

## **Framing the agricultural use of antibiotics and antimicrobial resistance in UK national newspapers and the farming press**

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## **Abstract**

Despite links to animal disease governance, food and biosecurity, rural studies has neglected consideration of how actors make sense of the use of antibiotics in animal agriculture and the implications for animal and human health. As antimicrobial resistance (AMR) has become a high-profile problem, the contribution of animal antibiotics is frequently mentioned in scientific and policy documents but how different agricultural actors interpret its significance is less clear. This paper offers the first social scientific investigation of contestation and consensus surrounding the use of antibiotics in agriculture and their implications for AMR as mediated through mainstream news-media and farming print media in the UK. Frame analysis of four national newspapers and one farming paper reveals three distinct frames. A 'system failure' frame is the most frequently occurring and positions intensive livestock production systems as a key contributor to AMR-related crises in human health. A 'maintaining the status quo' frame argues that there is no evidence linking antibiotics in farming to AMR in humans and stresses the necessity of (some) antibiotic use for animal health. A third frame - which is only present in the farming media - highlights a need for voluntary, industry-led action on animal antibiotic use in terms of farmer self-interest. Common to all frames is that the relationship between agricultural use of antibiotics and problems posed by AMR is mostly discussed in terms of the implications for human health as opposed to both human and animal health.

**Key words:** antibiotics, agriculture, antimicrobial resistance, frames, animal health

## **1. Introduction**

Within rural studies agricultural and other rural animals are now well established as a legitimate research interest, with animal health and welfare governance being one important theme (e.g. Bock and Buller, 2013; Enticott, 2009, 2012; Miele and Bock, 2007; Miele et al., 2005). Livestock disease episodes, for example, of bovine tuberculosis, avian flu, foot and mouth disease, and BSE, have been a particular focus of concern, reflecting their profound and immediate implications both for the agricultural community and its animals, rural society more broadly and policy-makers (Law, 2006; Law and Mol, 2010). However, in spite of the burgeoning interest in animal diseases and their management, the use of antibiotics in animal agriculture has received very little attention from social scientists. Although limited discussion has taken place in agricultural and environmental ethics (e.g. Anomaly, 2009; Dukenfield, 2013; Rollin, 2001; Pluhar, 2009) the relative absence of social scientific interest is remarkable for a number of reasons.

First, within rural studies there is a long tradition of examining the adoption of technologies in agriculture (Ruttan, 1996) with a recent special issue of the *Journal of Rural Studies* devoted to the co-production of animals and technology (Holloway et al., 2014). Given this history it might be anticipated that antibiotics would have been a technology subject to one of these forms of analysis. Second, biosecurity has become a central concept within rural animal studies (Donaldson, 2008; Donaldson et al., 2004; Enticott, 2008a; Enticott and Franklin, 2009; Enticott et al., 2012; Ilbery, 2012; Mather and Marshall, 2011; Nerlich et al., 2009). Arguably, antibiotics constitute an important technology in the 'securing of life' (Hinchcliffe and Bingham, 2008) in animal agriculture and yet their role within this process has been ignored. A third reason why it is surprising that sociologists of agriculture have neglected antibiotics as an object of in-depth analysis is because of their link to food. To be sure,

food scholars (e.g., Carolan 2011; Weis 2013) do highlight the presence of antibiotics in livestock agriculture but as part of a wider critique; a detailed look at how different rural actors are making sense of the significance of antibiotic use is lacking.

The use of antibiotics in farming has long been controversial, particularly the practice of adding small doses to pig and poultry feed in order to promote growth. This has been challenged because of concerns that it stimulates the rise of antibiotic-resistant bacterial strains, making it harder to treat bacterial infections (Lappe 1982). In the US, antibiotic growth-promoters have been the subject of a protracted disagreement between agri-industry groups arguing that the practice is unproblematic and groups campaigning against the practice, with both claiming that scientific evidence – or the lack thereof – supports their case (Martin 2005). In 2013, the Food and Drug Administration (FDA) signalled a shift in its position, calling for industry to phase out the use of medically important antibiotics. The European Union (EU) took regulatory action as far back as 1999 to ban the use of several antibiotic growth-promoters overriding farming groups who, like their US counterparts, had argued that the practice posed no risks.

Recent developments in this domain indicate that social scientific investigation of the issue is especially timely. Despite the EU ban on growth-promoters, the question of the extent to which antibiotics ought to be used in farming and how they relate to problems posed by the rise of resistance remains unsettled. A recent case of 'pig-MRSA' reported in the British media suggests that familiar concerns about biosecurity in agriculture (e.g. around contamination of food by pathogens such as E.coli and Salmonella) are converging in new ways with those around the use of antibiotics (Harvey et al. 2015). In 2015, the *Guardian*, a British national newspaper, reported the discovery of the bacterium, MRSA, in

pork products sold in British supermarkets. Notably, this became a story not only about food contamination, infection and ways of handling them, but also about what was represented as the root cause, namely: (over)use of antibiotics in pig farming; antibiotic-resistant bacterial strains (in this case, MRSA) becoming endemic in farms and eventually finding their way into livestock products; and the implications for human health. Although the distinction was made between livestock-associated MRSA and the human variant, it was stressed that both biosecurity measures and 'responsible antibiotic usage' were needed in order to avert a wider health crisis in the future.

Responsible antibiotic use has particular resonance at a time when antibiotic and other forms of antimicrobial resistance (commonly referred to by the acronym, AMR) have become prominent policy concerns. The UK Department of Health together with the Department of Food, Agriculture and Rural Affairs (DEFRA) issued a 5-year AMR Strategy in 2013, highlighting multiple threats from the rise of AMR and initiatives for prudent use of antibiotics in both humans and animals. The Prime Minister commissioned a review of AMR by economist Jim O'Neill who recommended, in the first of a series of reports for the review, "coherent international action" on antibiotic use "across humans, *animals* and the environment" (O'Neill 2014, p. 2, emphasis added). These documents appear to signal an emerging policy consensus on the need to curtail all uses of antibiotics including farm-level usage that extends beyond growth-promoters.

