Regulating Animal Health, Gender and Quality Control: a study of veterinary surgeons in Great Britain

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Dr Gareth Enticott
School of City and Regional Planning
Cardiff University
Glamorgan Building
King Edward VII Avenue
Cardiff
CF10 3WA

Tel: 02920876243
Email: enticottg@cardiff.ac.uk

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1. Introduction

Given the agricultural origins of rural sociology, it is surprising to find few mentions of the veterinary profession or accounts of the work of veterinary surgeons in rural sociology. Whilst, accounts exist of the work of agronomists, soil advisors, crop scientists, organic advisors, pollution inspectors and other agricultural advisors (see for example: Bell, 2004; Henke, 2008; Ingram, 2008; Lowe et al., 1997; Morris, 2010), the veterinary profession is mainly linked to studies investigating sources of farmers' knowledge (for example: Sligo and Massey, 2007), rather than specifically focusing on the actions and practices of vets. By contrast, studies of medical doctors have played a profound role in shaping modern sociology and although there are many journals of medical sociology, there are no equivalents for animal disease or the veterinary profession. The outbreak of Foot and Mouth Disease (FMD) in 2001 in Great Britain has, however, helped to stimulate a nascent sociological interest in the veterinary profession. Combined with theoretical approaches from science and technology studies, research has begun to focus on the practices of animal health regulation (Enticott, 2012; Law and Mol, 2011; Roe et al., 2011; Singleton, 2010) as well as critically engaging with veterinary concepts such as biosecurity (Bingham and Hinchliffe, 2008; Donaldson, 2008; Enticott, 2008).

This paper aims to contribute to this growing social scientific interest in the veterinary profession, by focusing on the role of veterinary surgeons in conducting surveillance for animal diseases. In the United Kingdom, vets in private practice are routinely called on by the Government to conduct tests for diseases that are subject to international trading restrictions. Private vets were integral to bringing the 2001 FMD outbreak under control but have been historically involved in fighting other endemic animal diseases such as bovine Tuberculosis (bTB) and Brucellosis in cattle. However, there are few sociological studies that have investigated this work, the skills involved or the most appropriate organisational structures that are required to ensure that regulation can occur efficiently. In addressing these gaps, this paper therefore concentrates on the role of vets in conducting surveillance for animal diseases. It seeks to critically analyse attempts to monitor the performance of vets conducting bTB tests using a system of performance indicators. In doing so, the paper shows that the results of bTB tests significantly vary according to the gender of the veterinary surgeon conducting the test and argues that sociological investigation of the practices of vets is essential in designing effective regulatory frameworks for animal health.

2. Bovine Tuberculosis, Veterinary Regulation and Performance Management

Bovine tuberculosis is a serious infectious disease affecting cattle in Great Britain and is particularly common in south-west England and West Wales. In 2009, over 25,000 cattle were compulsorily slaughtered following a positive test for bTB (Defra., 2010). Managing the disease costs the Government approximately £100m per annum but attempts to eradicate the disease are complicated by the involvement of the badgers. Whilst badgers are a disease vector, they are also protected species and cultural symbolic form of wildlife in the UK (Enticott, 2001, 2011).

The primary means of detecting bTB is by using a single intradermal comparative cervical test, also known as the 'skin test', usually carried out by veterinary surgeons acting on behalf of the Government (for details see: de la Rua-Domenech et al., 2006). Farms in areas where levels of bTB are high are tested at least on an annual basis. Where infected cattle are found, farms are prohibited from moving any livestock onto or off their farm until all cattle pass subsequent tests. The bTB test has a strict protocol detailed in the Animal Health and Veterinary Laboratories Agency's (AHVLA) operations manual (Animal Health, 2010) and in European Union Directive 64/432 (Council of the European Economic Community, 1964). On completing a test, vets are required to certify that they have completed the test according to these rules.

