

REVIEW

Backyard poultry: legislation, zoonoses and disease prevention

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In law, backyard poultry are “food-producing animals” and “farmed animals” and are subject to regulations regarding welfare, prescribing, banned procedures, disposal of carcasses, feeding bans, notifiable diseases and disease surveillance in addition to those applying to most other pets. Many owners and some veterinary surgeons are unclear about the requirements of these regulations. Backyard poultry are also associated with some different zoonotic disease risks to mammalian pets. Because a high proportion of poultry morbidity and mortality relates to infectious diseases, the health of backyard poultry is amenable to improvement through basic husbandry, biosecurity, hygiene and preventive medicine measures that can be incorporated into a simple “flock-health plan”. This article reviews these topics.

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INTRODUCTION

Laying hens have become popular pets. The husbandry and common diseases of backyard poultry are described in several books and reviews, e.g. Raftery & Poland (in press), Roberts (2008a,b, 2009), Houghton-Wallace & Lister (2012), Lister & Houghton-Wallace (2012). However, little has been published concerning the regulatory, zoonotic and disease prevention aspects of the keeping and veterinary treatment of backyard poultry. A recent small survey found that many owners of backyard flocks in the London area are poorly informed regarding such matters (Karabozhilova *et al.* 2012) corresponding with the authors' experience in other areas of the UK. Anecdotal reports indicate that some veterinary surgeons are also not fully aware of the relevant regulations.

REGULATIONS

Regulations define certain species, including the common poultry species, as food-producing animals. A number of legal obligations relate to any food-producing animal, even if kept only as a pet as the regulations do not recognise the “pet” status of food-producing animals. Backyard poultry are subject to legal requirements, in addition to those applying to non-food-producing pet species, that relate to husbandry and welfare, prescribing, banned procedures, feeding bans, disposal of carcasses, notifiable diseases and disease surveillance, the supply of eggs

and food safety, disposal of waste and environmental protection. This section reviews those aspects of UK legislation of most direct relevance to veterinary practice. Unless otherwise stated, all regulations referred to apply specifically to England, although relevant legislation in Scotland, Wales and Northern Ireland is similar.

Welfare regulations

The Animal Welfare Act (2006) applies to all domesticated animals and includes the Welfare of Farmed Animals (England) Regulations 2007 that set minimum standards for the welfare of farmed animals, defined as animals “bred or kept for the production of food, wool, or skin or other farming purposes.” The Department for Environment, Food and Rural Affairs (DEFRA) Poultry Farming Welfare Regulations (DEFRA 2013) are largely based on the Farm Animal Welfare Council's “five freedoms” (Farm Animal Welfare Council 2013). All owners of laying birds should be familiar with DEFRA's Code of Recommendations for the Welfare of Livestock: Laying Hens (DEFRA 2002). There are also Codes of Recommendations for the welfare of ducks and turkeys (DEFRA 2009a,b).

Medicines

The Veterinary Medicines Regulations (VMR) apply to food-producing species as for other pets, with three differences: Many drugs used in pets cannot legally be used in food-producing species, withdrawal periods must be applied, and both owner and veterinary surgeon must keep additional, specified records.

Medicines for food-producing animals

Under the VMR it is an offence to administer any animal medicine to an animal unless that product has a marketing authorisation allowing its administration in the UK, but where no

authorised product exists for a particular condition in a particular species, a veterinary surgeon can administer certain other products in accordance with the Prescribing Cascade. Unlike other pet species, for food-producing animals only medicines whose ingredients have been sufficiently assessed for residues safety can be used under the Cascade.

The Animals and Animal Products (Examination for Residues and Maximum Residue Limits) Regulations 1997 control residues of animal medicines in food-producing animals, prohibiting the sale or supply for slaughter of animals and animal products if the withdrawal periods for any administered animal medicines have not been followed or complied with, if residues greater than the specified maximum residue limit (MRL) are present, or if residues of drugs without a specified MRL are present. These Regulations divide all medicinal substances into three categories; allowed, prohibited and unlisted. Allowed substances have MRLs determined in at least one food-producing species. Any allowed substance, including all medicines authorised for use in at least one food-producing species, can legally be used under the Cascade in any food-producing animal, including laying hens. All allowed substances are listed in Table 1 of EU Regulation 37/2010, downloadable as a pdf file (EU 2010).

Any medicinal substance that is not an allowed substance cannot legally be used in any food-producing animal, and these medicinal substances fall into the two categories prohibited and unlisted. Prohibited substances have no MRLs because they are considered a hazard to human health at any residue level and must never be used in any food-producing animal. They are listed in Table 2 of EU Regulation 37/2010 and in Table 1A here. All other medicinal substances have not had their residues safety adequately assessed. These substances are not currently listed in Tables 1 or 2 of EU Regulation 37/2010 and so are neither "allowed" nor "prohibited" substances. Under Schedule 4 of the VMR it is illegal to prescribe any unlisted substances for, or administer them to, a food-producing animal. It is possible that some unlisted substances may become allowed substances in future. However, currently, the unlisted substances include