Yet, this consensus is more ambiguous than initially apparent with the UK AMR Strategy calling for action to reduce farm-level antibiotic use and simultaneously appealing to scientific evidence to claim that "clinical issues with antimicrobial resistance that we face in human medicine are primarily the result of antibiotic use in people, rather than the use of

antibiotics in animals” (Department of Health and DEFRA, 2013, pg. 8). In evidence presented to the House of Commons Select Committee on Science and Technology (2014), groups campaigning for changes in agricultural systems have challenged this argument with a different interpretation of the evidence, suggesting that the link between farm antibiotics and problems of AMR in human health might be more open to contestation than apparent from headline policy statements. Against this background, key questions arise that social scientists are well equipped to address though the few social science papers on AMR (Brown and Crawford 2009; Landecker 2015; Lee and Motzkau 2013; Nerlich 2009) largely ignore the agricultural dimension. Martin (2005) and a series of other contributors to a book on scientific controversies (Barlam 2005; Mlot 2005; Salyers 2005) do explore agricultural antibiotics but focus on controversy over their use as growth-promoters in the US. Although Carolan (2011) highlights the role of antibiotics in contributing to the production of his primary object of interest - cheap food - and its real costs and Weis (2013) signals the role of antibiotic use in fuelling the process of ‘meatification’ these authors are not concerned with the controversy or different positions on antibiotics in agriculture. By contrast, we focus on the UK - where growth-promoters are banned under EU legislation, but other uses are permitted - where a detailed analysis of discussions around farm-use of antibiotics has not been forthcoming.

The paper is motivated by a lack of clarity on how different agricultural actors position themselves on how antibiotic use should be governed. So, beyond the policy context, how strong is the consensus in the UK that antibiotic use in farming needs to be curtailed? Who are the key actors involved in the debate, what perspectives do they adopt and on what basis? Also of interest is the relative significance accorded to animal health vis-à-vis human health in the debate on antibiotic use. The UK’s AMR Strategy is framed in terms of clinical problems created by AMR in

human medicine, but it makes no mention of possible implications for animals or for agricultural systems more generally. UK policy also makes reference to the concept of OneHealth where human and animal health are seen as linked, but how far does this carry over into wider discussions of agricultural antibiotics and AMR? How do the farming community and groups campaigning to transform farming practices perceive these issues?

This paper undertakes a preliminary examination of both contestation and areas of consensus surrounding the use of antibiotics in agriculture and their implications for AMR as these are publicly expressed and mediated through mainstream news-media and farming print media in the UK. Specifically, it will explore how actors involved frame the relationship between agricultural use of antibiotics and problems posed by AMR. In doing so the paper argues that this relationship is discussed largely in terms of the implications for human health as opposed to both human and animal health in spite of the mobilisation of the Onehealth agenda. Within this debate scientific evidence serves in the familiar role of arbiter, a role that remains impossible to fulfil given that evidence is open to interpretation and uncertainty. However, new opportunities for reframing the issue in terms of farmers' self-interest in voluntary action on animal antibiotic use (rather than evidence on health risks per se) are opening up, perhaps reflecting a wider neoliberal turn in animal health governance (Enticott 2008b; Enticott 2012). It should be noted that while our analysis sheds light on debate that is played out in the media on how farm-level antibiotic use should be governed, investigation of the policymaking process in which governance decisions are made on the subject is beyond the scope of this paper.

The paper will proceed as follows. In the next section further contextualisation is provided by a discussion of AMR and the recent efforts to govern the use of antibiotics in agriculture. The paper then specifies a

methodological approach to studying the different framings of agricultural use of antibiotics and AMR before justifying an investigation of these frames through analysis of various forms of print media. Three frames are identified and discussed: 'system failure'; 'maintaining the status quo' and 'voluntary action'. The paper concludes with a reflection on the implications of the analysis both for the governance of antibiotic use in agriculture and for social science research into animal health and food systems.

## **2. AMR and the governance of antibiotic use in agriculture**

Antimicrobial resistance is a collective term used to characterise the development of resistance in infectious microbes to the action of antimicrobial agents designed to eliminate them. Within AMR, the rise of antibiotic resistance – i.e., bacterial resistance to antibacterial agents, notably, antibiotics - has been of particular concern as a (human) public health problem where it becomes harder to treat or prevent potentially life-threatening infections (O'Neill 2014). The rise of antibiotic resistance has long been linked to overuse of antibiotics. Yet, the precise implications of agricultural use vis-à-vis human use of antibiotics remain unsettled, making this a subject ripe for social science attention.

Antibiotics are used in agriculture in three ways: firstly, therapeutic use to treat bacterial infections in sick animals; secondly, prophylactic use where there is risk of infection; and finally, in small quantities in feed and water to promote animal growth (Salyers, 2005). This practice began in the USA and then Europe in the 1950s (Dibner & Richards, 2005) and although the mechanism of growth promotion was – and still is - not fully understood, it became widely utilised in the UK and elsewhere. In 1960, the Agricultural and Medical Research Councils set up a committee, chaired by Lord Netherthorpe, to investigate possible risks from antibiotic feed



additives for human and animal health – the report published in 1962 found no persuasive evidence for concern. In 1969, the Swann report found otherwise, recommending a ban on certain antibiotics for non-prescription 'feed' use (e.g. for growth promotion) in livestock production and calling for veterinary oversight of all antibiotic uses. On this basis, penicillin, tetracyclines, and tylosin were banned for use without a veterinary prescription under the Therapeutic Substances Act 1956 (Hansard, 1970; 1971i; 1971ii). Eventually industry pressure resulted in the reversal of these regulatory changes allowing these antibiotics to be once more purchased by farmers for growth promotion without veterinary oversight. Eventually, as public health experts first began to articulate the threats posed by AMR in the mid-late 1990s, the EU phased out all antibiotic growth promoter usage between 1999 and 2006 (European Commission, 2003; Cogliani, Goossens & Greko, 2011).

The debate that took place around this EU level action is articulated by Rollin (2001):

“On the one hand, such [growth promoter] antibiotic use is depicted as a necessary condition for producing cheap and plentiful food... On the other hand, such antibiotic use seems to breed antibiotic resistance into pathogens affecting human health.” (Rollin, 2001, pg. 29)

But far from resolving concerns about animal antibiotics, further issues have been opened up, this time around the routine addition of antibiotics to feed to prevent disease. In 2011 the European Parliament passed a non-binding resolution calling for greater scrutiny of such prophylactic uses of antibiotics in agriculture, in particular looking to distinguish between 'appropriate' and 'non-appropriate' prophylactic use (European Parliament, 2011). This suggested that prophylactic practices remain a

'grey' area for policy makers, reflecting an earlier observation in the Swann report (1969, p.11) that whether an antibiotic was used in a preventative or growth promotion role "depends on what is in the mind of the farmer".

