Report of the second RSPCA/AHVLA meeting on the welfare of agricultural animals in research: cattle, pigs, sheep and poultry

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Introduction

This meeting was jointly convened by the RSPCA and AHVLA, to bring together animal technologists, researchers, veterinarians and students with an interest in the welfare of cattle, pigs, sheep and poultry used in research and testing, for a programme of talks and discussion sessions. The meeting, which was held in September 2014, addressed a range of topics including refining endpoints in avian influenza studies, reducing farm animal numbers in research, pain management in pigs, housing refinements for singly housed pigs, the use of cortisol levels to predict farm animal welfare, promoting positive welfare for chickens and replacing ewes in education and training. A discussion session on positive welfare in farm animals concluded the programme.

Refining endpoints in avian influenza studies

Sharon Brookes, AHVLA

Avian influenza (AI) is caused by viruses of the family Orthomyxoviridae, in the genus influenza A virus. Many species of bird are susceptible to infection with influenza A viruses, including aquatic birds (a major reservoir), chickens and turkeys. Most isolates in chickens and turkeys have been of low pathogenicity (LP, low virulence) but some influenza A viruses can be highly pathogenic (HP), causing morbidity and devastating mortality.

Outbreaks of avian influenza present significant animal health and welfare, economic and human health concerns, so research that aims to improve the understanding, diagnosis, treatment or prevention of the disease is essential. However, some of this research has the potential to cause severe suffering, which is an ethical and animal welfare concern for us.

The outcome of infection with the HP virus depends upon the bird's species and age, characteristics of the viral strain involved and environmental factors. There may be sudden death, preceded by few or no overt clinical signs or birds may contract a more characteristic infection with variable clinical presentations including respiratory signs, swelling of the sinuses and/or head, apathy, reduced vocalisation, markedly reduced feed and water intake, nervous signs and diarrhoea. Egg production can be markedly reduced in laying birds.

These clinical signs are associated with AI but they are not *pathognomonic*; that is, they are not definitive indicators of the disease. The level of variability in responses also presents some real challenges for veterinary inspectors in the field and for scientists in experimental situations. All naturally occurring virulent strains isolated to date have been either of the low virulence H5 or H7 subtypes but these may mutate and become virulent.

This means that a risk assessment has to be carried out to determine the level of biosecurity needed for laboratory diagnosis and poultry inoculation, with characterisation of the HPAI and other Notifiable Avian Influence (NAI) viruses at biocontainment level (BCL) 3 and other LPNAI at BCL level 2 (at least). The AHVLA avian virology and mammalian influenza team carries out a small number of diagnostic pathogenicity studies such as Intravenous Pathogenicity Index (IVPI) studies but most of our *in vivo* studies involve infecting poultry species with avian influenza (HP and LP) viruses to determine susceptibility, pathogenicity, transmission and/or disease intervention. A specialist area of interest has been cross-species transmission in avian hosts. These data collectively provide evidence for assessing risk of disease introduction and dissemination within the UK poultry industry, plus informing control strategies and business continuity.

AHVLA uses around 600 birds in AI studies per year (i.e. 200 chickens, turkeys and ducks) and over the last five years we have worked to refine humane endpoints and establish indicators of mortality with the objective of reducing the numbers of 'sudden deaths' to a minimum. One obvious approach was to increase the frequency of clinical observations, with three assessments per day, for virus-host combinations with the potential to cause severe disease, especially in the case of pathogens such as HPAIV where birds often transition rapidly from inapparent clinical disease to sudden death. We also introduced a binary score sheet for these studies (Figure 1) which has helped to reduce the number of birds found dead and increase the number of sick or moribund birds humanely killed during the course of experiments.

