specific requirements on reports from animal welfare inspectors. Both are divided according to whether the comments concern animals or resources. The general comments on animals and resources are further divided into sub-categories.

	Organic farms	Convential farms	*P*-value
General comments			
Animals			
Cleanliness	11	12	0.83
Hooves	6	17	0.02*
Body condition	2	10	0.01**
Fur, wool	3	3	1.00
Other	2	3	0.77
Health	4	0	0.07(*)
Total general comments on animals	28	45	0.12
Resources			
Dimensions	17	17	1.0
Fittings in buildings	15	9	0.30
Density	15	7	0.06(*)
Hygiene	4	6	0.57
Ventilation, climate	2	5	0.2
Feeding climate	5	1	0.07(*)
Total general comments on resources	58	45	0.33
Specific requirements: total on animals	22	8	0.04*
Specific requirements: total on resources	51	29	0.06(*)
General total	86	90	0.75
Specific total	73	37	0.005**

The last three columns show differences between organic and conventional farms and the *P*-value of the comparison using a Wilcoxon signed rank test. ** $P < 0.01$; * $P < 0.05$; (*) $P < 0.1$.

(same inspector, same animal species and approximately similar size of farm) of O and C farms contributed to the final analysis. The mean number of matched pairs per inspector was 3.14.

In total, there were 73 general comments recorded about the animals themselves and 103 about the buildings and equipment. The total number of general comments ranged from zero-to-seven on any one farm. In total, 30 specific requirements for correction referred to the animals and 80 referred to the buildings and equipment. The total number of specific requirements for correction ranged from zero-to-six on any one farm. Cleanliness (total = 23), hooves (total = 23) and body condition (total = 12) were the most commented upon deficiencies regarding the animals (animal-based measures) accounting for 79% of all animal remarks. Whereas measurement shortfalls (total = 34), equipment (total = 24) and stocking density/space allocations (total = 22) were the most commented upon environmental and equipment aspects (resource-based measures) accounting for 78% of all remarks on the building or facilities (Table 1).

Comparison of organic and conventional farms

With regard to the general comments about the animals, there were significantly more comments about body condition in conventional farms (C) than organic farms (O) (total C = 10, total O = 2; $P = 0.01$) and animals' hooves (total C = 17, total O = 6; $P = 0.02$), and a tendency for the opposite, ie more comments on O farms regarding animal health (total C = 0, total O = 4, $P = 0.07$). There were no significant differences between other sub-categories of animal-based measures.

With regard to general comments about the building and equipment, there were no significant differences between O and C farms for any of the sub-categories, but there were tendencies for more comments about feeding (total C = 1, total O = 5; $P = 0.07$) and space allowances (total C = 7, total O = 15; $P = 0.06$) on O farms.

The number of requirements for change was greater on O than C farms regarding animals (total O = 22, total C = 8; $P = 0.04$) and there was a tendency for more requirements for change regarding resources on O compared to C farms (total O = 51, total C = 29; $P = 0.06$). It is worth noting that

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Table 2 Descriptive statistics of the total number of general comments (animal- and resource-based) on organic (O) and conventional (C) farms.

Inspector	General comments			Specific requirements		
	O	C	*P*-values	O	C	*P*-values
1	6	4	0.7516	0	0	–
2	4	8	0.3908	4	1	0.3768
3	4	2	0.6902	3	1	0.6282
4	6	3	0.5257	6	2	0.2894
5	3	7	0.3448	3	2	1
6	43	21	0.0095	46	18	0.00005
7	0	1	1	0	1	1
8	0	5	0.0595	0	1	1
9	13	34	0.005	8	10	0.8086
10	0	0	–	0	0	–
11	3	3	1	0	0	–
12	1	1	1	1	0	1
13	2	0	0.4803	2	0	0.4908
14	1	1	1	0	1	1
Joint *P*-value			< 0.001			0.005

Separate *P*-values for two-sided exact χ^2 tests of a difference between the O and C farms as well as a joint *P*-values for all the inspectors derived by multivariate permutation with the Fisher omnibus combination function. *P*-values cannot be calculated if the inspectors gave no comments at all.

even though more general (non-compulsory) comments referred to conventional farms (45 compared to 28; ns) the number of specific requirements shows the opposite effect (22 requirements on organic farms compared to 8 for conventional farms; $P = 0.04$). And, although not independent, the numerical relationship of specific requirements to general comments, when combined for conventional and organic farms, was much lower for animal-based measures (30/73; 41%) than it was for resource-based measures (80/103; 78%). This meant that even if inspectors had mentioned animal-based measures to a similar extent as resource-based measures in their general comments, they were less likely to frame a specific requirement in the form of output requirement related to the animals themselves. Instead, most specific requirements were formulated as an input measure, related to the building or the equipment.