In the UK, an Action Plan to address AMR was issued in 2000. Of note was the commitment made to 'prudent use' in animals for purposes of *animal* health (the ability to treat infections in animals which too is compromised by the rise of resistance to antibiotics used for their treatment) as well as the human implications. During the 2000s, concerns about AMR, including the role of agricultural antibiotics, remained significant in the public health community but the issue only gained wider public and policy resonance in the second decade of the 21<sup>st</sup> century with publication of the 2013-18 AMR Strategy, the first two reports of the O'Neill review in 2014 and 2015, the second of which focuses on the use of antibiotics in animals and agriculture, all of which received widespread media coverage. These developments signal an intensification of interest with respect to the governance of antibiotic use in UK farming, though the question of whether/how this should be realised remains unsettled. The subsequent empirical sections of the paper will reveal there is disagreement between groups with an interest in these developments. The discussion now turns to the means by which this disagreement can be analysed, and the relative attention therein given to the human as opposed to the animal health consequences of AMR.

### **3. Exploring the contribution of agriculture to AMR through a frame analysis: concept and method**

The concept of framing has been utilised in a variety of disciplinary contexts and recently has been mobilised in the analysis of both US and UK agri-food policy specifically as this relates to food security (Mooney

and Hunt 2009, Kirwan and Maye 2013) and analysis of the BSE crisis (Demko 1998, Miller 1999, Washer 2006). As described by Entman (1993, pg. 52, emphasis in original) “to frame is to *select some aspect of a perceived reality ... in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation*, for the item described.” In this definition, a frame is an active social construct developed by groups that are deliberately and strategically seeking to convince others of their understanding of an issue and the particular modes of action required to address it. In turn, different social groups are likely to adopt different ways of framing reality, which may lead to deep-seated differences in views about how the problem at stake is to be governed.

The notion set out above of a frame as a *purposively-deployed* construct contrasts with its usage in science and technology studies (STS) where frames and framing refer to a *tacit* set of assumptions that shape problem definitions, interpretation and recommendations (Wynne 2001). Where science-based controversies were once seen as arising from conflicting ideological interests that shaped how different actors interpreted evidence (e.g., Martin and Richards 1995), STS scholars have since tried to unpack implicit meanings that are rarely spelled out but might be shared across an overt disagreement. For example, actors might disagree on what the scientific evidence tells us about the safety of GM crops, but in framing their debate on GMOs in these terms implicitly assume that the question at stake is about ‘safety’ and that science can settle the matter (Wynne 2001). STS scholars aim to open up implicit frames for critical scrutiny and raise alternative framings – e.g., around choices in innovation policy - that have not yet been considered.

In this paper, our working assumption is that both approaches can be useful depending on the context. In a widely studied case like GMOs

where conflicting positions are well-charted, it is useful to be able to identify what we miss by simply following different 'sides' and the interests that drive them. In a case like ours, different positions on the role of antibiotics in agriculture are little known outside of a relatively small group of actors. Here, it is useful to be able to map these perspectives – as we do in this paper - before analysing potentially shared assumptions – which we briefly consider.

Where Wynne's (2001) use of framing focuses on shared assumptions underlying a disagreement, another influential approach in frame analysis is to investigate 'consensus frames' (Gamson 1995; Mooney and Hunt 2009) in order to unpack the dissent that might underpin an apparent agreement between groups. This work builds on Goffman's (1974) concept of 'keying' to make nuanced distinctions between groups that are both looking to draw upon a similar language repertoire (some of which may be more strongly associated with powerful institutions and others with outsiders). In our case, the initial analysis of media sources suggested that the consensus which appears in policy documents on the need to control the use of antibiotics in farming quickly falls apart. What we have here is an issue marked by significant disagreement between key actors, at least to begin with. The consensus frame approach was therefore not suitable for analysing the case, although this might change as the debate around antibiotics develops in future.

We adopt frame analysis as developed in Snow and Benford (1988) who break down a frame into core framing tasks: diagnostic framing (identification of problem and its cause/attribution of blame), motivational framing (impetus for action), and prognosis framing (presentation of solutions) (Benford & Snow, 2000). This three-way structure is helpful for distinguishing the main points of contention in the agricultural antibiotics case. Benford and Snow (2000) subsequently include the formation of

persuasive counter frames. Counter framing emerges as either a direct rebuttal or as a result of increased scepticism over time with regards to an initial dominant frame (Wright and Reid, 2011).

Within frame analysis an important role is given to the media and the print media in particular as a locus in which to examine different language repertoires used to encode knowledge and understanding about the world. The focus on print media is partly a matter of convenience since textual data exists in a form that is widely and publicly available. Equally, this very ubiquity can be a limiting factor since issues of importance to a particular profession are likely to be missing. Hence, the research reported here is based on a combination of newspaper articles oriented to a general readership and articles from a specialist farming publication. The media products analysed for the frames associated with the contribution of agricultural use of antibiotics to AMR were four UK mainstream newspapers: *The Guardian*, *The Independent*, *The Telegraph* and the *Daily Mail*, and the most widely read farming publication in the UK, *Farmers' Weekly*. The rationale for the choice of these publications was threefold, the first being pragmatic as the four newspapers do not have a paywall on the internet, whilst one of the authors has a pre-existing subscription to *Farmers Weekly* allowing access to their archive. Secondly, the selected national newspapers provide perspectives from across the political spectrum with two considered right-of-centre (*Daily Mail* and *Telegraph*) and two considered left-of-centre (*The Guardian* and *The Independent*) in their editorial emphasis. As there is limited cross-over in readership between these titles (Sparks 1999), we were able to examine frames over a relatively stable and distinct consumer base. Third, if the purpose of framing is to persuade and convince the people that need convincing (Fairclough, 2010, see also Leach 1998) it is farmers and vets that are likely to be required to take action in relation to any further changes within the governance of antibiotic use. As such, it was

important to scrutinise a media product targeted at this key community, an approach that is missing within analyses of media coverage of other cases such as the BSE crisis.

The selected newspaper and magazine archives were searched using a number of terms including: antimicrobial resistance, AMR, antibiotic resistance and antibiotic use, in conjunction with animal health, animal welfare, agriculture, farming, animals, veterinary, or some derivative of these terms. The search was undertaken between 01/01/1998-01/07/2014 and resulted in a total of 91 articles, once duplicates had been removed. This timeframe was chosen as it represented a period that spans important developments with regards to livestock antibiotic use and AMR. 1998 marks the year when AMR became an object of policy concern with the publication of a House of Lords (1998) report which considered agricultural aspects in addition to other dimensions of AMR, and the EU ban on growth promoters a year later. The research was conducted in mid-2014 when AMR re-emerged more strongly as a public issue with agricultural antibiotics receiving some attention and with the UK government's 'One Health' strategy that recognises the role of agriculture (Department of Health, 2013). The overwhelming majority of the articles were published from 2011 onwards and analysis focuses on this most recent period during which the overriding agricultural policy concern has been food security and an associated drive to 'sustainably intensify' the sector (Government Office for Science, 2011; Garnet et al. 2013). Only a small number of articles were written before 2006 and in this earlier period three years – 1999, 2003 and 2005 – saw small 'spikes' in publication of articles (12 in total across these three dates) and mainly concern antibiotics and growth promotion. The concentration in coverage in the last 5 years may be due to limitations in the online media archives of some of the newspapers, or it may represent a genuine lack of coverage of agricultural antibiotics overall in the media.

