Module 2
Welfare Assessment and the Five Freedoms
Lecture Notes

Slide 1:

This lecture was first developed for World Animal Protection by Dr David Main (University of Bristol) in 2003. It was revised by World Animal Protection scientific advisors in 2012 using updates provided by Dr Caroline Hewson.

Slide 2:

In our discussion of the definition of animal welfare in the first lecture, we mentioned the Five Freedoms. The freedoms are a very important landmark in scientific and ethical approaches to animal welfare, and many current welfare assessment tools have been developed from them. So, in today's lecture we are going to look at them in some detail.

Slide 3:

If you ask someone how they are, they often respond with a single phrase or concept, like "pretty good", or "OK" or "terrible". We can rank these on a continuum from 'good' to 'poor', as you see on the slide.

If you ask for further detail, and try to determine the cause behind the person's answer, you will usually get a reply that incorporates different feelings about various aspects of the person's life.

For example, an individual may feel that work is good but his/her personal life is only reasonable, etc.

Slide 4:

In other words, although we might be able to describe how we are feeling overall, this is affected by many components that may be independent of each other. For example, the comfort of your chair is not related to how hungry you feel; however, they both affect how you feel at any one moment.

So we can see that human welfare is a combination of independent components, some of which may be good and some of which bad.

The Five Freedoms are likewise a list of components of animal welfare.

Slide 5:

The UK's Farm Animal Welfare Council proposed the Five Freedoms in 1992, using the recommendations from an earlier government enquiry known as the Brambell Committee (1965).

Each of the Five Freedoms can overlap with the others. For example, if an animal is hungry, he or she will seek food and eat it – this is normal behaviour. If the animal cannot find food, or if the environment does not allow him/her to show normal food-seeking behaviour, s/he may become distressed. Therefore, if animals are not free from hunger and are not free to express normal behaviour, they may also not be free from distress.

All life ends in death; therefore, freedom from death is not something that we can provide to any organism. However, we kill most of the animals that we keep. The issue of whether or not we should kill animals is an ethical one. The avoidance of death in animals has an ethical value for many cultures. Moreover, from the animal's point of view, animals have an interest in life and, generally, will try to avoid death.

Even though we cannot guarantee freedom from death to any animal, the manner of an animal's death does concern animal welfare. For example, if someone keeps a chameleon as a pet and does not feed the animal properly, the animal will die of malnutrition and associated diseases. In that case, the animal's death comes about because several of the Five Freedoms have been compromised (freedom from hunger, freedom from disease, freedom from distress and, possibly, freedom to express normal behaviour).

Slide 6:

Here you see each of the freedoms on a scale from poor welfare to good welfare. The 'Poor' side of the spectrum signifies that the particular need has not been met. Moving towards the 'Good' end, we see that the need (or freedom) has been fulfilled.

As you see, an animal may have different levels of each of the Five Freedoms – some of the aspects may be good, while others may be poor. This diagram suggests that we can assess each area and then come up with an overall welfare score. However, this is not as simple as it sounds.

Slide 7:

This approach relies on the underlying assumption that welfare lies on a continuum, as shown on this slide.

Under that assumption, welfare ranges from 'Poor' to 'Adequate' to 'Good'.

At the 'Poor' end, the animal's environment is such that the animal has largely negative experiences and constant suffering so that his/her life is not worth living.

With better care and a better environment, animal welfare may be 'Adequate': the animal may have few negative experiences, but no positive ones either. That is thought be a life worth living.

At the other end of the continuum, welfare is 'Good', i.e. the animal has mainly positive experiences and not just the absence of negative ones (FAWC, 2009).

There is ongoing research into this, and some scholars argue that this view of welfare is too simplistic. However, for you as a vet in practice, it remains a matter of assessing specific aspects of welfare and then making your best judgment of how relatively good or bad they are in comparison with similar situations, or the situation as it was previously. Module 9 will explore this in more detail.

Slide 8:

Here we see dairy cows who are housed. Housing makes it easier to safeguard cows' health and production in climates where cold, wet weather makes it impossible to manage the cows on pasture.

However, housing restricts cows' normal ranging behaviour. Therefore, housing keeps cows free from some diseases, but it reduces their freedom to express normal behaviours. That is, it can also predispose them to diseases such as mastitis and foot disorders, both of which can be very painful and which can be present at levels of 20 per cent or higher in dairy farms in many parts of the world.

For this reason, a survey in New Zealand suggested that farmers in most parts of that country should not invest in housing because it would create more welfare and production (and therefore economic) problems than it would solve.

Slide 9:

Some restrictions of normal behaviour, such as farrowing crates, are obvious.

Farrowing crates restrict movement (in order to prevent piglet crushing) and this prevents many aspects of normal behaviour, such as maternal behaviour and social interaction with other adults.