Comparisons between inspectors

Different inspectors showed differences in the style of their reports. This was expected and was the reason behind the matched-pair design. Reports from 14 different inspectors were therefore included in the analysis to further investigate this and pay specific attention to whether there were differences between inspectors in the number of general comments or specific requirements they made dealing with the animals (animal-based measures) and the building or equipment (resource-based measures), as well as in the manner in which they assessed organic versus conventional farms.

Differences in the number of general comments and specific requirements

For ease of analysis, each inspector was classified according to the number of general comments they had on the different farm visits and according to the number of specific requirements. The tables were then analysed using a Fisher's exact test for independence between the number of general comments (or specific requirements) per farm and inspector, ie equivalent to independence between columns and rows in the table. A statistically-significant test indicates a difference between inspectors in the number of general comments (or specific requirements) that they give. There were significant differences between inspectors in both analyses: a highly-significant difference ($P = 0.0002$) when the number of general comments per farm was compared and a significant difference when the number of requirements was compared ($P = 0.023$).

Differences between inspectors remained even when general comments were divided according to whether or not they were animal-based ($P = 0.0013$) or resource-based ($P = 0.0003$). The differences between inspectors did not remain when this division was repeated with specific requirements for improvements related to an animal-based measure ($P = 0.689$) but there was a trend towards differences between inspectors with regard to specific comments related to improvements in a resource-based measure ($P = 0.074$). These final four analyses were based on tables with only three columns each, corresponding to 0, 1, or > 1 general comments (or specific requirements) per inspector.

Differences when visiting organic and conventional farms

A similar comparison to that presented above was made to see how inspectors commented upon organic and conventional farms regarding the total number of general comments concerning the animals or buildings per farm and regarding specific requirements. For each inspector, an exact χ^2 test of proportions was used to investigate whether the distribution of the general comments between the O and C farms was significantly different from that of 50% in each category (two-sided test). Two of the fourteen inspectors were significantly different in their judgement of O and C farms and one showed a strong tendency to judge them differently (see Table 2). Since these results may have occurred by chance, due to multiple testing, a joint *P*-value was derived from the separate *P*-values by a multiple permutation test with Fisher's 'omnibus' combination function (Pesarin 2001). In 1,000 re-sampling rounds, the total number of general comments given by each inspector was redistributed over the categories O and C so that each general comment was classified as belonging to O with probability 0.5 and C with probability 0.5. The true value of

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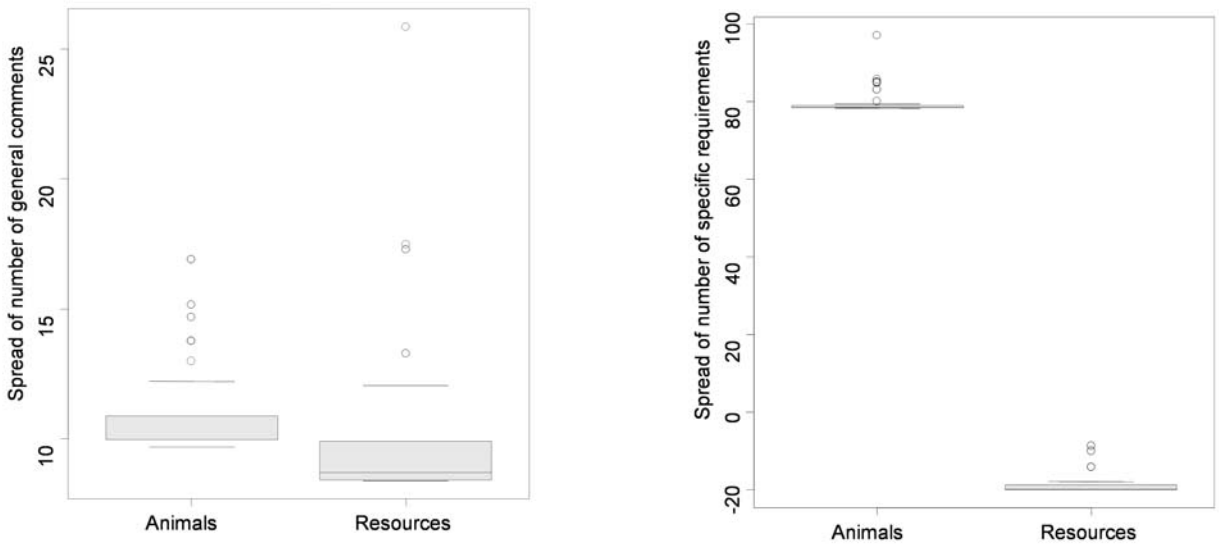
Figure 1



