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Cattle Health and Welfare Group Antimicrobial Usage Subgroup (CHAWG AMU) recommendations for measuring and comparing the use of antibiotics on UK dairy farms

Summary

The CHAWG Antimicrobial Usage Subgroup (CHAWG AMU) core set of standard metrics for benchmarking antibiotic use on UK dairy farms was developed in consultation with the wider dairy industry. The CHAWG AMU group recommends that the following core metrics are calculated for benchmarking dairy farms, for both total usage and overall usage of Highest Priority Critically Important Antibiotics (HP-CIAs), defined as category B by the Antimicrobial Advice Ad Hoc Expert Group (AMEG)[1], i.e. quinolones (including fluoroquinolones), 3rd and 4th generation cephalosporins and colistin:

- Core Metric One = mg/Population Correction Unit ($PCU^{dairy\ farm}$)
- Core Metric Two = Average number of antibiotic courses per dairy cow for dry cow therapy
- Core Metric Three = Average number of antibiotic courses per dairy cow for lactating cow therapy

The following additional (non-core) metrics are also discussed as they can provide additional value for internal management and benchmarking purposes.

- Youngstock metric = mg/ $kg^{dairy<6months}$
- Animal based metric one = % Animals Treated
- Animal based metric two = % Treatment Days

1. Responsible Antibiotic Use

Antibiotics are very important medicines. Every time an antibiotic is used, there is a risk that it will increase the number of bacteria resistant to that antibiotic. This means that these antibiotics will stop being effective for treating infections in people and animals. Responsible antibiotic use, alongside measures to prevent disease, is therefore vital to help preserve these life-saving medicines.

Some antibiotics are also very important as a last resort for use in the treatment of serious infections in people. These are called Highest Priority Critically Important Antibiotics (HP-CIAs). The HP-CIAs, as currently defined by the Antimicrobial Advice Expert Group (AMEG)[1] within category B[1], are quinolones (including fluoroquinolones), 3rd and 4th generation cephalosporins and colistin. It is very important to minimise how much of these HP-CIAs are used on farms and to only use them when needed, for example when bacterial culture and sensitivity show it is the only antibiotic that is effective to treat a particular case.

Dairy farmers and vets should work together to monitor the amount of antibiotic used on farm every year and ensure that antibiotics are used responsibly. This is now part of the Red Tractor standards for dairy farms[2].

2. Benchmarking Antibiotic Use

Farm benchmarking refers to the comparison of a farm's antibiotic usage with other farms in the region/country. This has several benefits:

- It allows farms to understand their antibiotic use and how this is changing over time and relative to the industry
- It stimulates the vet-farmer conversation and should encourage persistently high using farms to look into their management practices and make changes

Monitoring antibiotic use and benchmarking is increasingly being carried out by veterinary practices, and some food retailers and milk buyers are placing emphasis on regular reporting of antibiotic usage data[3,4]. In addition, all Red Tractor dairy farms are required to collate antibiotic usage and undertake an annual review of antibiotics with their vet[2].

When interpreting benchmarking data, it is vital to focus on encouraging responsible antibiotic use. Herd health planning and strategies to prevent disease are key to reducing the need to administer antibiotics and improving health and welfare on the farm. Reducing use by, for example, withholding necessary treatment, using lower than recommended doses or switching to an inappropriate antibiotic because it has a lower amount of active ingredient per dose, is not responsible use.

The CHAWG AMU group have carried out an open consultation with dairy farming and other organisations to develop a core set of standard metrics for benchmarking UK dairy farms. This document reports on the chosen core metrics, which will be incorporated into the Medicines Hub for Cattle and Sheep, as well as additional metrics that could be considered. There has not been unanimous agreement from all CHAWG AMU group members/ stakeholders consulted but, on areas where there are disagreements, the arguments for and against and the consensus view are presented here.