However, some restrictions are only highlighted after scientific investigation. For example, the lying surface in a cubicle shed can affect the lying time as much as the design of the cubicles (see next slide).

Slide 10:

This study on cows assessed the time they spent lying in a 24-hour period on different lying surfaces in a cubicle shed. Cows provided with a soft compressible bed would lie down for about 70 per cent of the time, which is similar to a cow grazing at pasture. However, this time was reduced when a harder rubber mat or concrete surfaces were used.

These harder surfaces, therefore, restrict normal behaviour. Furthermore, this restriction of lying behaviour has health implications – increased lameness is associated with reduced lying times.

Slide 11:

The Five Freedoms are ideal states that are extremely difficult to achieve. For example, some freedoms may conflict.

To be free of disease sometimes requires treatment, and this induces fear during handling.

To allow an animal to express normal behaviour will inevitably cause distress on certain occasions during 'normal' social interactions.

When one of the freedoms is compromised (e.g. during handling and/or during normal social interactions), this can have both short-term and long-term negative effects on an animal's welfare. See Balcombe et al. (2004) for more information on this.

In farming, as in the wild, it is impossible to fully provide the Five Freedoms at all times. Sometimes it is undesirable to satisfy them all, for example:

- if a dog is free to express normal behaviour, the dog should be allowed to chase and kill sheep or cats – but this is undesirable;

- restraining farm animals inevitably causes some distress, but is necessary in order to vaccinate them, trim their feet and keep them free from disease. Clearly, the distress of restraint should be minimised, but some animals will feel it more than others, no matter how good and concerned the stockperson.

Such compromises are inevitable. The only way for wild or domesticated animals to avoid some form of welfare compromise at one time or another is for the animals not to exist at all. Therefore the more realistic question is: what is the extent and the nature of the compromises that we should accept? This is an ethical question, which science informs but cannot answer on its own. The question of which compromises are acceptable, and why, causes a lot of disagreement in society.

Additionally, the list of Five Freedoms emphasises avoiding negative experiences for the animal (there are four 'freedoms *from*'), and does not promote positive experiences.

Slide 12:

The Five Freedoms are intended primarily to prevent suffering, not to completely eliminate stress. As such, they are a list of the outcome of good husbandry. As a result of the widespread popularity of the Five Freedoms as a basis for assessment, they have been adapted and modernised in various forms to help the public, legislators and farmers everywhere to understand how best to care for captive animals.

Five examples of this are:

1. The development of the Welfare Quality® project to assess the welfare of farm animals from birth to death. The project involves the EU and four South American countries, and the areas of welfare assessment were developed directly from the Five Freedoms. We will cover this in Module 9.

2. The veterinary literature increasingly mentions the Five Freedoms: of the five, vets have been most concerned with the first three, i.e.

   • freedom from hunger and thirst

   • freedom from discomfort

   • freedom from pain, injury and disease.

   However, there is growing appreciation that all five are interrelated. For example, a recent review of ocular pain (Williams 2010) in livestock points out that "diseases that compromise vision have significant effects on the freedom to behave normally and increase fear and distress. We should continually reflect on how these conditions are affecting all five of these freedoms".

   In a completely different paper (Jongman 2007), the Five Freedoms are cited as the basis for assessing the welfare of indoor-only cats.

3. The third example is from international finance: the International Finance Corporation of the World Bank Group supplies loans to businesses in developing countries. This includes livestock businesses, and the Corporation has publications specifically on the topic of animal welfare. The one cited on the slide states

   "At the project appraisal stage the International Finance Corporation (IFC) will review and assess how the applicant addresses or plans to address various animal welfare aspects. IFC will decline, at their discretion, selected projects where the system is incompatible with the Five Freedoms" (p.17, World Bank, 2006).

4. The fourth example is from the World Organisation for Animal Health (OIE). We mentioned the OIE in the Module 1, and you will recall that it has ~178 member countries which have authorised the organisation to "take the lead internationally on animal welfare with guidelines and recommendations". The opening statement of the chapter on animal welfare within the OIE's Terrestrial Animal Health Code says that "the internationally recognised 'Five Freedoms' provide valuable guidance in animal welfare" (OIE, 2011).

5. Private retailers also use the Five Freedoms as a basis for assuring customers that the food they are buying has come from animals who were well treated. For example, the international retailer Marks & Spencer specifies "ensuring that farming systems meet as many of the Five Freedoms as possible".

Slide 13:

In order to know exactly which aspects of animals' experience we might measure in welfare assessment, it helps to break it down into a sequence, as shown in this slide.

Here we see that animals get sensory input from their environment – e.g. they see, hear and touch aspects of their housing or the events around them.

