On-farm Handling and Storage of Medicines on beef and dairy farms

INTRODUCTION

Veterinary medicines are stored on the majority of UK farms, and include antimicrobials, anthelmintics, non-steroidal anti-inflammatories and vaccines (Rees et al. 2018). All prescription veterinary medicines have storage requirements as directed in the datasheet or summary of product characteristics (SPC) Vaccines often have storage and handling instructions on the SPC that are in addition to those applied to other medications. Most vaccines require storage between 2-8°C and have short shelf-lives (usually hours) once broached. As well as storage requirements, medicines have specific instructions for how, when, and where they should be administered.

Research by Cresswell et al. (2014) found that 93% of surveyed beef and dairy farmers reported obtaining vaccines from their veterinary surgeon. This suggests that the relationship between farmers and their veterinary surgeons is an important area to focus on when discussing vaccination of cattle. This article aims to highlight areas where on-farm medicine handling and storage could be improved and provide suggestions for how veterinary practices can support their clients to ensure medicines are used to their maximum benefit.

STORAGE

Health and safety requirements as well as farm assurance schemes require that medicines be stored and handled appropriately, including keeping medicines in a secure, lockable cupboard, away from domestic, office or public areas. They should not be kept with human or animal food or drink and should be separated from application equipment. Records of stock levels should be kept by the farmer and vaccines and other medicines, which require refrigeration, need to be stored in separate fridges from those containing food (HSE, 2018, Red Tractor, 2018).

There is a growing body of evidence that medicines are not being stored and handled correctly on beef and dairy farms in the UK (Rees et al., 2018). One of the main concerns is the maintenance of the vaccine 'cold chain', i.e. keeping vaccines consistently between 2-8°C. A recent study concluded that on-farm fridges sampled by Williams and Paixao (2018) failed to keep the vaccines within the required temperature range for a sustained period at least during in the study period, and to such an effect that this compromised the efficacy of the vaccines stored in those fridges.

In a study carried out in the UK, Meadows (2010) observed that although refrigeration was used prior to collection of the vaccine and once it arrived on farm, the ability to maintain a chilled temperature during transport (either by farmers or vets) was not available in 89% of cases.. As it takes only 20 minutes for vaccines to equilibrate with the ambient environmental temperature (Williams and Paixao, 2018), transportation is potentially a key target area to maintain the cold chain.

Recommendations for maintenance of the cold chain should be focused on both transport of the vaccines and storage once on farm. As the cold chain is unlikely to be successfully maintained in most farm fridges (Williams and Paixao, 2018), it may be helpful to minimise the length of time that vaccines are stored on farms, so that they are brought onto the farm just prior to a vaccination session. The Veterinary Medicines Directorate require veterinary practices to monitor fridge temperatures daily, with the aim of storing vaccines appropriately up until the point of collection, and this should also include fridges and storage used for delivery. The beef and dairy industry in the UK is in a privileged situation where it has become common practice for vets and non-vets (where suitably qualified persons (SQPs) are prescribing) to dispensevaccines and let farmers vaccinate their own cattle; in the Netherlands for example, only few veterinary medicines can be left on farm and vaccination is always carried out by vets.

As part of their role in disease prevention, it is in the interest of vets to ensure that the product sold to their clients is as effective as possible when reaching the animal. Vaccines may be delivered by

practice members, e.g. vets going out to farm visits, or picked up from the practice by the clients themselves. As vets' vehicles and veterinary medicine storage compartments are reported to routinely exceed the temperature storage requirements for most veterinary medicines (Ondrak et al. 2015), providing specific cool storage, such as a cool box, for transportation of vaccines, both for vets and clients would be a cost effective way in which to ensure the cold chain is maintained until vaccines reach the farm.

Considering the observed challenges with on farm fridges, on-farm monitoring of fridge temperatures is important and can be done cost effectively by putting a max-min thermometer in the fridge and checking this on a regular basis. This ongoing requirement to monitor regularly may be challenging to already time-poor farmers. Continuous data loggers with alarms, which alert when temperatures approach unacceptable ranges can be helpful and are in use in some veterinary practices (BSAVA Veterinary Resources). In the human field vial monitors, visual freeze indicators and 'shake tests' have been used to provide a quick and easy indication of whether vaccines have been potentially affected by temperature extremes, and have potential for application in the veterinary field (WHO, 2015).