There are many different ways of benchmarking dairy farms, each with their own advantages and disadvantages[3,4]. If a standard UK benchmarking system is not developed, there is a risk many different methods will be developed, potentially meaning farmers and/or vets may need to provide different data to different interested parties, which could prove an added burden.

The CHAWG AMU group have considered many different possible benchmarking metrics used across Europe[3,4,5,6,7,8] with the aim of choosing the core metrics that are most appropriate for use in the UK dairy sector. While different metrics show different things, the CHAWG AMU group believe that the number of metrics should be minimised as far as possible, as having too many metrics may be confusing for vets and farmers.

There is always a balance between improving accuracy and having a metric that as many people as possible can use. The recommendations provide a core set of metrics that include standardised average weights at treatment and standardised treatment courses. The metrics should therefore be considered "technical units" rather than true values, as the standard assumptions may not reflect the actual weights at treatment or treatment courses used on each farm. The results need to be interpreted carefully by the farm's veterinary surgeon on a case by case basis, considering specific factors on each individual farm.

The recommendations assume a 12-month benchmarking period is being used which could be based on a calendar year (e.g. 2020) or a rolling year to date figure (e.g. 1st September 2019 to 31st August 2020).

3. Core Metric

The CHAWG AMU group recommends that the following core metrics are calculated, for both total usage and overall usage of Highest Priority Critically Important Antibiotics (HP-CIAs), as defined as category B by the Antimicrobial Advice Ad Hoc Expert Group (AMEG)[1], i.e. quinolones (including fluoroquinolones), 3rd and 4th generation cephalosporins and colistin:

3.1 Core Metric One = mg/PCU$^{\text{dairy farm}}$ for total use and use of HP-CIAs:

a) *mg = the total weight of antibiotic active ingredient used:*

Every antibiotic product contains a known amount of active ingredient. This is part of its registration with the Veterinary Medicines Directorate (VMD) and is centrally recorded. By measuring the number of units used on a farm in each recording period (e.g. calendar year or rolling 12-month recording period) then it is possible to calculate the weight of active ingredient in milligrams (mg):

Antibiotic product	Amount used (A)	Concentration mg/unit (C)	Total antibiotic used in mg (A x C)
Duphapen + Strep	1500 ml	372 mg/ml	558000
Betamox LA	250 ml	150mg/ml	37500
Chloromed	500 g	150 mg/g	75000
Tetra-Delta Intramammary Lactating Cow	200 items	366 mg/item	73200
Ubro Red Intramammary Dry Cow	250 items	346 mg/item	86500
Total amount of antibiotic used (mg)			830200

The amount of antibiotic used can be collected from details of the antibiotics supplied/ prescribed to a farm (e.g. veterinary practice records) and/or records of actual use, for example from a farm medicine record book. However, caution should be exercised when comparing data from different sources as they may differ. For example:

- Veterinary practice data on antibiotics purchased by the farm has a number of limitations. For example:
  - It does not take into account possible wastage or products going out of date
  - A product purchased one year may be used in the next usage year (although in some systems this is taken account of)
  - A farm may purchase antibiotics from more than one source, for example if a farm has more than one veterinary practice looking after its animals and/or purchases medicines from a different supplier under prescription
  - For mixed enterprises, for example with dairy, beef and/or sheep, it may be difficult to determine in which species or enterprise a product has been used
- Farmer derived data overcomes the issues highlighted above, but relies on accurate and diligent recording of all medicines administered and this may be variable between farms

When recording medicine use it is important that it is linked to a standard product name and Veterinary Medicines (Vm) number (also called an MA or Marketing Authorisation number) and that it is recorded in (or can be converted into) a standard unit, i.e. ml, grams or items (where an item refers to, for example, a single bolus tablet or intramammary tube).

When calculating the weight of active ingredient used, the recommendation is to follow the methodology set out by ESVAC, which currently includes all antibiotics except topical antibiotics such as eye drops and sprays[9].