Next, the brain evaluates this sensory input in accordance with the animal's experience, genetics, etc. For example, the brain may evaluate the input as novel (e.g. the arrival of a new animal), or as a potential threat (e.g. the vet), or as a source of pleasure (e.g. the approach of another animal for mutual grooming or play), or as neutral (e.g. the tractor passing by).

The brain's evaluation may, then, create an emotion that is negative (e.g. anxiety on seeing the vet or seeing a new animal), or positive (e.g. pleasure because of anticipated grooming or play). Or, there may be no new emotion because the sensory input is neutral (e.g. the sound of the tractor).

Next, the body responds to the emotion, as appropriate. For example, fear can increase the heart rate and cause the animal to behave differently (e.g. stop grazing, get up, run away, etc.). Pleasure can also increase the heart rate and cause the animal's behaviour to change: he or she may also stop grazing or get up, but will probably approach rather than run away.

Therefore, the final result of this sequence is that the animal can adapt to its environment and the events there and thus 'survive' in a very general sense. For example, the animal ignores the tractor and does not waste energy avoiding it, because he or she has learned that it is benign. However, he or she does expend energy trying to get away from the vet (not knowing that the vet's diagnosis and treatment may be what he or she needs to survive).

There are two important concepts applied to the adaptive process – 'homeostasis' and 'allostasis'. We shall now look briefly at those, and at the central role of the brain.

Slide 14:

First, we will discuss homeostasis: animals need to maintain their cellular environment around narrow set points, so that the vital organs keep functioning. This steady internal state that is necessary for the basic processes of life is called 'homeostasis', which literally means 'same state'.

Maintaining homeostasis is an automatic process involving central control by the brain. An example is the pH of the blood: in domestic mammals, blood pH needs to be kept within a very narrow range, otherwise the vital organs do not function as well and this may become life-threatening. Consequently, the body has sensors that enable the appropriate excretion of

bicarbonate and acid ions, via breath and urine respectively, so that the pH is maintained at the set point of 7.35 to 7.45.

At the cellular level, homeostasis is essential. However, the concept does not adequately describe how animals adapt in order to survive. That broader adaptive process is called 'allostasis'.

Allostasis literally means 'other state': it is a state of stability that is achieved through change. Hence it is different from homeostasis, which is a steady state that revolves around unchanging, narrow set points.

'Stability through change' comes about because the brain has a memory: it evaluates sensory input against its existing information, so that the animal can respond appropriately to the events in future. Those events might be part of the life cycle, such as pregnancy, or they might be a completely novel challenge, such as the first time a cow experiences milking by a machine. In all cases, the animal has an expanding repertoire of physiological and behavioural adaptations that enable him/her to keep functioning within his/her environment.

The brain, memory and emotions play a central role in 'driving' adaptive changes in physiology and behaviour, which we can then measure in welfare assessment. So, we will look at the brain next.

Slide 15:

The brain is of interest in regard to welfare, because of emotions. We cannot assess emotions directly in animals. However, we can now assess their brain activity under specific conditions and compare that with the activity in humans who report themselves to be feeling a particular emotion. For example,

the main picture on the slide shows typical human brain activity when a person is feeling sad. The insert shows a guinea pig's brain activity when the animal is showing distress on being separated from others. You can see how similar the anatomical circuits are in both brains; both involve clusters of neurons within structures such as the PAG (parahippocampal gyrus) and the DMT (dorsal medial thalamus), both of which we see in each picture here.

Research on the neurobiology of emotions is growing, but is not exhaustive for all our domestic species in all husbandry conditions. However, close similarities with human studies, as illustrated on the slide, allow us to infer what emotions the brain may generate in animals that are in particular conditions.

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Slide 16:

Going back again to our framework: let us now look at the aspects of the four elements of an animal's experience we can measure, so that we can assess welfare.

Slide 17:

First, environment and resources create sensory input.

As animal owners, we provide animals with resources, e.g. we breed them to have a particular genetic makeup, we house them in a certain way. Also, various events happen around our animals during the day. There are regular daily events such as the change from day to night, or the arrival of food. Other events will be occasional, such as a visit from the vet and a clinical examination, or transport to market. There are also internal events, such as the animal's bladder filling with urine.

All these events and resources create ongoing external and internal sensory stimulation for the animal. We cannot easily measure that sensory input. However, we can record the resources that are available to them, and many of the events in their environment.

Next, the animal's brain evaluates the sensory input. For example, is what the animal sees familiar or not? If it is familiar, is it associated with anything threatening, painful or pleasant?

The brain's evaluation gives rise to emotions (e.g. fear, happiness) and to physical feelings (e.g. pain, excitement, nausea). The animal's body responds to these feelings, both physiologically (e.g. increased heart rate) and behaviourally (e.g. urinating, vomiting, hiding). There is no easy way to measure their emotions and feelings for welfare assessment. However, we can measure their responses.