USAGE AND HANDLING

With vets administering vaccines on farm in only 6% of cases in the UK (Cresswell et al. 2014), the responsibility for administration of vaccines and other veterinary medicines largely falls to the farmer and farm workers. It is unknown how aware farmers are of the need to keep vaccines within specified temperature ranges until they are administered to the animal. For example, some vaccines are required to be brought up to ambient temperatures of 15-25°C before administration. Although this information is on the datasheet, only about one third of farmers refer to the datasheet before starting a vaccination session (Cresswell et al. 2014). There is limited published data on the actual

74 effect on efficacy of the vaccine when not administered at the correct temperature, and more
75 research in this area could help farmers and vet focus on the key areas to improve.

76 Rees et al. (2018) demonstrated that 25 out of 27 farms stored expired veterinary medicines. Whilst
77 some efficacy is assumed after the expiry date of unopened veterinary medicines, large-scale studies
78 and information on specific products are not widely available (Ondrak et al. 2015). It is difficult to
79 assess whether the storage of expired products relates to their usage on farms. It is therefore
80 unclear what the impact of on-farm storage of expired medicines is, and this warrants further
81 investigation both from vets in practice as suppliers of veterinary medicines (i.e. how often are
82 products being used after the expiry date and why), and in the wider context (i.e. what is the effect
83 of using expired products?). However, from a perspective of appropriate medicines use and to
84 comply with datasheet regulations, expired medicines should be disposed of appropriately.

85 The same applies to vaccine bottles which have been broached; most vaccines have short shelf lives
86 once broached or reconstituted and should therefore be used within the time stated on the SPC
87 which could be only a couple of hours dependent on the vaccine used. On-farm storage of open
88 vaccine bottles is therefore unnecessary and should be discouraged. Ensuring that veterinary
89 practices stock smaller pack sizes will ensure that vaccines are only purchased for the number of
90 animals which require vaccination, which may help smaller herds or those with year-round calving
91 patterns where very few animals fit into a specific timing window. Some practices have started
92 'vaccination days' where clients share bottles of vaccine in order to vaccinate larger numbers of
93 animals on the same day. When particular attention is paid towards biosecurity in these cases, it can
94 be an effective way to reduce vaccine wastage amongst smaller herds.

95 Many vaccines have specific timing schedules for administration in order to optimise the immune
96 response of the animal. For example, calf vaccine schedules are designed so that the antibody
97 response is not adversely impacted by maternally derived antibodies. Conversely, colostral vaccines
98 to prevent *E.coli*, rota and corona virus infection in calves are designed to confer immunity from the

cow to the calf when administered at the appropriate interval pre-calving. Many vaccines specify that sick animals should be excluded from vaccination in order that the animal mounts the appropriate immune response and does not further compromise the animal's health (NOAH, 2018).

A

In a study evaluating farmer compliance with vaccination protocols, 27% of farmers were incorrectly administering vaccines compared to the route of administration described on the datasheet. The most common mistake was administering intramuscular vaccines subcutaneously and vice versa (Cresswell et al. 2014). In the same study, 31% of farmers were administering vaccines at the incorrect site compared with that recommended on the datasheet, with the majority of farmers injecting in the gluteal region where the neck was recommended. The actual effect on vaccine efficacy when using a different route or site of administration is not described in the published literature. It can be hypothesised, considering what is known from the human literature, that it will have a detrimental effect on efficacy and duration of action of veterinary medicines, as well as increasing the risk of formation of injection site lesions (Cresswell et al. 2017). In dairy systems where injections often occur in the milking parlour, injections are given in the gluteal region but aution should be taken when injecting in this site to avoid damaging the sciatic nerve. Where safety permits and where no injection site is specified the neck region is always preferred (Kirkwood et al. 2018) and appropriate handling systems such as races and feed barriers with self-locking head yokes can help to facilitate this. A short video directed at farmers who regularly inject in the gluteal region ('Research explained: Risk of iatrogenic damage to the sciatic nerve in dairy cattle' https://youtu.be/MXZFjXa2LUA) indicates key areas to focus on to prevent damage.