A medicine list showing all currently licensed medicines for all species (alongside the standard Vm number and name) can be found here - https://www.vmd.defra.gov.uk/ProductInformationDatabase/.

A cattle and sheep specific spreadsheet, showing all currently licensed cattle and sheep medicines (as well as medicines which expired in the last 24 months and those known to be commonly used under the cascade) and, for all non-topical antibiotics, standard units and the amount of active ingredient per unit in mg/unit (using ESVAC principles) can be found here – https://www.vmd.defra.gov.uk/productinformationdatabase/downloads/CattleSheepProductData.xml.

b) *PCU $^{dairy\ farm}$ = the estimated weight of animals at risk on the dairy farm (in kg):*

This refers to the estimated weight of animal at risk on the dairy farm, based on the average weight at time of treatment. This is calculated by multiplying the average number of adult dairy cows by 425kg. Adult dairy cows are defined as female dairy breed animals 2 years of age or older, including those that are lactating, in the dry period or destined to become culls. A list of dairy breeds is included in the Supplementary Materials.

425 kg is the weight used by ESVAC in the PCU figure used for national monitoring of antibiotic sales data and is intended to represent the average weight at time of treatment[8].

In the example above, if we assume there were an average of 100 dairy cows during the recording period then:

- PCU = 100 * 425kg = 42500kg

c) *Calculation of mg/PCU$^{dairy\ farm}$:*

mg/PCU$^{dairy\ farm}$ is calculated by dividing:

- The total weight of antibiotic used on the farm (in mg) by
- The total weight of animals at risk on the farm (in kg)

If we use the figures described in this section then we get the following:

- mg/PCU$^{dairy\ farm}$ $= \frac{830200\ \text{mg}}{42500\text{kg}}$ = 19.5

It is important to note that, even though only the weight of the adult dairy cows is considered in the kg “weight of animals at risk”, all usage on the dairy farm should be included in the weight of antibiotic used on the farm (including usage from calves and replacement dairy heifers).

3.2 Core Metric Two = Average number of antibiotic courses per dairy cow for dry cow therapy

This is calculated by dividing the number of dry cow antibiotic tubes sold by 4 (the assumed number of tubes used per course) and then dividing this by the average number of adult dairy cows.

If we use the figures described in the section above then we get the following:

- $\frac{(\frac{250 \text{ tubes}}{4})}{100 \text{ dairy cows}}$ = 0.625

3.3 Core Metric Three = Average number of antibiotic courses per dairy cow for lactating cow therapy

This is calculated by dividing the number of lactating cow antibiotic tubes sold by 3 (the assumed number of tubes used per course) and then dividing this by the average number of adult dairy cows.

If we use the figures described in the section above then we get the following:

- $\frac{(\frac{200 \text{ tubes}}{3})}{100 \text{ dairy cows}}$ = 0.667

The core metrics described in this section align with how national use in the dairy sector is being reported, for example in the UK-VARSS report[10] and in the antibiotic usage targets for the dairy sector[11]. It should be noted, however, that the antibiotic usage targets are based on a total national UK figure and therefore reflect the mean usage per dairy farm. They are not intended to be a farm-level target and, when interpreting farm level antibiotic usage, the specific situation on that farm, include system type and disease challenges, need to be considered.

4 Additional Youngstock Metric

In addition to the Core metrics described in section 3, it is recognized that antibiotic use in calves is an important issue on some farms[12]. However, due to the smaller liveweight of calves relative to the weight of the adults, especially those less than 6 months of age, their antibiotic use can be hidden in farm “mg/kg” metrics relative to the use in larger adult cattle. In addition, industry feedback suggests that high use in youngstock doesn’t necessarily mean high use in adults and vice versa. It is therefore recognized that, where possible, there is value for management purposes in capturing and benchmarking youngstock antibiotic use separately, alongside the overall farm-level figure(s). This data can also be compared to other data, such as vaccine usage and mortality, which is invaluable in helping feed into the vet-farmer discussion.

