



EVIDENCE AND THE WELFARE OF FARMED ANIMALS

PART 2: EVIDENCE-BASED DECISION MAKING

June 2018

Farm Animal Welfare Committee
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CONTENTS

Chair’s letter to Senior Responsible Owners	2
I – Introduction	3
FAWC’s philosophy of approach.....	3
Scope and structure of this report.....	4
II – The purpose of evidence	6
III – Establishing the validity and reliability of evidence	7
IV. The limitations of evidence.....	11
a. Lack of access to evidence.....	11
b. Validity of individual pieces of evidence when using research as evidence in policy making	12
c. Shortcomings in evidence collation and appraisal	13
V. Evidence-based approaches within animal welfare practice and policy	15
VI – Using evidence in animal welfare policy and practice.....	17
VII –Conclusions	19
VIII - Recommendations	22
Appendix 1 – Case studies	24
Appendix 2. An example framework for the review of animal welfare evidence.....	29
Appendix 3 – Membership of the Farm Animal Welfare Committee (2018)	31
Appendix 4 – Acknowledgements	32
Appendix 5 – Contact details	33

Chair's letter to Senior Responsible Owners

Mr Alex Thomas (Director Animal and Plant Health and Welfare) – Defra
Mrs Sheila Voas (Chief Veterinary Officer) – Scottish Government
Professor Christianne Glossop (Chief Veterinary Officer) – Welsh Government

Dear Mr Thomas, Mrs Voas and Professor Glossop

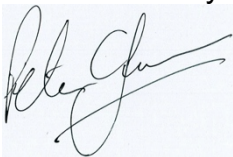
This report is the second of two on the subject of evidence and animal welfare¹. It is aimed at providing not only a guide to the use of welfare science derived evidence in policy making but it also contains recommendations about aspects of current practice that need consideration and attention by administrations and all those who produce, publish and use scientific evidence.

Only by understanding the limitations of the different forms of evidence or means of deriving it can there be a real chance of formulating appropriate policy or testing that it is indeed working as intended. In addition, we express concerns that the form and extent of scientific evidence derivation on farm animal welfare is not overly dictated by the publication formats and editorial dictates of standardised protocols.

That animals may be the subject of failed or incomplete experimentation or experimentation that gave unfavourable results should not be grounds for failing to publish the outcomes of any intervention; and not just those subject to control under the Animals Scientific Procedures Act 1986. There will be lessons to be learned and the opportunity to avoid the same procedures being repeated unnecessarily. We can also ensure that more animals are not subjected to nutritional, genetic, building related or any other interventions whilst outcomes that are favourable can be disseminated with additional confidence.

The appendices provide some examples of how welfare science and practice currently use evidence.

Yours sincerely



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FAWC Chairman

¹ First report published June 2014. [FAWC report on evidence and the welfare of farmed animals, part 1, the evidence base.](#)

I – Introduction

1. The Farm Animal Welfare Committee (FAWC) is an expert committee of the Department for Environment, Food and Rural Affairs (Defra) and the Scottish and Welsh Governments. Its terms of reference are: i) to provide independent, authoritative, impartial and timely advice to Defra and the Devolved Governments in Scotland and Wales on the welfare of farmed animals, including farmed animals on agricultural land, at market, in transit and at the place of killing; and on any legislative or other changes that might be considered necessary to improve standards of animal welfare; and ii) to provide independent scientific support and advice as required by Article 20 of Council Regulation (EC) No.1099/2009 on the protection of animals at the time of killing.

FAWC's philosophy of approach

2. In the UK, farm animals are kept for the production of meat, milk, wool and eggs and provision should be made for their needs in terms of legal requirements and good practice. The Animal Welfare Act 2006 (England and Wales) and the Animal Health and Welfare Act 2006 (Scotland) include a duty of care to provide for the needs of farm animals for which humans have permanent or temporary responsibility. FAWC believes that our obligations include identifying and ensuring that certain serious harms never occur to farm animals, and minimising compromises to welfare applied for human benefit or the benefit of the larger animal population. At a minimum, each individual farm animal should have a life that is worth living and a growing proportion should have a good life².

3. There have been many attempts to define animal welfare. In FAWC's view, welfare encompasses both physical and mental health for farmed animals. Good welfare is largely determined on a daily basis by the skills of the stock people, the system of husbandry and the suitability of the genotype for the environment. External factors may have a sudden impact on animal welfare, for example, infectious disease epidemics, adverse weather conditions and the mental and physical wellbeing of those responsible for their care³. Although short-term measures may offer temporary solutions, such factors will require longer-term responses to ensure good welfare.

4. In considering provisions that should be made for farm animals to avoid unnecessary suffering and to promote good welfare, the Committee is guided by the Five Freedoms. The Five Freedoms remain the cornerstone of government and industry policy for the welfare of livestock:

Freedom from hunger and thirst, by ready access to fresh water and a diet to maintain full health and vigour.

Freedom from discomfort, by providing an appropriate environment including shelter and a comfortable resting area.

Freedom from pain, injury and disease, by prevention or rapid diagnosis and treatment.

² Farm Animal Welfare Council: Report on Farm Animal Welfare in Great Britain: Past, Present and Future (2009)

³ Farm Animal Welfare Committee. FAWC opinion on the health and wellbeing of farmers and farm animal welfare, (2017)

Freedom to express normal behaviour, by providing sufficient space, proper facilities and company of the animal's own kind.

Freedom from fear and distress, by ensuring conditions and treatment which avoid mental suffering.

5. Difficult ethical and agricultural decisions have to be made when considering the welfare of farmed animals. While every effort should be made to remove suffering, sometimes a lesser act that may cause short-term pain or distress can provide long-term welfare gain for the individual or group. The ultimate objective should be to avoid this lesser act by eliminating the source of a problem through evidence-led improvements in disease control, husbandry and breeding. For instance, horn removal in cattle is an example of a current practice aimed at reducing injury to the individual and within a herd, but the practice could be eliminated by selective breeding for polled (unhorned) animals in the long term.

6. When assessing animal welfare it is necessary to consider the potential for suffering, the intensity and duration, the number of animals involved, the alternatives available and the cost and opportunities to promote wellbeing. Equally important is the ability to improve welfare immediately through existing sound husbandry with appropriate stockmanship. Many day-to-day welfare challenges are manageable across all systems, although some may be intrinsic to certain production systems. Animal welfare is about the experiences of individual animals, but this can be lost where animals are kept in very large numbers or with limited visibility, e.g. poultry and farmed fish⁴. When evidence is inconclusive, the individual animal should be given the benefit of any reasonable scientific or moral doubt.

7. In preparing its advice about the welfare of farm animals, FAWC takes account of current scientific evidence, the knowledge of veterinarians, scientific researchers, farmers and the practical experience of others involved in agriculture. FAWC undertakes field visits as appropriate to the subject being considered both in the UK and abroad. FAWC's advice draws on, relevant views and takes account of human interests but with a concern to ensure that the animal's interests remain to the fore.

Scope and structure of this report

8. The last two decades have seen a strong commitment to evidence-based policy-making including in the area of farm animal welfare. In 2012, FAWC established a working group to review the evidence base for farm animal welfare policy leading to a report to be published in more than one part. Part One was published in 2014⁵.

9. The aim of this second Report is to consider and evaluate procedures by which evidence is gathered and used in the policy and decision-making processes associated with aspects of farm animal welfare from national flock/herd to individual animal.

⁴ Farm Animal Welfare Committee. Opinion on the welfare of farmed fish (2014)

⁵ Farm Animal Welfare Committee. Evidence and the Welfare of Farmed Animals Part 1: The Evidence Base. 2014. www.gov.uk/government/publications/fawc-report-on-evidence-and-the-welfare-of-farmed-animals-part-1-the-evidence-base

10. The objectives pursued in order to achieve this aim were:
 - i. To clarify the definition of evidence used in this report and describe the purpose of evidence in relation to animal welfare.
 - ii. To review and assess the range of methodologies used in human and animal health and welfare research evaluation and their reliability for use in farm animal welfare policy development.
 - iii. To describe limitations and biases inherent in using relevant sources of evidence and raise awareness for policy makers of the methodological risks in developing evidence-based policy.
 - iv. To describe current approaches (including case studies) which illustrate the challenges of evidence production for policy development and on-farm practice.
 - v. To review critically the use of evidence in animal welfare policy development.
 - vi. To propose guidelines with which to conduct evidential reviews in farm animal welfare.

