

Who or what has agency in the discussion of antimicrobial resistance in UK news media (2010-2015)? A transitivity analysis.

Abstract

The increase of infections resistant to existing antimicrobial medicines has become a topic of concern for health professionals, policy makers and publics across the globe, however among the public there is a sense that this is an issue beyond their control. Research has shown that the news media can have a significant role to play in the public's understanding of science and medicine. In this article, we respond to a call by research councils in the UK to study antibiotic or antimicrobial resistance as a social phenomenon by providing a linguistic analysis of reporting on this issue in the UK press. We combine transitivity analysis with a Social Representations framework in order to determine who and what the social actors are in discussions of antimicrobial resistance (AMR) in the UK press (2010-2015), as well as which of those social actors are characterised as having agency in the processes around AMR. Findings show that antibiotics and the infections they are designed to treat are instilled with agency; that there is a tension between allocating responsibility to either doctors-as-prescribers or patients-as-users; and collectivisation of the general public as an unspecified 'we': marginalising live-stock farming and pharmaceutical industry responsibilities.

Keywords

antibiotic resistance, AMR, media, social representations, transitivity

Introduction

This paper combines transitivity analysis with a social representations framework in order to examine the ways in which the issue of antimicrobial resistance (AMR) is discussed in UK news publications (2010-2015). A more specific aim of the paper is to determine which social actors are presented as having agency in tackling this global issue. The concept of agency construction brings together the analysis of discourse through transitivity, with Social Representations Theory (SRT) (Moscovici, 1988) as a framework for understanding how a community comes to comprehend, discuss and behave in relation to a social object (in this case, the issue of AMR).

In 2015 the issue of 'antibiotic resistance' (resistance that bacteria develop to drugs used to treat bacterial infections), or, more generally, 'antimicrobial resistance' (AMR) (resistance that bacteria and other microbes develop to antibiotics and antimicrobials) was widely discussed in the media. The year 2015 ended with reports that antibiotic resistant gonorrhoea is becoming untreatable (Blakemore, 2015) and that scientists in China discovered a gene in E.Coli that makes it resistant to a class of 'last-resort' antibiotics and transfers resistance to other epidemic pathogens (Food Safety News, 2015). It has become increasingly evident that "if we fail to find effective antibiotics and manufacture them at the scale needed, ten million people a year across the world will die by 2050" (Dhaliwal, 2016).

Both DeSilva et al (2004) and Bohlin and Höst (2014) found that the most commonly reported cause of increasing antibiotic resistance was the unnecessary prescription of antibiotics. Patient expectation is one of several factors that underlie primary care physicians' decision-making regarding the prescription of antibiotics (Coenen et al 2000). In their survey of patients with upper respiratory tract infections, Linder and Singer (2003) found that physicians prescribed antibiotics to 46% of patients who requested them. Their multiple regression model demonstrated that patients asking for antibiotics was a significant independent predictor of physicians prescribing them.

Nisbet and Markowitz (2016: 56) have pointed out in a recent report for the *American Association for the Advancement of Science* that

Despite the pervasive use of antibiotics and growing problems, research on public awareness, knowledge, and attitudes about antibiotic resistance is limited, as is research on communication and engagement strategies.

McCulloch et al.'s (2016) systematic review of public knowledge and beliefs about antibiotic resistance found that people believed that (1) others were largely responsible for the development of antibiotic resistance; (2) they had a low personal risk from resistance; (3) their risk increased if they were hospitalised or used prolonged courses of antibiotics; and (4) causes of resistance included *antibiotic use and overuse* and *not completing an antibiotic course*. Most importantly, McCulloch et al. (2016) found that people believed that minimising antibiotic resistance was outside their control and, therefore, that strategies should be aimed at clinicians. This is consistent with Brooks et al.'s (2008) work, which found that patients

generally viewed antibiotic resistance as a societal problem rather than as one that would affect them individually. Similarly, Wood (2016: 2) found that “most people do not feel they have a personal role in either the problem of AMR or its solution”. Nisbet and Markowitz (2016) found that members of the public put trust in science to find new antibiotics, thus distancing their own actions and responsibilities from this issue. They concluded that this “disconnect between science, knowledge, and patient expectations has led some scientists to argue that public health campaigns need to focus on bolstering public understanding of antibiotics” (Nisbet and Markowitz, 2016: 57).

Gill et al (2006) show that both patients and medical professionals have high levels of knowledge concerning MRSA (Methicillin-Resistant Staphylococcus Aureus), a particular hospital infection resistant to antibiotics. For both patients and visitors, general media constituted the most common source of information concerning MRSA, which is consistent with other studies of public understanding of science and medicine (Bucchi, 1998). It has been recognised that “[a]s a forum for the discourses of others and a speaker in their own right, the media have a key part in the production and transformation of meanings” (Carvalho, 2007: 224). Although forms of social and digital media offer alternative sources and means through which such information is accessed by members of the public, research has shown that social media users rely just as much on local and national newspaper websites for information (Hermida et al 2012).

Discussion of AMR in the media

Given the prominence of the news media as a source of information concerning medicine, science and technology (Picard & Yeo, 2011), it is important to explore existing research into media representations of antibiotic resistance. Across the globe, the news media have been shown to have an impact on public understanding of health issues (Trumbo, 2012; van der Schee et al 2012), which contribute to the formation of social representations and, in turn, guide perceptions, attitudes and behaviour. DeSilva et al (2004) found that two key individual measures (recognizing that antibiotics are ineffective for viral disease; and completing the entire course of antibiotics) were not frequently reported in discussion of AMR in North American news articles (22% and 10% respectively; 6% together). In the Swedish

press, Bohlin and Höst (2014) found that reporting of these measures was even lower (less than 5% and less than 1% respectively).

Media coverage of antibiotic resistance goes back as far as 21 November 1969, when the *New York Times* published an article on the so-called Swann Report on the use of Antibiotics in Animal Husbandry and Veterinary Medicine (Swann et al., 1969). The article focused on the British Government's early efforts to restrict the use of antibiotics for farm livestock, as this can lead to the emergence of antibiotic-resistant bacterial strains in humans. 'Antimicrobial resistance' was discussed in the journal *Chemical Week* in 1984 (10 October, 1984) in an article that focused on the use of antibiotics in animal feed and the dangers this poses to human health.