Table 1. (A) Medicinal substances prohibited in food-producing animals (from Table 2 of EU Regulation 37/2010). (B) A selection of medicinal substances that are not listed in EU Regulation 37/2010 (i.e. are neither "allowed" nor "prohibited" substances) and so cannot legally be used in food-producing animals in the UK

(A)	
<i>Aristolochia</i> species and preparations thereof	
Chloramphenicol	
Chloroform	
Chlorpromazine	
Colchicine	
Dapsone	
Dimetridazole	
Metronidazole	
Nitrofurans (including furazolidone)	
Ronidazole	
(B)	
<i>Topical parasiticides</i>	<i>Sedatives, anaesthetics and analgesics</i>
Emodepside	Acepromazine
Fipronil	Alfaxan
Imidacloprid	Bupivacaine
Indoxacarb	Buprenorphine
Metaflumizone	Diazepam
Pyriprole	Halothane
Selamectin	Fentanyl
	Medetomidine
<i>Antibiotics</i>	Methadone
Amikacin	Morphine
Carnidazole	Midazolam
Cefovecin	Pethidine
Ceftazidime	Phenylbutazone
Cefuroxime	Propofol
Clindamycin	Sevoflurane
Fucidic acid	
Framycetin	<i>Other</i>
Polymyxin B	Lufenuron
Pradofloxacin	Spinosad

Table 2. Medicines authorised in the UK for use in laying hens and covering many common diseases

Active ingredient	Indication	Trade name	Manufacturer	Species	Withdrawal days	
					Meat	Eggs
Colistin	Bacterial disease (Gram -ve)	Colibird (soluble)	CEVA	All poultry	1	0
		Coliplus	Bimeda	Chickens	1	0
Phenoxymethyl-penicillin	Bacterial disease (Gram +ve)	Phenoxyphen	Bimeda	Chickens	2	0
		Tiamulin	Novartis	Chickens and turkeys	2	0
Erythromycin	Mycoplasmosis	Denagard 12.5% oral solution				
		Erythrocin 16.5% Soluble	CEVA	Chickens	6	6
Tylosin	Mycoplasmosis. Necrotic enteritis	Tylan Soluble	Elanco	Chickens and turkeys	0 or 1	0
		Pharmasin 100% granules	Huvepharma	Chickens and turkeys	1 or 2	0
Flubendazole	Helminths	Flubenvet* (powder)	Elanco	Chickens, turkeys, geese	7	0
		Solubenol (soluble)	Elanco	Chickens	4	0
Fenbendazole	<i>Ascaridia galli</i> and <i>Heterakis gallinarum</i>	Panacur AquaSol	MSD	Chickens	6	0
Amprolium	Coccidiosis	Coccibal	SP Veterinaria SA	Chickens and turkeys	0	0
		Eimeryl	Global Vet Health S.L.	Chickens and turkeys	0	0

*Use of Flubenvet other than the 60 g (1%) size requires a mixing licence

many medicines commonly used in pet species, some of which are listed in Table 1B. Use of any such medicine in poultry is illegal, and meat or other products from an illegally treated animal are potentially unsafe and must never enter the food chain [Veterinary Medicines Directorate (VMD) personal communication. Dec 2013], mandating “for life” meat and egg withdrawal.

Specifically, fipronil is not an allowed substance. However, many owners use non-food animal – veterinarian, pharmacist, Suitably Qualified Person (NFA-VPS) fipronil medicines to treat poultry ectoparasites, and the authors are aware that some veterinary surgeons recommend the Prescription only medicine – veterinarian (POM-V) fipronil spray (Frontline; Merial) for poultry, despite this being illegal and the potential for eggs to be unsafe to consume. The authors are not aware of tests for fipronil residues in eggs after topical treatment of laying hens, but fipronil residues are detectable in chicken eggs after oral dosing [Food and Agriculture Organisation 2002, European Food Safety Authority (EFSA) 2012].

Withdrawal periods

Medicines authorised for use in food-producing species have withdrawal periods for their authorised use(s) stated in their summary of product characteristics (SPCs) and data sheets. Allowed substances used under the Cascade must have appropriate withdrawal periods set by the prescribing veterinary surgeon, which must be at least the statutory minimum of 7 days for eggs and 28 days for meat, but can be much longer. For some medicines used under the Cascade, residues will be detectable for longer than the statutory minimum withdrawal periods and, because there is often little or no evidence to inform a decision, veterinary surgeons should err on the side of caution as they may be accountable if residues are detected. Chicken eggs take 15 days to form, so a minimum egg withdrawal of 15 days would be appropriate unless the veterinary surgeon has reason to think otherwise.

Deslorelin implants (Suprelorin; Virbac) are used in the treatment of reproductive problems including egg peritonitis (yolk coelomitis). Deslorelin is an allowed substance, but it is not known how long such implants continue to release deslorelin when used off-license in poultry and so “for life” meat and egg withdrawal may be appropriate.