11. A public consultation was carried out and written submissions were received from eight organisations and individuals. FAWC is grateful to those who assisted with the study. All those who gave evidence and assistance are listed in Appendix 4.

II – The purpose of evidence

12. For the purposes of this report evidence is defined as information that supports or refutes a proposition that is used in decision-making or policy formulation⁶.

13. Part 1 of the Report observed that policy is increasingly stated as being ‘evidence-driven’, i.e. evidence, rather than opinion or belief, is being used to inform, justify and defend policy decisions. Evidence may form the basis for:

- raising and defining new issues and areas;
- establishing the veracity of a particular claim;
- allowing the comparative assessment of different policy options;
- quantifying risk;
- supporting a selected course of action;
- assessing the impact of a particular decision, procedure or policy;
- improving policy through critical review and assessment; or
- contesting an existing policy or mechanism.

14. To fulfill this role effectively, evidence should meet agreed standards of scrutiny as to its origin, application and relevance; it should be demonstrably robust, reliable and relevant to the argument being put forward. Evidence should:

- come from credible sources;
- be obtained through accepted methodologies and be defensible before external scrutiny; and
- be precise, pertinent, up-to-date and have sufficient power to support the claims being made.

15. Not all evidence is of equal value or strength. Evidence can be misused or erroneously used. Specific evidence can be over-generalised or over-extrapolated. Bias may exist in the way in which evidence is obtained, presented and used for different purposes. Evidence can be time- and context-specific. The nature of the data and the methodologies employed to establish evidence are critical. It is also important to state that the absence of evidence does not necessarily mean that a proposition or claim is unfounded or has no value

16. Decisions as to policy and implementation involve some level of value judgment and prioritisation. Ultimately, decisions are not made on the basis of scientific evidence alone. They will be influenced to a greater or lesser degree by, amongst other things:

- financial and economic considerations;
- cultural practice and community customs;
- professional standards and conventions;
- political agendas;
- prior experience;
- tradition; and
- religious belief.

⁶ Farm Animal Welfare Committee. Evidence and the Welfare of Farmed Animals Part 1: The Evidence Base. 2014.

III – Establishing the validity and reliability of evidence

17. As we demonstrated in Part 1 of this report⁷, the potential sources of evidence in animal welfare policy and decision-making are multiple and include the reported and published outputs of experimental scientific research, observational studies, economic analyses, social scientific studies, consultations, professional opinion, individual observations and practical experience. In an increasingly information-rich world, establishing the validity and reliability of evidence used in policy-making, and demonstrating the transparency of that establishment, emerge as critical tasks.

18. Evidence-based veterinary medicine (EBVM), which can be defined (in much the same way as its medical equivalent) as "the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual [*animal*] patients or groups [*flocks/herds*]"⁸ is gaining momentum. As 'evidence-based' medicine (whether human or veterinary) along with evidence-based policy-making becomes progressively more widespread, robust mechanisms for the objective, qualitative assessment of 'best' evidence are increasingly necessary.

19. The drive towards greater evidence-based decision and policy-making places particular value on published scientific information. The need to validate effectively and efficiently the outcomes of scientific research (whether lab or field based, quantitative or qualitative, or from the 'natural' or the 'social' sciences) as 'best' evidence has led to the establishment of recognised mechanisms and procedures for the assessment of scientific outputs as evidence, particularly in the field of medical science but increasingly in the field of veterinary and animal welfare science.

20. For the most part, these mechanisms and procedures are based upon the formalised and systematic review of published findings from experimental and observational scientific research. Within medical research, particular credence is afforded to research findings derived from randomised controlled trials (RCT). In animal science, RCT are more frequently associated with vaccine and medicine research and development than with animal welfare. However, as the first FAWC Evidence Report⁹ demonstrated, RCT sit high in the evidence hierarchy in welfare science too, but for ethical, practical and economic reasons are relatively uncommon.

21. Observational trials encompass a variety of scientific studies that are designed to characterise associations between exposures (e.g. environmental, pathogenic, therapeutic) and animal health and welfare outcomes. They may also be used to estimate incidence or prevalence of disease within a population. Unlike most experimental studies, they take place in less controlled environments, such as field conditions; as such they are usually unable to prove causation definitively although they may provide strong evidence to this end.

22. In welfare science, a large proportion of the published scientific literature is based around various types of observational study. Cohort, case-control and cross-sectional

⁷ Farm Animal Welfare Committee. Evidence and the Welfare of Farmed Animals, Part 1: The Evidence Base. 2014.

⁸ Sackett DL, Rosenberg WMC, Gray JAM and Richardson WS (1996). Evidence-based medicine: what it is and what it isn't. *British Medical Journal*. 312 (13 January 71-72). The quote comes from human literature, the adaptation is FAWC's own.

⁹ Farm Animal Welfare Committee. Evidence and the Welfare of Farmed Animals, Part 1 The Evidence Base, 2014

studies (e.g. survey or prevalence studies) can provide valuable evidence provided they are well-designed, of sufficient size and power, and that their respective limitations are appreciated.

23. The growth of Precision Farming has delivered a valuable source of information on animal health and welfare and will be further developed and exploited in future, particularly as a data source for observational studies. Thought may need to be given to methods of harnessing this information that otherwise might evolve in a piece-meal and uncollectable fashion.

24. Evidence may be direct or indirect. Direct evidence is usually more reliable, and care must be taken when inferring facts from indirect evidence. For example, in a precision broiler farming system input data such as water and feed levels may be taken as indicators of animal health. However, precision systems may not detect other important indicators, especially at the level of the individual animal. In such a context, direct and frequent observation of an animal group by a competent stockperson is the most reliable method of verifying group health.

25. A significant advance in deriving reliable, unbiased and transparent evidence-based recommendations from multiple research sources has been the systematic review. Replacing the more traditional and largely selective literature review, systematic reviews represent a transparent mechanism for identifying, assessing and summarising both the methodological quality and the findings of multiple research outputs in order to remove bias. Systematic reviews and their forerunners, 'meta-analyses', are now key elements of the defining vocabulary of evidence-based medicine and evidence-based veterinary medicine.

26. In farm animal welfare-related science, both meta-analyses and systematic reviews have been rare and largely restricted to animal health outcomes usually from dietary interventions and supplements. However, this is changing with more such reviews being undertaken and collected, for example at the Centre for Evidence-based Veterinary Medicine which hosts the VetSRev database of systematic reviews in veterinary medicine and science. The Royal College of Veterinary Surgeons has established through its charity partner, RCVS Knowledge, a dedicated web portal and online journal as an information source specifically to promote and contribute to evidence-based clinical decision making.

27. Reflecting their growing significance as evidence, the procedures for undertaking and reporting scientific research are becoming increasingly standardised. The first of these guidelines, CONSORT (Consolidated Standards Of Reporting Trials)¹⁰, was developed and published in 1998 to address poor reporting standards of RCTs in humans. This was later adapted for animal research under the REFLECT statement (Reporting Guidelines for Randomized Controlled Trials for Livestock and Food Safety)¹¹.

28. There are a number of statements or guidelines that have since been published to enhance methodology and reporting of animal-based scientific studies. Although not

¹¹ O'Connor A., Sargeant J. M., Gardner I. A, *et al.* (2010) The REFLECT statement: Methods and processes of creating reporting guidelines for randomized control trials for livestock and food safety. *J Vet Intern Med* 2010; 24:57–64.

restricted to RCT, the ARRIVE (Animal Research: Reporting of In Vivo Experiments¹²) guidelines were developed by the National Centre for the Replacement, Refinement and Reduction of Animals in Research to improve the standard of reporting animal research and minimise unnecessary and repetitive research¹³. Other guidelines of relevance to animal welfare research reporting would include:

- The STROBE (STrengthening the Reporting of OBservational studies in Epidemiology) statement for observational studies¹⁴.
- The STARD (Standards for Reporting Diagnostic accuracy studies) statement for diagnostic accuracy studies¹⁵.
- The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement for reporting of systematic reviews and meta-analysis¹⁶.

29. Various techniques exist that go beyond the review and summation of published research findings (e.g. via systematic review) and statements or guidelines for their reporting (e.g. PRISMA) to offer methodologies for qualitatively assessing the reliability of the evidence generated. The GRADE (Grading of Recommendations Assessment, Development and Evaluation) method is one such approach¹⁷.