***Annex 3* Poultry record Sheet**

VI6 work group

Project number:

Project title:

Personal licensee responsible for animals:

Group name: Box no. Inoculated with:

Indicate presence of a sign with a (+)

	Date						
	Day						
	am. / pm.	am pm	am pm	am pm	am pm	am pm	am pm
A	***Physical/Behavioural***						
1	Huddling / ruffled feathers						
2	Eyes closed						
3	Dropped wings						
4	Oedema (swelling)						
5	Cyanosis (blue discolouration) of the comb and wattles						
B	***Respiratory/Enteric***						
1	Discharge eyes or beak (mucus)						
2	Diarrhoea						
3	Visual reduction in weight gain/weight loss						
C	***Neurological***						
1	Loss of balance						
2	Tremors						
3	Torticollis						
4	Paralysis & inability to eat or drink						
	Signs/death – Bird ID Euthanized (E) Found Dead (FD)						
	Initials						

ALL ANIMALS MUST BE CHECKED AT LEAST TWICE DAILY

Any bird showing more than one of signs in A, B or C persisting for more than 24 hours will be examined by the NVS

Any bird showing either C3 or C4 will be examined by the NVS immediately

Figure 1. Poultry record sheet used during Avian Influenza

This is a step in the right direction but we want to achieve further refinements with respect to identifying indicators of mortality and implementing humane endpoints. Body temperature has been successfully used to reduce mortality in mammals such as rodents, pigs and ferrets in disease and vaccine development research and we are exploring the potential to use this indicator in poultry. In the case of AI, we have used thermal imaging to establish that increasing pyrexia is followed by a rapid decrease in body temperature as the clinical score escalates. This area is being further investigated via both thermal imaging and biothermal microchip profiling, to gather baseline data and trial adaptations for BCL3 usage. We are also making progress with alternative techniques such as *in ovo* and *ex vivo* organ culture models, whilst we continue with our efforts to refine study protocols and reduce severity.

Could reproductive technologies reduce farm animal numbers in medical research?

Susannah Parkin and Jennie Litten-Brown, Canterbury College

Sheep are currently used in many areas of biomedical research including cardiovascular studies, kidney dialysis research and the development of artificial lungs. Transgenic sheep are also used in 'pharming', in which animals are genetically modified to produce pharmaceutically active compounds in their milk, such as factors IX and VIII to treat haemophilia, human protein C to treat thrombosis and cystic fibrosis transmembrane conductance regulator (CFTR).

A total of 45,790 sheep were used in regulated procedures in the United Kingdom in 2013, a 7% increase on the previous year.[1] Given this increase, it may be useful to consider whether the number of sheep used in medical research might be reduced using reproductive technologies (RT) such as:

1. Sexing semen (SS).
2. Artificial insemination (AI).
3. Intracytoplasmic sperm injection (ICSI), an *in vitro* fertilisation procedure in which a single sperm is injected directly into an egg. This procedure may be used for the production of transgenic animals.
4. Embryo transfer (ET), the process by which fertilised embryos are flushed (removed) from a source ewe and transplanted into recipient ewes.
5. Stem cells (SC), undifferentiated cells that can produce other cells that eventually make up specialised tissues and organs. There are two major types of stem cells; embryonic and adult.
6. Nuclear transfer (NT), which was used to produce the first 'cloned' mammals. The nucleus of a somatic cell is transferred into an egg cell whose own nucleus has been removed, which is then stimulated by an electric shock to divide and form an embryo.
7. Transgenic (TG) animals, who have had one or more genes inserted into their genome from the genome of another species.

These techniques could be used to either accelerate the process of breeding farmed species or reduce animal numbers. This might include reducing wastage, if a particular sex is required; or reducing numbers by facilitating more predictable growth and development. Other applications could comprise improving disease control; producing animals with a known response to anaesthesia; or compacting lambing time – which could shorten trial length and reduce numbers due to reduced impact of environmental variants. Cloning could be used to eliminate genetic variation.