All 91 articles were uploaded to NVivo. Coding of the data within nVivo enabled the identification of three frames which is consistent with Snow and Benford's approach and the unlikelihood of a larger number of frames (i.e. four or more). The first reading of the data within NVivo produced 192 individual codes; a figure that was reduced through a process of merging duplicates and amalgamation of thematically similar codes into a set of 34 codes. The data were then re-read to ensure that these 34 codes adequately represented the different frames within the text as well as their constituent elements i.e. diagnosis, motivations for action and prognosis. For example 'overuse of antibiotics in agriculture' was coded separately to 'intensive agriculture/factory farming' but they were strongly interlinked in the data, present together across numerous articles, and therefore brought and discussed together under the diagnostic element of the 'system failure' frame. Another example from the prognostic element of the 'status quo' frame contained 4 codes: 'need antibiotics for animal health and welfare', 'antibiotics well-regulated/vet oversight', 'voluntary action effective', 'mustn't adopt over the top response'. These were folded into this frame on the basis of who was making that claim and that each code is linked to the notion of protecting the status quo of antibiotic use.

It was notable that the frames were internally very consistent which may be attributed to the relatively small number of voices involved and which shared a common narrative. In the following analysis, we use extracts from the original texts where these especially capture key messages from the wider dataset.

#### **4. Framing antibiotic use in agriculture and AMR**

The analysis of the four national newspapers revealed two contradictory or oppositional framings of antibiotic use and AMR in agriculture. The

disagreement revolves around competing interpretations of the significance of antibiotic use in livestock farming for problems posed by AMR in human medicine. The first and most frequently occurring frame, entitled 'system failure', positions intensive livestock production systems as a key contributor to AMR-related crises in human health. The second frame – 'maintaining the status quo' - challenges these claims, arguing that there is no evidence linking antibiotics in farming to AMR in humans, stressing the necessity of (some) antibiotic use for protecting animal health and welfare, and highlighting the role of existing regulation and veterinary oversight in ensuring antibiotics are used responsibly. In the first frame, significant action is required to transform current practices, while in the second, no such action is necessary. However, these conflicts are nuanced by a third frame, entitled 'voluntary action', that is only evident within the farming press. This frame makes the case for taking pragmatic action on potential consumer concerns about the role of farms in human AMR, calling for measures such as improved hygiene, biosecurity and animal management, alongside the development of Farm Health Plans and closer working practices with vets.

The groups that drew upon language associated with the 'system failure' frame included the Soil Association and the Alliance to Save Our Antibiotics, a group founded in 2011. The alliance is composed of the Soil Association, Sustain, and Compassion in World Farming, all of which are 'alternative' agriculture groups, critical of intensive agricultural practices. The 'maintenance of the status quo' frame was drawn upon by three main industry groups: the National Office of Animal Health (NOAH)<sup>1</sup>, the

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<sup>1</sup> NOAH represents the animal medicines industry in the UK. The organisation consults and lobbies on the industries behalf to promote the safe use of medicine for animal welfare



Alliance for the Responsible Use of Medicines in Agriculture (RUMA)<sup>2</sup> and the National Farmers Union (NFU)<sup>3</sup>, alongside the two government departments, DEFRA, and the Veterinary Medicine Directorate (VMD) that take the policy lead in this area. The 'voluntary action' frame was articulated by the same groups that engaged in the 'maintenance of the status quo' frame.

Although particular organisations feature strongly either in relation to the 'system failure' and 'status quo' frame, individual – key – actors are notable by their relative absence. Aside from Dame Sally Davies, the UK Chief Medical Officer (who has commented mainly on the threats to humans posed by AMR) and Richard Young, science advisor to the Soil Association, no other individuals appear consistently. In addition to the representatives of industry groups and government departments, occasionally the voices of scientists and vets, were also heard, usually in response to a specific development – MRSA being found in UK milk for example. The authority of these voices and their findings was often drawn upon by the groups deploying the dominant frame as a means of reinforcing their claims. There is a lack of stable authorship of articles on this topic; the largest number of articles from a single author is five, (James Meikle, of The Guardian 1999-2003 & Jeremy Laurance, The Independent, 2011). Otherwise journalists typically contribute one, perhaps two articles, further suggesting that this issue has failed to garner sustained attention and dedicated correspondents.

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<sup>2</sup> RUMA is an alliance of 'farm to fork' organisations that sets the best practice standards for medicines use that are incorporated into industry assurance schemes. The alliance is observed by the Food Standards Agency and the VMD.

<sup>3</sup> NFU is a farming membership organisation that functions as a trade organisation representing the interests of the UK agricultural industry across a range of forums including to the UK government.

The three frames identified are summarised in Table 1 and will now be discussed in detail with the frame content explored in relation to its constituent diagnostic, motivational, and prognostic aspects.

**Table 1. Summary of the three frames and the key actors involved**

	<b>System failure frame</b>	<b>Maintenance of status quo frame</b>	<b>Voluntary action frame</b>
Key actors associated with frame	Soil Association, Alliance to Save Our Antibiotics,	National Office of Animal Health, Alliance for the Responsible Use of Medicines in Agriculture, National Farmers Union, DEFRA, Veterinary Medicine Directorate	National Office of Animal Health, Alliance for the Responsible Use of Medicines in Agriculture, National Farmers Union, DEFRA, Veterinary Medicine Directorate
Diagnosis	Overuse of antibiotics in intensive agricultural systems (driven by supermarket price pressures and consumer demand for cheap meat) contributes to AMR in humans	Challenges claim that intensive agriculture contributes to AMR in humans. Human use of antibiotics is the problem.	Challenges claim that intensive agriculture contributes to AMR in humans. Human use of antibiotics is the problem.
Impetus / motivation for action	Future risk to human health arising from inaction on antibiotic use	No action required but problem of human health impact from AMR not contested.	Need to maintain consumer confidence in the agricultural industry by being seen to take action on antibiotic use. Risk to animal health from AMR bacteria.
Prognosis	Legally binding government intervention and regulation needed to reduce antibiotic use in agriculture. Not always linked to intensive agriculture.	Existing stringent regulations and veterinary oversight of antibiotic use on farms sufficient. Antibiotics must be available to treat sick animals.	Voluntary measures are the effective and appropriate response e.g. improving hygiene and biosecurity farm management practices.