30. The GRADE method combines statistical indicators (confidence intervals) and qualitative ratings (from 'high' quality to 'very low') to determine the reliability of evidence and, ultimately, any subsequent recommendation for the use or otherwise of a medical treatment. Studies are assessed using a 5 point evaluation system:

- risk of bias;
- inconsistency between studies;
- imprecision;
- indirectness; and
- 'other considerations' of published research outputs.

31. The National Institute for Health and Care Excellence (NICE) is currently the sole provider of formal advice to the National Health Service and the largest healthcare technology assessment body in the world, and regularly undertakes systematic reviews using GRADE methodology for assessing the strength of medical research evidence.

32. The European Food Standards Authority (EFSA) also provides guidelines for the use of systematic reviews in food and feed safety assessments¹⁸. EFSA is undertaking a major review of the use of evidence in scientific assessments under the rubric PROMETHEUS¹⁹. A brief review of EFSA's approach to using evidence in the field of farm animal welfare is described in case study 1 (Appendix 1). In addition, an EFSA output in relation to pig welfare and husbandry is identified that shows the challenge of producing an evidential base for change when there is a limited amount of relevant underpinning research.

¹² <https://www.nc3rs.org.uk/arrive-guidelines>

¹³ Kilkenny, C. et al. (2010) Improving bioscience research reporting: The ARRIVE Guidelines for reporting animal research. *PLoS Biology* 8 (6).

¹⁴ <https://www.strobe-statement.org/index.php?id=strobe-home>

¹⁵ <http://www.stard-statement.org/>

¹⁶ <http://www.prisma-statement.org/>

¹⁷ See various publications of the GRADE Working Group at www.jclinepi.com/content/jce-GRADE-Series

¹⁸ EFSA (2010) Application of systematic review methodology to food and feed safety assessments to support decision-making. *EFSA Journal* 8 (6)

¹⁹ EFSA (2015) Principles and processes for dealing with data and evidence in scientific assessments. *EFSA Journal* 13 (6) 4121.

33. Reputational experience and expertise continues to be validated largely by relevant qualifications, through peer group recognition and through membership of professional bodies.

34. The Delphi approach is an iterative survey technique that uses expert opinion for developing understanding and problem solving within a particular field of research and learning. It involves the systematic solicitation and collation of informed judgments, through purposeful selection of experts in a particular field. Responses are anonymous, data collection proceeds as a series of rounds, and controlled feedback on the views of others is provided to participants. While not always the key objective, it is generally recognised as an effective method for reaching consensus and/or forecasting future events, for planning, decision-making and policy research.

35. Delphi technique has been applied widely in the social sciences, however, seldom used in the field of animal welfare *per se*. There are some exceptions. For example, several studies used expert opinion to identify appropriate animal-based measures for the assessment of animal welfare²⁰, to evaluate the importance of various policy objectives, instruments and indicators in delivering farm animal welfare²¹ or to examine the impact of farm animal welfare policy on the welfare of animals²². More recently, it was employed to explore the ethical challenges faced by veterinary professionals²³. The approach is particularly useful when historical data (which will allow for robust statistical analysis) is missing or limited and some human judgement in addressing complex issues is required.

36. Social science, particularly qualitative research methodology, is increasingly being used as a means of providing evidence in animal welfare policy-making. Although systematic reviews, along with comparative statistical assessments of research findings, are commonly associated with quantitative natural or medical science research, systematic reviews are increasingly used to synthesise qualitative research. Such research is subject to similar procedures of critical peer review and publication standards.

37. Qualitative social research that is methodologically robust in its descriptive, interpretive, conceptual and policy-making contribution, can offer valid evidence in real-world and every-day contexts that cannot be met by standard scientific experimental approaches and controlled trials²⁴.

²⁰ Whay, HR, Main, DCJ, Green, LE & Webster, AJF (2003), '[Animal-based measures for the assessment of welfare state of dairy cattle, pigs and laying hens: consensus of expert opinion](#)', *Animal Welfare*, 12 (2), pp. 205 - 217.

²¹ Hubbard, C and Garrod, G (2011). Development of policy instruments and indicators towards the EU Action Plan on Animal Welfare: The Delphi Report, EconWelfare Project (unpublished but available from the authors).

²² Bennett, RM; Broom, DM; Henson, SJ; Blaney, SJP; Harper, G, (2004) Assessment of the impact of government animal welfare policy on farm animal welfare in the UK, *Animal Welfare*, 13 (1), pp.1-11.

²³ Magalhães-Sant'Ana, M, More, SJ, Morton, DB and Hanlon, A (2016), Ethical challenges facing veterinary professionals in Ireland: results from Policy Delphi with vignette methodology, *Veterinary Record*, October, Open access, <http://veterinaryrecord.bmj.com/content/179/17/437>

²⁴ Farm Animal Welfare Committee. [FAWC opinion on the health and wellbeing of farmers and farm animal welfare](#). February 2017

IV. The limitations of evidence

38. Within the context of formulation of evidence-based decisions and policy, there are several limitations that may inhibit or prevent a completely rational objective process.

a. Lack of access to evidence

39. Access to evidence may be limited. This may be due to a need for evidence or research that has not been undertaken or to an inability to access work that has been done through physical, social or financial barriers.

40. Research within the field of farm animal welfare science has significantly increased in the last 20 years, but this has not always been sufficient to address the dearth of scientific work necessary to provide evidential answers to many welfare-related questions. Historically, scientific research has often been too narrow to be applied easily to the commercial world (e.g. objective studies in the welfare of free farrowing systems in pigs). There has also been a lack of near-market or developmental research, traditionally not funded by central government.

41. In some cases, there are sound ethical reasons not to undertake certain experimental research on animals, for example, where unnecessary and avoidable harm may result, or where the repetition of previous research is deemed inappropriate and unnecessary. Research may also not take place as a consequence of the challenges of complying with legislation such as the Animals (Scientific Procedures) Act 1986 (as amended). While these clearly serve an important purpose in the protection of animals, they may also discourage some useful research due to additional financial and human resource requirements.

42. There is an increasing requirement for published research to be accompanied by the data used. This information could be used for checking results but could also fill servers with data that might never be accessed. Data access requirements should be proportionate.

43. The cost of accessing research findings is considerable. Most journals, especially those that are highly ranked, require readers to pay to access content. Universities, government departments, research organizations and private companies subscribe to large bundles of journals, although it is also possible for groups and individuals to access content on a pay per view basis.

44. However, the funders, producers and users of research are all increasingly dissatisfied with this situation. Funders rightly expect that the work they pay for be disseminated as widely as possible. Producers allow journals to publish their work without payment, as well as undertaking extensive unpaid peer review work for publishers. Research users frequently regard research findings as a public good. "Open access" routes to research findings have therefore been developed. Under the "gold" route, a journal article is made immediately freely available online to anyone, including non-subscribers. To compensate the publisher for notional lost subscription income, the author's institution or research organisation pays a substantial article processing charge

(also known as a publication fee), which is approximately £2100 on average.²⁵ Because of the high cost of this access route, research organisations have developed an alternative “green” route (also called self-archiving). This is when the author or their institution places a version of the article (e.g. the accepted but unformatted version) online in an institutional repository after its publication in a subscription journal. This makes the article freely available to everyone.

45. It is extremely encouraging that many animal health research institutions are now including the necessary fee for “gold” open access to research findings in grant applications. However, the question remains of whether publishers should require payment for research that is publicly funded, whether via a research grant or through being conducted on university or public premises that are supported by public money.

46. Given this situation, research findings may not reach a wide audience in a timely manner. Articles may be published online for advance subscriber access as soon as they have been accepted and formatted, before being assigned to an issue of the journal. However, under “green” open access, different publishers enforce different rules about the length of time that must elapse before an article is freely available via an institutional repository (e.g. six months, one year, two years).²⁶

47. Moreover, incomplete results, such as those from abandoned research, are usually not disclosed, even though the reason for their abandonment may be significant and may prevent similar research being repeated in future unmodified. Furthermore, when the commissioners or funders of research have vested interests a conflict of interest may result, which prevents publication or results in partial publication.

48. A further reason for failure to publish may be lack of time, where researchers suffer from work overload due to the total amount of research, teaching and administration that their institutions require them to undertake. However, it is usually quicker to publish the results of research that has already been completed than to initiate an entirely new project.