The term 'superbug' appeared in relation to antibiotic resistant bacteria in an article published in the *New York Times* in April 1985. *The Guardian* also referred to 'superbugs' in an article published on 21 December 1985 when reporting on antibiotic resistance in the context of livestock. Figure 1 shows that the use of the terms 'AMR' and 'antibiotic resistant' in UK National Newspapers has become increasingly prominent since 2010, as has the discussion of 'superbugs' following fluctuations in the use of the term between 2003-2008, with the number of reported cases of MRSA in the UK hitting an all-time high in 2004 (Public Health England, 2014) and representing a key issue in the UK general election in 2005 (see Nerlich and Koteyko, 2009).

[Insert figure 1 here]

This increase in coverage from 2010 onwards prompted our investigation of the discussion of the topic in the period 2010-2015. Dr Helen Lambert, who in 2015 was appointed the Economic and Social Research Council (ESRC) AMR Research Champion, maintains that the "rise of resistance to antibiotics (Anti-Microbial Resistance, AMR) is largely a consequence of human action, and is as much a societal problem as a technological one". Furthermore, the ESRC research brief states that:

in order to develop effective patient education and health promotion materials to reduce inappropriate antibiotic use we need to understand how people talk about, and think about, antibiotics and infection. Possible approaches might include a discourse analysis of media reports (Wood, 2016: 3).

'Discourse analysis' can be defined as: "the study of language above the level of a sentence, of the way sentences combine to create meaning, coherence and accomplish purposes", however, "even a single sentence or utterance can be analysed as a 'communication' or an 'action'" (Gee and Handford, 2012: 1). In this work, we are concerned with how language constructs at the clausal (micro) level shape the broader news discourse around AMR 2010-2015 at the macro level, thereby creating the potential for the emergence of social representations about the issue and the role that individuals have in its development and possible mitigation.

Theoretical and conceptual framework

Theoretically, our study is grounded in social representations theory (SRT) (Moscovici, 1988), offering a framework for understanding and exploring how scientific knowledge diffuses in society and informs thought and action at both social and individual levels. A social representation is defined as a system of values, ideas and practices regarding a given social object (in this case, AMR), as well as the elaboration of that object for the purpose of communicating and behaving in relation to it. The theory posits that social representations emerge when novelty (in this case, AMR) is *anchored* to existing stimuli that are known about in a given social context and when it is *objectified* through the invocation of metaphors and images that can describe it (see Breakwell, 2014; Höijer, 2010; Jaspal & Nerlich, 2014a, 2014b, 2016; Moscovici, 1988). Accordingly, it can provide a shared social 'reality' and 'common consciousness' *vis-à-vis* AMR. This study forms part of a growing tradition of SRT-informed research into science, technology and society (e.g. Jaspal & Nerlich, 2014b, 2016; Washer, 2010).

Social representations theory is combined with transitivity analysis (Matthiesen & Halliday, 1997) as a means of offering an account of agency that is predicated on examining the 'choices' that speakers (in our case journalists and commentators writing about AMR) make when constructing sentences and making meaning. Transitivity analysis has offered a systematic method for examining how discourses at the macro level are formulated by language constructs at the clausal level, which has been influential in critical discourse analysis studies (for example: Fairclough, 1992; Fowler, 1996; Matthiessen, 2012; van Dijk,

2002). The approach considers the clause in terms of the ‘process’ (event or state) that is being described; the participants involved in the process; and the circumstances associated with the process.

Consider the following example: *Most antibiotics are natural products derived from microbes in the soil.*

PARTICIPANT	Carrier	<i>Most antibiotics</i>
PROCESS	Relational (Attributive)	<i>are</i>
PARTICIPANT	Attribute	<i>natural products</i>
CIRCUMSTANCE		<i>derived from microbes in the soil</i>

The verb ‘are’ (the plural, present tense form of the verb ‘to be’) indicates that this is a relation process and in what follows (‘natural products’), one that provides some form of classification.

The subject ‘(Most) antibiotics’ represents the participant, which in a process of this type is labelled the Carrier. The grammatical Object of that attribution (here, ‘natural products’) is labelled the Attribute and the context or nature of this attribution provides the Circumstance (i.e. ‘derived from microbes in the soil’). This approach can reveal who is doing what and to whom in our exploration of media reporting on AMR. It can also reveal how social actors are subject to various means of ‘Inclusion’ (‘(Im)personalisation’, ‘Specification’, ‘Abstraction’, ‘Collectivisation’ etc.) and ‘Exclusion’ (‘Suppression’, ‘Backgrounding’, ‘(In)differentiation’ etc.) to use van Leeuwen’s (2003) terms, and thereby given prominence (or otherwise) in the text. As Li (2011: 205) suggests, transitivity analysis “can reveal how texts and discourse choose to represent the states of being, actions, events, and situations concerning the given society and show the bias and manipulation in the representations”.

The aims of this work are to examine the discussion of AMR as it appears in UK news publications (2010-2015) through transitivity analysis and social representations theory in order to determine what social actors are represented in the discussion and who (or what) is characterised as having agency, with a particular focus on the degree of agency attributed to ordinary members of the public.

Sample

We searched the news database Nexis® using the search terms ‘antibiotic resistance’ OR ‘antimicrobial resistance’ (called AMR on the graph), as well as ‘superbug’. Given the discernible increase in the use of these terms (as shown in Figure 1), we restricted our search to 2010-2015. Nexis® allows users to search a database of UK National newspapers, which comprises 16 full-text national newspapers, including their online publications. Although there are of course alternative news sources in online and digital media, it has been shown that the credibility of national quality press is rated higher than news on the Internet (Oscarsson and Bergström, 2012) and this database offered a sufficiently large dataset for our analysis. The distribution of the articles by publication and by year is shown in Table 1.

[Insert table 1 here]

At this point, our aim was to get a general sense of the ways in which the various social actors implicated in discussions of AMR are characterised before any breakdown of the dataset by publication type. The ideological standpoint and readership of the newspaper will have significance for how the material is presented and exploration of this would be a natural extension of our work, consistent with a critical discourse analysis approach (Fairclough, 1992; Van Dijk, 2002). It is noteworthy, for example, that the dataset is heavily dominated by articles published in the Mail Online (21.9%). However, in order to separate out those distinct voices (which may extend beyond not only the publication itself but also the individual journalist, the section of the newspaper, whether it is in print or online etc.) we must first obtain a sense of the overall picture that cuts across publications. As such, the entire 627 articles were taken as a single dataset, although the analysis is presented year-on-year in order to facilitate discussion of any changes over time.