Enrofloxacin is very commonly used in backyard poultry. No formulation of enrofloxacin is authorised for laying birds, but as an allowed substance it can be used in layers under the Cascade. Regulation 37/2010 does not contain an MRL for enrofloxacin in eggs but MRLs for meat and other organs of various food-producing species range from 100 to 300 µg/kg. Therefore, an egg withdrawal period ensuring enrofloxacin residues below 100 µg/kg would be reasonable. When given to laying hens orally or by intramuscular injection at typical therapeutic doses, residues of enrofloxacin (and its metabolite ciprofloxacin) in eggs fall below 100 µg/kg before 10 days after cessation of treatment (Lolo *et al.* 2005, Herranz *et al.* 2007, Goetting *et al.* 2011). Thus, a 15-day egg withdrawal period appears sufficient for enrofloxacin.

The few medicines authorised for use in laying birds are listed in Table 2; most have 0-day egg withdrawal. Withdrawal periods are defined as starting at the end of treatment. Eggs should not be

eaten during the treatment period except that, for medicines with 0-day egg withdrawal, eggs laid during treatment can be eaten (personal communication, VMD Nov 2013). All other medicines authorised for use in poultry contain statements within their SPCs and data sheets stating that they should not be used in and/or are not authorised for laying hens. The VMD’s guidance (VMD 2013) is that these medicines can be used in laying hens under the Cascade, with appropriate withdrawal periods, in the same way as any other allowed substance.

Karabozhilova *et al.* (2012) reported that 93% of owners gave away or sold table eggs, with a small proportion also supplying meat. Veterinary surgeons must instruct the owner that eggs laid during the withdrawal period must not be eaten by the owner or by anyone else. Despite the regulations, some owners may choose to eat eggs laid during the withdrawal period against the veterinary surgeon’s instructions and advice; without condoning such behaviour, veterinary surgeons should consider further emphasising the seriousness of supplying eggs laid during the withdrawal period to others.

Record-keeping requirements

A medicines book is a requirement for food-producing animals under the VMR and should contain the information listed in Table 3A for all medicines administered. Owners must keep records for 5 years after treatment has ended, even if the animal has died. It is illegal for owners to pass prescription only veterinary medicines on to others. Veterinary surgeons should remind clients about their responsibilities under the regulations when prescribing.

When prescribing under the Cascade for food-producing animals, the veterinary surgeon must record, and keep for 5 years, the information provided in Table 3B. Drug labelling requirements under the Cascade are as for pet species, except that withdrawal period(s) must be stated. When prescribing under the Cascade, whether or not for food-producing animals, veterinary surgeons must obtain informed consent; Royal College of Veterinary Surgeons guidance is that that consent should be written.

Table 3. Information that must be recorded when prescribing for food-producing animals

- | | |
|--|---|
| A. By owners in a medicines book | |
| • | Birds’ identification (species, breed, age, flock/hut, ring number) |
| • | Drug used |
| • | Batch number and expiry date |
| • | Dose and route of administration |
| • | Date of administration |
| • | Withdrawal period(s) |
| B. By veterinary surgeons prescribing under the Cascade | |
| • | Date of examination |
| • | Owner’s name and address |
| • | Identification and number of animals treated |
| • | Result of the veterinary surgeon’s clinical assessment |
| • | Trade name of the product if there is one |
| • | Manufacturer’s batch number |
| • | Name and quantity of the active substance |
| • | Doses administered |
| • | Duration of treatment |
| • | Withdrawal period(s) |

Banned procedures

Schedule 1 of the Mutilations (Permitted Procedures) (England) Regulations 2007, as amended in 2008 and 2010, provides a list of procedures “involving interference with the sensitive tissues or bone structure of an animal” permitted for the purposes of the Animal Welfare Act (2006) to be carried out on birds. For each such procedure, Schedule 4 defines conditions under which that procedure is permitted. Some of the procedures may be carried out by laypersons, others only by veterinary surgeons. These Regulations do not limit what veterinary surgeons may do in the course of treatment of ill animals, but do limit what they can do for purely management purposes, i.e. for the convenience of the owner. Some of the procedures permitted for birds are specifically not permitted for farmed birds. Farmed animals are defined in the Welfare of Farmed Animals (England) Regulations 2007 as “animals bred or kept for the production of food, wool, or skin or for other farming purposes,” which could be interpreted to include all backyard poultry or to exclude, e.g. birds kept only for the purposes of showing or a cockerel kept as a pet never to be eaten.

Devoicing is not permitted in any bird. Owners may ask whether cockerels can be physically or chemically castrated to prevent nuisance noise and/or aggression. Implantation of a subcutaneous contraceptive and castration are not permitted in farmed birds, and may only be carried out as part of a conservation breeding programme, castration only by a veterinary surgeon with administration of an anaesthetic. While oral, injectable or implantable reproductive hormones can theoretically be used to treat noisy or “aggressive” cockerels, such usage of deslorelin implants could potentially be interpreted as a management tool (illegal) rather than as a medical treatment necessary for the animal’s welfare (legal).

Owners sometimes ask for procedures that limit flight. It is legal to clip the flight feathers of one or both wings. Dewing, wing notching and tendon severing are not permitted in any birds. Pinioning is not permitted in farmed birds. Pinioning can be carried out on non-farmed birds, but only by a veterinary surgeon, and an anaesthetic must be administered if the bird is 10 days or over (Gibbens 2013).