Recently, however, a number of high profile cases have publicised concerns over substandard bTB testing practices amongst veterinary surgeons. In 2006, a farmer in Devon complained about the quality of a bTB test after a bull reacted to the test. When it emerged that the vet had not followed the correct procedure, a review into testing practices was commissioned by the UK Government which found that the testing protocol was routinely broken by practicing vets (DNV Consulting, 2006). Unease about the variability of the quality of the application of the skin test by vets was raised by the Independent Scientific Group analysing the effect of badger culling on bTB incidence (Independent Scientific Group, 2003). In 2011, a vet was struck off the register of veterinary surgeons for 10 months after failing to conduct a bTB test according to the test protocol (Anon, 2011) and a whole practice banned from bTB testing in 2012 (Anon, 2012). In general, concerns have related to the failure to check all animals have been tested, failure to measure the skin thickness of all cattle using callipers, failure to prepare the injection site adequately and/or application of subjective judgement by vets over what constitutes a positive test (see Enticott, 2012). Organisational cultures in veterinary practices appear to play an important role in creating and legitimising such bTB testing practices that diverge from the standard testing protocol (Enticott, 2012).

Similar worries about the variation of medical standards are present in public health research (McDonald et al., 2005; Waring et al., 2007; Waring, 2005). Whilst some of this research has stressed the value of intuitive knowledge held by health professionals (Currey and Botti, 2006; Currey et al., 2006), others have stressed the need to find ways to overcome cultural barriers that prevent health professionals from making errors or following standardised guidelines and protocols (Dixon-Woods et al., 2009). One approach traditionally used in the public and private sectors has been to use a system of performance management and performance indicators to assess individuals' or organisations' outcomes, effectiveness and/or efficiency. A performance management system is a collection of indicators that reflect an individual's or organisation's progress to specific aims and objectives, and which can be compared with other similar individuals or organisations (Audit

Commission, 2000). More often than not, performance indicators (PIs) will be statistical, although they may also be qualitative or classified into groups (such as the labels ‘excellent’, ‘good’, ‘fair’ or ‘poor’).

In the last 20 years, performance management regimes have emerged as a common tool to help judge the effectiveness of public organisations, but they are also an important way of encouraging individuals to change and adapt their behaviour. The emergence of performance management is associated with the what has been called the New Public Management (Hood, 1991) – broadly the application of private sector management and accounting techniques to the public sector. In the UK, these methods have been used extensively within public sector as part of the Labour Government’s public service modernisation agenda (Boyne, 1998). Although this approach began in the 1980s, the use and number of PIs rapidly increased during the 1990s and 2000s as the Labour government sought to ensure minimum standards and demonstrate improved performance in health, education and other public services.

For some, these techniques help an organisation to focus on results rather than process and reward achievement rather than failure (Osborne and Gaebler, 1992). Thus, studies have recorded how systems of metrics, targets and performance management are associated with improved outcomes within the public sector (Bevan and Hood, 2006; Boyne and Chen, 2008). Others however have criticised the effect of PIs for eroding trust within the public sector and creating perverse organisational behaviour by encouraging gaming and fraud (Mather, 2003; Power, 1997; Public Administration Select Committee, 2003).

Whilst PIs may be used to report on organisations as a whole, they may also be used by individuals to improve their own performance. In effect, PIs provide a means of self-surveillance: individuals can rate their performance against others and see how much they need to improve. At the same time, the publicness of these PIs creates coercive social pressures to improve performance. By making performance visible, adaptations in behaviour should follow as most people do not want to be seen to be different. However, as some studies have shown, there is no guarantee that individuals will seek to maximise their behaviour. Indeed, regression to the mean has many advantages as overachievement may bring other penalties, such as loss of social status and self-image amongst one's peers (Smith, 1993). Other studies have shown that comparisons of performance indicators between organisations are often false where they fail to take into account the effect of different environmental contexts (Andrews, 2004; Andrews et al., 2006).