Analysis

The aim of the transitivity analysis was to identify the different social actors and their respective roles in the debate on AMR, focusing not only on their responses to the issue but also on their perspectives on its emergence. As such, we extracted all mentions of ‘antibiotics’ from the data and systematically assessed the clause construction to identify who and what was discussed in relation to ‘antibiotics’, as well as the process between them. Across the 627 articles this amounted to 2500 mentions of ‘antibiotics’ (not all were strictly

clause constructions, e.g. the noun phrase 'Antibiotics apocalypse') distributed as follows: 2010: 103; 2011: 288; 2012: 274; 2013: 525; 2014: 384; 2015: 926. Table 2 indicates who and what were the most frequently referred to participants in the Subject position (the 'enactors' of the Process) for clauses involving 'antibiotics' across each year's corpus.

[Insert table 2 here]

The data show that, although there is an increase in the number of terms to refer to agents in the discussion of AMR, these terms generally relate to a small number of social actors. Thus we find 'antibiotics' and the 'infections' ('bacteria', '(super)bugs', 'strains') that they are designed to treat across the dataset, with doctors/GPs and patients also at the heart of the discussion. Some nouns (such as '(over)use'), however, are more abstract and without a clear individual, or group of individuals, in the Subject position. This is one form of Exclusion (van Leeuwen, 2003) that obscures the identity of the social actor. Similarly, it is not always clear to whom 'we' and 'you' refer. These are explored in turn below.

Antibiotics Table 3 shows which are the most frequent verbs (determining process) that are used when 'antibiotics' is in the Subject position. The most frequent processes attributed to 'antibiotics' are: the relational process indicated by 'are', which provide some form of identification or classification of 'antibiotics'; and the material process 'used' to indicate how and where antibiotics function. By positing 'antibiotics' in the Subject position the 'user' is given an indirect role or omitted altogether in a passive construction. This is observable in the following example:

Antibiotics are used on farms, on livestock, under the prescription and care of a veterinary surgeon (*The Independent*, 20 June 2011).

The relevance of the farming context (Circumstance) is relegated to a prepositional phrase and the role of the veterinary surgeon is given less prominence due to their position in the sentence. This is a common way of 'backgrounding' (Fairclough, 1992) social acts and actors. It is 'antibiotics' that appears at the beginning and in the Subject position and so is the more obtrusive agent. Where 'prescribing' is the process of 'antibiotics' a passive construction is also often used, foregrounding what it is that is prescribed (i.e. 'antibiotics') but providing only an allusion to the agent doing the 'prescribing' by relegating this to the prepositional phrase

(Circumstance) 'in GP surgeries'. As such, GPs are Suppressed (van Leeuwen, 2003) as social actors with their involvement only implicit.

The verbs 'losing' and 'becoming' indicate relational processes in the present continuous tense, demonstrating that this is an ongoing process. The use of 'losing' is generally in reference to the 'effectiveness' of antibiotics in treating bacterial infections. Similarly, antibiotics are reported to be 'becoming less effective'. The material process of 'working' works to the same effect in that references generally report that 'antibiotics *are no longer working*'. This is another series of examples where the factors causing the decreasing efficacy of antibiotics are not reported in a direct way. Rather, 'antibiotics' is reported to be the agent active in a process of 'losing' or 'becoming'.

[Insert table 3 near here]

'We', 'patients', 'people' and 'you' Several terms appear to refer to members of the general public with varying degrees of specificity. In Table 3 we see how frequently the terms 'we', 'you', 'people' and 'patients' are used, with the latter positing the Subject group more strictly in the role of health care users. As with 'antibiotics' above, in discussing 'patients', the actions of GPs/doctors are again suppressed through passive constructions. Patients 'receive' or 'are given'/'prescribed' antibiotics; are 'exposed to antibiotics needlessly' (*Express Online*, 8 May 2013).

'We' appears throughout and, although lacking specificity, contextual cues from the surrounding text suggest that it is generally used to refer to the general public. This indicates a focus on 'our' (that is, the readers') responsibility in the rise of AMR (together with the writers, scientists, doctors and so on). This also allocates blame to 'us' in making AMR materially happen, most notably in the material process of 'using' antibiotics, the mental process of 'expect[ing]' and also the verbal processes of 'ask[ing]' and 'demand[ing]' antibiotic treatment. Subsequently, we are depicted as agents who potentially have some active role in 'preserving' existing antibiotics by 'reduc[ing]' our use of them. From 2013, this is formulated as a discussion of our 'need' for antibiotics, including some more instructive pieces offering advice as to when a patient might need antibiotics but equally, when they might not. The

ambiguity afforded by this collectivisation ('we') means that there is no impetus on individual responsibility since there are no named individuals.

There are some changes in the use of 'we' over time. In 2010 we can find, for example, a statement of the problem that we all face:

Not so long ago, *we imagined that antibiotics could cure all such infections* [...] Without effective antibiotics, modern medical care is not possible. *Activities we consider routine* - such as heart bypass surgery, care of premature infants and joint replacement - would be perilous. [...] It is not surprising that many drug companies are reluctant to invest in discovering new antibiotics. Yet no one doubts that *we need new treatments*.
(*The Times*, 1 January 2010)

This narrative of the AMR problem has become very familiar. It tells us that what 'we' once imagined was a once and for all cure of bacterial infections, no longer is; that routine activities have now become perilous; that we need new and innovative treatments; and that economic factors prevent drug companies, positioned as 'our' saviours, from coming forward with a robust solution to the problem of AMR. 'We' however, are not involved in any material processes in this narrative and as such, there is no demonstration of what 'we' can do in response to this problem.

'*Superbugs*', '*infection(s)*', '*bacteria*' and '*strain*' In the same way that 'antibiotics' are instilled with agency in 'becoming' less effective, the infections they treat are also depicted as being agentive. Infections, which had previously been 'defeated', 'treated', 'remedied', 'destroyed', 'beaten' by antibiotics are now 'developing' into forms that 'survive' and 'evade' antibiotic treatment. Representing the infections themselves as active – as agentive – helps to depict an opposing force: an 'enemy' that we as a society of patients, doctors, scientists etc. might collectively resist. However, this does generate a sense that the 'blame' for the symptoms of these illnesses lies with the bacteria themselves and thereby may detract from the sense of responsibility that we the public might assume.

'*GPs*', '*doctor(s)*' and '*hospitals*' In the corpus we find statistical reports that indicate, for example, that: "Some 74% of antibiotics are prescribed by GPs in the UK" (*The Daily Mirror*,

16 November 2015). The medical domain is reported to be the disseminating source of antibiotics, which in turn implies that 'doctors', 'GPs', 'hospitals', 'medics' etc. are the ones with the capacity to inhibit their use. The distribution of antibiotics is reported in a handful of terms, from simply 'using' (which from the context we can generally take to mean using on their patients, rather than themselves), 'dishing out', 'handing out', 'doling out', to the overwhelmingly most frequent: 'prescribing'. In terms of transitivity, the process of 'prescribing' has evoked some debate (Tucker, 2014) as it seems to originate from a verbal process, has been cited as a behavioural process (Martin, Matthiesen & Painter, 2010) but unarguably has more material consequences in terms of access to medications.