Needle hygiene is an important focus to reduce the risk of injection site lesions. During a vaccination session, using one needle for drawing up and another needle for injecting animals is good practice to avoid contamination. Gross contamination of the bottle should also be prevented and the top of the bottle kept clean using disinfectant. Changing the needle every few animals is advisable and should

be recommended at least between different groups of animals, to prevent the possible spread of contamination and disease via injection; there is a suggestion that Bovine Viral Diarrhoea virus may be transmitted via injection (Niskanen and Lindberg, 2003). The use of multi-dose injection guns with built-in needle cleaning systems have become more widespread and could help to prevent spread of contamination and disease via injection. It is also important to ensure the animal's skin is clean and dry. In the pig industry intradermal injections are becoming more commonplace to help avoid the problems such as injection site lesions that can be associated with vaccination by injection (MSD Animal Health).

Considering the significant attention towards the reduction of antimicrobials in the farm animal industry, the focus of this article is around vaccination, as the uptake of veterinary vaccines is likely to increase in the future, due to the more preventative approach that is taken on farm towards disease control. However, the principles of appropriate storage and usage apply across all veterinary medicines. Moreover, for medicines such as antibiotics, anthelmintics and non-steroidal anti-inflammatory drugs, correct dosing of products is even more important compared to vaccines as the dose of the medication is based on the animal's weight. Accurate weighing of animals either using scales, weigh tapes, or precision livestock technologies can ensure that appropriate doses of medicines are administered, as visual estimation has been demonstrated to be inaccurate (Wood et al. 2015).

TOP 10 RECOMMENDATIONS

1. Have in-car fridges/cool boxes for vets with max-min thermometers
2. Recommend cool boxes for farmers to use when collecting vaccines and during vaccinating sessions
3. Recommend placing max-min thermometer or temperature loggers in farm fridges
4. Implement 'Medicine storage & Fridge health' checks in your routine visits

5. Discuss with your farm clients how they/their staff are administering medicines and provide readily accessible support/training – annual reviews as part of farm assurance schemes are an excellent opportunity for this
6. Provide flyers with key points to consider when prescribing veterinary medicines
7. Recommend the use of weigh tapes or scales to check correct dosage
8. Offer vaccination services carried out by trained practice staff such as technicians
9. Include handling and storage of medicines topics in farmer discussion groups, share experiences, invite other sectors such as pig and poultry farmers, and promote best practice using examples in practice newsletters/social media
10. Challenge research, levy boards and the pharmaceutical industry to investigate and provide evidence for best practice and the effects of non-compliance.

ONLINE RESOURCES

The resources below are focussed around vaccination practices but include important handling, use and storage information relevant to all veterinary medicines used on farm.

Vaccinating Cattle Safely and Effectively - brought to you by DairyCo

youtu.be

Vaccines help to reduce the incidence or the severity of disease by stimulating the immune system to provide protection. This film has been created for farme...

Quiz: https://dairy.ahdb.org.uk/technical-information/animal-health-welfare/vaccination/vaccination-quiz/#.We4hgFuPKCg

Vaccination Quiz - AHDB Dairy

dairy.ahdb.org.uk

Vaccination Quiz. Related Links & Publications. Dairy Pro; Terms of Use; Privacy Policy; Accessibility Statement

Webinar Best practice for vaccination of beef and dairy cattle - AHDB Dairy, AHDB-Dairy (https://youtu.be/m6MrO1CacB4?list=PLbxhW7-AcgGWbM_ghrkza5VHAARM57LCg)

Best practice for vaccination of beef and dairy cattle - AHDB Dairy

youtu.be

Vaccines are an important tool to use in herd health programmes, however, the success of any vaccine is dependent on good management practices. There are man...

https://dairy.ahdb.org.uk/technical-information/animal-health-welfare/vaccination/#.We4hVluPKCg