It should be noted that the dominance of a frame in media coverage does not necessarily mean that the frame in question is dominant in policy and practice. Indeed, it may be the lack of influence on policy/practice that motivates voices critical of the situation and more coverage of these voices. Nonetheless, examination of antagonistic frames in media discussions helps us understand how it is possible for actors to identify and contest implicit assumptions and in turn, open up these assumptions to wider scrutiny.

#### **4.1. The 'system failure' frame**

##### *4.1.1. Diagnostic element*

In the majority of articles analysed (55 of the 91 articles, 60%<sup>4</sup>), antibiotic use in farming was diagnosed as a significant factor contributing to and exacerbating problems of AMR. No other frame appeared in as many articles. This dominant diagnosis was elaborated in terms of the claim that antibiotics were overused in agriculture, driven by practices of intensive agriculture or factory farming.

The diagnostic element of this frame highlights what might be called *system failure*. Intensive farming has failed as a system of agriculture, in this view, as it requires prolific antibiotic use to control and prevent disease which has exacerbated the development of antibiotic-resistant bacteria and its attendant problems for human health. This core message is exemplified by the following quotes:

“The use of some of the most potent antibiotics available has surged among British farmers in the last decade, stoking fears that the burgeoning number of factory farms could greatly increase the

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<sup>4</sup> Percentages rounded up or down as appropriate.

risk of antibiotic-resistant strains of bacteria escaping and infecting people.” (Harvey, 2013 in The Guardian)

“The overuse of antibiotics in intensive farming means that these creatures provide a breeding ground for the development of antibiotic-resistant strains of diseases such as MRSA, E.coli and salmonella, which pass from animals to humans.” (West, 2011 in The Daily Mail)

“Richard Young, policy director at the Soil Association, said these estimates indicated ‘large numbers of resistant infections due to the overreliance on antibiotics in intensive livestock farming’.” (Davis, 2013 in Farmers Weekly)

As shown, linking intensive large scale or factory farming to the exacerbation of AMR impacting on human health, is a core aspect of the dominant frame’s diagnosis. This element is presented within the Independent, Guardian and Daily Mail, and to a lesser extent Farmers Weekly where it only arises when the Soil Association is quoted in the article. The only media source that does not make reference to this relationship is the Telegraph which instead takes aim at specific antibiotic practices without addressing the context within which these practices take place. For instance:

“Miss Soubry<sup>5</sup> has now called for the preventative - also known as prophylactic - use of antibiotics to be banned... She said that it is ‘not acceptable practice’.” (Dixon, 2013 in The Telegraph)

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<sup>5</sup> Anna Soubry is Conservative MP for Broxtowe, Nottinghamshire and at the time Parliamentary Under-Secretary of State in the Department of Health.

Therefore the Telegraph article implies that prophylactic use of antibiotics in agriculture is a problem, but makes no explicit claims about the conditions or systems which facilitate this perceived overuse of antibiotics. Furthermore, the article reports a critical comment made by a junior minister in the Department of Health which contrasts with statements from DEFRA and the VMD officials featured in the 'maintaining the status quo' frame (below). Whether this is an instance of a junior minister breaking ranks, or exposes differing departmental positions is unclear from these data.

Another dimension of the diagnosis of this frame, evident in some of the articles, is the claim that price pressures have forced farmers to intensify their livestock enterprises as a means to remain competitive. This extends the boundaries of who is to blame to include supermarkets and consumers. The former is cast as financially pressuring farmers, whilst the latter is blamed for demanding cheap meat. Shifting the emphasis of the 'origin' of intensive practices away from farmers and towards other system actors recognises that farmers are embedded within a wider system of market practices and pressures to which they must respond. This was a narrative that was found across the national newspapers but not within the farming press. It is exemplified by the following quotes:

"Experts say intensive farming, with thousands of animals reared in cramped conditions driven by price pressure imposed by the big supermarket chains, means infections spread faster and the need for antibiotics is greater." (Laurance, 2011, The Independent)

"They are produced intensively simply to keep up with demand - but why do we need all this cheap meat - the sausages, the burgers, the chicken tikka masala?" (Purvis, 2005 in The Guardian)

However, by expanding the scope of blame to include consumers demand for cheap meat, responsibility is abstracted and obscured. Furthermore, this aspect of the diagnosis element is not linked to a prognosis element, consumer action or boycott for example, suggesting that it acts to obscure responsibility rather than pointing to areas of traction for solutions.

Finally, in terms of the nature of evidence to support the diagnosis of the 'system failure' frame, claims about intensive practices are linked to scientific research on the presence of AMR bacteria in food or the environment. However, given that the release of such studies was often the catalyst for pushing this topic into the news this strategy can be interpreted as a simple process of linking the frame to the story of relevance. Nevertheless it also reveals how the frame draws on the authority of science in attempting to substantiate its claims.

#### *4.1.2. Motivational element*

Once the diagnostic element has established the overuse of antibiotics in intensive agriculture as a key cause of problems of AMR, it is then presented as having the potential to significantly impact on human health outcomes. This element appears in 45 (50%) of the articles. The main motivation for action is therefore the future risk to *human* life, emerging as a result of inaction on this issue. In particular outbreaks of food poisoning are drawn upon to illuminate the number of deaths already occurring due to AMR infections. The implicit and often explicit suggestion is that continued overuse of antibiotics in agriculture will escalate this trend. Many articles contain personal stories of illness as a result of food poisoning or MRSA, anchoring the claims made in real life experiences and enhancing the resonance of the message with a, 'it could be you' factor (Washer, 2006). The following quotes highlight this construction of

the motivational dimension often with explicit linkage to the diagnosis within this framing:

“We always knew factory farming was a scar on our conscience, but it turns out it is also an urgent threat to our health.” (Hari, 2011 in The Independent)

“‘We have people dying who do not need to die, because you should not be using these drugs in food animals at all, particularly in poultry,’ says Peter Collignon” (Rawstorne, 2013 in The Daily Mail)

Occasionally, the ‘end’ result of failing to grapple with overuse is framed as a post-antibiotic era, or a return to the pre-antibiotic era, in which human mortality will be significant due to the inability to use antibiotics to treat bacterial infection. The following example is illustrative:

"If we don't take action, then we may all be back in an almost 19th-century environment where infections kill us as a result of routine operations... Prof Davies said. (Anon, 2013b in Farmers Weekly)

By failing to take action against the overuse of antibiotics, the claim is made that antibiotics will become increasingly ineffective in treating disease and will lead to increased risk of death. However, this claim is familiar from wider discourse around the overuse of antibiotics in human medicine as a cause of AMR and should be understood in that context. For the purposes of this paper, the issue is whether farm-level use also contributes to this decline in efficacy.

