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Change it or perish? Drug resistance and the dynamics of livestock farm practices

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ABSTRACT

Farm practices related to drug use in animal agriculture play an important role in the development of drug resistance. In this paper, I use Bourdieu's theory of practice to explore the *field* of deworming and how the use of deworming medications, also called anthelmintics, by farmers may be a pragmatic choice within the *habitus* of livestock farming. Drawing on 42 in-depth interviews with livestock farmers across England I show how farmers prioritise farm productivity and animal health and welfare to the detriment of an adequate use of anthelmintics, which may lead to an increase in drug resistance. I also discuss some of the particularities regarding the engagement between farmers, veterinarians and the industry, and how expert advice is commonly limited to one-way flow of information. As a strategy to address drug resistance in livestock, mainstream policy approaches to drug management in the farm have prioritised the development and dissemination of technical guidelines. However, these guidelines are usually disconnected from the farming context, do not take into account the complexity and challenges of farm everyday practices and are eventually rejected by farmers. Although there has been increased interest from the social sciences in studying the intersection between drug resistance and farmers' perceptions and behaviour, there is still a need for unpacking the often hidden dynamics and logics of farm practices, understanding how they shape animal health management and, more specifically, drug use. I argue that farm practices related to drug use are situated within a larger context of intensive animal production systems, which themselves contribute to the emergence of animal diseases, the medicalisation of animal production and drug resistance.

1. Introduction

Antimicrobial resistance has been framed as one of the biggest threats to global health and development in the 21st century (Broom et al., 2014; Podolsky, 2015). Antimicrobials work by destroying microbes, i.e. micro-organisms which are not visible to the naked eye, such as bacteria, virus, fungi and protozoa (Bisen et al., 2012). As other anti-infective drugs, antimicrobials can lose efficacy over time, for example, due to overuse and the emergence of pathogen resistance. Moreover, the use of antimicrobials by one individual (human or non-human animals) can affect the ability of another individual to benefit from the same drug, for example, by transmission of the resistant pathogen or drug residues through contaminated food and water (Spellberg et al., 2016). Strategies for tackling antimicrobial resistance have gradually moved towards interdisciplinary and integrative approaches that address the human, animal and environmental dimensions in tandem (Rock et al., 2009; Leach and Scoones, 2013; Queenan et al., 2016). The relationship between the use of antimicrobials in animal agriculture and the emergence of antimicrobial resistance in humans has been debated since the 1960s (Podolsky, 2015; Begemann et al., 2018). Until the early 2000s, the mainstream narrative from policy-makers and the industry had rejected such a link, despite evidence produced by the animal health sciences (Marshall and Levy, 2011). This rejection was motivated by a paradigm of 'therapeutic progress' and 'economic worth' of antimicrobials, which was instrumentally used to increase productivity in agriculture (Rivera-Ferre, 2008; Podolsky, 2015). As a consequence, not only a clear standpoint between the risks and benefits of antimicrobial use in livestock systems has been prevented (Rock et al., 2009; Podolsky, 2015), the relationship between farming practices and antimicrobial resistance has been overlooked in public health policy.

Microbes are not the only threat to animal and human health. The use of drugs to protect against *macro*-organisms, such as helminths (i.e. large multicellular parasitic worms), also remains widespread in

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agricultural and medical practice (Geerts and Gryseels, 2000). In this context, resistant macro-organisms are increasingly prominent worldwide in humans and non-human animals, while available drugs are less effective and new drugs are lacking (Geerts and Gryseels, 2000; Vercruysse et al., 2011). The inadequate use and the overutilisation of anthelmintic drugs have been linked to the emergence of pathogen resistance in livestock and humans (Stafford and Coles, 1999; Waghorn et al., 2006; Suarez and Cristel, 2007; Demeler et al., 2009; Gasbarre et al., 2009). This suggests that another public health crisis, similar to that of antimicrobial resistance, could also emerge in the context of anthelmintics. However, compared to the issue of antimicrobials, the prominence of the topic of anthelmintic resistance in humans has been limited to its occurrence in the global South in the context of neglected tropical diseases (Stelma et al., 1995; Ismail et al., 1996; De Clercq et al., 1997; Reynoldson et al., 1997; Esteban et al., 1998). This could partially explicate why the topic has received much less attention from international health agencies and policy-makers compared to that of antimicrobial resistance. For example, although countries from the global North have shown increasing concerns about *Fasciola hepatica* in its livestock industry (Skuce and Zadoks, 2013), most of the cases of human fascioliasis, which is a zoonosis, have been documented in the global South (Esteban et al., 1998; Mas-Coma et al., 1999). Although the risks related to resistance of this pathogen are likely to be underestimated (Mas-Coma et al., 1999), this has meant that the attention paid to this disease in humans is still little in the global North and its occurrence is considered to be mainly related to imported cases (Bennett and Ijpelaar, 2005; Chand et al., 2009).