The use of sheep in orthopaedic research may be taken as a case study. Sheep bone is anatomically close to human bone, so sheep are used to evaluate orthopaedic techniques such as developments in intramedullary nailing, which is the standard method of internally stabilising closed diaphyseal long-bone fractures.[2] Current protocols for treating humans with such fractures involve immobilisation and surgery to facilitate bone healing but continuous monitoring of changes in the load distribution between the implant and surrounding bone could inform interventions and improve patient outcome. Sheep have been used to evaluate a telemetric strain gauge positioned within the intramedullary nail.[3] If crossbred sheep are used in such studies, there are likely to be significant variations in relevant traits. Using purebred sheep and RT (AI and ET), may give rise to animals with more consistent bone structures, enabling experimental group numbers to be reduced.

Although there is potential to reduce animal numbers using RT, many techniques involve procedures that can cause pain and distress. For example, obtaining gametes, preparing females for pregnancy, insemination procedures and removing embryos can involve restraint, anaesthesia and surgery. Health and welfare concerns have also been reported for transgenic and cloned animals. These potential harms need to be weighed against the benefits of reducing animal numbers for each project.

In conclusion, once the technologies have been developed to a stage where they can be used repeatedly and consistently, RT could be used to reduce the number of farm animals in some studies. However it is worth noting that whilst these technologies may be used to reduce numbers, that is not always the preferred option if harms to individual animals are increased.

Pain management in pigs undergoing experimental surgery

R. Eddie Clutton, University of Edinburgh

Estimated numbers of pigs used recently (2011 – 2013) in biomedical research are 53,260 (Canada) 61,384 (USA) and 77,280 (EU).[1] A proportion of these animals are involved in experimental surgical studies conducted under general anaesthesia, some of which are terminal (or 'unclassified') while others involve recovery. Recovery procedures carried out on pigs are associated with postoperative pain in human patients, so the animal 'model' should be treated in a similar manner to the 'modelled' (i.e. humans) and provided with appropriate perioperative analgesia. This reflects legal requirements to reduce or eliminate suffering[4] and helps to improve the translational value of the research, since human patients receive pain relief. From an ethical standpoint, it is also an injustice to use animals in scientific procedures without ensuring that all available refinements have been fully implemented.

We aimed to evaluate whether the 'model' and 'modelled' were receiving a consistent standard of care, by conducting a structured literature review of perioperative pain management in the pig (Bradbury et al. submitted).[5] The results are soon to be published in the journal *Laboratory Animals*,[5] so a brief overview will be set out in this report.

A total of 233 papers described recovery surgery procedures, using pigs, which would have been painful for humans. Postoperative analgesia was explicitly described in just 87 studies (37%). Postoperative pain assessment was described in 10% of papers and only one article described the use of a pain scoring system.[6] Six articles which described the use of analgesics gave no information on the drugs involved, including their identity and only 20 included all of the information on analgesic agents recommended by the ARRIVE guidelines,[7] which set out good practice for reporting animal use (the name of the drug, dose, frequency, route and duration of treatment).

Our study showed that the reporting of postoperative pain management for pigs involved in biomedical research is poor and falls short of the level of detail necessary for study replication. This of course raises the question of whether analgesia is actually not provided or its use is simply not reported. Unfortunately, it may be that the situation as reported does reflect current practice. In a similar study of analgesia reporting in rodents, the authors contacted researchers who had not included information on pain relief in their publications, to ask whether they had administered analgesia but had not described the regimen in the materials and methods section.[8] They found that in 71% of cases, analgesia had not in fact been given. If this is also the case for pigs, this would indicate a serious animal welfare concern in many of the procedures described in the literature.

Housing refinements and enrichment for single housed pigs

Peter Gade, Novo Nordisk

Many pigs used in biomedical research undergo instrumentation with a device to facilitate dosing or sampling, such as ear vein catheters or access ports. This makes group housing quite a challenge, as the inquisitive nature of the pig increases the risk of another pig manipulating, damaging or even removing the device. Once the device is inoperable, the animal can no longer be used, so single housing is often necessary to prevent pigs from being wasted and to avoid any pain or distress caused by other animals interfering with devices.