In contrast, only 10 (11%) sources made an explicit reference to implications for animal health from AMR bacteria. Only five (6%) of these sources highlight animal health alone as a cause for motivation. The other

five sources make a more generic reference to 'human and animal health' implications as a motivational rationale. In short, animal health does not appear as a key motivation for action.

#### *4.1.3. Prognostic element*

The dominant prognosis element was present in 51 (57%) of the sources and positioned legally binding government intervention and regulation as the most effective means of reducing antibiotic use in agriculture. It is important to note that this overarching theme of government driven action included a range of different interventions, some of which were linked to the frame's critique of intensive agriculture and some which were not. This suggests a lack of consensus within the system failure frame with regards to what constitutes the best form of action. The recommended interventions most likely to be linked directly to the intensive farming diagnosis included prophylactic uses of antibiotics in agriculture (29 of sources - 32% - deploying the dominant prognosis frame), encouraging less intensive or organic systems of production (18 sources - 20%), and banning antibiotics of critical importance to human disease treatment (16 sources - 18%). A clear example of this diagnostic-prognosis frame linkage taking place is observed in a quote from Conservative MP Zac Goldsmith which appeared in a number of sources across the different publications:

"Governments have routinely ignored the link between antibiotic resistance and the excessive use of drugs on factory farms,' says Tory MP Zac Goldsmith. 'It's time there was a ban on routine use of antibiotics for prevention in poultry flocks.'" (Burne, 2013 in The Daily Mail)

In some cases, the prognosis – a ban on routine prophylactic antibiotic use – appears independently of a causative diagnostic element such as



intensive production systems. The following quote is an example:

"The government should make it illegal to feed livestock antibiotics on a preventative basis, according to the Soil Association, Sustain and Compassion in World Farming." (Anon, 2013a in *Farmers Weekly*)

## **4.2 'Maintaining the Status Quo' Frame**

### *4.2.1. Diagnostic element*

The diagnosis offered by the 'system failure' frame was countered in 19 (21%) of the sources with the argument that it was riddled with misconceptions, misinformation or based on inconclusive science about the contribution of intensive agriculture to the problem of AMR. Most of these articles appeared in the *Guardian* and *Farmers Weekly*. In the *Guardian* this usually provided an element of balance within the reporting with voices associated with both frames hosted within the narrative. In *Farmers Weekly* the diagnostic element of the 'status quo' frame is much more pronounced. The presence of the frame was largely found to be associated with quotes from industry groups and government spokespersons. As the vet Stephen Lister comments in *Farmers Weekly*:

"Some of these concerns lack facts and focus, due to misunderstanding and some degree of misinformation from critics of intensive farming." (Anon, 2011c in *Farmers Weekly*)

The most prominent diagnostic aspect focused on undermining, dismissing as inconclusive or non-comparable to the UK context, scientific evidence linking intensive agriculture to human disease, when presented by the 'system failure' frame diagnosis. Industry and government representatives quoted in the text often responded directly to these

claims. The following example is a response from Steve Dean, the then chief executive of the VMD in the Independent, to an article the week before, also in the Independent, titled *Death wish: Routine use of vital antibiotics on farms threatens human health*:

"Steve Dean, ... complained that the article had "overplayed" the role of farm antibiotics in the development of antibiotic resistance, [and] that there was "no evidence" such use caused "any resistant infections" in humans." (Laurance, 2011b, Independent)

Equally the frame often expanded to include claims that reconceptualised the appropriation of blame away from agriculture entirely by claiming that science points to human antibiotic use as the main cause of AMR bacteria that impact on human health. The quote below succinctly expresses both aspects of this frame:

"Ms Gray [NFU] explained how there was "growing hysteria" that resistant animal bacteria could pass on to human pathogens. 'There is very little scientific evidence to support this and there is much more evidence to support resistance in human bacteria comes from the misuse of antibiotics in humans.'" (Trickett, 2012 in Farmers Weekly)

Government voices, particularly DEFRA spokespersons, adopted a very similar position and one that replicates the 5 year AMR strategy statement:

"'Most of the resistance to infections in humans in the UK is generated by human antibiotic medicines,' said a DEFRA spokesman. 'There is no evidence that antibiotics given to animals

have caused any significant resistance to infections in humans in the UK.'" (Anon, Farmers Weekly, 2012)

A particular attempt is made within this frame to reappropriate blame to human use of antibiotics whilst responding directly to claims made about the contribution of agriculture to the issue of AMR and the scientific studies used to bolster that claim. Government officials responsible for agriculture and agricultural medicines, and industry representatives are presented as sharing a voice. This is perhaps unsurprising as both groups have a shared interest in defending the status quo. A position otherwise would be an admission from government institutions, directly tasked with regulation and oversight of antibiotic use, food safety, and animal health, that current structures were not fit for purpose. Meanwhile, industry groups would be acknowledging that their systems of production were a contributory factor to the loss of human life from AMR. However, whether this is correlation or coordination is beyond the scope of this study. We have not examined the networks and interactions between actors that may have shaped this shared framing, and which is an avenue of future research.

#### *4.2.2. Motivational element*

Since this element of the frame is embedded within a diagnosis which dismisses agricultural contributions to AMR human health risks altogether there is no attempt in the articles to directly counter the motivational element of the diagnosis of the 'system failure' frame, i.e. the veracity of these health risks or the need to do something about them. This is not surprising. It would be much harder to contest the general concern that AMR poses public health risks as signalled by statistics on death from antibiotic-resistant infections and, on occasion, personal stories of illness. From the perspective of the 'status quo' frame, these motivations offered by the 'system failure' frame are not in themselves problematic – the

question rather is whether animal antibiotics have anything to do with them, to which the answer is no. What we do find is a motivational element for defending the alternative prognosis that we find in the second frame, namely, to persist with the status quo or to do nothing. We consider this below.