49. Even where research is published, for those outside of institutions that have comprehensive journal access the financial cost of accessing such research may be prohibitive.

b. Validity of individual pieces of evidence when using research as evidence in policy making

50. In the general scientific context, it is claimed that much published research is to a greater or lesser extent flawed²⁷. However, it is not to say that this necessarily diminishes its usefulness as evidence or value to society²⁸, but highlights the need to strive for improved standards of research and close scrutiny of findings. There needs to be a degree of caution exercised because of these faults. Thus, scientific and statistical literacy

²⁵ ‘How much do publishers charge for open access?’, University of Cambridge website, <https://osc.cam.ac.uk/open-access/open-access-policies/paying-open-access/how-much-do-publishers-charge-open-access>.

²⁶ M. Laakso and B.-C. Björk (2013), ‘Delayed Open Access – an overlooked high-impact category of openly available scientific literature’, *Journal of the American Society for Information Science and Technology* 64, 1323–9 .

²⁷ Ioannidis, John P A (2005) Why most published research findings are false. *PLoS medicine* 2 (8) e124

²⁸ Djulbegovic, Benjamin; Hozo, Iztok (2007) When should potentially false research findings be considered acceptable? *PLoS medicine* 4 (2) e26

in those appraising evidence or forming policy is an invaluable skill, and a cornerstone of Evidence-Based Veterinary Medicine.

51. Most scientific studies set out to investigate whether a relationship exists between an exposure or treatment and an outcome, and the magnitude of that relationship if present. The design of the study and in particular, number of animals studied can dramatically influence the probability of identifying a relationship where present, or obtaining results by chance that lead to the incorrect conclusion that a relationship exists where it does not. Small studies, common in animal welfare research, are particularly at risk of this. Even the results of large studies should be viewed with caution, as unapparent biases or methodological flaws may exist; it is therefore desirable for replication or having multiple studies examine the proposed relationship, especially where findings are surprising or where the social impact may be great.

52. A key criterion in determining the validity of scientific results is experimental repeatability. There is a risk of missing some biological variability in results if research is not repeated. Extraordinary scientific findings require extraordinary scrutiny and surprising results almost demand repetition of research or verification in related work. However, because some research may involve moderate to severe impact on animals, e.g. welfare at killing research, repetition might not always be desirable. In addition, work that is aimed at replicating the findings of others is very unlikely to be funded.

53. FAWC was told at consultation that research findings are likely to align with the views or objectives of the funding organisation more often than could be supposed by chance, even allowing for publication bias. Although scientific fraud does occur, this effect is more likely due to subtle 'moving of goalposts', such as changing the stated trial outcome measures or stopping trials prematurely if positive results occur. If the stated objectives, methodologies and outcome measures are registered in advance, the risk of this bias is reduced. In addition, if the research has received publicly funded support through either direct grants, human resources or tax subsidy for the research organisation (e.g. NGO) then there is an argument that full publication should be a pre-condition of the commissioning arrangement.

c. Shortcomings in evidence collation and appraisal

54. The growth of evidence-based (veterinary) medicine favours certain research methodologies as procedures for knowledge production (notably experimental trials). Research findings available elsewhere (whether in 'grey literature' such as unpublished or 'internal' or 'private' research reports) are rarely included in such methodologies for evidence generation, leaving potential gaps in the evidence base.

55. The focus on experimental quantitative research that is explicit in most evidence-based approaches can reduce the potential evidential impact of alternative research approaches that adopt more qualitative techniques or other methodologies. The growing institutionalisation of formal evidence gathering through distinctive private and public organisations, each with distinctive methodologies and approaches, might result in a narrowing down of the opportunities for other forms of knowledge-making to be recognised and to contribute to both clinical and policy decision/policy-making.

56. Holmes and Cockcroft (2004) argue, "the value of evidence from clinical trials is directly proportional to the statistical power of the study [and ...] the probability of an effect

actually being detected by that study”²⁹. Expertise, expert engagement and informed judgement remain critical in the translation of evidence to advice and to policy or clinical decision-making.

57. Animal welfare research and policy development normally incorporates a balance of evidence from scientific and ethical domains as well as other considerations, such as economic, commercial and political. The public declaration of all potential conflicts of interest by those producing, reviewing, or using evidence to promote policy is therefore essential and should be open and transparent. Such transparency is particularly applicable to those whose livelihood is directly affected by the policy outcomes, with the caveat that highly specialised and relevant expertise will still be needed, albeit in a controlled context. Equally, ideological views relevant to the topic under review may compromise objectiveness of assessors and therefore should be made clear.

58. Where specific recommendations for the use of a medicine or treatment are the required end-point of evidence assessment, expert opinion will still always come into play. The culmination of NICE’s GRADE method, for example, is the Standing Committee of appointed experts whose role is to interpret the results of the GRADE assessment, to ascertain what the evidence means in the context of the questions set in the original review and, finally to decide what recommendations can be made.

59. While more formalised procedures for assessing evidence invariably have a positive impact on rational advice and policy, they are typically very resource-heavy (in both financial and human terms) and may not be able to operate within the timeframes sometimes imposed by decision-makers or necessary for society. In this respect there is a risk that “the perfect may become the enemy of the good”; and there is a line of reasoning that the method of evidence appraisal should remain proportionate to the societal impact and the necessities of the end-users.

²⁹ Holmes, M. and Cockcroft, P. (2004) Evidence-based veterinary medicine: Why it is important and what skills are needed. *In Practice* 26 (1) 28-33.

V. Evidence-based approaches within animal welfare practice and policy

60. Veterinary medicine has embraced the evidence-based approach developed for human medicine. The Royal College of Veterinary Surgeons (RCVS) states that ‘the case for evidence-based veterinary medicine (EBVM) is [...] one for improving the success rates of clinical decisions, saving lives and providing better standards of care’³⁰. Evidence-based approaches form part of the core curriculum of modern veterinary education³¹. The establishment of the Centre for Evidence-based Veterinary Medicine at the University of Nottingham in 2009 and the later RCVS charity partner Knowledge being established as an international information hub of evidence-based veterinary knowledge for veterinary professionals are clear examples of the evidence-based approach.

61. Large-scale trials, and particularly randomised controlled trials, are a lot less frequent than studies on smaller samples, principally for reasons of funding and methodological feasibility, particularly within ‘real-world’ contexts of commercial livestock farming. Moreover, where they do occur, they are far more often found in the development and testing of veterinary medicines than in the more specific field of animal welfare.

62. Evidence-based approaches in the field of animal welfare are therefore currently limited by a much smaller volume of published research; some study results remain in the form of unpublished research reports to public or private commissioning bodies and may not meet eligibility criteria for submission to scientific, peer-reviewed journals.

63. There are notably far fewer guidelines for the reporting and publication of veterinary and animal welfare research than exist in medical science (for example, STROBE). The opportunities for systematic review and meta-analysis are thereby more constrained. As a result, the existing concise methodologies developed for qualifying the validity and reliability of medical evidence, such as GRADE, are not always easily or equally applicable to welfare research outputs and evidence.

64. The nature of animal welfare, with its unique combination of science and human values requires what is often a more balanced approach to evidence. Both animal and human behaviour are critical considerations of animal welfare practice and policy. Yet over simplistic models of human behavioural change are often employed in the absence of robust social science research.

65. The funding sources for animal welfare research are diverse ranging from research councils, levy boards, Defra and the Devolved Governments to NGOs, professional bodies and commercial interests. Reduced state support for animal welfare research where commercial or economic advantage may not be immediately apparent may endanger progression in some areas; it will therefore fall to such private organisations to ensure that funding for these areas continues. The ‘applied’ nature of animal welfare research also potentially makes it a less attractive prospect for funders with a remit focussed on progress in fundamental science.

³⁰ RCVS (2012) *RCVS Position Paper on Evidence-Based Veterinary Medicine*, RCVS, London.

³¹ Cockcroft, P. and Holmes, M. (2003) *Handbook of Evidence-based Veterinary Medicine*. Blackwell, Oxford.

66. Scientific evidence from animal welfare science and the reporting of research findings is no more or less prone to misrepresentation than any other field; the commercial implications of welfare research and consumer/media interest in farm animal welfare can lead to problematic distortions of evidence.

67. The day-to-day procedures of clinical veterinary practice and on-farm animal welfare decision-making are not necessarily easily served by the current formalised processes of evidence-based veterinary medicine. Expertise and reputation, experience and practice and the establishment of relationships between stockperson and veterinarian strongly guide clinical situations and diagnostic practice in the field and decisions made concerning the welfare of farm animals. Case study 2 (Appendix 1) exemplifies the importance of thorough diagnostic investigation as a method of evidence gathering and observational experience required to resolve a clinical welfare problem.