Beak trimming – ideally just beak tipping, but it can be up to one third of the lower and upper beak – is permitted. Backyard hens forage best with a full beak and beak trimming should be done only to ameliorate an outbreak of feather pecking or injurious pecking. A complete ban on beak trimming is proposed to take effect in the UK in 2016.

Dubbing, and de-toeing of domestic fowl and turkeys, can be carried out up to 3 days old without anaesthetic, and turkeys can be desnooded up to 21 days old.

Disposal of carcasses

A derogation from the Animal By-Products Regulations allows owners to bury pets such as dogs and cats at home. Poultry do not meet the definition of pet animals under the Animal By-Products Regulations and it is illegal for dead poultry to be buried or incinerated at home; carcasses of food-producing animals not killed for human consumption are “fallen stock” and category

2 animal by-product waste, requiring disposal by licensed operators such as veterinary practices, pet crematoria or incinerator plants approved under the Animal By-Products Regulations. Pet crematoria are allowed to return to owners the ashes of poultry (and horses, but the ashes of hooved farm animals must be buried in deep landfill).

Karabozhilova *et al.* (2012) reported that only 27% of owners disposed of carcasses legally, with 33% putting them in the general rubbish, 40% burying in the garden and 17% feeding them to wild animals.

Feeding bans

There has been a ban on feeding kitchen and catering waste to food-producing animals under the Animal By-Products Regulations since 2001. The ban was enacted to prevent spread of diseases such as foot and mouth disease, swine fever, avian influenza (AI) and Newcastle disease (ND), and specifically includes food-producing animals kept as pets [Animal Health and Veterinary Laboratories Agency (AHVLA) 2012]. It includes vegetarian homes – the only exception is homes where all the food is vegan. Vegetation from garden or allotment can be fed to laying hens if given directly and not via a kitchen. Poultry must not have access to compost heaps containing kitchen waste. The relevant Regulations are EC 1069/2009 and EU 142/2011. DEFRA (PB11755) is an information leaflet suitable for clients. The feed ban under the Transmissible Spongiform Encephalopathies Regulations in England, Scotland and Wales prohibits the feeding of raw or cooked meat and any meat products to poultry.

The practice of feeding kitchen waste to pet poultry is extremely common; in one survey 80% of 30 backyard flock owners stated that they fed their chickens waste food (Karabozhilova *et al.* 2012), consistent with the authors’ experience that the great majority of owners do so and are unaware that this practice is illegal. We suspect that the majority of owners who are aware of this illegality disregard the law. To reduce the risk of disease transference, AHVLA and the Scottish and Welsh governments have requested that veterinary surgeons remind their clients that this practice is illegal (Papadopoulou *et al.* 2013).

Notifiable diseases and disease surveillance

The two UK notifiable diseases of birds are AI and ND. Both have occurred in the UK in the last decade (Aldous *et al.* 2005, DEFRA 2009c, Irvine *et al.* 2009) and been confirmed within the EU in 2014, and there is a constant risk of either disease entering the UK via imported or wild birds. Equine viral encephalomyelitis is also notifiable, but has never occurred in the UK. It causes disease in horses and people; birds are the reservoir host and are typically unaffected. Under the Animal Health Act (1981), if a veterinary surgeon or owner has reason to suspect a notifiable disease, the local AHVLA office must be informed immediately. Salmonellosis, although not notifiable, is reportable, meaning that if it is identified in a laboratory that must be reported to AHVLA.

For both AI and ND, signs of infection in birds can range from asymptomatic to severe per-acute disease causing high

mortality. Signs of the two diseases can be very similar and may mimic those of the common respiratory diseases of chickens (Capua & Alexander 2009). Both diseases have affected backyard flocks as well as commercial poultry in other Western countries (Crespo *et al.* 1999, Schelling *et al.* 1999, Capua *et al.* 2002, Whiteford and Shere 2004, Bavinck *et al.* 2009, Smith & Dunipace 2011) and seroprevalence studies have demonstrated exposure to AI (Yendell *et al.* 2011, Madsen *et al.* 2013) and ND (McBride *et al.* 1991) in clinically healthy backyard poultry in the USA. The chances of an AI or ND outbreak first appearing in a backyard flock appear small (Bavinck *et al.* 2009, Smith & Dunipace 2011). This is fortunate, as many owners are not aware of their obligation to report such diseases and a large proportion of backyard flock owners do not consult veterinary surgeons about illness in their birds (Karabozhilova *et al.* 2012), potentially limiting reporting of notifiable diseases.

Primary pieces of legislation regarding notifiable diseases relevant to backyard poultry are the Avian Influenza (Preventive Measures) (England) Regulations 2006 and the Avian Influenza and Influenza of Avian Origin in Mammals (England) (No. 2) Order 2006 (DEFRA 2006a,b).