#### *4.2.3 Prognosis element*

The prognosis element – do nothing on animal antibiotic use - has two key aspects. The first responds to claims within the 'system failure' frame's prognosis element about the need for more effective regulation and instead draws attention to veterinary oversight of antibiotic use on farms, alongside the existing regulatory environment which it highlights as being already stringent. This aspect appears in 23 (25%) of the sources. The attention drawn to the role of veterinarians as a custodian of antibiotic use attempts to utilise the wider societal standing of the vet. The profession benefits from high levels of public trust (Saad, 2006) and their position of authority on matters of animal health is often seen as equivalent to that of the doctor in human health. The following quotes highlight the framing of the regulatory situation and veterinary oversight:

"Antibiotics are now only used under the prescription and care of a veterinary surgeon to combat and prevent bacterial infections which may cause animals to become sick, in the same way that humans use antibiotics," the NFU said. (Anon, 2011b in Farmers Weekly)

"Farming groups were quick to point out that the use of antimicrobials in the UK was well regulated, and rejected calls for a ban." (Anon, 2013b in Farmers Weekly)

The second directly rebuts demands for a ban of certain antibiotic practices or certain antibiotics for use in livestock production on the basis

of our moral and ethical obligation to treat sick animals, or animals at risk of disease. This aspect of the frame, which appears in 14 (15%) of the sources, is most forcefully exemplified by the following quote from RUMA that was repeated in a number of the sources from different publications:

"[RUMA] said: 'Allowing animals to become ill and then treating them is not considered good practice. Such a practice in human medicine would be considered negligent, and the same consideration applies to animals at risk.'" (Dixon, 2013 in The Telegraph)

So where groups in the 'system failure' frame argue that intensive farming promotes disease and necessitates the inappropriate use of antibiotics, groups employing the 'status quo' frame reverse this line of argument to some extent by defending prophylactic use on animal welfare grounds. This assertion of human obligations to preserve animal health is sometimes enlarged to include references to how banning or restricting of antimicrobials can also fail to achieve its given aim of reducing the occurrence of AMR impacting on human health. In doing so such a policy of legally mandated restrictions is accused of failing on all fronts, for example:

"We know from the USA and Denmark that banning or restricting the use of certain antimicrobials in certain species has not reduced the incidence of resistance to certain organisms in humans," said BVA president Peter Jones. "Banning the veterinary use of antimicrobials could have a severe impact on animal health and welfare without achieving the desired impact in humans." (Vinter, 2012 in Farmers Weekly)

By framing the international examples in this way the groups symbolically

illuminate the failure of government intervention to reduce agricultural use of antibiotics and, by extension, AMR incidence in humans. However, this framing does not trace in detail the reasons why these actions might have failed including whether they went far enough in implementation practice.

### **4.3 'Voluntary Action' Frame**

So far, it appears that the controversy over animal antibiotics follows a classic divide between two opposing frames. However, the analysis also revealed an alternative frame that has emerged very recently, since 2011. This frame does not directly contest the 'system failure' frame, instead it presents an alternative interpretation of the issue, in particular illuminating alternative solutions and motivations. The frame is presented almost entirely within *Farmers Weekly* and has very limited exposure within the mainstream print media. It is therefore a frame constructed with a very specific audience – the farming community - in mind. The alternative frame draws upon the 'status quo' frame's diagnostic element in downplaying the nature and scale of the threat from agricultural uses of antibiotics. It then diverges from this analysis of causes by offering alternative motivations for action and a different set of solutions. This suggests a more nuanced picture than that presented in the interaction between the two main frames in the mainstream media.

#### *4.3.1 Motivational element*

The motivational element of the third frame appeared in 8 sources (9%) from the overall sample but only in articles from *Farmers Weekly* (22% of the 35 articles from this publication). It is characterised by a highlighting of the public scrutiny of livestock agriculture and the requirement this places on the industry in terms of maintaining consumer confidence. The following quotes are examples:

Consumer concern over the misuse of antibiotics in animals was something that the poultry industry "would ignore at its peril", according to Stephen Lister of the Crowshall Veterinary Practice. (Anon, 2011c in Farmers Weekly)

She [NFU representative] warned farmers and vets not to underestimate the power of perception and urged the industry to make structured, informed and responsible decisions when it came to antibiotic use. (Trickett, 2012 in Farmers Weekly)

Whilst the diagnosis element of the frame effectively reassures this community that AMR is not an issue that they have caused, it still attempts to motivate action on antibiotic use by speaking to the role and identity of farmers as business people, primarily dependent on UK consumer demand for their products.

A further aspect of the motivational dimension of the alternative frame is the risk to animal health from AMR bacteria. As previously noted only five articles in the sample made explicit reference to this (three of which were in Farmers Weekly), whilst a further five used the more generic term 'human and animal health'. An expectation is reported that the issue of AMR bacteria that impact agricultural animals is going to persist and escalate:

"It was a fact of life that the use of antibiotics in animals would lead to resistance, just as antibiotic use in humans will contribute to the development of resistant organisms in the human population.

"Blanket over-use of antibiotics aids natural selection of resistant populations - it is just a numbers game over time." Said [Veterinarian] Mr Lister." (Anon, 2011c in Farmers Weekly)

“Resistance to antibiotics has previously been rare among livestock, but its prevalence has taken a worrying twist recently with the discovery of an enzyme in E coli which is resistant to all penicillins.” (Long, 2005 in Farmers Weekly)

In this context the need to use antibiotics to treat animal disease now and in the future is invoked as a motivation to change existing practices of antibiotic use in agriculture.

“To ensure the future availability of antibiotics for animal use, all those involved in the supply, procurement and usage of these products should act responsibly. Turkeys, like all farm animals, needed medicines, he emphasised.” (Anon, 2011c in Farmers Weekly)

The means of motivating change appeals to farmer’s self-interest by identifying adjustments to antibiotic use as safeguarding *their* ability to treat their animals in the future. Again this motivational element is constructed with a specific farming audience in mind.

#### *4.3.2 Prognosis element*

A distinctive prognosis is found in a greater number of sources, in total 28 (30%). However, once again this element of the frame has greater coverage within Farmers Weekly, with the majority (81%) of all instances of this frame element being found within articles from this publication. This prognosis attempts to position voluntary measures as effective and appropriate in responding to this issue even though the voluntary nature of these measures is often left implicit. The proposed or highlighted measures are twofold and often interlinked: decreasing the incidence of disease through improvements in farm management practices concerning hygiene and biosecurity; and the following of guidelines on responsible



use of antibiotics set by RUMA, an industry body composed of numerous 'farm to fork' stakeholders. This begins to tackle the implications of animal antibiotics for AMR as it might impact on animal health itself, potentially reframing the controversy which has so far been almost entirely about human health. This solution is expressed in one article as follows:

"We [vets] are challenging ourselves and our farmers to look critically at our use of antibiotics on farms and to employ more effective preventative medicine and management processes."  
(Wilson, 2013 in Farmers Weekly)

As such, farmers are called upon to respond to the increased public scrutiny of antibiotic use while not rejecting the use of current antimicrobials in livestock farming. The following quote illustrates the under-emphasising of the role of agriculture in contributing to AMR, presented in the diagnostic element of the system failure frame, whilst stressing a different motivation and solution:

"... the epidemiology of antimicrobial resistance is complex and simply laying the blame on one sector is unrealistic. Nevertheless, all sectors need to consciously review their prescribing and usage practices of antimicrobials *to prolong the useful life of these valuable chemicals.*" (Anon, 2014 in Farmers Weekly, emphasis added)

Overall the frame leaves implicit the voluntary nature of its proposed solutions. It maintains the diagnostic element of the 'status quo' frame but identifies public scrutiny of agriculture and the need to safeguard public support for farmers as the motivation for action. Importantly however, it begins to introduce a potentially novel element into the

discussion, namely the need for action in order to preserve the future efficacy of antibiotics in animals and not just in humans.