68. Not all evidence on which decisions about farm animal welfare are made is necessarily drawn from veterinary practice, veterinary science or animal welfare science. Elsewhere, FAWC has emphasised the fundamental role of the stockperson³² in ensuring and maintaining the health and welfare of livestock on the farm. As the custodians of farm animal welfare, stockpeople have a responsibility to try and incorporate objective sources of evidence into their decision making, whilst trying to balance this with the immediacy of the many decisions they must make relevant to welfare on a daily basis.

69. A significant amount of research relevant to animal welfare is now undertaken by commercial businesses, usually seeking competitive advantage through improved production efficiencies or reputational advance. Such commercial research may not be designed, implemented or interpreted by those with robust scientific training, and this may lead to erroneous conclusions and inappropriate policy decisions. Such research is also typically commercially restricted, meaning that any potential benefits to welfare are not adequately disseminated across the farm animal industry.

³² Farm Animal Welfare Council. Report on stockmanship and farm animal welfare, 2007.

VI – Using evidence in animal welfare policy and practice

70. Greater clarity is needed on how public and other bodies use evidence in the formulation of policy. Case studies 3 and 4 (Appendix 1) describe Defra's and the Agriculture and Horticulture Development Board's approaches. Policy should be based on evidence, but evidence should not be selected to prove a pre-determined policy. From FAWC's point of view the policy objective should be to maintain or improve animal welfare. This may not always be the focus for other stakeholders or may be dependent on circumstances (e.g. disease control). Policy relating to the health and welfare of farmed animals will take account of socio-economic, political, and other fields of evidence as well as that from animal welfare science. There should be clarity in policy statements about the limitations and gaps in evidence and how this is dealt with in policy formulation.

71. The European Food Safety Authority (EFSA) has recently published guidance on the structure and content of its scientific opinions and statements³³. A possible structure for reviews of animal welfare evidence, with reference to this guidance, is at Appendix 2.

72. Animal welfare evidence is particularly difficult to assess because of biological variation between species, between groups and between individuals within a species. Caution should be exercised about the use of outlying results and the exclusion of parameters/results from an experimental study that might be nevertheless present on the farm because of field conditions.

73. Eminence-based evidence, (e.g. a panel of experts), may be necessary/used where there is a lack of clear scientific evidence, in which case the selection of experts is an important component. With the ever increasing expansion of knowledge, it is not sufficient to rely on one expert and therefore a group of experts with a range of knowledge and experience are increasingly required. A representative panel might be tilted towards scientific expertise, but in the field of farm animal welfare inputs from practical expertise and experience are valid³⁴.

74. Government advisory committees, such as FAWC, usually comprise a range of experts from disciplines relevant to the issues being addressed and in FAWC's case is assisted by embedded vets and scientific advisors (from APHA) within the Defra support team. Expert views can also be co-opted on an *ad hoc* basis. The Defra Chief Scientific Adviser's review of expert evidence has raised the possibility of a collegiate approach of retained expertise to be brought in to advise on single issues or task and finish groups. Government (and FAWC) also uses stakeholder expertise through written and face to face consultation.

75. It is important for transparency that members of appointed expert advisory groups should always declare any personal, commercial or non-commercial interest which might, or might be perceived to, influence their judgement. This includes, as a minimum,

³³ http://www.efsa.europa.eu/sites/default/files/scientific_output/files/main_documents/3808.pdf

³⁴ Farm Animal Welfare Council. Report on stockmanship and farm animal welfare, 2007. Farm Animal Welfare Committee. [FAWC report on education, communication and knowledge application in relation to farm animal welfare](#). 2011

personal direct and indirect financial interests. The register of interests for members of public expert and advisory panels is usually available on request.

76. FAWC accepts that not all systematic approaches to the assessment of evidence may be appropriate to farm animal welfare policy-making. It may not be possible when formulating animal welfare policy to use formal evidence assessment structures as the numbers of evidential papers and particularly systematic reviews may be limited. Care needs to be taken when formulating policy to consider the impact on millions of animals and ensure the evidence base is as robust as possible. GRADE-type systems may be an aspirational level of evidence evaluation for critical policy decisions but farm animal welfare policy may not have a sufficient or robust enough evidence base available to it to operate this level of evaluation system.

77. In order to target resource on the highest priority areas for research, processes should be put in place whereby all stakeholders can be involved in identifying gaps in evidence. Similar situations might be considered in other agricultural systems or farmed species, but caution is needed in extrapolating farm animal welfare issues across several, often widely biologically different, species.

78. Existing policy can be challenged or confirmed by new research results and technological advances. If science is driving change elsewhere it can apply pressure on UK policy.

79. Evidence should be evaluated on its merits rather than its source. Those assessing the evidence need to evaluate but also communicate the evidence to those deciding policy. Policy officials need a level of scientific literacy, or access to relevant advice, sufficient to understand the evaluation they are presented with and to translate this into policy proposals.

80. Communication of evidential policy should set out the degree of confidence in the evidence, the limitations, gaps and further research requirements particularly if the policy impact requires monitoring. Economic impacts and cost-benefit arguments are important in agriculture where commercial interests may conflict with animal welfare and social concerns³⁵

81. Timescale is important. Government regulatory and legislative policy activity can move slowly. The situation will impact on the level of evidence relied upon, e.g. a carefully planned, high cost policy and a disease outbreak will have different timescales and different capacity for evidence gathering. Other organisations, e.g. retailers and quality assurance schemes, can react faster on economic grounds and place pressure on agricultural systems for change.

³⁵ Farm Animal Welfare Committee. [FAWC report on education about farm animal welfare](#). December 2011

VII –Conclusions

1. To clarify the definition of evidence used in this report and describe the purpose of evidence in relation to animal welfare.

82. The definition of evidence used, which is information that supports or refutes a proposition used in decision/policy making, is dependent on the availability of information which is both reliable and relevant.

83. The purpose of animal welfare evidence is both prospective - to establish new issues and policy drivers, and retrospective - to critically review the impact of existing policy and practice with a goal of identifying areas for future research.

2. To review and evaluate the range of methodologies used in human and animal health and welfare research evaluation and their reliability for use in farm animal welfare policy development.

84. Animal welfare research is in its (relative) infancy when compared to either human or animal health research. Nevertheless, the importance of finding solutions to existing welfare issues demand that existing research and evidence sources are used as effectively as possible to drive policy changes.

85. FAWC has reviewed briefly the range of quantitative and qualitative research methodologies relevant to all of these domains and has proposed the potential applicability of key methodologies from all domains to animal welfare. The limitation of material to undertake systematic reviews of animal welfare evidence means that more reliance is placed on expert views.

86. FAWC emphasises the key importance of establishing the limitations of using these sources of material, including conflicts of interest, when evaluating reliability for 'evidence based' policy formulation.

3. To describe the limitations and biases inherent in using relevant sources of evidence, and raise awareness for policy makers of the methodological risks in developing evidence based policy.

87. FAWC concludes that there are a number of key limitations that may inhibit or prevent a completely rational process of evidence-based policy development. These limitations are described firstly as a lack of access to evidence caused by its absence or non-publication or the inaccessibility of published material. The report makes clear recommendations to open access to all animal welfare research that has used live animals or has been full/part funded by public money or indirectly by tax advantages. The limited evidence base inhibits systematic review and the changes that could be driven as a result, as in human medicine. It is emphasised that an inability to publish negative results that conflict with aims may lead to experimental repetition and therefore a possible increased detriment to animal welfare. A number of recommendations are made to try to resolve this unsatisfactory situation.

88. The misreporting of research results due to lack of accuracy or skill in interpretation may also limit the value of the evidence. Systematic review and the collation of evidence

from the range of disparate sources available present particular risks for policy makers to accommodate. Experts evolve their views from a range of relevant sources and policy makers need to be aware of not only the key message but also the reliability of that message. This is particularly important in relation to ethical considerations in animal welfare and the potential for conflicts of interest for those closely involved in policy advice.

4. To describe current approaches (including case studies) which illustrate the challenges of evidence production for policy development and on farm practice.

89. The report has detailed a range of case studies which illustrate the importance and challenge of the systematic study of welfare topics and also of maintaining progress in on farm practice based on good husbandry. These studies provide an important context within which acceptable standards of evidence production can take place.

90. Animal welfare research is rarely undertaken on a sufficient scale to directly translate to commercial policy. Where experimentation has been adapted at commercial levels the results have not always been validated. There may be a need to scale up from experiment to pilot in commercial practice before a policy is adopted. Validating research in this way can identify unforeseen animal welfare issues.