Concerns over the quality of bTB testing have led some countries to develop performance management systems to monitor the performance of vets. In Ireland, a suite of performance indicators derived from bTB testing data is used by Government regional veterinary officers. Where appropriate, they are able to issue warnings and sanctions to individual vets (Duignan, 2009). Despite concerns over the quality of bTB testing in the UK, there are currently no performance indicators or management systems aimed at providing vets with increased knowledge of their or their colleagues performance. However, using existing bTB testing data, it is possible to calculate relevant PIs such as the number of reactors per 1000 cattle tested which could be used to assess the performance of vets. Potentially, using PIs like these could generate socially relevant coercive pressures to follow bTB testing procedures more closely. These coercive pressures may arise either through the knowledge that Government is monitoring individual performance, or through the publication and sharing of performance indicators between vets in practice. Indeed, if practice cultures and social relations are important in legitimising alternative testing practices (Enticott, 2012), then PIs may offer a way of reversing this using the same social mechanisms. However, were a system of PIs to be implemented in the UK, it would be important that they had legitimacy amongst veterinary practitioners, and that they were not systematically biased between vets with, for example, different social characteristics. If so, presenting figures for comparison could result in perverse changes in behaviour or wrongly identify 'failing' vets.

3. Materials and Methods

To test the validity of a performance management regime for veterinary regulation, the rest of this paper examines the potential of one PI: Reactors per 1000 cattle tested (henceforth RpT). RpT was chosen as an exemplar indicator as it focuses on the main outcome of a bTB test – the number of animals testing positive or reacting to the test. Traditionally this figure has been used to express incidence of bTB in any given area, but as noted in the previous section, given the subjectivities of the bTB skin test, it may also reflect vets' own testing practices (Enticott, 2012).

The study used data extracted from the Animal Health and Veterinary Laboratoraties Agency's (AHVLA) Vetnet database. The database holds records of all bTB tests and is used for epidemiological analysis of disease trends. The aim of the analysis was to highlight any systematic differences that would compromise comparisons between different vets' performance and render its behavioural change properties problematic. To do this, results of all bTB tests were drawn from Vetnet for the years 2004-2009 in three counties of England and Wales: Devon, Dyfed and Gloucester. These counties were chosen because they have high levels of bTB incidence.

The dataset records the location of each test as defined by the county that the farm is located within. Finer geographical analysis is possible, but for anonymity reasons was not made available by AHVLA. For similar reasons, the location of each practice was not provided. However, whilst the dataset's focus on the spatial distribution of disease may serve veterinarian requirements from epidemiological modelling, this "architecture" embeds a view that social characteristics are not important in the regulation of animal health. As this architecture is fixed, it presents the following problems. Firstly, at an organisational level, it is not possible to compare the results of bTB tests between veterinary practices. This is because when data is extracted from Vetnet, only the current practice is recorded against each vets' test results. As many vets are likely to have changed practice over time, practice level aggregations will be inaccurate except for the most recent cases. Secondly, most social characteristics of vets are absent. The age or length of service of each vet is not recorded within the dataset. Gender is recorded, although it must be deduced from the vets title (e.g. Mr, Mrs, Miss etc). Fortunately, unlike their medical counterparts, in Great Britain vets are not given the title of "Doctor", otherwise this would have made any analysis of social characteristics impossible. The gender of Government veterinarians is also not recorded. For this reason, only tests conducted by private vets are included in the analysis.

The aim of the analysis was to look for systematic differences within the data between different types of vet, rather than compare data between counties. In fact, this would have merely reflected differences in disease incidence, rather than differences in practice. Because of the limited social characteristic data in Vetnet, the gender of veterinary surgeons forms the basis of the analysis. It is hypothesised that there should be no difference between gender and the results of a bTB test. However, although gender was the only variable available for analysis, it does appear to be highly relevant. There have been broad concerns about the impact of the feminisation of the veterinary profession, particularly upon large animal practice (Lofstedt, 2003; Lowe, 2009) and several studies have shown that gender is associated with injuries sustained during veterinary work. Directly related to this study, Wilkins et al (2009) show that the gender of veterinary surgeons is related to the injury rate sustained by vets at bTB tests. They show that female vets are 3.3 times more likely to sustain an injury during a bTB test, although this may over-estimate the actual rate due to non-response bias (Wilkins et al., 2009). Gabel and Gerberich (2002) find that decreased risk of injury to veterinarians is associated with male gender and experience (older vets were less injury prone). Arguably, however, the fact that gender is the only social variable in the dataset potentially also reinforces a focus on gender roles as being of prime importance to the future of the veterinary profession rather than encouraging a broader and less reductionist debate about the abilities of different veterinary surgeons[1].