In order to do this, a separate “mg/kg” calculation (for both total and HP-CIA use) can be carried out for calves under 6 months. It is important to reiterate that, even if using the youngstock metric, the antibiotics used in youngstock must still be included in the total weight of antibiotics used on the farm when calculating $mg/PCU^{dairy\ farm}$. Calculation of the youngstock metric for calves under 6 months is only recommended for management purposes and will not be used for national reporting.

4.1 $mg/kg^{dairy<6months}$ for total use and use of HP-CIAs:

a) $mg^{dairy<6months}$ – weight of active ingredient for calves under 6 months of age

In order to determine usage in calves up to 6months of age, it is necessary to know the volume of medicines that have been used in these calves (as opposed to the cattle which are 6 months of age and over).

If using farm data, this can be achieved by the farmer assigning medicine use (e.g. on an electronic medicines book) to:

- an individual animal ID
- a particular age-group or animal/ group of animals, for example by choosing on a drop down menu “< 6 months” or “≥ 6 months”

If using vet prescription/ delivery data, this can either be achieved by:

- Assigning at the point of sale that the medicine is being prescribed to be used in cattle “< 6 months” or ““≥ 6 months” (the preferred method)
- Retrospectively looking at the vet data and assigning particular products (or volumes of products) to cattle “< 6 months” or “≥ 6 months”

We will use the example in section 3 and assume that all the Betamox LA (37500mg) was used in calves under 6 months of age.

b) $kg^{dairy<6months}$ – average liveweight of cattle <6 months of age on the farm (in kg):

This can be calculated using a national traceability database to collect the "average number of animals on the farm less than 6 months of age" (see question and answers for more details on how this is determined) using the following categories and standard weights:

	Standard Weight
Dairy sired female	108kg
Dairy sired male	118kg
Beef sired female	112kg
Beef sired male	122kg

A list of breeds which are considered "Dairy" are included in the Supplementary Materials. Other breeds should be considered beef.

These weights are consistent with those used in the beef benchmarking metrics and represent "the average category liveweight" (which is different to the $PCU^{dairy\ farm}$ where 425kg represents the average weight at time of treatment). Liveweight was chosen in this case, as it can be estimated for different categories of animals using available liveweight/ carcass weight data, whereas data on the average weight at time of treatment for these different categories is not available.

If in this case, the farm has an average number of 6 dairy sired females <6 months of age and an average number of 4 dairy sired males <6 months of age then:

$kg^{dairy<6months}$ = (6*108kg)+(4*118kg) = 1120kg

c) *Calculation of $mg/kg^{dairy<6months}$:*

$mg/kg^{dairy<6months}$ can be calculated by:

- Dividing the total weight of antibiotic used in calves <6 months on the farm (in mg) by
- The total liveweight of calves <6months at risk on the farm (in kg)

If we use the figures described in this section then we get the following:

- $\mathbf{mg/kg^{dairy<6months}} = \frac{37500\ \text{mg}}{1120\text{kg}}$ = 33

4.2 Animal based metrics

Because of the limitations of weight-based metrics, where more detailed farm level data is available, CHAWG AMU also recommend that animal based metrics are considered for farm and youngstock monitoring, and for assessing total use and use of HP-CIAs. These have a number of additional advantages as follows:

- Each animal is treated the same (e.g. calves and adults)
- There is no need to apply standard animal weights
- They can be more easily applied to non-antibiotics e.g. Non-Steroidal Anti-Inflammatory Drugs
- The figures may be more tangible and easier for the vet and farmer to understand and monitor progress

However, they are considered to be "non-core" as they require information to be obtained directly from the farm (for example using the farm's animal medicine records or electronic medicine records) and cannot be calculated using vet prescription/ delivery data.