176

177

178 EASIER SAID THAN DONE

179 Often the so-called 'simple solutions' as described in this article, are the most challenging to enact
180 on farm. Studies have shown that encouraging a change to improve compliance requires individual
181 farm insight into clients' motivations, values and goals (Kristensen and Jakobsen, 2011). What can
182 you do to help your clients change their current behaviour and check their fridge, expiry dates,
183 injection techniques? Asking them this question is often the best way to access this information and
184 it may take a bit of time for people to answer this question truthfully. It may be your clients want to
185 do the best they can for the animals under their care; in those situations explaining the impact of
186 using and handling medicines incorrectly (i.e. it may increase the change of disease and reduce
187 welfare compared to inadequate use) may encourage them to change their technique. Some clients
188 are motivated by money; explaining that they have just lost £2000, which they spent on
189 inappropriately stored vaccines may help to motivate an investment in ensuring for example, a
190 correct fridge temperature. Other farmers are finding time to be their main barrier and therefore
191 never 'get round' to improving their use and storage of medicines, even though they are aware of
192 their shortcomings; discussing how your practice could offer support by providing for example
193 vaccination services may help. Most farmers highly regard and trust their vet (Richens et al. 2015)
194 and by finding out what drives them, we can offer bespoke solutions and support. This could be in

the form of providing knowledge transfer through information events, or through more practical solutions such as transport and administration of vaccines.

CONCLUSION

Much of the handling and storage of medicines on farm occurs with minimal veterinary input. However, it has been repeatedly demonstrated that farmers value veterinary input on their farms (Hall and Wapenaar, 2012, Cresswell et al. 2014), particularly with regards to distribution and administration of vaccines (Richens et al. 2015). As practitioners are often regularly on farm and able to view medicine storage and administration veterinary practices are well-placed to provide services and advice in this area. Further research is warranted from levy boards and the pharmaceutical industry to provide evidence for best practice and the effects of non-compliance.

SELF ASSESSMENT QUIZ

Q1. Most vaccines should be stored between…

0-1 degrees Celcius

2-8 degrees Celcius

9-15 degrees Celcius

16-20 degrees Celcius

(Cresswell, E., Brennan, M. L., Barkema, H. W. and Wapenaar, W. (2014) A questionnaire-based survey on the uptake and use of cattle vaccines in the UK. Vet Rec Open 2014;1:e000042. doi:10.1136/vropen-2014- 000042)

217

218 Q2. What is the approximate percentage of cattle carcasses in the UK that have abscesses at
219 slaughter which are most likely due to poor injection technique and reduce carcass value?

220 2%

221 **6%**

222 12%

223 16%

224 Cresswell, E., Remnant, J. G., Butterworth, A., & Wapenaar, W. (2017). Injection-site lesion
225 prevalence and potential risk factors in UK beef cattle. Veterinary Record, 180(3)

226

227 Q3. What percentage of beef and dairy farmers obtains vaccines from their veterinary surgeon?

228 **93%**

229 73%

230 53%

231 23%

232 (Cresswell, E., Brennan, M. L., Barkema, H. W. and Wapenaar, W. (2014) A questionnaire-based
233 survey on the uptake and use of cattle vaccines in the UK. Vet Rec Open 2014;1:e000042.
234 doi:10.1136/vropen-2014- 000042)

235

236 Q4. What percentage of farmers report they do NOT read the instructions before they start
237 vaccinating?

93%

73%

53%

23%

(Cresswell, E., Brennan, M. L., Barkema, H. W. and Wapenaar, W. (2014) A questionnaire-based survey on the uptake and use of cattle vaccines in the UK. Vet Rec Open 2014;1:e000042. doi:10.1136/vropen-2014- 000042)

Q5. In a study monitoring farm fridges, what percentage of fridges maintained a temperature within the storage range required for vaccines (monitored over an 8 month period)?

0%

20%

40%

60%

(Williams P.D. and Paixão G. On-farm storage of livestock vaccines may be a risk to vaccine efficiency: a study of the performance of on-farm refrigerators to maintain the correct storage temperature. BMC Veterinary Research. 2018;14(136))

Q6. In a study investigating vaccine compliance, what percentage of farmers used a new needle for each animal they vaccinated?

0%

6%

16%

26%

(Cresswell, E., Brennan, M. L., Barkema, H. W. and Wapenaar, W. (2014) A questionnaire-based survey on the uptake and use of cattle vaccines in the UK. Vet Rec Open 2014;1:e000042. doi:10.1136/vropen-2014- 000042)

Q7. In a study assessing risk of nerve damage by injecting in the gluteal region, what percentage of participants were injecting in the 'high risk' area?

29%

49%

69%

89%

(Kirkwood, RM., Remnant, JG., Payne, RM., Murphy, AM., Wapenaar, W. (2018) Risk of iatrogenic damage to the sciatic nerve in dairy cattle *Veterinary Record* **182,** 140.)