[1] Thanks to an anonymous reviewer for this suggestion.

Data were converted from a raw text file into SPSS format for analysis for all tests in each county. Where practices conducted tests in neighbouring counties, data for those tests are not included. RpT was calculated for each test by dividing the number of reactors by the number of cattle tested and multiplying by 1000. Gender was coded according to the title of the vet. From these data, mean RpT by gender, test type, county and year was calculated. For there to be no relationship between gender and RpT we should expect there to be similar RpT for male and female vets. That is to say, RpT for male vets should not be consistently higher or lower across the 6 year period when compared to their female counterparts. Analysis was performed in SPSS using a series of independent t-tests, and using Ordinary Least Squares (OLS) and logistic regression.

Results of the skin test can be interpreted in two ways: standard interpretation or severe interpretation if a farm has had a confirmed case of bTB in the past[2]. However, a significant limitation with the data was the absence of any indication of the interpretation at which the test was read. Conflating results read at severe interpretation with those at standard interpretation might affect the calculation of RpT. To accommodate these problems, separate RpTs have been calculated for routine tests and short interval tests. Routine tests are never interpreted on severe interpretation, but short interval tests (tests that occur when a herd has bTB) may. As short interval tests represent a different form of epidemiological investigation they deserve separate analysis. Other individual animal tests such as pre-movement tests and tracing tests have been excluded from the analysis.

4. Results

[2] Following a positive bTB test, cattle are slaughtered and a necropsy performed. If tuberculous lesions are found, this confirms bTB infection and the herd becomes subject to much stricter controls. This involves interpreting subsequent bTB tests at ‘severe interpretation’ until no more reactors are discovered. Severe interpretation effectively makes it harder for cows to pass the test.

Data were provided for a total of 97522 bTB tests conducted by private vets. Gender information was missing for 7559 tests, and 14 tests had no vet identification number. A further 12674 tests were excluded as they did not test the whole herd and served a different epidemiological purpose[3]. These were excluded leaving a total of 77275 bTB tests conducted between 2004-9. The tests were performed by 873 vets. On a yearly basis, the number of bTB testing vets was lower, ranging from 416 in 2004 to 555 in 2009, an increase present in all counties. Overall, the proportion of female vets rose over time from 30.5% to 39.6%. On a regional level this change was more pronounced in Dyfed, rising from 30.8% to 42.7%. Fewer female vets were found in Gloucestershire (27.2% in 2004, and 33.9% in 2009). The increase in the total number of vets and the proportion of female vets both reflects the increase in levels of disease during this time, and the ongoing feminisation of the profession. Overall, female vets conducted around eight fewer bTB tests than their male colleagues each year. Although there were only small differences between male and female vets in the average herd size of bTB tests, male vets tested more animals (as suggested by differences in the number of tests), but also those male vets testing most frequently did so to a much greater extent than the most frequently testing female vets (see table 1).

[insert table 1 here]

Table 1 shows that there are statistically significant differences between overall levels of RpT between male and female vets, and separately for all years except 2004. The gap is highest in 2008 when male vets RpT was 8.41 compared to the female rate of 5.81. Tables 2 and 3 disaggregate these results according to test type and location. When routine tests and short interval tests are analysed separately, overall male RpT is higher than female RpT for both types of tests ($p=0.000$). When these data are analysed by year a similar pattern emerges. For routine tests, analysis shows that the differences between male and female RpT were statistically significant ($p<0.05$) in three out

[3] These included tracing tests (tests of individual animals that have moved from herds that subsequently suffered from bTB), and retests of inconclusive reactors. Only routine or short interval tests were included in the analysis. Tests which farmers pay for, such as pre-movement tests or export tests were also excluded.

of six years. For short interval tests, RpT differences in four out of six years were statistically significant.