While it is clear that the global 'war' against the overuse of antimicrobials has been officially proclaimed with the introduction of new regulations (Nehrlich and James, 2008; Rushton, 2015), the same is not true for anthelmintics, which despite being massively consumed (Geerts and Gryseels, 2000; Vercruysse et al., 2011), remain poorly overseen by the animal industry and public health authorities (WHO, 1995; Marquez Lara, 2003; SCOPS, 2003; COWS, 2010). Furthermore, similarly to the case of antimicrobial resistance, the role of farming practices, particularly around drug use in animal health management, has been neglected in approaches designed to address anthelmintic resistance. In the context of both antimicrobials and anthelmintics, studies of farmer behaviour have been limited to the deployment of models and theoretical frameworks that narrow the understanding of farming practices to communication and knowledge transfer strategies (Enticott, 2008; Escobar-Tello and Buller, 2014; Fortané et al., 2015). In this paper, I contribute to expanding current debates on the complexity of farmers' practices around drug use in the livestock sector. To broaden the scope of studies on the relationship between drug use and farm everyday practices, I draw on Bourdieu's theory of practice to investigate how livestock farmers in the United Kingdom (UK) make decisions on drug administration, especially for drugs which use is still poorly regulated, such as anthelmintics in the dairy cattle sector. In doing so, I argue that an improved understanding of the complex and often hidden dynamics of farm practices is essential to comprehend the emergence of drug resistance and the medicalisation of livestock production, more broadly.

2. Governing drug resistance in the UK livestock industry

Agriculture has played an important role in the UK economy for centuries. After the Second World War, the volume of agricultural gross output rapidly rose due to processes of industrialisation, scientific advances and technological innovations. The agricultural sector enjoyed new political incentives such as farm subsidies, which helped expanding the livestock and arable industries, but which decreased the area available for livestock grazing in the country (Whetham, 1978; Bowers, 1985; Brassley, 2000). Over the years, the overall number of UK dairy farms fell drastically while the average size of dairy herds and the average milk yield per cow increased (AHDB, 2016). This allowed the UK to remain the third largest milk producer in Europe, behind Germany and France, with nearly 13 million litres of milk produced in 2016 by its dairy farms (AHDB, 2016). Today, the dairy industry is one of the largest in the UK agricultural sector, accounting for around 17% of the country's agricultural production in terms of value (DEFRA, 2012).

British post-war productivism has, however, been accompanied by negative impacts on the health and welfare of animals, the landscape and the environment. These included, for example, the destruction of many historical heritages, reduced water quality, and the decimation of wildlife (Bowers, 1985). These developments have progressively led to a call for a change to post-productivist farming regimes that could promote the sustainability of the sector in the UK (Mathera et al., 2006). To ensure the viability of their businesses, UK livestock farmers have become compelled to improve the efficiency of their production, diversify their activities (e.g. cultivation of land, and rearing of different livestock) and minimise the negative effects of their production systems, whilst avoiding competition with other forms of land use, protecting natural resources and preventing infectious diseases (Herrero and Thornton, 2013; Rushton, 2017). Consumers' concerns about chemical residues and animal welfare have also been responsible for increasing the pressures on farmers towards more ethical and animal-friendly approaches to food production (EC, 2013).

2.1. The medicalisation of animal agriculture

To meet the economic and development objectives initially set up by the UK government in the post-war period, a substantial increase in productivity was expected in animal agriculture. One of the objectives was to meet the estimated demand for food from the British population and reduce dependency on food imports (Bowers, 1985). One way of encouraging this increase in productivity was via the provision of subsidies on chemical inputs and structural changes in farming systems, such as the increase of unit sizes, the standardisation of practices and the mechanisation of farming (Bowers, 1985). In this context, drugs became instrumental to the modernisation of animal agriculture and the possibility of producing abundant and cheap food. These 'technologies' allowed for improving the health and growth of food-producing animals, which were raised under particularly demanding conditions. In this productivist framework, drugs such as antimicrobials became legitimised and accepted as preventive, therapeutic and growth promoting tools (Begemann et al., 2018).

Although less visible in current drug resistance debates (Podolsky, 2015; Rushton, 2015; Begemann et al., 2018), other drugs than antimicrobials have also been used and gradually integrated into practices to maintain intensive animal production in the UK. Helminths - also known as parasitic worms - are macro-organisms that are ubiquitous on livestock farms. Through ingestion of the larvae of the parasites on the contaminated grass, livestock can be infected with a variety of helminths on pastures, the most important of which are gastrointestinal nematodes and flukes in the UK (Van Dijk et al., 2010). Helminths have been a longstanding concern for the livestock industry (Waller, 2006) given that these parasites have a negative impact on animal productivity and welfare, affecting feed intake, growth rate and milk yield (Charlier et al., 2014). Their spread is associated with outdoor grazing in the context of an increased density in livestock farming where animals are more susceptible to infection, a shortage of clean pastures, and the sharing of pastures between different livestock species such as cattle and sheep. In addition, many helminth infections are subclinical (i.e. the symptoms are not visible), particularly in cattle, making their control often difficult. Indeed, farmers tend to adopt 'blanket treatment' (i.e. treating all animals in a group regardless the presence of infection) with broad-spectrum anthelmintics to prevent or regain production losses from multiple helminth infections. Yet, like antimicrobials, the intensive use of anthelmintics has progressively led to an increase in helminth resistance to available drugs, making this practice