4.1.1. % Animals Treated:

For this calculation, you need to know the number of animals treated with an antibiotic over the 12 month recording period – which could be calculated using, for example, the farm's animal medicine records or an electronic medicines book. Treated animals refers to any animal that has received one or more antibiotic courses at any point in the recording period. There is no distinction made between an animal that has received one treatment course and one that has received multiple courses.

The number of treated animals during the recording period is then compared with the total number of animals that have been on the farm during the course of the calendar year, or rolling 12-month period, irrespective of how long they have been on the farm. This can be obtained using a national traceability database and takes into account all animals on the farm, including dairy cows and youngstock.

$$\text{\% Animals Treated} = \frac{\text{number of animals treated with antibiotics}}{\text{total number of animals which have been on the farm}} * 100$$

If we consider the same example included earlier, the following would be calculated:

Total number of animals on the farm (N)	Number of animals treated (T)	% animals treated (T/N) x 100
160	15	9%

This means that 9% of the animals on the farm have been treated with an antibiotic in the recording period.

4.1.2. % Treatment Days:

This is an extension to the calculation in 4.1.1 but instead of looking at the number of animals treated, it looks at the number of days that an animal receives an antibiotic. This has the advantage in that it takes into account course length and repeat treatments for the same animal. However, it does require more detailed information on course lengths prescribed. In addition, if an animal is treated with a long-acting antibiotic, then the number of days treatment will need to be multiplied by the length of activity for that product. Please see section 4 of the Supplementary Material for information relating to the average duration of action for the currently licensed long acting active ingredients used in cattle.

The total number of treatment days is then compared with the average number of animals which have been at the farm during the recording period multiplied by 365, to create a figure that represents the average % of time that each animal has received an antibiotic treatment:

$$\% \text{ Treatment Days} = 100 * \frac{\text{number of days animals were treated with antibiotics}}{(\text{average number of animals which have been on the farm}) * 365}$$

If we consider the example farm discussed, the following would be calculated:

Average number of animals on the farm (N)	Number of treatment days (T)	Treatment days per animal (T/(N*365)) *100
160	28	0.05%

This means that, on average, each animal was treated for 0.05% of the time.

5 Questions and answers

How are adult dairy cows defined?

Adult dairy cows are defined as female dairy breed animals 2 years of age or older, including those that are lactating, in the dry period or destined to become culls. A list of dairy breed animals is included in the Supplementary Materials.

How is the average number of adult dairy cows, calves under 6 months of age and animals on the farm calculated?

This should represent the average number of adult dairy cows (for the farm metric) or calves under 6 months of age (for the youngstock metric) and animals on the farm (for the % Treatment Days metric) in the 12-month monitoring period. This number may vary over the year, especially in seasonal herds. It is therefore recommended that the number is measured at specific time-points. The ideal would be an average daily count using national traceability data, but for the $mg/PCU^{dairy\ farm}$ core metric, at least once per quarter is the recommended minimum for assessing the average number of dairy cows and, for the additional (non-core) $mg/kg^{dairy<6months}$ metric, at least once monthly is the recommended minimum for assessing the average number of calves under 6 months of age and the average number of animals on the farm.

Example for the $mg/PCU^{dairy\ farm}$ metric:

- 1st January – 100 adult dairy cows
- 1st April – 110 adult dairy cows
- 1st July – 120 adult dairy cows
- 1st October – 90 adult dairy cows

Average number over the year = ((100+110+120+90)/4) = 105 adult dairy cows

Why is the liveweight of 425 kg per dairy cow used as the Population Correction Unit (PCU)? This isn't the weight of a dairy cow in the UK?

The Population Correction Unit (PCU) is a theoretical unit of measurement developed by the European Medicines Agency (EMA) in 2009 and adopted across Europe. This area has been subject to a lot of debate. The average weight of an adult dairy cow in the UK has been estimated to be 627 kg[13], with the recognition that liveweight varies considerably within and between breeds.