Here, 'prescribing' is the process most frequently attributed to the various medical agents ('doctors', 'practices', 'hospitals', also 'veterinary surgeons') and is presented as a process central to the development of AMR. Phrases such as 'doling out' imply that there is little regard for the quantity of antibiotics being prescribed and that the 'prescribers' (i.e. doctors) are blithely doing so. Substantiating this more critical view of medical professionals is the oft-cited circumstance(s) in which antibiotics are prescribed, such as 'when they are not needed', 'unnecessarily' or 'for coughs and colds'.

However, this does not tell the full story in that there are instances where we find that GPs are 'pressured to prescribe' antibiotics. Thus, although GPs are the active agents in the prescribing of antibiotics, there is another force applying 'pressure' for them to do so. What we can surmise from this type of construction is that the writers may want to allude to the demands of patients, who are likely candidates for the source of this pressure, but do not cite them directly as the instigators of this process. It would be telling therefore, to look more closely at the patient-GP relationship as depicted in the data. We are told, for example, that GPs who refuse to give out antibiotics are 'less popular' (*The Times*, 7 December 2015). Furthermore, some texts directly instruct readers to 'Avoid your GP to slow rise of superbugs' (*The Times*, 23 September 2014). This example does highlight one of the potential oversights of the focus on grammatical agency employed here, where the imperative form omits the Subject for the verb/process ('avoid') and thereby the 'patient' (the 'you' and possessor of the GP) is subject to exclusion. However, van Leeuwen (2003) cites the use of possessive pronouns in this way as a recognised strategy for indicating sociological agency (as opposed

to grammatical agency) and his expanded 'system network' offers some guidance on how to account for such examples.

'(Over)Use' The 'use' and 'overuse' of antibiotics is reported to 'lead to' the issues associated with AMR but once again, the 'users' undergo exclusion in this depiction. There is some sense in this: if we acknowledge that it is not patients/the public themselves that is the issue but rather their (over)use of antibiotics then it seems reasonable to foreground this aspect. However, what this construct avoids is implicating agents such as the public, doctors and farmers in the 'overuse' of antibiotics.

'Farmers' as a group of social actors also experience exclusion when the discussion of the 'use' of antibiotics is situated in the 'livestock' domain. For example:

"The routine preventative use in farming of colistin, and all antibiotics important in human medicine, needs to be banned immediately." (*The Telegraph*, 21 December 2015).

'Farmers' and 'chicken(s)' There are very few examples in the data of 'farmers' in the Subject position. This is in contrast to statistical reports in the dataset where we are told that "An estimated 80 percent of antibiotics used in the United States are administered to livestock with the use expected to surge by two thirds globally between 2010 and 2030" (*Mail Online*, 19 May 2015). In fact, over the dataset the 'chickens' that farmers rear are more frequently in the Subject position than the farmers themselves. This indicates a preference for the passive construction e.g. "chickens [...] raised on antibiotics" (*The Guardian*, 4 March 2015), which excludes those providing the chickens with antibiotics. The farming context itself is marginalised, appearing in prepositional phrases such as 'in the meat industry', or 'as medicated feedstuffs'. This practice then is not foregrounded as a focus of the discussion and thereby becomes incidental, which has the effect of normalising it.

Where there are interventions or actions in this context for reducing the use of antibiotics, this is enacted not by farmers but rather the companies who trade with farmers for their livestock. For example, "McDonald's has also pledged to eliminate chickens fed on

human antibiotics” (*Mail Online*, 19 May 2015). This does, however, only constitute a verbal process (‘pledge’) rather than any real transitive action.

One of the contributing factors to the issue of AMR is that in the last 40 years, only two new classes of antibiotics have been developed¹. There were only 37 references [2010: 4; 2011: 3; 2012: 6; 2013: 7; 2014: 5; 2015: 12] to social actors representing the industry of antibiotic production², who were characterised as having ‘lost interest in developing’/‘not working hard to produce’/‘reluctant to invest in developing’ new biotics and as such, actors in the negation of material process pertaining to antibiotics. Thus while largely subject to exclusion (given the limited number of mentions), when mentioned, ‘drug companies’ are represented as being inactive. Furthermore, the use of passive constructions to report that ‘the manufacture of antibiotics is not seen as profitable’ offers another form of exclusion by omitting the actors who hold this profit-oriented perspective.

Similarly, there are 44 references to the people and processes involved in the research behind antibiotics³, where scientists are discussed in terms of their ability to ‘develop’/‘produce’/‘come up with’ new antibiotics. However, this is presented in the context that ‘microbes mutate faster than scientists can come up with new antibiotics’ (*Express Online*, 28 May 2013), demonstrating the inability to complete a material process quickly enough. Other processes are verbal: trials ‘promote’; findings ‘reveal’; research ‘offers’; and scientists ‘blame’ and ‘call for’, so their role in the fight against AMR is not shown to be as impactful as transitive, material processes would be.

Discussion

In May 2016 the UK economist Jim O’Neill published a long-awaited report on how to tackle AMR (O’Neill, 2016), which recommended *inter alia* that “a massive global campaign should be launched to make the world more aware of the dangers of antimicrobial resistance” (Kupferschmidt, 2016). Moreover, in September 2016 the General Assembly of the United

¹ <http://www.antibioticresearch.org.uk/about-antibiotic-resistance/>

² Identified by the terms: ‘drug companies’; ‘pharmaceutical companies’; ‘the pharmaceutical industry’; ‘pharmaceutical firms’; ‘Big pharma’ and indirectly, ‘manufacture of antibiotics’ and ‘the (antibiotics) pipeline’.

³ Identified by the terms: ‘research’; ‘scientists’; ‘microbiologists’; ‘study’; ‘trials’; and ‘findings’.

Nations held a special high-level meeting on AMR and committed to addressing the challenges posed by AMR to health, food security and development.⁴ The growing problem of AMR can be attributed not only to biological and pharmacological causes but also to human action. Public perceptions of AMR play a fundamental role in how individuals engage with antibiotics and, consequently, in the progression of AMR. This ties in with existing research findings that patients may expect, and even demand, the prescription of antibiotics although they are not needed; that there is a tendency to misuse antibiotics; and that AMR is frequently attributed to external causes, such as to doctors, 'dirty hospitals', 'others' who overuse antibiotics, and society as a whole, rather than to one's own individual actions (McCullough et al., 2016; Pinder et al., 2015; Wellcome Trust, 2016). An apparent disconnect between science, knowledge and patient expectations has led scientists and commentators to argue for greater public understanding of AMR. We strongly believe that the news media constitute an important starting-point for understanding the nature and structure of representations of AMR, which in turn inform thought and action *vis-à-vis* AMR.