## **5. Discussion and conclusions**

Through analysis of mainstream and farming print media in the UK this paper has explored the debate surrounding AMR and the use of antibiotics in animal agriculture. Debate is ongoing as the EU ban on antibiotic growth-promoters has failed to resolve controversy over animal antibiotics which has now shifted to the role of routine prophylactic use. The paper has deployed Snow and Benford's method of frame-analysis to identify a series of frames deployed by different actors who are contributing to the debate. A 'system failure' frame is critical of the routine use of antibiotics associated with intensive livestock systems; a 'maintenance of status quo' frame disputes this framing and asserts instead that existing regulation is adequate to ensure responsible use of antibiotics; an alternative frame is aligned with some elements of the status quo frame but urges the farming community to take voluntary action on antibiotic use in order to keep UK food consumers 'on side'. Common to all frames, albeit most pronounced in the two most prominent frames, is the emphasis placed on the implications of AMR for human rather than animal health. This is a key finding of our analysis. In this final section we reflect on the implications of our investigation for the governance of antibiotic use in agriculture and for future social scientific studies of animal health and food systems.

In this debate unfolding within the mainstream and professionally orientated print media, frames are packaged with subtle differences dependent on the intended audience. In particular, although the farming press plays host to both the 'system failure' and 'maintenance of the status quo' frames, it also presents a separate, alternative frame aimed

directly at influencing the farming community. Once this 'voluntary action' frame is incorporated into the analysis, the contestation over what constitutes 'responsible use' of antibiotics within agriculture develops a new character. Rather than being a relatively straight forward claim and counter claim frame structure, where one group demands action whilst the other denies its necessity the farming community is presented with an alternative set of voluntary actions, positioned as a means of 'heading off' a potential public backlash associated with inaction. This recommendation for an industry lead approach appears to be in keeping with the neoliberal turn in UK animal health governance observed by Enticott (2008b) and Enticott et al. (2012) in the context of bovine tuberculosis. A key dimension of this form of governance is the emphasis placed on the agricultural community to take ownership of an animal health problem and voluntarily sign up to strategies through which it might be addressed, rather than through state-led regulation. The UK government's 2013 Antimicrobial Resistance Strategy also endorses non-statutory avenues for future governance of animal antibiotics, for example:

"the use of 'farm assurance schemes' as a mechanism to increase adherence to best husbandry including isolation of sick animals, testing of new stock and responsible use of antibiotic principles, while ensuring animal health and welfare" (UK Department of Health and DEFRA 2013, pg. 24)

Farm assurance schemes are voluntary, do not result in legal sanctions for non-compliance and often include industry guidelines. RUMA, for instance, devised the responsible use of antibiotic guidelines referred to in the quotation. Therefore the 'voluntary action' frame, presented to the farming community as the appropriate action response, currently seems to be finding more traction within the policy arena. Meanwhile, although it dominates the mainstream print media, the 'system failure' frame utilised

by alternative agricultural groups appears to have been unable to find resonance with policy makers and the wider farming community and this may be due in part to a lack of wider public and media engagement with the issue. Only 91 articles in total on AMR and agriculture were found over a 15 year period. Indeed this may be an instance where the mainstream print media is playing host to dissident voices that are otherwise frozen out of other spheres of influence including government policy (Miller, 1999).

Yet, at the same time, the 'voluntary action' frame potentially opens up the opportunity to consider a way out of the disagreement which does not require scientific evidence to settle the matter. Rather than framing the question on whether or not animal antibiotic use exacerbates problems of AMR in human medicine, it turns the lens back to farm systems and their own future including the capacity to continue to rely on antibiotics to prevent and treat infections. Despite the rise of the OneHealth agenda this is still a minority position, but future research might illuminate how it develops. Indeed, for social scientists of food, agriculture and animal health governance, AMR and the role of animal antibiotics presents a rich subject for analysis.

A focus on the media in this paper has helped to open up this relatively new and underexplored topic for analysis and debate. Nevertheless there are limits to an examination based on media materials alone.

Ethnographic and interview-based studies might in future explore how different uses of antibiotics actually unfold in practice on farm, the extent to which a distinction can be made between growth-promotion and prophylaxis, and the capacity of key actors including vets to transform current practices. Extending analysis beyond media products, research could explore the history and development of other forms of communication between the agri-pharmaceuticals industry and farmers

and how this process has helped to shape relations of trust about antibiotic use, and associated with this the emergence of the 'maintenance of status quo' frame. Cross-national comparisons of governance approaches would also be valuable alongside studies of biosecurity and antibiotic-resistance across borders. The recent pig-MRSA story (Harvey et al. 2015) is notable for becoming one about Danish pork products sold in British supermarkets. A further promising line of inquiry is to explore understandings of AMR as an environmental risk where the presence of antibiotic-resistant bacteria in soil and water and the implications for future disease outbreaks and the efficacy of antibiotics are being highlighted on a par with their presence in the food chain (e.g. Esiobu et al. 2002). Finally, more work is needed on a key finding raised by our media analysis within the UK, namely, the potential for animal health implications of animal antibiotic use and the rise of AMR to be taken more seriously than has been the case in a discussion largely centred on human health consequences alone.

Our final point concerns the selection of media products for inclusion within a frame analysis. The identification of an alternative frame within the farming press that emphasises self-regulation not only reinforces social science research that finds farmers to be generally critical of government intervention and red tape (e.g. Pile 1991; Fisher 2013) but also highlights the importance of including print media targeted at specific professional communities, in particular those with a powerful voice in deliberation around policy action, alongside and in relation to mainstream print media. Different professional and other communities have varying degrees of interest and influence with regards to shaping the response to a particular controversy. As this study highlights, dominating the mainstream media narrative does not necessarily indicate that policy is aligned to this position. Therefore it is important to incorporate media publications aimed at a range of constituencies within frame analysis

methodologies, as a means of better understanding the effect of discursive processes on shaping and influencing action.

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