However, 425 kg is the weight used by ESVAC as the PCU figure for adult dairy cows[8] and is intended to represent "the average liveweight at time of treatment" over the entire lifetime of the dairy cow from birth to leaving the farm. However, concerns have been raised that explaining this concept to dairy farmers can be difficult[3].

On the other hand, the national figure for monitoring antibiotic usage will be calculated using the ESVAC methodology and, if a different weight is used for benchmarking farms, this could be confusing. In addition, while increasing the weight (for example to 627 kg) will reduce the overall farm mg/PCU, it will not affect the relative position of one farm compared to another farm. The PCU should be considered a technical unit used for the benchmarking metrics rather than a true value.

Won't the average weight vary by breed?

Yes, liveweight varies both within and between breeds. In the UK it has been estimated that, for example, the average weight of a Jersey cow is 466 kg while the average weight of a Holstein is 636 kg[13]. However, collecting animal numbers and applying different weights by breed would add an extra layer of complexity to the metric, especially as many farms have mixed-breed animals. This should be considered carefully when comparing the figures, particularly between farms with very diverse breed types.

Why are only dairy cows used when calculating the farm animal weight? What about calves, replacement dairy heifers, etc.?

It is true that some groups are missing when calculating the kg of animals at risk in the $mg/PCU^{dairy\ farm}$ metric. With this measure, usage in calves and replacement dairy heifers, for example, will be captured in the mg part of the mg/PCU calculation but their weights are not captured in the PCU part.

It was considered by CHAWG AMU that information on the average number of adult dairy cows is relatively easy for farmers to provide, compared with the average number of calves which, for seasonal herds in particular, can fluctuate widely throughout the year. Given that the majority of antibiotic active ingredient (in volume terms) is likely to be given to the adult dairy cows, the omission of calves/ replacement dairy heifers from the PCU is, in most cases, unlikely to significantly influence the relative position of one farm against another. However, CHAWG AMU does recognize that antibiotic usage in calves, for example for calf pneumonia, is a big issue on some farms and that is why using the additional youngstock metric to better understand the use of antibiotics in youngstock is recommended where possible.

What about dairy farms that also rear beef animals?

CHAWG AMU recognize that some dairy farms do rear beef animals as well. Where possible, it is advisable that farmers and veterinary practices separate dairy and beef usage, for example by having one sub-account for dairy cattle/ replacements and another for animals being reared for beef; otherwise the usage on these farms may appear high when compared with dairy farms that that do not rear beef animals.

Why are topical products excluded?

Topical products (such as antibiotic sprays and eye drops) account for a small proportion of antibiotic active ingredient used in dairy farms (1.9% for the 2016 FarmVet Systems dairy survey[10]) and removing them is in line with ESVAC methodology.

Why has mg/PCU been chosen as the core metric rather than daily doses or course doses? Might this not drive people towards using HP-CIAs?

Mg/PCU is now becoming widely recognized for national monitoring and is relatively easy to calculate and understand. It is largely a measure of injectable and oral use. For example, from the 2016 VetImpress dairy sample, 68% of use was made up of injectable preparations and 17% oral preparations[10]. This is because the amount of active ingredient per course for intra-mammary preparations is relatively lower.

A disadvantage of the mg/PCU measure is that different antibiotic active ingredients have different dose rates, and so products with higher amounts of active ingredient per course will push mg/PCU up more than products with a lower amount of active ingredient per course. In addition, mg/PCU tends to over-represent oral products relative to injectable products as, on average, these have a higher amount of active ingredient per course.