5. To review critically the use of evidence in animal welfare policy development.

91. The Report has reviewed current practice in the use of evidence to produce animal welfare policy and has stressed the importance of clarity in how evidence is used and also how the limitations of the evidence are managed.

92. It is critical that policy is built on the evidence base produced and is not biased by pre-selection to meet predetermined goals. In this context it is critical that all of those involved in interpreting the evidence are scientifically literate and also meet the criteria discussed related to potential conflicts of interest.

93. An awareness of the limitations of the evidence base is vital. The impact of combining a wide range of sources of variable scale and quality accommodating the variation of differing animal species; and also potential conflicts of interest when using expert views, is crucial and should be clearly stated.

94. Generally, the lack of evidence to generate systematic reviews and also to construct GRADE type assessments make the identification of data gaps and programmes to fill them of particular importance in the future.

95. Where panels of experts are convened to provide opinion and advice on farm animal welfare (based on the available science and other information) there should be both academic and practical expertise and experience represented. It is also imperative that there is transparency about conflicts of interest.

6. To propose guidelines with which to conduct evidential reviews in farm animal welfare.

96. The field of animal welfare presents particular evidential challenges. Farming systems, infrastructure, environments, feeds, medicines, other animals, all generate contexts for the emergence of welfare issues. The provision and improvement of the

welfare of farm animals is critically an issue of human behaviour, action and practice. The interdisciplinary nature of animal welfare requires an innovative and holistic approach to the generation and use of evidence in policy making

97. Retailer and other commercial and assurance schemes should be based on sound evidence. As the greatest source of practical impact of policy on welfare they should be encouraged to contribute to evidence provision by allowing wider access to their data.

VIII - Recommendations

1. Evidence definition and purpose

98. We recommend that all evidence used to support or refute a proposition used in decision-making or policy formulation meets robust methodological standards.

2. Methods and reliability

99. Bodies involved in making policy decisions which have an impact on farm animal welfare (e.g. government, retailers, quality assurance scheme owners, veterinary surgeons' representative bodies, farmers' organisations and NGOs) should ensure they are based on the best available evidence that meets agreed standards and transparently states the process by which all such evidence is used.

100. There should be support from funding bodies for systematic reviews of (such) evidence where a sufficient body of work exists in a particular topic area.

3. Limitations

101. To ensure the best use can be made of research results in policy making, end-users of research need to be clear in communicating their needs to those funding or undertaking research.

102. Policy makers, whether in government, commercial or non-commercial organisations, or on-farm, should have access to sufficient people with scientific literacy to assist understanding of the advice they are given and in particular its limitations and the evidence gaps that exist.

103. Negative, abandoned and "failed" experimental outcomes, process and data should be made public by researchers or sponsors in a timely manner and with the same rigour as positive results.

104. FAWC recommend that, as part of corporate responsibility policies, there should be accessible information about commercial and other trials outside of direct government funding or control.

105. In animal welfare research, conclusions should emphasise, where appropriate, the limitations of experimental assumptions, methods (including sample size) and analysis.

106. There should be an obligation as a precondition of funding research to publish results. This is particularly the case for research involving public support (for example as direct grants, human resources or through taxation).

107. FAWC recommends that policy advisers and members of expert advisory groups should always declare any personal, ethical, commercial or non-commercial interest which might be perceived to influence their judgement.

4. *Current approaches/case studies*

108. Case studies that illustrate how evidence is used in animal welfare policy formulation can be found at Appendix 1.

5. *Use of evidence*

109. All stakeholders involved in farm animal welfare should actively help to identify research needs for communication to those allocating scarce research resources, in order to gain a body of evidence for decision making.

110. Government should enter into discussion with publishers with the aim of increasing the volume of research freely available online. This objective may be promoted by inter-governmental cooperation.

111. Organisations should provide a policy statement on their use of evidence in policy making for farm animal welfare declaring underlying ideological positions which may impact on selection, interpretation and application of evidence.

112. Any self or circular referencing should refer to the full source so it can be reviewed in context.

113. Where organisations introduce or amend animal welfare policy it should be driven by the evident interests of the animals per se and not only by commercial interests aimed at creating marketing points of differentiation.

114. Experimental results should be validated to ensure that they will translate into commercial practice, e.g. through commercial trials.

6. *Framework*

115. We recommend consideration of the framework at Appendix 2 to organise evidence-based policy submissions.

Appendix 1 – Case studies³⁶

Case Study 1: The collation of information and synthesis of evidence for policy formation: European Food Safety Authority (EFSA)

The members of EFSA's 10 scientific panels work to prescribed operating principles within an independent framework. The workflow proceeds from the Mandate received primarily from the Commission (but could also be from Member States or self-tasking) through the panel's risk assessment protocol and, after adoption by the panel (this process is systematised but is not a formal independent peer review process), to a communication phase which is fully transparent. EFSA staff themselves may also deliver outputs on specific topics.

EFSA's panels access evidence from three main sources: data; peer reviewed research; and expert opinion. Evidence derived from systematically reviewed scientific research and from expert opinion follows strict published EFSA Guidelines.

Animal welfare evidence review and risk assessment (RA) is often hampered by the lack of usable harmonised data and limited specific published research. Where data and evidence is insufficient or unavailable EFSA places a significant onus on expert opinion to estimate the degree of uncertainty, distinguishing between natural variability and lack of information.

EFSA has recently described a highly systematised process for selecting experts and processing their inputs (Guidance on Expert Knowledge Elicitation in Food and Feed Safety 2-14; 12(6):3734). Experts from outside the panel with unique experience may help to produce the draft opinion but adoption is determined by panel members only.

The reliance on experts to estimate risk places a very significant priority on the selection process for experts and on the process (aggregation of opinion) through which the decision-making takes place.

Example: Opinion 2014; 12(5); 3702 on the multi factorial nature of tail biting

Terms of Reference

1. Identify the multiple interactions between risk factors, welfare consequences and animal-based and non-animal-based measures.
2. Identify the strength and predictive capacity of the above identified interactions.
3. Propose a model to evaluate how likely certain welfare consequences may happen given specific risk factors and which animal and/or non-animal-based measures would better fit for the assessment of those consequences.

This study, which was tasked to quantify the relationship between the absence of manipulable materials and tail biting through the analysis of available and relevant data bases, concluded that:

'With present knowledge the relative importance of different risk factors as hazards for tail biting and the interactions between those risk factors cannot be scientifically quantified.'

The balance of the decision was that expert opinion could not compensate for the absence of quantitative information in existing studies. This study, which had to contend with a short timeframe, recommended improved harmonised data collection across Europe, including input and output data and farmer attitudes.

The strength of approach of the EFSA's approach to evidence synthesis are that it:

- Works to prescribed, transparent operating principals via a systematised process
- Encompasses several different sources of information (data, published research and expert opinion)
- Identifies information gaps and does not over-reach beyond the limitations of information (i.e. may not offer evidence or opinion where evidence is lacking).
- Takes great care to ensure that experts serving on the panel do not allow conflicts of interest or potential professional biases to influence the evidence presented.

³⁶ Case studies are in the order in which they are referenced in the text. There is no ranking of the case studies as a judgement on quality.

The potential weaknesses of this approach are that:

- Where an opinion cannot be reached, and where policy makers may still need to make a decision, this may result in policy being led by belief or from a less informed viewpoint.
- Excluding all panel members with potential (e.g. commercial) biases may see a loss of expertise, particularly in the practical application of any recommendations in a commercial setting.
- The rigorous and systematised approach may be a barrier to the timely production of evidence or opinion where a decision needs to be made within a short time-frame.

Case Study 2: The veterinary clinician

Veterinary clinicians are at the forefront of day-to-day decision-making with respect to the health and welfare of farm animals. Their access to and use of evidence may be fundamentally different to policy-makers, with a greater weight being placed upon evidence from diagnostic skills, on-site observation and experience than upon trial data and systematic reviews. Yet, when problems occur it is essential, to be able to recommend the best intervention strategies, that an accurate diagnosis is achieved. With any clinical problem the diagnosis is reached following a standard sequence of evidence gathering involving all or some of the following:

1. Farm background enquiry;
2. History of the problem;
3. Preliminary inspection of the problem;
4. Detailed clinical examination of affected animals;
5. Collection of samples from live animals;
6. Post mortem examination of fatalities;
7. Sacrifice of affected animals for post mortem examination;
8. Detailed laboratory tests on collected samples.