For naturally gregarious animals, like the pig, single housing is undoubtedly a welfare problem. At our facility we have successfully introduced refinement initiatives to improve the welfare of singly housed pigs, while achieving the scientific objectives. We designed the pens so that the pigs do not feel isolated, using clear Perspex dividers with holes of 10 cm diameter drilled into them so that animals can have visual, olfactory and tactile contact with their neighbours (Figure 2). Chains for pulling are also set up so that an animal pulling the chain in one pen causes the other end to move within the neighbouring pen (Figure 3).

Figure 2. Snout-to-snout contact between pigs in neighbouring pens
Photo credit: Novo Nordisk

Figure 3. Chain enrichment for singly housed pigs
Photo credit: Novo Nordisk

We also make good use of the areas adjacent to the home pens. Pigs are allowed supervised exercise times with other animals, both in corridors between the pens and outdoors in a designated exercise area, as shown at http://tinyurl.com/pfc75z8. This clip also shows outdoor enrichment in the form of brushes and a paddling pool which has since been filled with bark chips which the pigs use for rooting (the pigs shown in the video are not individually housed, as they have no exteriorised instrumentation). Pigs regularly spend time outdoors for as long as the weather permits this, although we cannot always let them out in cold weather and we have to make sure that they do not get sunburn in the summer.

There are some increases in both staff workload and cost associated with these refinements but in our view, these are by far outweighed by the increased welfare for the animals.

Can cortisol levels really predict the welfare of farm animals?

Julie Lane and Fiona Bellamy, National Wildlife Management Centre, AHVLA

Stress is an important consideration with respect to farm animal welfare and disease control. On-farm outbreaks of diseases, such as campylobacter in chickens, are suspected to be more common in situations where there are higher levels of stress and laboratory studies have demonstrated that chronic stress reduces the body's ability to fight a variety of virus and bacterial infections. So an effective and objective indicator of stress for livestock, in a commercial setting, is vital for economic as well as animal welfare and ethical reasons. Robust indicators of stress are also essential for farm animals used in scientific procedures with respect to designing and evaluating refinements, defining and implementing humane endpoints and assessing the actual severity of procedures.

Behaviours can be important and useful indicators of stress but can also be difficult to interpret and to measure objectively. There are many physiological indicators that a body is under stress, which lend themselves to more objective measurement but these often require instrumentation of the animal or restraint and blood sampling – both of which can cause stress to the animal, affecting the integrity of the data collected. There are also usually financial and temporal constraints that limit the number of indicators that can be assessed. It is important, therefore, to develop reliable, appropriate and accurate indicators of animal welfare.

It has been established for nearly half a century that stressful experiences cause the synthesis and release of glucocorticoids, such as cortisol or corticosterone, from the adrenal gland. It used to be necessary to obtain blood samples to measure glucocorticoid levels but non-invasive techniques have been developed including the analysis of saliva and faeces. We have used these methods to assess levels of cortisol in a wide variety of farm animals under many conditions and shown that cortisol can be an effective and accurate tool for assessing stress. For example, a study of sheep welfare during transport involved two groups of sheep transported by drivers using either a 'forward', aggressive or a 'defensive' driving style. There were no significant differences in behavioural responses or heart rate between the two groups of sheep but salivary cortisol levels were significantly increased following transport in the sheep driven by the 'aggressive' haulier.

In the above example, it was the cortisol levels that showed animals were stressed, when other indicators were not significantly increased. This makes measurement of cortisol an attractive tool for helping to assess welfare. In addition, cortisol levels are not affected by an animal's social standing or normal levels of exercise or by diet.

However, the use of cortisol is not without its issues and caveats, which need to be identified and explored before use of these techniques is considered. For example, levels can be affected by blood sampling, anaesthesia, an animal's age or sex, pregnancy, infertility and the time of day, as cortisol rises and falls according to circadian or ultradian cycles depending on species. It is essential to understand how all of these factors interact and affect cortisol level data, especially now that the technology is becoming increasingly more sophisticated, enabling very small concentrations to be measured in animal by-products such as hair and milk. The answer to the question *Can cortisol levels really predict the welfare of farm animals?* is therefore yes – provided that the context for the data is clearly understood and results are properly interpreted.