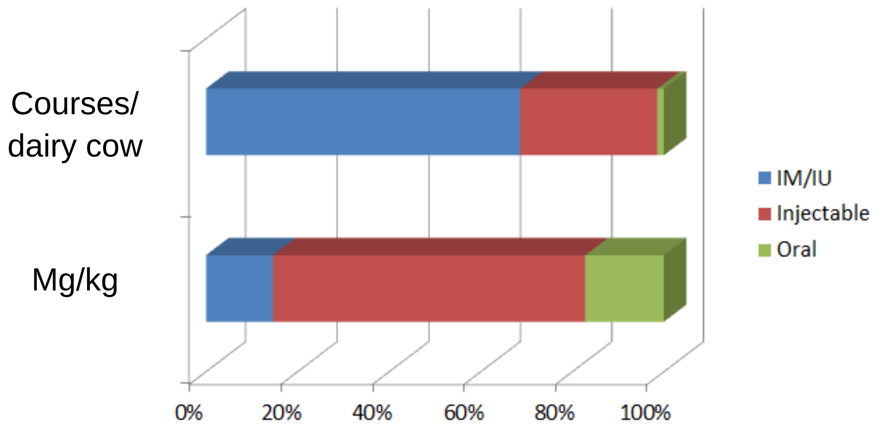
These issues can be overcome by measuring the average number of antibiotic courses per dairy cow for injectable/oral products, for example by assuming standardised doses/course lengths related to how these products are licensed for use in the UK. CHAWG AMU has received some feedback that this is easier to communicate to farmers than mg/PCU. However, average number of antibiotic courses per dairy cow was not included as a core metric for injectable/ oral products as:

- The calculation is more complicated to carry out than mg/PCU
- The products with the lowest amount of active ingredient per course are the HP-CIAs and, as long as a separate mg/kg PCU metric for HP-CIAs is monitored, this will reduce the risk that farmers will switch to these products
- The CHAWG AMU group considered that vets choose products based on what is most appropriate for that particular case, and so are unlikely to move towards using an inappropriate product just to reduce the mg/kg PCU figure

Why do we need a figure based on courses for intra-mammary products?

Because of the use of intra-mammary products in dairy cattle, the mg/kg and course metrics can differ greatly. This is because, although intra-mammary products account for around 65% of all courses given, as the amount of active ingredient per dose is lower, they only account for approximately 15% of the mg/kg PCU metric[10].

The relative make up of mg/kg PCU and average number of course doses/dairy cow from the 2015 VetImpress dairy sample:[10]



IM = IM =intra-mammary, IU = intra-uterine

Why have 4 tubes per course been chosen for dry cow therapy and 3 tubes per course chosen for lactating cow therapy?

It was considered that, although some farms practice quarter level drying off, in most cases, every quarter of a cow's udder is treated for dry cow therapy.

For lactating cow therapy, while licensed treatment courses can vary from 1-4 treatments, 3 is the average number of tubes per course for the UK-licensed products and so CHAWG AMU considers this to be a reasonable assumption. This also aligns with the assumptions used by ESVAC as well as the figures which are included in the dairy sector targets.

CHAWG AMU has received feedback that off-label use of lactating cow products does occur on some farms, and so the figure may not represent the actual number of courses used on that farm. However, as described earlier, the metric should be considered a "technical unit" rather than a true value and will still allow for trend monitoring and farm benchmarking.

Can we just create one metric for intra-mammary products?

It is possible to combine the intra-mammary metrics, but the CHAWG AMU group feel it is more useful to separate them out as they represent different things. For example, dry cow therapy tube use may give you an indication of the uptake/ success of any selective dry cow measures whereas lactating cow therapy tube use can give you an indication of the number of cases of clinical mastitis on the farm.

Are off-label products (e.g. antibiotic footbaths) included in any of the analyses?

Yes, the amount of active ingredient in off-label oral and injectable products will be captured in the $mg/PCU^{dairy\ farm}$ calculation.

Why do we need to measure total use and HP-CIA use?

Because of the risks of cross-resistance and co-resistance (i.e. the use of one antibiotic class can induce resistance to another antibiotic class), reducing overall use of antibiotics is important in minimising the risk of the development of antimicrobial resistance.

However, there is particular scrutiny on reducing antibiotics that are considered highest priority for human medicine (defined as category B by the European Medicines Agency[1]), so categorised if they are used as a last resort antibiotic for serious infections in people and the risk of resistance transfer is considered high.