For disease surveillance purposes, in the regulations “poultry” includes chickens, turkeys, ducks, geese, partridges, quail, pheasants, peafowl, pigeons (reared for meat), guinea fowl, ostriches, emus and rheas. It is a legal requirement that all flocks of 50 or more poultry must be registered on AHVLA’s GB Poultry Register. This applies even if the flocks consist of a mixture of species and if there are 50 or more birds on the premises for only a small part of the year. Smaller flocks can register voluntarily, but few do so (Karabozhilova *et al.* 2012).

There is a low level of awareness among owners of what the regulations relating to notifiable diseases may require them to do urgently in the event of an outbreak. The Notifiable Avian Disease Control Strategy for Great Britain (DEFRA 2012) details the measures to be applied in the event of an outbreak. If AI or ND is confirmed, the default position is that all birds on the infected premises would be culled and the premises will be cleaned and disinfected by AHVLA. Birds on high-risk in-contact premises may also be slaughtered. All owned birds within the 3- and 10-km “protection” and “surveillance” zones, respectively, around any infected premises must immediately be housed or otherwise kept separate from wild birds for 3 weeks or until the outbreak is brought under control, which may take much longer. In an outbreak of highly pathogenic AI, the Government may possibly issue a temporary nationwide legal order for birds to be housed indoors. During an outbreak, if owners cannot meet these requirements they may have to reduce stock numbers by culling or face prosecution for failing to meet requirements. Within the protection and surveillance zones there will be restrictions on the movement of birds and eggs on and off bird premises and increased biosecurity measures enforced.

Routine preventive vaccination against AI is prohibited in the UK under the Avian Influenza (Vaccination) (England) Regulations 2006. Birds can be vaccinated against ND; the vaccine does not completely prevent infection but reduces disease severity.

If a case of suspected AI is presented to a veterinary practice, AHVLA must be informed immediately. If AI is confirmed, practice staff and clients that might have been exposed must be advised to contact the Health Protection Agency or their local doctor so that any suitable vaccinations can be given. ND is also potentially zoonotic, but in humans the signs are usually restricted to conjunctivitis.

ZOONOSES AND RESPONSIBLE ANTIBIOTIC USAGE

Table 4 lists zoonotic diseases present or potentially present in UK poultry (European Commission 2002, Grunkemeyer 2011, Dale & Brown 2013). Poultry owners in the London area have poor awareness of the main zoonotic diseases (Karabozhilova *et al.* 2012). Backyard poultry may also increase the risk of exposure to zoonoses carried by rodents, including leptospirosis, rat bite fever and hantavirus (Health Protection Agency 2013).

Campylobacteriosis and salmonellosis are common gastrointestinal infections in the UK (Health Protection Agency 2014), the two most commonly reported zoonotic diseases in the EU, and strongly associated with poultry (EFSA, ECDC 2013). The best protection against these diseases is good hand hygiene, good kitchen hygiene and thorough cooking of poultry meat and eggs. *Salmonella enteritidis* and *Salmonella typhimurium* are the two commonest causes of human *Salmonella* food poisoning and much effort has been put into reducing these organisms in UK commercial poultry. Live (Avipro Salmonella vaccines, Lohmann; Gallivac SE, Merial) and inactivated (Gallimune Se+St, Merial; Nobilis Salenvac T, MSD) vaccines against *S. enteritidis* and *S. typhimurium* should reduce faecal excretion and egg contamination by these bacteria, potentially reducing risks to humans (use of some live vaccines requires special precautions). The vaccines do not protect against other *Salmonella* species but those are mostly not zoonotic. Vaccination against *Salmonella* should

Table 4. Zoonotic disease agents associated with poultry

Viruses

Avian influenza
Newcastle disease

Bacteria (primarily food-borne)

Campylobacter
Salmonella
Escherichia coli (colibacillosis)
Clostridium perfringens
Listeria monocytogenes
Staphylococci
Other bacteria

Bacteria (other)

Chlamydia psittaci (ornithosis, psittacosis)
Erysipelothrix rhusiopathiae
Mycobacterium avium (avian TB)
Pasteurella multocida (respiratory pasteurellosis)

Fungi

Aspergillus species*
Microsporium gallinae (favus, ringworm)

*Aspergillosis is primarily an environmental infection, but is at least potentially zoonotic and is associated with poultry

Table 5. Empirical choices of first-line antibiotic for some common presentations of backyard poultry, as alternatives to fluoroquinolones

- Primary or secondary* bacterial respiratory disease:
Doxycycline³, tylosin¹, tiamulin¹, tilmicosin², tylvalosin², lincomycin/spectinomycin²; all active against *Mycoplasmas*
- Respiratory or systemic *Escherichia coli* infections, egg peritonitis[†] and other systemic bacterial infections:
Doxycycline³, potentiated amoxicillin, lincomycin/spectinomycin², apramycin²
- Trauma:
Amoxicillin², potentiated amoxicillin
- Bacterial enteritis:
Phenoxymethylpenicillin¹, tylosin¹; active against *Clostridium perfringens*
Colistin¹, apramycin²; gut activity against gram-negative enterobacteria
Tiamulin¹, amoxicillin², lincomycin/spectinomycin²

^{1,2,3}Available in a formulation authorised for: ¹Egg-laying chickens; ²poultry but not egg-laying chickens; ³pigeons and cage birds

*Many respiratory cases are viral

[†]Most cases of egg peritonitis presented to veterinary surgeons in general practice have a poor to grave prognosis and euthanasia should be considered

not be needed in most backyard flocks, but may be considered in certain circumstances, e.g. a school flock.