Measuring positive emotions in dairy cattle

Helen Proctor and Gemma Carder, World Animal Protection

A sentient animal can consciously experience both positive and negative emotions. As a result, their feelings matter, to both the animal and to us. The importance of promoting positive emotions in animals, as well as, avoiding or minimising the negative emotions, is increasingly recognised.[9,10] Despite this, we still know very little about the subjective minds of animals and much of what we do know is focussed on indicators of negative experiences and emotions such as pain and suffering.[11] In 2013 we published a systematic review of the scientific literature where we searched for evidence of animal sentience.[10] We found that not only is animal sentience more accepted than is often thought to be the case but most of the sentience traits utilised in research were negative ones such as pain, fear and anxiety. Knowledge of negative states in animals is important for improving animal welfare but this is only part of the issue. We still need to develop our understanding of positive emotions and how animals express these, so that we may promote and assess positive emotional states in the animals under our care.[12]

Emotions are subjective and personal states and are therefore difficult to interpret and measure; especially in animals, as we do not have a shared language. However, animals do feel, experience and communicate emotions – in fact, emotions are essential in enabling animals to communicate with one another, interpret situations correctly and facilitate appropriate responses.[11]

In this study we sought reliable measures of positive emotions in dairy cows, testing the suitability of ear postures as a reliable measure of a positive, low arousal emotional state in cattle. To elicit this state we emulated allogrooming in 13 habituated dairy cows by stroking them on regions of their head, neck and withers that have been shown to be preferred areas during both allogrooming and stroking,[13,14] at the rate allogrooming typically occurs.[13] Stroking calms cattle and has been shown to reduce cortisol levels[15] and heart rate.[16] The stroking stimulus was performed only to habituated cows and on a voluntary basis, as the cows were able to move away at any point and were not pursued or followed.

This study is in press elsewhere[17], so a brief overview of the conclusions will be presented here. We analysed video footage from the focal observations and found four distinct ear postures (Figure 4 a-d). The duration of time spent in each of the postures was significantly affected by the stroking stimulus. The 'alert' ear postures 1 and 2 (EP 1 & EP 2) were performed for significantly less time during the stroking segment and the 'relaxed' ear postures 3 and 4 (EP3 & EP4) were performed for significantly longer during the stroking segment. The positive, low arousal stimulus therefore caused significant differences in the time spent in each of the four ear postures.

a: Ear posture 1 (EP1)

b: Ear posture 2 (EP2)

c: Ear posture 3 (EP3)

d: Ear posture 4 (EP4)

Figure 4. Ear postures associated with 'alert' and 'relaxed' states in cattle
Photo credit: Helen Proctor, World Animal Protection

These results suggest that ear posture could be a useful indicator for assessing low arousal, positive emotional state in dairy cows, although further work needs to be done to validate these results before ear postures can be used in routine welfare assessments. The next steps will involve testing this indicator on other stimuli, including on high arousal, positive stimuli, in order to further explore the effects of arousal. Once validated, ear posture could provide a non-invasive, easy and objective measure of emotional state in dairy cows. These results also provide a helpful insight into positive emotions, an area that is often neglected yet is essential to good animal welfare. Further research into this important field needs to continue and our study demonstrates that such research can be carried out on existing commercial farms. By conducting the research in this way we not only assured that the measure is valid in the industry setting but it allows us to utilise existing populations of animals and enables us to work with farmers to provide solution-focussed animal welfare research.

A 'good life' for chickens

Jo Edgar, University of Bristol

In 2013, 129,448 domestic fowl were used in 129,538 scientific procedures in the UK.[1] The majority (90%) of procedures were for the purpose of applied veterinary research, with most birds used in the production of infectious agents and parasitology. Domestic fowl are also used in fundamental research (8% of procedures), psychology (3%) and pharmaceutical efficacy testing (9%). The care and use of domestic fowl kept for scientific research is regulated by legislation and Codes of Practice that largely focus on the alleviation of negative aspects of welfare. However, it is becoming increasingly accepted that good welfare is not simply the absence of negative subjective states, but also includes the presence of positive experiences such as pleasure (e.g. references 11 and 18).