Attribution is a key component of social representations (Hewstone et al., 1982), and it can be regarded as a subprocess of anchoring (Jaspal & Nerlich, 2014a). Indeed, problems need to be attributed to specific causes in order for them to be understood and discussed. In the data there was no sense of individual responsibility but rather AMR was attributed either to the bacteria themselves or to society as a whole. This could plausibly encourage the social representation that AMR is a biological and societal problem, over which individuals have no control, such as was found in reported studies. Patients tend to make "external attributions" and to perceive a lack of control over the development of AMR or its solutions (see Hayden, 2013: 129). Chandler et al. (2016: 33) have observed similar 'blame-games' (or forms of external attribution/ anchoring) in media and political discourse:

framing doctors as over-prescribers and patients as misusers and over-consumers of antibiotics, with selective and/or limited attention, intentional or not, to contributions of socioeconomic inequalities and inequities, demographics and differences in exposures to infectious diseases, let alone the pharmaceutical industries role in the levels of antimicrobials sold.

⁴ (<http://www.un.org/pga/71/2016/09/21/press-release-hl-meeting-on-antimicrobial-resistance/>)

This highlights that the response to overuse of antibiotics needs to come at multiple levels and the media might have a role to play in promoting individual action among members of the public but there are also political and economic structures that will continue to determine who has access to antibiotics. Boyce, Murray and Holmes (2009) found that the British press often based antibiotic resistance reporting on governmental agency press releases rather than research reports, which will have consequences for the linguistic construction of this media discussion of the issue if the content is appropriated from reports or other documents that are written for a different purpose, in a different register. Potentially, studies that adopt a systematic linguistic approach as we have presented here can inform media practices as to how to incite individual action, if this is an accepted strategy for tackling AMR.

Given the centrality of human action to the development of AMR, it is key that we understand the underpinnings of the social reality and public consciousness around AMR. Sources of societal information such as the media contribute to the development of social representations and yet the media can only possibly play a partial role in this developmental process, since individuals, groups and other channels of societal information (e.g. political rhetoric) function as co-constructors of social representations (Breakwell, 2014; Smith & Joffe, 2013). Future research must explore how AMR is portrayed not only in the traditional mainstream media but also in social media, such as on websites, blogs and in political rhetoric. The Wellcome Trust, for instance, is doing an excellent job in disseminating information about AMR on social media platforms such as Twitter in order to enhance public understanding about it. An important next step in research into AMR would be to explore the impact of social media campaigns on the structure and quality of public understanding of AMR. Machin and Mayr (2013) have shown how transitivity analysis can be combined with a multimodal critical discourse analysis in their examination of the representation of criminals and crime fighters in the television show *Crimewatch*, which can offer some guidance as to how to extend this type of work into a multimedia/multimodal domain.

In adopting a transitivity analysis we were able to identify those instances where the social actor was labelled in the process and thereby explore the more overt ways in which particular agents were implicated in the discussion of AMR. But as van Leeuwen (2003: 32) observes, “sociological agency is not always realised by linguistic agency, by the grammatical

role of Agent⁹. Therefore, there may be other ways in which doctors, patients, drug companies etc. can be implicated with less overt naming strategies, such as the use of possessive pronouns ('Avoid your GP'). It is necessary to consider what effect these have too. Extending this research in the ways that van Leeuwen identifies in his (2003) 'system network' could offer a more comprehensive picture.

Our findings provide some indications of emerging social representations of AMR. Bacteria, superbugs and infections are positioned as the enemy which needs to be beaten but there appeared to be little focus on solutions or on the tools that might be utilised in the fight against AMR. Adopting a 'solutions journalism' approach has been shown to improve readers' engagement with an issue as well as inspiring them to work towards a solution (Curry and Hammonds, 2014). Antibiotics are defined, categorised, but ultimately no longer responsive to bacterial infections. The agricultural dimension of AMR was largely marginalised, despite the central role that this domain also plays in the development of AMR (Morris, Helliwell and Raman, 2016). Thus, AMR was anchored principally to these entities: bacteria, superbugs and infections; and the war metaphors employed in relation to these entities (e.g. defeated, destroyed, beaten) *objectified* AMR as being driven by belligerent forces requiring action and mitigation (see also Höijer, 2010). Research and manufacture of antibiotics were also subject to exclusion. Thus, a stable social representation of AMR in the news media concerns the anthropomorphic agency of bacteria, antibiotics and infections, which, despite the use of war metaphors, discursively attenuates the ability of human beings to engage successfully with the problem of AMR.

It is easy to see how representations observed in the data might inhibit engagement with the problem of AMR by disempowering individuals who indeed could take action against its progression. Indeed, self-efficacy, which this representation may well inhibit, is a key predictor of behaviour change (Holloway & Watson, 2002). Clearly, those social representations that empower people to engage with AMR should be encouraged and disseminated. Existing work on antibiotic resistance seems to suggest that there is a shortage of accurate and empowering information on the phenomenon. In other words, readers are not habitually exposed to representations that can inform them about the complexity of the problem or that can provide them with possible ways in which they *as individuals* may

contribute to the prevention of antibiotic resistance. The findings from our media analysis seem to support this assessment.

References

Blakemore E (2015) Gonorrhoea is Developing Antibiotic Resistance. *Smithsonian Magazine*, 29 December. Available at: <http://www.smithsonianmag.com/smart-news/gonorrhoea-developing-antibiotic-resistance-180957665/> (accessed on 16 November 2016).

Boyce T, Murray E and Holmes A (2009) What are the drivers of the media coverage of methicillin-resistant *Staphylococcus aureus*, the inter-relationships and relative influences? *Journal of Hospital Infection* 73(4): 400-07.

Breakwell GM (2014) Identity and social representations. In Jaspal R and Breakwell GM (eds) *Identity process theory: identity, social action and social change*. Cambridge: Cambridge University Press, pp. 118–34.

Brooks L et al (2008) Towards a better understanding of patients' perspectives of antibiotic resistance and MRSA: a qualitative study. *Family Practice* 25(5): 341–8.

Bucchi M (1998) *Science and the media: Alternative routes in science communication*. London: Routledge.

Carvalho A (2007) Ideological cultures and media discourses on scientific knowledge: re-reading news on climate change. *Public Understanding of Science* 16(2): 223–43.