Moving down our slide, we see that these responses enable the animal to adapt to the initial event as appropriate, and therefore to survive. Survival, or death rate, can be a very crude indication of welfare within a group of animals. However, more accurate and feasible measures are in italics on the slide:

- measures of the events and environment (e.g. handling, housing), and

- measures from the animals themselves – their physiology and behaviour.

Slide 18:

The events and resources which give rise to sensory input are known as 'welfare inputs' or 'resource-based measures'.

The animal's responses to this input are known as 'welfare outputs' or 'outcome-based measures'.

Slide 19:

This slide illustrates this more clearly.

Welfare inputs – the resources that are available to the animal – fall into three main categories:

1. Management/stockperson resources (e.g. how well trained the stockperson is; how much time he or she has to care for the animals).

2. Environment resources (e.g. the kind of housing; the quality and amount of the animals' food; the use of vaccines, anthelmintics, etc.).

3. Animal resources (e.g. the animal's genetic makeup and early experience, which affects disease resistance, fear thresholds, etc.).

Welfare inputs are relatively easy to measure – especially stockperson and environment related ones. Because of this, some welfare assessments only look at inputs. However, you cannot know how an animal is experiencing his/her life if you do not also gather data directly about the animal.

Consequently, welfare outputs – the animal-centred measures – must be part of the welfare assessment.

There are three main categories of welfare output:

1. Measures of disease (e.g. lameness, coughing and other clinical signs) and of production (body weight; milk production).

2. Measures of behaviour (e.g. the amount of time a cow spends lying down, or the presence of stereotypic behaviour).

3. Measures of physiology (e.g. heart rate).

As veterinary students, much of your training concerns the first group of measures: disease and production. We list them separately here, but they also overlap with the measures of behaviour and of physiology. We will look at three categories of welfare output in more detail in Modules 3, 6, 7 and 8.

Slide 20:

We shall now pull all this together by looking at how the Five Freedoms can direct us, broadly, to the most important welfare inputs and welfare outputs.

The next few slides take you through examples of welfare inputs and outputs within each of the Five Freedoms.

Slide 21:

Note that, as they are written, these examples would not help you very much in doing an actual assessment because they are too vaguely worded. In Module 9, you will look at how the Five Freedoms have developed into a specific tool through the Welfare Quality® project.

However, to close today's lecture, let us look at how you could do a welfare assessment right now using the Five Freedoms to guide you.

Slide 22:

Because, at this point in your programme, you might not yet know the specifications for all the different welfare inputs (e.g. the right dimensions for feeders, or the correct number of drinkers, or the vaccines that a farmer should be using), you could just use your best judgement of welfare outputs.

For each freedom, you would estimate:

- the percentage of animals affected (e.g. by hunger, thirst, fear, etc.)
- how badly they are affected (e.g. how many are moribund vs. how many have mild clinical signs vs. how many are healthy)
- how long that compromise has being going on for.

Slide 23:

This slide shows you how you would apply those principles in a flock of sheep, in the area of freedom from hunger.

We noted much earlier that, while it is convenient to then provide an overall welfare score, it is difficult to do and may, in fact, not be desirable because it may not adequately reflect the animal's experience in each area of concern.

If you were doing the assessment in our example here, using the Five Freedoms, you could simply provide the numbers for each specific point. By doing so, the farmer would now have a benchmark against which to measure progress, and to compare his farm with other farms.

Slide 24:

In today's lecture, we have covered some important background information that we will apply in other lectures.

To sum up:

You now know the theory of the Five Freedoms, and how they have influenced the development of assessment tools around the world. For example, we mentioned the Welfare Quality® project – which is academic and practical – and the International Finance Corporation of the World Bank which is economic, and the retailer Marks & Spencer, which is commercial.

You also know the limitations of using the freedoms as an assessment tool by themselves because they are anthropocentric, and they focus on the negative experiences rather than suggesting the promotion of positive experiences. They also do not account for any adaptation the individual animal may be able to make in response to a bad situation.

You know too, however, that the freedoms can guide us in finding out more about what is important in an animal's experience.

In particular, you have seen that an animal's experience has four main elements: sensory input to the brain, emotions, body responses and consequent adaptation through allostasis and homeostasis.

You also know that the brain's evaluation and the emotions that this generates are very important.

Next, you know that, to assess the animal's experience, the easiest things to measure are the welfare inputs; i.e. the resources that create the sensory input, which are the stockperson, the environment, and the animal (e.g. his/her genetics).

Also easy to measure are welfare outputs – i.e. the body's responses, which you can assess in terms of the number of animals showing a given response (e.g. body condition, fearful behaviour), how severe that response is, and how long that problem has been going on.