Boxplot of contributions of each farm-corresponding number of general comments (left) or specific requirements (right) to the variance within inspectors of the number of specific requirements or general comments on animals and resources respectively, on a log scale. The boxes range from the first to the third quartile, including the median bar. Whiskers extend to the most extreme data point.

the combination function was compared to the empirical distribution of the 1,000 equivalent values from the permuted datasets. The resulting joint *P*-values of $P < 0.001$ showed an overall significant bias for inspectors to assess organic and conventional farms differently although the pattern of the bias in judgement was remarkably even across all inspectors; five inspectors had more comments on O farms, 5 more comments on C farms and 4 equal numbers of comments. Repeating this analysis with specific requirements showed a similar pattern. Although only one inspector was highly biased against organic farms, when all inspectors were included in the analysis, there was an overall significant bias ($P = 0.005$) to give more specific requirements for change to O farms.

Variation within the same inspector

A final analysis investigated the variation/consistency between reports by the same inspector. This analysis showed a significantly greater variation in number of general comments about the animals by the same inspector than there was around the number of general comments referring to the buildings or equipment ($P = 0.0001$). A similar analysis for specific requirements also showed a highly-significant difference in variation ($P < 0.0001$). For this analysis, we used an asymptotically distribution-free test for dispersion based on the jack-knife — medians not necessarily equal — analysis of Miller (Hollander & Wolfe 1999). We corrected the analysis for the different medians in the number of animal-based comments and resource-based comments, as well as for the different means in the number of comments given by different inspectors (Figure 1).

Discussion

This study shows that it is possible, despite the lack of a standardised report-writing format, to analyse reports from animal welfare inspections to answer specific questions. For example, the results show that the most common animal welfare problems encountered in practice in Sweden during routine official inspections are to do with dirty animals, the condition of their hooves and, to a lesser extent, poor body condition. This might imply that efforts in Sweden to improve farm animal welfare could be targeted most usefully in these areas. One could speculate whether these topics should be the focus of more research attention or whether it would be better to investigate why, despite our effective understanding of the causes of these particular welfare problems, they are still so prevalent in practice.

This study also shows that it is possible to interpret free phrasing about animals and their housing as comments that could be regarded as dealing with animal-based measures and comments that could be regarded as referring to resource-based measures. The results are now discussed in the light of a specific prediction that organic farms would have fewer deficiencies related to their animals and conventional farms fewer deficiencies related to the buildings and equipment. The overall findings from this study on animal- and resource-based measures and what they might mean for a more standardised control of animal welfare across the EU are also discussed.

To a certain extent, the prediction that there would be fewer overall comments about the state of the animal themselves on organic farms versus conventional farms and fewer

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comments about equipment and housing in conventional farms versus organic farms was observed, although in neither case was this difference significant. More specifically, and in keeping with the hypothesis, significantly fewer comments about body and hoof condition were made on organic farms, although there was a trend towards more negative comments regarding animal health on organic farms. Also, in keeping with this assertion, there was a trend towards fewer comments related to feeding and space allowances on conventional farms. These results would support the view that a number of aspects of welfare are better on organic farms and others better on conventional farms and that the findings here can be explained in the light of other research in these areas. For example, the provision of straw bedding on organic farms and the requirement that animals are put out on pasture probably contributed to improved hoof health (Loberg *et al* 2004; Norring *et al* 2008) and the emphasis on optimal output rather than maximal output, in combination with the use of slower growing breeds, may have contributed to fewer animals in poor condition on organic farms. On the negative side, it seems that the restrictions on the use of antibiotics in organic production may be having a negative effect on animal health (as found for mastitis in the first two years after conversion by Vaarts *et al* 2003). Less expected was the trend to more negative comments related to stocking density in organic farms, since space allowances on organic farms tend to be more generous. The tendency towards more comments related to feeding equipment was also unexpected since any deficiencies in feeding space would be expected to have been reflected in more poorly conditioned animals whereas body condition was judged to be better on organic than conventional farms.

Despite the above, when it came to the specific requirements, ie points that the farmer had to address within a specified timeperiod, it was the organic farms that had significantly greater numbers of negative comments, both animal- and resource-based. The total number of general comments was similar for O and C but the number of specific requirements was almost twice as high for O than for C. This effect is perhaps not surprising for the resource-based measures since, numerically, the same was seen for general comments. However, this comes as a surprise when it comes to animal-based measures, since five-out-of-seven sub-categories of measures showed conventional farms receiving most general comments and in two cases this difference was significant. In only one sub-category did the organic farms receive more negative comments than the conventional and that was with regard to animal health, although this did tend towards significance.