The frequency of food poisoning associated with poultry *Campylobacter* and *Salmonella* species adds particular importance to the responsible use of antibiotics in poultry. Several countries, including the UK, have high levels of fluoroquinolone resistance in human clinical isolates of these bacteria, a large proportion of which originate from poultry (Cody *et al.* 2012). Some countries, including the USA, Australia and Finland, have bans on the use of fluoroquinolones in poultry because of concerns regarding resistance, particularly in *Campylobacter* (Nelson *et al.* 2007, Smith & Fratamico 2010). In commercial poultry, antibiotic resistance arising in other bacteria, e.g. *Escherichia coli*, and from the use of other antibiotics, is also causing serious human health concerns, particularly abroad (Collignon *et al.* 2013).

Enrofloxacin is commonly used as a first-line antibiotic in UK backyard poultry and, given concerns over the development of antibiotic resistance in food animals, it may be over-used. Fluoroquinolones and third- and fourth-generation cephalosporins are classified as “critically important” for human medicine (World Health Organisation 2011) and should not be used as first-line antibiotics in food-producing species, particularly poultry. Ideally, antibiotic selection would be on the basis of culture and susceptibility, but that is often impractical. Table 5 lists other antibiotics, including some authorised for use in laying hens and others available under the Cascade, that are suitable empirical choices for some common presentations of backyard poultry.

Most antibiotic preparations authorised for use in poultry are only available in large volumes that may be prohibitively expensive for treating individual chickens or small backyard flocks.

DISEASE PREVENTION, HEALTH CARE AND WELFARE

Little has been published regarding backyard poultry welfare. One survey of London backyard poultry owners found that

welfare, assessed in terms of the five freedoms, of 30 backyard flocks was “in need of improvement” in 20%, acceptable in 63% and very good in 17% (Karabozhilova *et al.* 2012). That survey used a convenience sample of owners and may have selected “better” owners.

Backyard poultry live longer, more enriched lives than commercial poultry and have a greater ability to express natural behaviours. Welfare depends on many factors including disease prevention – dependent on stockmanship, husbandry, biosecurity, hygiene, preventive medicine – and disease treatment. Disease prevention and treatment for backyard poultry are often poor compared to pet cats and dogs, potentially negatively affecting their welfare. The following factors contribute to sub-optimal disease prevention and treatment:

Reluctance of owners to seek veterinary attention

One of the five freedoms is freedom from pain, injury and disease, and owners have an obligation to prevent and treat illness in their animals. However, many owners are reluctant to seek veterinary care for backyard poultry. Karabozhilova *et al.* (2012) found that owners used a variety of information sources, but only 26% used veterinary surgeons for general advice and only 57% consulted veterinary surgeons when disease was present in the flock. In the USA, the proportion of owners contacting veterinary surgeons appears much lower (Garber *et al.* 2007, Yendell *et al.* 2011). The authors’ practices receive more requests to diagnose and treat over the phone “because it is not worth spending much on a chicken” than for other species.

Some veterinary surgeons appear to have relatively low expertise and/or interest in backyard poultry. If perceived as so by owners, they may be discouraged from consulting veterinary surgeons. Veterinary surgeons should recognise when a case or treatment option is outside their area of competence and be prepared to refer the case accordingly.

Poor awareness of poultry diseases and detection of illness by owners

On average, backyard chickens presented to veterinary surgeons are more ill than mammalian pets, often being emaciated and in end-stage disease, resulting in a much higher proportion of presented chickens requiring euthanasia than is the case for mammalian pets, even for owners willing to cover the cost of treatment. Reasons include but are not limited to; chickens are outside and so may not be observed as much as other pets, they are rarely handled, their plumage hides their body condition and, being prey species, they tend to hide signs of illness. In addition, there is a low level of awareness among owners of the common diseases of chickens and their clinical signs (Karabozhilova *et al.* 2012).

Poor biosecurity and hygiene

The incidence of the various diseases of UK backyard poultry has not been quantified. Experience indicates that a high proportion of total morbidity and mortality among poultry presented to veterinary surgeons is related to infectious diseases, amongst which those listed in Table 6 are common. Poor biosecurity and hygiene promote the entry and establishment of infectious

Table 6. Common infectious diseases of backyard poultry at least partially preventable by prophylactic treatments or vaccination