The following case study from an indoor commercial pig farm illustrates elements of this diagnostic sequence.³⁷ The problem occurred in young growing pigs and was first described by the farm manager as rotting feet and dropped hocks. Pigs were weaned on the farm at an average of 25 days weighing 6-8kg. On the day of weaning they received a single dose vaccine for PCVAD (Porcine circovirus associated disease) having also been similarly vaccinated against *Mycoplasma hyopneumoniae* four to five days previously. In both cases the job was undertaken by a single stockman catching and lifting the pigs by the hind leg, swinging them up under his arm to hold them such that the neck became exposed for injecting.

Problems were first seen at around 40 days of age towards the end of the stay in the wire floored first stage accommodation and continued into the second stages on concrete slats. The farm had had a history of very aggressive Greasy Pig Disease (*Staph hyicus* dermatitis) but this was not evident at the time of this problem.

Clinical examination was dominated by the existence of severe ulceration, necrosis and granulation tissue formation just above the claw of approximately 10% of pigs in the group but in every case only the left hind leg was affected. A number of pigs from this and previous weekly groups had been euthanased already due to such damage. In addition pigs with undamaged legs had hyperextension of the left hind legs and in some cases there was a marked knuckling of the lower left leg such that the dorsal aspect of the foot dragged on the floor. There was no skin sensation below the hock in affected pigs.

Deep swabs were taken from the ulcerated tissue of both live and euthanized pigs but revealed no significant bacteria, although most affected pigs had already received antimicrobial treatment on farm prior to examination. Dead pigs were subjected to detailed dissection of the left hind limb musculature, along with histo-pathological examination of tissue from the ischiatic nerve and the ulcerated granulation tissue. The latter confirmed extensive necrosis and reactive tissue with widespread inflammatory damage. Dissection of the area around the left hip joint revealed extensive fibrosis (scarring) around the main nerve as it passed around the hip joint and histopathology confirmed degeneration of the nerve below the mid-thigh level plus inflammatory scarring higher up the leg. In all cases the right hind leg was unaffected.

The evidence available suggested that pigs were suffering damage and degeneration of the main nerve trunk of the left hind leg as a result of trauma, leading to loss of limb function which either resulted in

³⁷ Strugnal B, White MEC, Scholes SFE, Hateley GOH and Woodger NGA (2001) Pig Journal 66 60-66

knuckling and abrasion or collapse of the limb such that the hock dropped to the floor (plantigrade stance). Scaring deep within the musculature around the left hip joint effectively trapped the ischiatic nerve leading to its degeneration distally. The necrosis and granulation reaction may have involved specific bacteria but whilst this was not proven, it was clearly a secondary effect to the primary nerve damage.

The stockman responsible for handling the pigs at and prior to weaning under close questioning refused to accept that he was twisting the leg of the pigs as he lifted them, claiming that he was doing what he had done for years. However, the evidence from both clinical and detailed post mortem examination indicated that trauma was occurring around the left hip resulting in nerve damage and no other feasible explanation for such trauma existed. It was concluded that the stockman had adapted his lifting technique to gain speed of operation. Immediate re-training occurred and no further cases were seen in pigs handled following re-training.

Case study 3: Department for Environment, Food and Rural Affairs

The Department for Environment, Food and Rural Affairs (Defra), a UK government department, defines 'evidence' as "reliable and accurate information that [it] can use to inform sound decisions in developing and implementing policy". For Defra, evidence includes "economics, statistics, natural and veterinary scientific information, social research, operational research, engineering, analysis, advice, monitoring and surveillance".³⁸ Acknowledging the duty of government to provide the regulatory and policy means for farm animals to be properly looked after, the function of evidence for Defra is to aid and support the decision and policy-making process and thereby maintain and improve the welfare of farmed animals.

All government departments, including Defra, assert their commitment to 'evidence-based policy'. Defra uses, in its own words, "high quality evidence, using an interdisciplinary approach (in terms of drawing together expertise from across scientific disciplines, policy areas and partner organisations) and excellence in the management and communications of evidence".³⁹

For Defra, good evidence, combined with informed judgment, is critically important in the field of farm animal welfare where the precise quantification of an animal's welfare is often difficult to achieve and can be highly contextual. The economic circumstances of livestock farming, the attitudes, behaviour and professional role of farmers, as well as different cultural settings for livestock farming complicate welfare policy decisions further. As a result, Defra has developed clear guidelines and procedures in the use, evaluation, prioritisation and creation of natural and social science evidence.

A clear distinction exists within Defra between 'expertise' and 'policy'. Expert groups, made up of scientific advisors (such as, for example FAWC), are charged with providing independent evidence, advice and expert opinion for policy makers. A specific 'Evidence Team' exists within Defra for animal health and welfare whose role is to keep abreast of scientific and other data and knowledge at both a UK and international level. Policy-making is distinct, undertaken by Defra officials and government (and for 'strategic oversight' by the intermediate and semi-regulatory Animal Health and Welfare Board for England). Defra's policy teams weigh and assess evidence and advice alongside other considerations such as cost effectiveness and the requirements of cost sharing, regulatory reform, political acceptability, fiscal responsibility, legality and practicality. Although increasingly 'evidence-based' policy-making in Defra has been described as being also by varying degrees and by necessity, rationalist, bureaucratic and expedient.⁴⁰

Along with its associated agencies, Defra collects data through statutory surveillance and inspection roles. Although it collates and synthesises scientific data and knowledge, rather than undertaking new scientific research itself, it commissions research from an increasingly wide range of providers in natural and social sciences, including projects on economics, cost/benefit analysis, monitoring, testing and surveillance activities. Defra as a whole spends £200 million on evidence each year and is part of a far wider evidence network of reference centres in the scientific and policy field of animal welfare.

In setting out future objectives in the domain of animal welfare, Defra's *Evidence Strategy*⁴¹ identifies three different forms of evidence: monitoring evidence of how statutory obligations are being met; applied

³⁸ Defra (2012) Defra Open Data Strategy 2012-2014. London, Defra, page 4.

³⁹ Defra (2011) Defra's Evidence Investment Strategy 2010-2013 and Beyond. Defra, page 11.

⁴⁰ Wilkinson, K. (2010) Organised chaos: an interpretive approach to evidence-based policy making in Defra. *Political Studies* 59, 959-977

⁴¹ Defra (2014) Making the most of our evidence: a strategy for Defra and its network. Defra, London

evidence, drawn primarily from research, that addresses policy and operational issues; and more forward looking strategic evidence to identify future challenges and potential solutions to them.

Monitoring evidence is widely used by Defra and associated agencies and bodies to assess statutory compliance to animal welfare legislation and policy. Information from farm, transport and slaughterhouse inspections may be generated – whether by formal inspection procedures or as part of specific research data-gathering exercises – to assess how policy is working or is not working in maintaining and improving the health and welfare of farmed animals. Where evidence suggests that the desired goals of specific instruments are not being met, then the evidence may be employed to justify and defend modifications to those instruments.

Applied evidence is more flexible. It seeks more explicitly to inform policy makers on whether policy intentions and operational objectives are appropriate, to identify the wider implications of the policies and objectives and any further evidence gaps that might arise. Applied evidence, often derived from commissioned research, directly informs the priorities and agendas of Defra policy, for example in the fields of animal disease protection and the implications of different responses to current or future legislation in animal welfare. Defra's *Evidence Plan* identifies the need to obtain evidence of 'effective alternatives to existing systems where proven to be necessary or to make aspects of systems more welfare friendly'.

Strategic evidence is generated and employed within Defra to support and develop responses to current and long-term challenges in animal welfare. Often this entails research into the generation of entirely new information and data to be employed as evidence in the determination of new strategic policy objectives. Defra's *Evidence Plan* for example refers to the need to develop evidence of how breeding and selection can affect the future welfare of farm animals. Risk management, contingency planning, enhanced competitiveness, non-regulatory forms of welfare governance, innovation, predictive data and responses to new and emerging issues of concern all require strategic evidence whose exact nature and form may not be yet known.

As a public authority, Defra's use and generation of evidence is purposeful. It serves the development and implementation of welfare policy and the monitoring and surveillance of compliance to welfare rules. It needs to be informed, robust and transparent. While policy must be evidence-based, as a government department Defra's use of evidence is set in the context of accompanying social, political and economic realities. Evidence is consequential and therefore weighted.