One interpretation is that organic farms justified their overall higher level of specific requirements for changes because welfare was genuinely poorer on these farms. However, if this was the case, one would also have expected more general comments about problems on organic farms, which did not prove to be the case, at least not for comments about the animal themselves. An alternative interpretation therefore is that inspectors, despite there being no overall difference in general aspects of welfare to comment upon, were actually stricter when it came to specifying that changes had to be made on organic farms. There might be two possible reasons for this. The first reason could be that experience had shown that it was necessary to enforce a change for an organic farmer, or, alternatively that they trusted conventional farmers to make the necessary changes without it needing to be enforced. The second reason might be a consequence of the methodology whereby only the number of general comments on the report was analysed rather than their seriousness. Thus, potentially, the situation may have been that conventional farms had a large number of smaller deficiencies whereas organic farms had fewer more severe deficiencies.

The analysis of the variation between inspectors supports the interpretation that inspectors are treating organic and conventional farmers differently in terms of specific requirements for change. Even though some inspectors had fewer general comments on organic farms and more on conventional and others the reverse, all gave more specific requirements for action to organic farms. Caution should be applied since these two analyses were performed on the same data set, but it does imply that even those inspectors who gave more negative general comments to conventional farms switched when it came to the more serious comments and ultimately gave more specific requirements for change to the organic farmers. One aspect to follow up might therefore be differences between organic and conventional farmers in their willingness to make changes in response to negative comments by the animal welfare inspector, irrespective of whether or not it is legally required of them. A second cautionary note refers to the matching process itself. While matching facilitated this new analysis of animal welfare control methods, it cannot be excluded that it biased which organic and conventional farms were included. For example, of the 88 farms analysed, ultimately there were no poultry and pig farms. If the aim of a follow-up study is specifically to compare the welfare of animals on organic and conventional farms, then it will be important to ensure that the farms whose reports are analysed are representative of their respective category in terms of species, number of animals and husbandry system.

The variation between inspectors was significant, both for the number of animal-based general comments and the number of resource-based general comments. There was also a greater variation between inspectors in the resource-based specific requirements for change but not in the animal-based specific requirements. In analysis, a large within-treatment variation can mask variation between treatments. This is unlikely to be the case here since the analysis on the variation between inspectors was based on total number of comments and is not taking into consideration the number of visits or the variation in the number of comments across those visits. A possible reason for the lack of variation between inspectors in specific requirements for change related to animal-based measures becomes clearer when one considers the large variation within inspector and the fact

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that this variation was greatest when concerning animal-based measures. It is tentatively suggested that an awareness of this inconsistency may make inspectors less confident and therefore less likely to make a specific requirement for change which has legal as well as possible economic consequences for the farmer, using an animal-based measure. No such consequences exist for taking it up in the general comments.

This lack of a significant difference between inspectors in animal-based assessments, should go some way towards reducing concerns about using animal-based measures as part of animal welfare assessment and control on an larger scale, perhaps throughout Europe. Although one should be concerned if this reason is a lack of confidence when using it in a legally-enforcing situation. Conversely, the fact that there was a significant difference between inspectors in specific requirements for change when resource-based measures are used should be of concern, as it implies that confidence in the reliability of resource-based measures may be misplaced. Both results build a strong argument for the importance of training official inspectors to build confidence and reduce variation both between and within inspectors.

Conclusion

This study demonstrated that analysis of inspection reports can be a potentially useful way forward in not only identifying deficiencies in current inspection methods but also in helping show where effort could be best directed if official control of animal welfare is to be used more widely. It is also a way to test whether or not criticism of current methods is justified. For example, this study found that while concern about variation between inspectors is justified, the belief that the problem lies in the assessment of animal-based measures was not supported. Rather, it appears that inspectors were cautious about making specific requirements based on animal-based measures, tending instead to rely on resource-based measures. The fact that we even observed significant variation here implies either that visits should be more structured than is current practice in Sweden or training to improve reliability is needed. The finding that non-compliance was greater regarding animal welfare legislation on organic farms is something organic organisations should investigate further. Last, but by no means least, it appears that the areas in which welfare is most deficient on farms are for those things not very high up on the research agenda for researchers. This may reflect a need for a re-evaluation of research priorities or a consideration of why much of what is thought to be already solved by researchers is not implemented in practice.

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