Virus	Marek's disease Infectious bronchitis (respiratory and reproductive disease) Infectious laryngotracheitis
Bacteria	Mycoplasmosis (<i>Mycoplasma gallisepticum</i>)
Protozoa	Coccidiosis (<i>Eimeria</i> species) <i>Histomonas meleagridis</i> (via preventive treatment for it's nematode vector <i>Heterakis gallinarum</i>)
Nematodes	Ascarids; <i>Ascaridia galli</i> and <i>Heterakis gallinarum</i> "Gapes" (<i>Syngamus trachea</i>) <i>Capillaria</i> species
Ectoparasites	Red mite (<i>Dermanyssus gallinae</i>) Northern fowl mite (<i>Ornithonyssus sylviarum</i>) Other mite species Lice species

diseases. Poor biosecurity and hygiene in backyard flocks has been reported in the UK (DEFRA 2006c, Karabozhilova *et al.* 2012), the USA (McBride *et al.* 1991, Graber *et al.* 2007, Donahue *et al.* 2011, Smith *et al.* 2012, Yendell *et al.* 2011) and New Zealand (Zheng *et al.* 2011). Common biosecurity deficits include: mixing birds from different sources, not quarantining

new or returning (e.g. from shows) birds, not restricting access of visitors to birds, no footwear precautions, not washing hands before or after handling the birds, poor rodent control and no control of access of wild birds to the poultry area (many owners even feed wild birds near their poultry). Karabozhilova *et al.* (2012) reported that 20% of backyard poultry owners cleaned daily and 50% weekly, but 10% cleaned only monthly. Table 7A lists simple biosecurity and hygiene guidelines and, although most owners will not want to apply all such measures, many may apply some of them if their potential benefits are explained, allowing a simple, bespoke "flock-health plan" to be drawn-up.

Low use of preventive medicine

The common diseases in Table 6 can each be at least partially prevented or ameliorated by preventive medicine (in addition to good biosecurity and hygiene). Ectoparasites and internal helminths, particularly the red mite *Dermanyssus gallinae*, the ascarids *Ascaridia galli* and *Heterakis gallinarum*, *Capillaria* species and the gapeworm *Syngamus trachea*, are common in chickens (Permin *et al.* 1999, Fiddes *et al.* 2005, Sparagano *et al.* 2009, Jansson *et al.* 2010) and frequently detrimental, some even fatal, to backyard poultry (Riddell & Gajadhar 1988, Kilpinen *et al.* 2005, Lister & Houghton-Wallace 2012), *H. gallinarum*

Table 7. Elements of a simple flock-health plan for backyard poultry

A. Biosecurity and hygiene measures

- Avoid mixing birds from different sources.
- Treat new birds for ectoparasites and worms (and/or carry out a faecal parasite screen) on arrival.
- Quarantine new (or returning, e.g. from a show) birds for 2 weeks.
- Dispose of old litter before introducing new birds, especially chicks.
- Change clothes and footwear before and after visiting other poultry sites, shows or sales.
- Do not share equipment with other poultry owners.
- Restrict access of visitors to your birds, especially if they also keep poultry.
- If visitors keep birds, ensure they wear clothes and footwear that have not been in contact with their birds.
- Have a dedicated pair of boots for entering the poultry area, and keep fresh disinfectant for dipping footwear at the entrance to the area.
- Wash hands before and after handling poultry.
- If you have other pet birds, e.g. cage and aviary birds, exercise careful hygiene when moving between them and your poultry.
- Do not feed wild birds near your poultry.
- Minimise perching points for wild birds above your poultry area.
- Minimise access of wild birds to housing and feed (keep feed under cover to minimise attraction to wild birds).
- Control vermin.
- Feed nutritionally-balanced feed (and do not feed kitchen scraps).
- Keep water fresh and feeders and drinkers free from droppings.
- Clean feeders and drinkers daily.
- Acidifying water sanitisers (not in metal drinkers) reduce bacteria in water.
- Ensure well-ventilated, draught-free housing with appropriate space for the number of birds.
- Thoroughly clean and disinfect housing at least weekly.
- If possible, move huts frequently.
- Ensure adequate protection against predators.
- Properly dispose of dead birds.

B. Additional measures related to preventive medicine and illness

- Worm the flock with an effective anthelmintic every 3 to 4 months or on the basis of worm egg counts.
- Monitor regularly for ectoparasites (both during the day and, for red mite, at night) and treat as necessary.
- Know if your birds have been vaccinated and, if so, against which diseases.
- If your flock is not "closed" or disease free, consider vaccination of homebred chicks and of incoming chicks and pullets against common diseases.
- Know the most common diseases and the signs of ill health.
- Monitor daily for any signs of disease or changes in behaviour.
- For small flocks, handle birds regularly to assess body condition.
- Separate sick birds from the rest of the flock.
- In any disease outbreak, seek an accurate diagnosis as soon as possible.
- If a sick bird dies, or a healthy bird dies unexpectedly, arrange a post-mortem examination to determine the cause of death.