Chandler CIR, Hutchinson E and Hutchison C (2016) Addressing Antimicrobial Resistance Through Social Theory: An Anthropologically Oriented Report. London School of Hygiene & Tropical Medicine. Available at: http://www.lshtm.ac.uk/php/ghd/research/app/anthropologyofantimicrobial_resistance.html (accessed 16 November 2016).

Coenen S et al (2000) Antibiotics for coughing in general practice: a qualitative decision analysis. *Family Practice* 17(5): 380–5.

Curry AL and Hammonds KH (2014) The Power of Solutions Journalism. *Solutions Journalism Network*. Available at: https://engagingnewsproject.org/wp-content/uploads/2014/06/ENP_SJN-report.pdf (accessed on 10 April 2017).

Desilva M, Muskavitch MA and Roche JP (2004) Print media coverage of antibiotic resistance. *Science Communication* 26(1): 31–43.

Dhaliwal M (2016) Antibiotic resistance is not theoretical: The threat is real and immediate. *The Guardian*, 11 March 2016. Available at: <https://www.theguardian.com/science/2016/mar/11/antibiotics-drug-resistance-is-not-theoretical-threat-real-immediate> (accessed on 16 November 2016).

ESRC (2015) Social scientists needed to solve the problem of antibiotic resistance. News, 6 October 2015. Available at: <http://www.esrc.ac.uk/news-events-and-publications/news/news-items/social-scientists-needed-to-solve-the-problem-of-antibiotic-overuse/> (accessed on 16 November 2016).

Fairclough NL (1992) *Discourse and social change*. Oxford: Polity Press.

Food Safety News (2015) Study: E. Coli Can Transfer Antibiotic Resistance to Other Bacteria, 21 November 2015. Available at: <http://www.foodsafetynews.com/2015/11/study-e-coli-can->

[transfer-resistance-to-last-resort-antibiotics-to-other-bacteria/#.V6632a6N1i4](#) (accessed on 16 November 2016).

Fowler R (1996) On critical linguistics. In Caldras-Coulthard CR and Coulthard M (eds) *Texts and Practices: Readings in critical discourse analysis*. New York: Routledge, pp. 3–14.

Gee JP and Handford M (eds) (2012) *The Routledge Handbook of Discourse Analysis*. London: Routledge.

Gill J et al (2006) Methicillin-resistant *Staphylococcus aureus*: awareness and perceptions. *Journal of Hospital Infection* 62(3): 333–7.

Hayden JA (2013) *Introduction to health behavior theory*. Jones & Bartlett Publishers.

Hermida A et al (2012) Share, Like, Recommend. *Journalism Studies* 13(5-6): 815–24.

Hewstone M, Jaspars J and Lalljee M (1982) Social representations, social attribution and social identity: The intergroup images of 'public' and 'comprehensive' schoolboys. *European Journal of Social Psychology* 12: 241–69.

Höjjer B (2010) Emotional anchoring and objectification in the media reporting on climate change. *Public Understanding of Science* 19(6): 717–731.

Holloway A and Watson HE (2002) Role of self-efficacy and behaviour change. *International Journal of Nursing Practice* 8: 106–15.

Jaspal R and Nerlich B (2014a) When Climate Science Becomes Climate Politics: British Media Representations of Climate Change in 1988. *Public Understanding of Science* 23(2): 122–41.

Jaspal R and Nerlich B (2014b) Fracking in the UK Press: Threat Dynamics in an Unfolding Debate. *Public Understanding of Science* 23(3): 348–63.

Jaspal R and Nerlich B (2016) A “morning-after” pill for HIV? Social representations of post-exposure prophylaxis (PEP) for HIV in the British print media. *Health, Risk & Society* 18(5-6): 225–46.

Kelley HH (1973) The processes of causal attribution. *American Psychologist* 28: 457–501.

Kupferschmidt K (2016) Long-awaited report outlines how to fight antimicrobial resistance—and how to pay for it. *Science (News)*, 18 May 2016. Available at: <http://www.sciencemag.org/news/2016/05/long-awaited-report-outlines-how-fight-antimicrobial-resistance-and-how-pay-it> (accessed on 16 November 2016).

Li J (2011) Collision of language in news discourse: a functional-cognitive perspective on transitivity. *Critical Discourse Studies* 8(3): 203–19.

Linder JA and Singer DE (2003) Desire for antibiotics and antibiotic prescribing for adults with upper respiratory tract infections. *Journal of General Internal Medicine* 18(10): 795–801.

Machin D and Mayr A (2013) Personalising crime and crime-fighting in factual television: an analysis of social actors and transitivity in language and images. *Critical Discourse Studies* 10(4): 356–72.

Martin JT, Matthiesen CMIM and Painter C (2010) *Deploying Functional Grammar*. Hong Kong: Commercial Press.

Matthiessen M (2012) Systemic Functional Linguistics as applicable linguistics: social accountability and critical approaches. *D.E.L.T.A.* 28: 435–71.

- Matthiessen M and Halliday MAK (1997) Systemic functional grammar: A first step into the theory. Macquarie University, Australia: Working Paper.
- McCullough AR et al (2016) A systematic review of the public's knowledge and beliefs about antibiotic resistance. *Journal of Antimicrobial Chemotherapy* 71(1): 27–33.
- Morris C, Helliwell R and Raman S (2016) Framing the agricultural use of antibiotics and antimicrobial resistance in UK national newspapers and the farming press. *Journal of Rural Studies* 45: 43 – 53.
- Moscovici S (1988) Notes towards a description of social representations. *European Journal of Social Psychology* 18: 211–50.
- Nerlich B (2009) 'The Post-Antibiotic Apocalypse' and the 'War on Superbugs': Catastrophe Discourse in Microbiology, its Rhetorical Form and Political Function. *Public Understanding of Science* 18(5): 574–88.
- Nerlich B and Koteyko N (2009) MRSA - Portrait of a Superbug: A media drama in three acts. In Musolff A and Zinken J (eds) *Metaphor and Discourse*. London: Palgrave Macmillan, pp. 153–72.
- Nisbet M and Markowitz E (2016) Americans' attitudes about science and technology: The social context for public Communication. Commissioned review in support of the Alan Leshner Leadership Institute American Association for the Advancement of Science. Available at: http://www.aaas.org/sites/default/files/content_files/NisbetMarkowitz_ScienceAttitudesReview_AAAS_Final_March10.pdf (accessed on 16 November 2016).
- O'Neill J (2016) *Review on Antimicrobial Resistance*. Available at: <http://amr-review.org/> (accessed on 16 November 2016).
- Oscarsson H and Bergström A (eds) (2012) Swedish trends 1986-2011. *SOM-rapport 2012* 27. Available at: http://som.gu.se/digitalAssets/1593/1593632_swedish-trends-1986-2015.pdf (accessed 18 January 2017).
- Picard RG and Yeo M (2011) Medical and health news information in the UK media: the current state of knowledge. University of Oxford, Reuters Institute for the Study of Journalism. Available at: https://reutersinstitute.politics.ox.ac.uk/sites/default/files/Media%20and%20UK%20Health_0.pdf (accessed on 16 November 2016).
- Pinder R et al (2015) *Behaviour change and antibiotic prescribing in healthcare settings: literature review and behavioural analysis*. London: Public Health England.
- Public Health England (2014) *Infection Report Volume 8 Number 32*. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/346324/Voluntary_reporting_S_aureus_bacteraemia_England_Wales_Northern_Ireland_2013.pdf (accessed 17 January 2017).
- Smith N and Joffe H (2013) How the public engages with global warming: a social representations approach. *Public Understanding of Science* 22(1): 16–32.
- Swann MM, Baxter KL and Field HI (1969) Report of the joint committee on the use of antibiotics in animal husbandry and veterinary medicine. Her Majesty's Stationary Office, London, 60.
- Tucker G (2014) Process types and their classification. In Kunz K, Teich E, Hansen-Shirra S, Neumann S and Daut P (eds) *Caught in the Middle – Language Use and Translation. A Festschrift for Erich Steiner on the Occasion of his 60th Birthday*. Saarbrücken: Verlag universaar, pp. 401–16.