This concept has been promoted by the Farm Animal Welfare Committee (FAWC; formerly the Farm Animal Welfare Council), an advisory body to the government on farmed animal welfare. In 2009 FAWC proposed that a 'good life' could be considered in terms of 'additional opportunities', for example, access to a resource that an animal does not need for biological fitness but which is valued by the animal.[19] FAWC identified four states – Comfort, Pleasure, Interest and Confidence – which are necessary for an animal to be considered to have a 'good life' (Figure 5).

When considering whether animals experience feelings like these, we can think about whether each might have a function, for example in motivating behaviours that are important for survival, such as seeking valuable resources or avoiding harms. Some have argued that

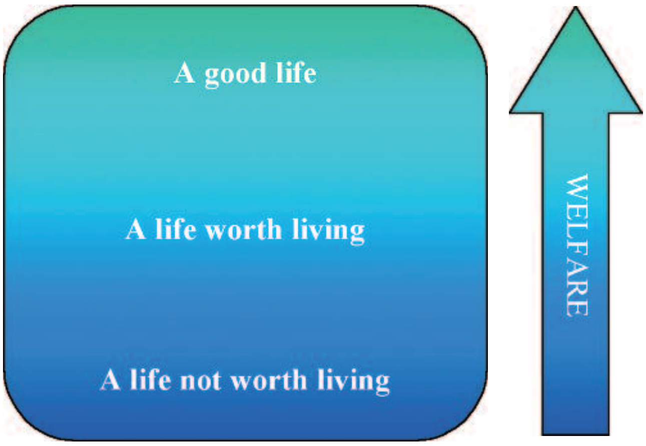

Figure 5. Quality of a life
Photo credit: Novo Nordisk

feelings, or emotions, do not necessarily need to be consciously experienced but concern for animal welfare rests on the assumption that animals do experience negative emotional states. There is a large body of evidence that has been used to infer negative emotional states in chickens, such as those associated with pain and distress.

Of course, emotions cannot be directly assessed in animals but there are physiological and behavioural indicators that can be used to infer how animals may be feeling. For example, hens show a strong motivation for mealworms over other feed rewards, displaying 'arousal-type' behaviour and changes in their surface body temperature when they are anticipating a mealworm reward. These behavioural and physiological changes during anticipation and consumption of rewards may provide indirect information about pleasure in chickens. 'Comfort behaviours', like dustbathing, may also be associated with a positive emotional state in domestic fowl.

On this basis, we proposed that animals can be said to have a 'good life' if their quality of life is substantially higher than that afforded by the current legal minimum standards of housing and care and includes positive experiences such as comfort and pleasure.[20] We needed to determine which resources laying hens require to make them happy and how important each of these resources are to the birds. As well as using published evidence, the resources required for a 'good life' were identified using the opinion of twelve experts from five academic institutions in the UK and New Zealand. These were researchers with extensive experience and knowledge of farm animal behaviour and welfare, including a sound publication record. The experts also provided guidance on the relative ranking of resources, i.e. which resources would be required to attain three tiers of higher welfare (+, ++ and +++) leading towards a 'good life'. The resources identified by the experts were organised according to FAWC's four opportunities, with a fifth opportunity added – Healthy Life. See Figure 6 for a diagram summarising the elements of the resource tiers, and reference 20 for a full explanation.