Table 8. Legal status of parasiticides commonly used for backyard laying birds

Ectoparasiticides	
Fipronil	AVM-GSL, NFA-VPS or POM-V Not an allowed substance: Use is illegal in poultry Often used by owners
Permethrin	AVM-GSL Use legal under the Cascade with appropriate withdrawal periods
Endoparasiticides	
Flubendazole (Flubenvet or Solubenol)	Medicated Premixture or POM-VPS Authorised for laying chickens Zero-day egg withdrawal
Fenbendazole (Panacur)	NFA-VPS, POM-VPS or POM-V Panacur AquaSol authorised for laying chickens has 0-day egg withdrawal Other formulations legal under the Cascade with appropriate withdrawal periods
Endectocides	
Ivermectin	POM-V, POM-VPS, ESPA* Use legal under the Cascade with appropriate withdrawal periods

AVM-GSL Authorised veterinary medicine – general sales list, NFA-VPS non-food animal medicine – veterinarian, pharmacist, Suitably Qualified Person, POM-V Prescription only medicine – veterinarian, POM-VPS Prescription only medicine – veterinarian, pharmacist, Suitably Qualified Person, ESPA Exemptions for Small Pet Animals (also known as the Small Animal Exemption Scheme)

*Use of ESPA medicines in food-producing species is illegal

primarily as a vector for *Histomonas meleagridis* (Schwarz *et al.* 2011). Yet backyard poultry are often not wormed, many have no treatment for ectoparasites and relatively few are vaccinated. Karabozhilova *et al.* (2012) reported that for 30 backyard flocks, 11 and 17 owners, respectively did not provide prophylaxis or treatment for red mites or helminth parasites. Veterinary surgeons should emphasise the benefits of preventive control of ecto- and endoparasites as they do for dogs, cats and horses.

Table 8 lists commonly used parasiticides. No ectoparasiticides are authorised for poultry. Owners frequently use permethrin and ivermectin, both of which can be prescribed under the Cascade, and fipronil, which cannot legally be administered to poultry; all three are available without a prescription. Red mites spend most of their time off the birds, in their environment. Frequent cleaning of the housing inside and out is important, ideally pressure washing or steam cleaning. Environmental sprays do not fall within the VMR. Spinosad (Elector; Elanco) is an effective spray for the housing, and any eggs laid during its use can be eaten, but its cost may be prohibitive for small backyard flocks. Permethrin and pyrethroid-based insecticidal and acaricidal environmental powders or sprays are also available, some of which also contain insect-growth regulators that may inhibit acarid growth. Frequently used “natural” remedies include diatomaceous earth, used in the hut for red mite and on the hens for all ectoparasites, that abrade and absorb lipids from the arthropods’ epicuticle causing them to dehydrate (Kirkwood 1974), and predatory mites which, when released in the hut, predate parasitic mites. Rigorous evidence for their efficacy is lacking, but both have plausible mechanisms and anecdotal support.

Fenbendazole (Panacur AquaSol; MSD) and flubendazole (Flubenvet or Solubenol; Elanco) are the only anthelmintics authorised for poultry; both are authorised for use in laying hens. Fenbendazole is authorised for the treatment of *A. galli* and *H. gallinarum* infections, flubendazole is authorised for the treatment of all the pathogenic nematodes and is available in amounts suitable for backyard flocks. It has demonstrated efficacy (Squires *et al.* 2012) and the authors recommend that backyard flocks be treated every 3 to 4 months or on the basis of regular worm egg counts. Several other anthelmintics can be prescribed under the Cascade. One herbal product (Verm-X) marketed in the UK for the “control of intestinal hygiene” in poultry is often used by owners as a wormer, but appears not to have suitable worming efficacy in chickens (Squires *et al.* 2012).

UK commercial poultry are routinely vaccinated, usually against Marek’s disease and infectious bronchitis (IB), often against ND and frequently against other diseases depending on local disease risk and whether they are breeders, broilers or layers. In the authors’ UK experience many breeders of pure-breed poultry do not vaccinate and it is rare for other owners to vaccinate backyard poultry. Karabozhilova *et al.* (2012) reported that 55% of London area owners had birds that had been vaccinated before obtaining them, but only 1 of 30 owners had their birds vaccinated after obtaining them. Garber *et al.* (2007) found that less than 3% of US backyard flocks had been vaccinated in the previous year.

Backyard chickens presented at veterinary practices are often suffering from diseases that could have been prevented or ameliorated by vaccination, including Marek’s disease, IB, mycoplasmosis, avian rhinotracheitis, infectious laryngotracheitis and coccidiosis. For established “closed” flocks, where the owner does not buy-in birds or go to shows and has not had previous disease problems, vaccination may be unnecessary. However, for flocks from which birds go to shows or where new birds are brought in, or there is a known endemic infection, targeted vaccination according to circumstances can greatly reduce disease risk. Although vaccines are typically available only in 1000 or more doses, most are inexpensive, and vaccinating a backyard flock may cost less than vaccinating a dog or cat.

Poultry vaccines are developed for commercial flocks with much shorter life expectancy than backyard poultry, and are authorised for administration to young birds. Most vaccines need to be given when the birds are young (for Marek’s disease ideally in ovo or 1 day old), and so must be given by breeders or suppliers. Several of the inactivated poultry vaccines are not very effective in adults unless the birds were primed as chicks. Vaccine manufacturers can be consulted for more information.

Summary of disease prevention

The health of backyard poultry may be improved by implementing basic biosecurity measures, improving hygiene, educating owners about the most common diseases and their clinical signs, regular observation and handling of the birds by the owner, increased use of endo- and ectoparasiticides and increased use of vaccination. Many of these measures can be incorporated into a simple flock-health plan (Table 7).

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