Trumbo CW (2012) The effect of newspaper coverage of influenza in the rate of physician visits for influenza 2002-2008. *Mass Communication and Society* 15(5): 718–38.

Wellcome Trust (2016) Antibiotic resistance poorly communicated and widely misunderstood by UK public, 29 July 2016. Available at: <https://wellcome.ac.uk/press-release/antibiotic-resistance-poorly-communicated-and-widely-misunderstood-uk-public> (accessed on 16 November 2016).

Wood F (2016) Antimicrobial resistance and medical sociology: Research brief. *ESRC AMR Research Champion/ University of Bristol*. Available at: <http://www.bristol.ac.uk/media-library/sites/social-community-medicine/documents/social-science-and-amr/MedicalSociology&AMR21092016.pdf> (accessed on 16 November 2016).

Van der Schee E, de Jong JD and Groenewegen PP (2012) The influence of a local, media covered hospital incident on public trust in health care. *European Journal of Public Health* 22(4): 459–64.

Van Dijk TA (2002) Ideology: Political discourse and cognition. In Chilton P and Schäffner C (eds) *Politics as text and talk: Analytical approaches to political discourse*. Amsterdam: John Benjamins, pp. 203–38.

Van Leeuwen T (2003) The representation of social actors. In Caldras-Coulthard CR and Coulthard M (eds) *Texts and Practices: Readings in critical discourse analysis*. Second Edition. London: Routledge, pp. 32–70.

Washer, P. (2010). *Emerging infectious diseases and society*. Basingstoke: Palgrave.

Tables and Figures

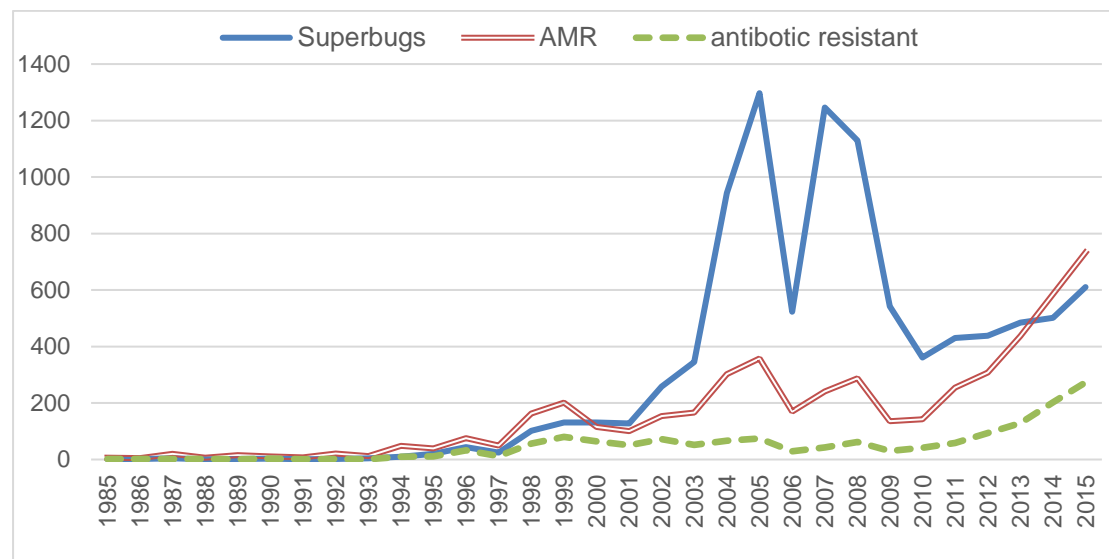


Figure 1. Distribution of articles using the key search terms, 1985-2015

	2010	2011	2012	2013	2014	2015	Total
Daily Mail/Mail on Sunday	3	6	1	5	8	14	37
MailOnline	0	0	15	22	49	51	137
Daily Mirror/The Mirror	3	5	5	3	7	9	32
mirror.co.uk	0	0	0	1	6	14	21
Daily Star/Daily Star Sunday	1	0	1	0	0	0	2
The Daily Telegraph/The Sunday Telegraph	8	5	4	2	11	13	43
telegraph.co.uk	1	1	6	6	12	10	36
The Express/The Sunday Express	9	6	0	4	3	0	22
Express Online	0	0	0	6	5	9	20
The Guardian	5	3	2	14	8	33	65
Guardian.com	1	1	1	8	2	0	13
The Independent/The Independent on Sunday	2	5	2	4	4	5	22
i-Independent	0	2	4	4	5	5	20
Independent.co.uk	0	13	11	2	10	20	56
Morning Star	1	0	0	0	0	0	1
The Observer	0	1	4	2	4	0	11
The People	0	0	2	1	0	0	3
The Sun	1	2	2	0	1	8	14
The Times/The Sunday Times	3	1	5	14	26	23	72
	38	51	65	98	161	214	627