References

BSAVA Veterinary Resources. Correct storage, dispensary management and standard operating procedures. https://www.bsava.com/Resources/Veterinary-resources/Medicines-Guide/Storage-and-dispensary-management (Accessed July 2018).

281 Cresswell, E., Brennan, M. L., Barkema, H. W. and Wapenaar, W. (2014) A questionnaire-based
282 survey on the uptake and use of cattle vaccines in the UK. Vet Rec Open 2014;1:e000042.
283 doi:10.1136/vropen-2014- 000042

284 Cresswell, E., Remnant, J. G., Butterworth, A., & Wapenaar, W. (2017). Injection-site lesion
285 prevalence and potential risk factors in UK beef cattle. Veterinary Record, 180(3)

286 Gregson, R. (2009) Cool Solutions for the Practice Fridge. *In Practice.* May 2009, 31 (5) 244-246

287 Hall, J. and Wapenaar, W (2012) Opinions and practices of veterinarians and dairy farmers towards
288 herd health management in the UK. Veterinary Record, 170 (17)

289 Health and Safety Executive, Veterinary Medicines: Safe Use by Farmers and Other Animal Handlers.
290 http://www.hse.gov.uk/pubns/as31.pdf (Accessed 1st July 2018)

291 Kirkwood, RM., Remnant, JG., Payne, RM., Murphy, AM., Wapenaar, W. (2018) Risk of iatrogenic
292 damage to the sciatic nerve in dairy cattle *Veterinary Record* **182,** 140.
293 Kristensen, E. and Jakobsen, E. B. (2011) Challenging the myth of the irrational dairy farmer:
294 Understanding decision-making related to herd health. *New Zealand Veterinary Journal* 59: 1, 1-7
295 Meadows, D. (2010) A study to investigate the use and application of BVDV vaccine in UK cattle.
296 *Cattle Practice* 18 (3)

297 MSD Animal Health IDAL Intradermal Vaccination http://www.msd-animal-
298 health.co.uk/pigs/idal.aspx (Accessed November 2018).

299 NISKANEN, R AND LINDBERG, A. (2003) Transmission of bovine viral diarrhoea virus by unhygienic
300 vaccination procedures, ambient air and from contaminated pens. The Veterinary Journal 165, 125-
301 130

302 NOAH (National Office of Animal Health) (2018) Compendium of Data Sheets for Animal Medicines.
303 National Office of Animal Health Ltd; p800, ISBN 978-0-9933994-3-5

304 Ondrak, J. D., Jones, M. L. and Fajt, V. R. (2015) Temperatures of storage areas in large animal
305 veterinary practice vehicles in the summer and comparison with drug manufacturers' storage
306 recommendations. *BMC Veterinary Research* 11:248

307 Red Tractor Assurance for Farms – Dairy Standards (2018). Version 4.1.
308 https://assurance.redtractor.org.uk/contentfiles/Farmers-6802.pdf?_=636645923445796065
309 (Accessed 13th July 2018)

310 Rees, GM., Barrett, DC., Buller, H., Mills, HL., Reyher, KK. (2018) Storage of prescription veterinary
311 medicines on UK dairy farms: a cross-sectional study *Veterinary Record* Published Online First: 09
312 November 2018. doi: 10.1136/vr.105041
313 Richens, IF., Hobson-West, P., Brennan, ML., Lowton, R., Kaler, J., Wapenaar, W. (2015) Farmers'
314 perception of the role of veterinary surgeons in vaccination strategies on British dairy farms
315 *Veterinary Record* **177,** 465

316

317 Wood, S. Reyher, K. K. and Barrett, D. C. (2015) Comparison of visual assessment and heart girth
318 tape measurement for estimating the weight of cattle in clinical practice. *The Veterinary Journal*
319 203:3, 337-338

320 World Health Organisation, (2015) Immunization in Practice - A practical guide for health staff,
321 Module 2: The vaccine cold chain. [online] Available from:
322 http://www.who.int/immunization/documents/IIP2015_Module2.pdf?ua=1 (Accessed 16th July
323 2018)

324 Williams P.D. and Paixão G. On-farm storage of livestock vaccines may be a risk to vaccine efficiency:
325 a study of the performance of on-farm refrigerators to maintain the correct storage temperature.
326 BMC Veterinary Research. 2018;14(136)