Case study 4: Agriculture and Horticulture Development Board (AHDB)

AHDB Dairy (formerly DairyCo) is a levy-funded, not for profit organisation working on behalf of Britain's dairy farmers. AHDB Dairy's remit is to solve 'market failure' in the dairy industry by tackling issues not currently being dealt with sufficiently to meet the needs of the industry. AHDB Dairy provides products and services to improve sustainability of British dairy farming by providing independent evidence-based information to British dairy farmers on: 1) feed and forage; 2) genetic improvement; 3) cattle fertility, health and welfare and 4) business skills and market intelligence. The AHDB Dairy Board (comprising the chair, eight farmers and an independent member) develop strategy and identify gaps where it considers resources should be targeted.

At a strategic level, AHDB Dairy works with farmers, vets, non-governmental organisations and academia to identify areas of concern and provide an evidence-based approach to improving animal welfare. AHDB Dairy has a five-year research and development strategy which is mapped directly on to keys areas identified as priorities. Research is commissioned and on completion of the research projects, AHDB Dairy works with its academic partners to translate and disseminate key messages to the farming community.

For example, lameness control is a key issue for the dairy sector and has been a focus of major effort for AHDB Dairy, through the development and promotion of the Healthy Feet Programme (HFP). Lameness is recognised as the third most important cattle health and welfare concern in the GB dairy industry (CHAWG, 2012). In 2012, AHDB Dairy commissioned a literature review on the treatment and prevention of lameness in cattle published between 2000 and 2011⁴². This gap analysis led by the University of Nottingham was designed to highlight what the authors believe are predominant gaps in current knowledge in the peer

⁴² Report available at: <http://dairy.ahdb.org.uk/research-development/health-welfare/completed-projects/treatment-and-prevention-of-lameness-in-cattle/>

reviewed literature. The result was that a huge gap in scientific evidence was identified as to how to effectively treat claw horn lesions. As part of the AHDB Dairy Research Partnership, the University of Nottingham was funded to conduct a randomised clinical control trial⁴³ on effective treatment of claw horn lesions (sole haemorrhage, sole ulceration and white line disease). The results from this work and all other lameness related research projects funded by AHDB Dairy are disseminated to vets, foot trimmers and farmers through the HFP. The HFP is the legacy of the Healthy Feet Project led by University of Bristol, which on completion of the project was handed over to the GB dairy industry. In 2011, the AHDB Dairy Healthy Feet Programme was launched nationally.

Improved calf survival is high up the AHDB Dairy priorities⁴⁴. In 2013, AHDB Dairy held an industry workshop with key industry stakeholders (academia, consultants, dairy farmers, farm assurance, farming unions, government, non-governmental organisations, nutritionists, retailers and vets/animal health) to discuss welfare, management and health practices to improve calf survival and drive success in the dairy industry. One key aspect identified was the need to identify and agree consistent messages to the farming community. As a result a series of factsheets and short films were produced with agreed messages on colostrum management and monitoring growth.

As messages change AHDB Dairy publish articles to update farmers and other stakeholders, for example, once-a-day feeding of calves. In 2013, confusion over the law surrounding the feeding of young calves on milk once a day was resolved by Defra /AHVLA issuing a statement outlining that it was a legal requirement to feed calves at least twice a day with liquid milk up to 28 days of age. AHDB Dairy published articles to ensure the correct information was reaching farmers. AHDB Dairy and other industry organisations including Red Tractor joined up communication and part of this joined up communication the legal requirement of feeding calves twice daily until 28 days of age has been included in the newest edition of the Red Tractor Dairy standards published in October 2014 and forms part of the audit for Red Tractor members. One challenge faced by AHDB Dairy is assessing the uptake of information as well as practice change at the farm level as a result of their knowledge transfer activities.

AHDB Dairy also has a role in improving the image of dairy farming with the public. One way this is achieved is by undertaking research to track consumer attitudes to dairy farming and consumption of dairy products. Working with industry colleagues, AHDB Dairy aims to engage and inspire consumers to take an active interest in modern dairy farming so that in the long term a positive image of the industry can be maintained. Public facing work spans a wide variety of activity to the public through www.thisisdairyfarming.com and www.foodfactoflife.org.uk.

As a levy organisation, AHDB Dairy prides itself on providing independent evidence-based approach to all its activities. Translating evidence to practice is required to create an environment that fosters change, implementation, innovation and evaluation for improvement. However, the availability of robust and reliable evidence can be a limiting factor.

⁴³ For more information on this research and its outputs see: <http://dairy.ahdb.org.uk/research-development/health-welfare/current-projects/lameness-control-in-dairy-cows/>

⁴⁴ See for example: **Best practice of rearing dairy heifers** <http://dairy.ahdb.org.uk/research-development/health-welfare/current-projects/best-practice-for-rearing-dairy-heifers/> and **Economics of rearing dairy heifers** <http://dairy.ahdb.org.uk/resources-library/research-development/health-welfare/an-economic-analysis-of-heifer-rearing-and-breeding-selection-in-great-britain—an-empirical-analysis/>

Appendix 2. An example framework for the review of animal welfare evidence.

1. **Title and aim of policy.**
2. **Objectives-** to focus the aim and encompass all relevant evidence of 'reliable' quality.
3. **Summary-** to reflect the full scope of the report and policy recommendations.
4. **Evidence base** - the sources of evidence and the reasons for inclusion and, where appropriate, exclusion. In animal welfare research the limitations in producing evidence from a restricted database and assumptions made when evidence is extrapolated to cope with data gaps should be justified in section 5.

(i) Individual studies:

- Peer reviewed Randomised Controlled Trials. Public domain.
- Agency reports. Government and non-Governmental. Not peer reviewed. Public domain
- 'Confidential' company data. Not peer reviewed. Not in the public domain.

(ii) Summary evidence.

Systematic reviews cited should state search strings and periods covered.

(iii) Expert knowledge/opinion.

Personal communications should only be used in very specific instances and be clearly cited.

5. **Assessment and Analysis.**

A cumulative assessment of the quantitative data and qualitative narrative evidence with reasoning fully justified.

Ethical considerations and animal sentience are two domains which distinguish animal welfare from other evidence bases. The treatment of these topics should be carefully integrated in to the analysis.

Animal welfare evidence normally originates from a wide range of sources and therefore the process of integration of evidence from all of the sources used should be carefully explained and a balanced opinion managed to reflect the relative weight of evidence and ethical considerations.

Limitations, uncertainty and variability should be described and quantified. (The 2015 EFSA draft guidance on quantifying uncertainty in science and risk assessments provides a 'toolbox of methodologies' for evaluating uncertainty- applicable to both qualitative and quantitative assessments.)

6. **Conclusions.**

Conclusions should:

- Be restricted to the data and reasoning already used.
- Summarise the assessment and the balance of uncertainties.
- Evaluate the success of the report in meeting the objectives and aim.

7. **Recommendations.**

Action points and policy recommendations.

8. **References**

¹ EFSA (2010) Application of systematic review methodology to food and feed safety assessments to support decision-making. EFSA Journal 8 (6)

¹ EFSA (2015) Principles and processes for dealing with data and evidence in scientific assessments. EFSA Journal 13 (6) 4121.

Appendix 3 – Membership of the Farm Animal Welfare Committee (2018)

Peter Jinman – Chairman
Martin Barker
Dr Andy Butterworth
Richard Cooper
Dr Jane Downes
Dr Troy Gibson
Dr David Grumett
Dr Carmen Hubbard
Richard Jennison
Richard Kempsey
Dr Dorothy McKeegan
Professor Richard Moody
Debbie Stanton
Mark White

FAWC Secretariat

Richard Aram
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Rachael Brunskill

Professor Laura Green, Professor Richard Bennett, Professor Henry Buller, Professor Mike Appleby and Huw Davies also assisted in the development of this report as members of the Evidence Working Group before stepping down from FAWC. The Group was also ably assisted by Brenda Rawson while she was a member of the Secretariat.

Appendix 4 – Acknowledgements

FAWC is grateful for the information and assistance provided by:

Agriculture and Horticulture Development
Board
Animal Health Veterinary Laboratories
Agency
Assured Food Standards
British Cattle Veterinary Association
Compassion in World Farming
Conservative Animal Welfare

European Food Safety Authority
National Farmers Union
National Institute for Health and Care
Excellence
National Pig Association
RSPCA
Scotland's Rural College
University of Leicester

Appendix 5 – Contact details

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Tel: 0208 02 63936 or 0208 02 63577

Website:

<https://www.gov.uk/government/groups/farm-animal-welfare-committee-fawc>

Email: fawcsecretariat@defra.gsi.gov.uk



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