Table 1. Distribution of articles in the data sample by publication and year

2010	2011	2012	2013	2014	2015
antibiotics [19] superbugs [6]	antibiotics [40] use [22] we [14] infection(s) [9] farmers [7]	antibiotics [43] we [20] patients [14] there [13] bacteria [10] doctors [9] overuse [8]	antibiotics [119] we [16] infection(s) [14] use [14] doctor(s) [13] patients [13] overuse [12] there [12] GP(s) [8] half ^a [8]	antibiotics [95] we [19] patients [14] you [14] infection(s) [11] resistance [11] bacteria [7] GPs [7]	antibiotics [242] we [30] bacteria [28] GPs [21] patients [20] use/usage [20] resistance [17] strain [15] chicken(s) [14] doctors [14]

people [13]
overuse [12]
hospitals [11]

^ahalf of all spinal surgery' is discussed in terms of potentially being replaced with the taking of antibiotics

Table 2. Frequency of Participants in the Subject position (the 'enactors' of the Process) for clauses involving 'antibiotics' by year

	Subject: Antibiotics	Most frequent verbs (PROCESS)
2010 [103 mentions]	<i>antibiotics</i> [19]	are [4], have [2]
2011 [288 mentions]	<i>antibiotics</i> [41]	used [7], are [4], lose/ing [4], prescribed [3]
2012 [274 mentions]	<i>antibiotics</i> [43]	are [7], losing [7], prescribed [3], taken [3], used [3], work/ing [3]
2013 [525 mentions]	<i>antibiotics</i> [119]	(over)used [20], work/ing [20], treat [12], become/ing [10], are [7]..
2014 [384 mentions]	<i>antibiotics</i> [94]	work/ing [15], are [14], lose/ing/lost [6], used [5]
2015 [926 mentions]	<i>antibiotics</i> [242]	used [37], are [23], treat [16], work/ing [16], prescribed [13], be/en [6], given [6]..
Subject: People		
2010 [103 mentions]	<i>we</i> [2]	-
	<i>we</i> [14]	have/had [5], use [4]
2011 [288 mentions]	<i>people</i> [5]	-
	<i>you</i> [5]	use [2]
	<i>patients</i> [2]	-
2012 [274 mentions]	<i>we</i> [20]	have [4], preserve [2], use [2], owe [2], prescribe [2]
	<i>patients</i> [13]	expect [5], demand [2], had [2]
	<i>you</i> [4]	-
	<i>people</i> [1]	-
2013 [525 mentions]	<i>we</i> [29]	use/ing [4]
	<i>patients</i> [13]	cured [2], exposed [2], having [2]
	<i>you</i> [7]	need [4], ask [3]
	<i>people</i> [3]	sent [2]
2014 [384 mentions]	<i>we</i> [19]	use [4], produce [3], prescribe [3]
	<i>patients</i> [14]	receive [3], given [2], prescribed [2]
	<i>you</i> [14]	need [11]
	<i>people</i> [4]	-
2015 [926 mentions]	<i>we</i> [34]	use [5], have [4], preserve [3], reduce [3]
	<i>patients</i> [20]	ask/ing [5], need [3]
	<i>people</i> [13]	-
	<i>you</i> [9]	need [4]
Subject: Pathogens		
2010 [103 mentions]	<i>superbugs</i> [6]	are [3]
	<i>bacteria</i> [4]	are [2]
	<i>strain</i> [1]	-
	<i>infections</i> [1]	-
2011 [288 mentions]	<i>infections</i> [9]	-
	<i>bacteria</i> [6]	become [2], develop [2]
	<i>(super)bugs</i> [5]	are [2]
	<i>strain</i> [5]	is/be/are [5]
2012 [274 mentions]	<i>bacteria</i> [10]	survive [4]
	<i>(super)bugs</i> [5]	beat [2], become/ing [2]
	<i>infection</i> [2]	-
2013 [525 mentions]	<i>infection(s)</i> [12]	are [6], treated [4], respond [2]
	<i>bacteria</i> [7]	becoming [4]
	<i>strains</i> [3]	are [2]
	<i>superbugs</i> [3]	defeated [2]
2014 [384 mentions]	<i>infections</i> [11]	treated [3], are [2], remedied [2]
	<i>bacteria</i> [7]	destroy [3]
	<i>strain(s)</i> [6]	is/be/are [6]
	<i>superbugs</i> [6]	evade [4]
	<i>bugs</i> [4]	rendering [2]
2015 [926 mentions]	<i>bacteria</i> [28]	become/ing [7]
	<i>strain(s)</i> [15]	is [4]
	<i>bugs</i> [9]	are [4]
	<i>infections</i> [9]	-
	<i>superbugs</i> [9]	-
Subject: Medics		
2010 [103 mentions]	<i>doctors</i> [2]	-
2011 [288 mentions]	<i>doctors</i> [3]	use/ing [2]
	<i>GPs</i> [2]	-

2012 [274 mentions]	<i>doctors</i> [10] <i>GP</i> [1]	prescribe/ing [5] -
2013 [525 mentions]	<i>doctors</i> [13] <i>GPs</i> [8]	prescribing [5], handed/ing out [3] prescribing [7]
2014 [384 mentions]	<i>GPs</i> [7] <i>doctors</i> [5] <i>hospitals</i> [1]	dishing out [3], prescribing [2], handing out [2] - -
2015 [926 mentions]	<i>GPs</i> [21] <i>doctors</i> [14] <i>hospitals</i> [11]	prescribing [12], handing out [3], doling out [3] prescribing [7] use [7], turning to [3]
Subject: Use		
2010 [103 mentions]	<i>use</i> [3] <i>overuse</i> [1]	- -
2011 [288 mentions]	<i>use</i> [22] <i>overuse</i> [4]	recognised [3], returned [3], risen [3] -
2012 [274 mentions]	<i>overuse</i> [8] <i>use</i> [5]	is [2], means [2] -
2013 [525 mentions]	<i>use</i> [14] <i>overuse</i> [12]	- led/leads to [4], create [3]
2014 [384 mentions]	<i>use</i> [6] <i>overuse</i> [2]	- -
2015 [926 mentions]	<i>use</i> [17] <i>overuse</i> [12]	banned [3], is [3] is [3], led/leading to [3]
Subject: Farming		
2010 [103 mentions]	<i>farmers</i> [1]	-
2011 [288 mentions]	<i>farmers</i> [7]	use/ing [3]
2012 [274 mentions]	<i>farmers</i> [4] <i>chickens</i> [3]	- fed [3]
2013 [525 mentions]	<i>chickens</i> [3] <i>farms/ers</i> [2]	- use [2]
2014 [384 mentions]	<i>chicken</i> [3]	raised [3]
2015 [926 mentions]	<i>chickens</i> [12] <i>farmers</i> [3]	raised [6], fed [4] -

Table 3: Frequency of Participants in the Subject position by category, with most frequent associated verbs