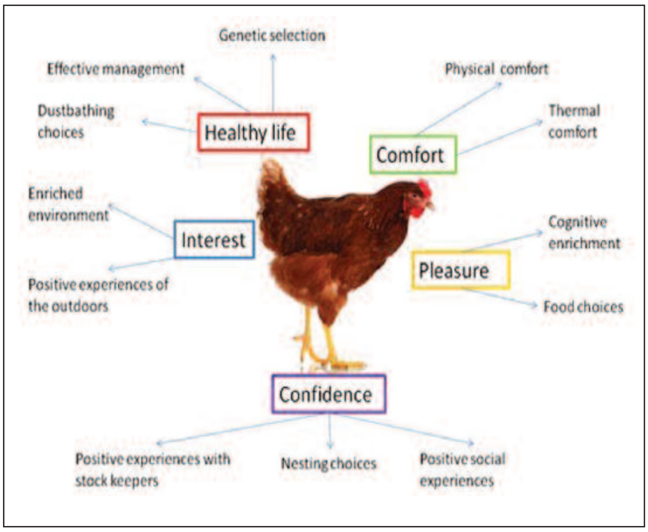

Figure 6. Elements of 'good life' resource tiers for laying hens

Following construction of the draft laying hen resource tiers, a pilot study was undertaken to establish the validity, reliability and feasibility of the framework for assessing whether birds had a good life within a given production system. Twelve farms from different systems were visited and assessed according to the criteria within the tiers and an interview with the producer. The average assessment time was 23 minutes (with a range of 15 to 45 minutes) and results were generally positive, with the 'good life' framework distinguishing between systems reliably.

The 'good life' framework could also be applied to laying hens in a research setting. Some elements make it more applicable to research animals than farmed animals, given the generally higher standards of housing and care for the former. Other criteria are less applicable, for example in a farm setting access to the outdoors and natural light, naturally lit verandas and well covered ranges score highly. One obvious difference between farmed and laboratory hens is that the 'Healthy Life' opportunity is often compromised, for example within disease studies. It may be possible to use the 'good life' framework to see how the effects of procedures might be ameliorated, by focusing on other resources that can still be provided.

Is ewe OK? Improving sheep welfare by use of simulation

Isobel Vincent, Royal Veterinary College

In their first year, Royal Veterinary College students spend two weeks at an allocated sheep farm to gain experience of the activities involved around lambing time. The farms vary greatly in size, housing, facilities and husbandry methods, so the resultant learning outcomes are likely to reflect these inevitable variations.[21] Some students will already come from farming backgrounds but ever-burgeoning numbers of undergraduates mean that providing sufficient opportunities to learn and develop practical skills such as lambing is increasingly challenging.

One way of addressing increasing numbers is to create simulated learning situations.[22] These provide safe, non-critical environments where students can practise certain skills repeatedly until they feel confident.

Ewe simulators are used as teaching aids prior to students observing and assisting at lambing. The simulators are made from plastic water tanks, with a 'birth canal' and 'uterus' made of polythene tubing. The tubing is fed through a life-sized fused pelvis fixed by stainless steel bars in the centre of the tank (Figure 7a). The 'uterus' can hold at least two cadaver lambs. The tank is filled with warm water providing the realistic sensation of pressure around the lambs.

Figure 7. The ewe simulator
(a) top view showing 'uterus'
(b) first year students practising on the simulators
Photo credits: Isobel Vincent, RVC

One of the most important components of this simulator system is the cadaver lamb. However, it is a constant logistical challenge to source enough on-site cadavers for the large numbers of students taught: lambs must be small enough to fit through the simulator birth canal and death cannot be due to disease. Although they provide the best alternative to the live lamb, they are of limited reusability due to *post mortem* changes and repeated 'births'! To address this, a fully-articulating 'manikin' lamb was commissioned in an attempt to supplement or replace cadavers.[23] However, students found the manikin less useful than cadavers and it was not as robust as had been hoped.

The practical class involves an initial demonstration of how to lamb a ewe using the simulator, highlighting welfare aspects; for example, do not intervene too early, have clean hands, use lubrication, be gentle and patient (Figure 7b).