Why is it recommended to have a 12-month (rather than a 3- or 6-month) benchmarking period?

A 12-month period (either based on calendar year or a rolling year to date figure) is recommended as it takes into account seasonal fluctuations, for example due to climate as well as management systems (e.g. Spring- and Autumn-calving herds). The metrics described in this paper could be adapted for a 3- or 6-month period. For example, to produce a comparable figure for the $mg/PCU^{dairy\ farm}$ calculation, it would be necessary to divide the denominator (i.e. average number of dairy cows during the benchmarking period) by 4 or 2, respectively.

How do those farmers just rearing replacement heifers calculate antibiotic usage?

Where farmers are rearing dairy heifer replacements as a specialist enterprise, these cattle should be considered as growing/finishing cattle and use the relevant metrics described in the CHAWG AMU Beef Benchmarking Metrics report.

How have the standard weights for the $mg/kg^{dairy<6months}$ metric been determined?

The standard weights for each category have been calculated based on the average weight of animals within each category, using the following standard weights (in kg):

	Dairy-sired female	Dairy-sired male	Beef-sired female	Beef-sired male
Birth	38	45	42	50
6 months	177	191	182	194
Average weight	108	118	112	122

These weights represent an estimated average of all cattle in that category, which includes cattle bred for breeding and slaughter across all different breeds. Multiple sources were used when making this judgement including internal AHDB data, annual carcase weight records, the AHDB dairy reference heifer management guide and BRP calf rearing manual.

Do we need so many categories for the mg/kg$^{dairy<6months}$ metric, e.g. there is not that much difference in weights between dairy and beef-sired cattle and males and females?

CHAWG AMU decided to recommend using beef/dairy sire and male/female as this information is easily available using a National Traceability Database and the calculation will go on "behind the scenes" without needing to ask the farmer to supply the data directly.

For the youngstock metric, why was 6 months chosen as a cut-off?

Feedback from the industry suggested that calves less than 6 months of age are in general the highest risk category for diseases such as diarrhoea and pneumonia[12]. However, because of their small size, use on these calves can be hidden in the mg/PCU$^{dairy\ farm}$ figure more than use in cattle 6 months of age or greater. CHAWG AMU considered adding an additional "pre-weaned" category for dairy origin beef calves. However, it was felt that asking farmers to split usage data into too many categories could provide added burden and could risk reducing the accuracy of the data obtained. In addition, it was thought that having multiple different youngstock metrics (e.g. pre-weaning, weaning to 6 months, 6 months to 12 months etc.) could cause confusion.

Isn't it confusing that the farm mg/PCU$^{dairy\ farm}$ weights are based on "average weight at time of treatment" whereas the mg/kg$^{dairy<6months}$ weights are based on average liveweight?

It was felt important that the dairy farm metric should align with the metric used for national monitoring. However, liveweight was chosen for the "dairy<6months" weight as the average weight at time of treatment for calves under 6 months is not known. Using liveweight also aligns with the beef youngstock metric. The farm and youngstock benchmarking metrics ultimately tell you different things and are intended to be used for trend monitoring and benchmarking rather than being directly comparing with each other.

It is important to reiterate that even if using the youngstock mg/kg$^{dairy<6months}$ metric, the antibiotics used in youngstock must still be included in the total weight of antibiotics used on the farm when calculating the mg/PCU$^{dairy\ farm}$ metric. Separating out the antibiotics used in youngstock for the metric for calves under 6 months is only recommended for management purposes and not for national reporting.

Won't it confuse the farmer is the mg/kg$^{dairy<6months}$ figure is higher than the mg/kg$^{dairy\ farm}$ figure?

Yes it is possible that the figure for youngstock will be higher than the total beef farm use (or it could be lower). The farm and youngstock benchmarking metrics ultimately tell you different things and are intended to be used primarily for trend monitoring and benchmarking rather than being compared directly.

References

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