The class also covers abnormal presentations, use of lambing aids and vaginal prolapse. Students are divided into groups of four or five to practise on one of the four available simulators. They are instructed to arrange the lambs in various positions 'in utero' in order to gain confidence for real scenarios. Those with prior lambing experience are encouraged to share their lambing tips with peers. However, for effective learning to occur, staff circulate amongst the subgroups to give feedback[24] and to ensure that any 'prior knowledge' is in fact describing good practice – formation of bad habits at this point could lead to real welfare issues. For example, delivering a lamb too quickly and roughly can cause internal trauma to the ewe leading to post-partum malaise and even death.

Students (n=42) were surveyed after this year's practical classes. Over 83% said practising on the simulator helped their confidence with lambing; and of those, nearly 89% said it helped familiarise them with the process without worrying about injury to ewe or lambs.

This year, in a continuing attempt to improve welfare of lambs, a group of students (n=75) were given the opportunity to practise tail docking and castration using elastrators on bespoke manikins just prior to carrying out the procedure on live lambs. A survey showed that 95% felt more confident about elastrating real lambs after practice with the manikins. Over 75% indicated that this was because they could not hurt the manikin, could take more time and did not feel pressured to 'get it right' first time. These findings back up research showing that simulators are particularly useful if they include some sort of palpation[25] and where they replace the live animal, there are important welfare benefits.

Discussion

In the final discussion session at the end of the meeting, delegates exchanged ideas about indicators of positive welfare in the animals they care for. Discussions at the previous year's meeting had also touched on this topic, indentifying 'playfulness' and positive social interactions with other animals and humans as indicators of positive welfare in sheep, cattle and pigs.[26] The discussion at this year's meeting reinforced the importance of understanding animal behaviour, especially with regard to observing and interpreting animals' responses to humans. This included understanding that animals do not always display behaviours that indicate pain or distress (e.g. the sheep in the transport study, where stress was only apparent when cortisol levels were examined). Delegates acknowledged the importance of using more than one indicator, to reduce the risk of missing signs of suffering – or wellbeing.

Delegates also discussed the application of the 'Three Ss': good Science, good Sense and good Sensibility, as set out by the late Dr Carol M Newton.[27] Many felt that taking play behaviour and positive approaches to staff, as indicators of positive welfare, was an example of applying 'good sense' to human-animal interactions as well as providing a useful early indicator that animals may be experiencing adverse effects, for example if play behaviour ceases or an individual is reluctant to approach a familiar carer.

Overall action points

The following action points are suggested on the basis of the talks and discussions on the day:

– If you are responsible for using, caring for or observing animals on studies where mortality occurs, set a goal to reduce this to a minimum. This could include reviewing monitoring frequency, implementing tailored assessment sheets and regularly reviewing these and actively seeking new indicators that will enable humane endpoints to be defined.
– Consider whether the use of reproductive technologies could help to reduce animal numbers, while still effectively addressing the scientific question. In doing this, carefully weigh the potential to reduce numbers against the harms caused to animals and/or their offspring by the use of reproductive technologies.
– If analgesia is withheld in a procedure that would be painful for a human, question the justification for this – either as an individual, via a Named Person or through a committee such as the Animal Welfare and Ethical Review Body (AWERB).
– If you are a researcher, always include information on refinements such as pain relief in your publications, justifying this if you encounter any resistance from editors or peer reviewers.
– If studies necessitate singly housing social animals, research whether they would benefit from some visual, tactile and/or olfactory contact – and if they would, refine their housing to accommodate this.
– Be aware that some species, including many 'farm' animals, do not always display signs of pain or distress that are obvious to human observers. Ask your Named Information Officer to periodically review the literature on welfare indicators including the use of non-invasive cortisol samples.
– If you work with or care for animals with ears, pay attention to their ear postures and see whether these might be useful welfare indicators in your particular setting.
– Look up the 'good life' paper for domestic fowl, to see how your facility compares to the different levels and whether there any improvements could be made.
– If you are involved in training staff to assist with lambing (or birth in other large animals), consider using simulators as described above.
– Initiate discussion at your facility about indicators of positive welfare, including which behaviours people can identify and whether these could be included in formal welfare assessment protocols.

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