[insert table 2]

When data are analysed at a county level, similar patterns emerge, but variations between counties are observable which may reflect different disease profiles of each county. When data is pooled for all years, male and female RpT is significantly different (*p=0.000*) for routine tests in Dyfed, but not for the other counties. For short interval tests, RpT differences are also significantly different in Devon and Dyfed. When data for routine tests are analysed separately by year and county, however, further differences can be found between male and female RpT. In Dyfed, the largest difference between male and female RpT is 3.79 and in 5 out of 6 years, male vets have higher RpT than females. These differences are statistically significant ($p<0.05$) in three cases. In Devon, less variation was recorded. Although female RpT was lower in five out of six years, none of these differences were statistically significant and the largest difference was when male RpT was highest. Results for Gloucestershire show the highest difference of 4.81 (in 2006). Male vets have higher RpT in 4 of the 6 years, but only two years are statistically significant. Overall, for routine tests, in 13 out of 18 cases (72%) male vets consistently found more reactors than female vets, but only five of these differences were statistically significant (27%).

[insert table 3]

This pattern was even more evident in short interval tests. In Dyfed, for all 6 years, male vets have higher RpT than females with five of these differences being statistically significant. The average difference in RpT is 5.35 and the most it differs by is 7.0. These differences were less pronounced in the other study areas. In Devon, female RpT was lower in five out of six years, with 4.45 the highest difference being 4.45. In three of these years the difference was statistically significant. In Gloucestershire, RpT was lowest for female vets for 4 out of 6 years. The largest differences between male and female RpT were for years when male RpT was highest, but no differences were statistically significant. Overall, for short interval tests, in 15 out of 18 cases (83%) male vets consistently found more reactors than female vets, and eight (44%) were statistically significant.

An Ordinary Least Squares (OLS) regression was used to check that the associations between gender and veterinary sector remained present when controlling for herd size. It is possible that these associations are influenced by the nature of the herd being tested. For example, if reactors are disproportionately found in large herds, were male vets from private practices more likely to only test large herds, this may affect their RpT. The dependent variable used was the number of reactors for each test. Independent variables included: number of cattle tested and number of inconclusive reactors. Dummy variables were used for gender, test type (routine or short interval), county and year of test. Results indicate that these independent variables explain 12% of the variation in the number of reactors (see table 4). Nine of eleven independent variables are significantly associated with reactor numbers. The strongest associations are between the number of inconclusive reactors and cattle tested. Unsurprisingly, reactors are more likely to be found in short interval tests. Gender is also positively associated with the number of reactors: the dummy variable indicates that tests by male vets are associated with the discovery of more reactors. Overall these results suggest that the gender of the veterinary surgeon conducting the bTB test is related to the number of reactors found when controlling for herd size, but the effect appears to be small.

Logistic regression shows that the chances of a male vet finding a bTB infected herd are about 17% greater than a female vet (Odds Ratio 1.167, CI 1.116 – 1.221). Moreover, larger breakdowns are more likely to be found by male vets. For TB tests that found five or more reactors, these tests were approximately 53% more likely to be conducted by male vets (OR 1.531, CI 1.407 – 1.665). When only herds of above average size (more than 118 cattle) were included in the analysis, a similar pattern was found. Male vets were more likely to find a herd with at least one reactor than female vets (OR 1.119 CI 1.055 – 1.187). Male vets were also more likely to find large breakdowns: they were 49% more likely to find a breakdown of more than 5 reactors than female vets, and approximately 78% more likely to diagnose a breakdown of more than 10 reactors (see table 5 and 6).

[insert table 5 and 6]

5. Discussion

Overall these data suggest that male vets are more likely to identify infected cattle than female vets during a bTB test. Differences are present on an annual basis, and at a county level. There are fewer significant differences when data is analysed both spatially and temporally, but the evidence still points to a relationship between the outcome of a bTB test and the gender of the vet. In particular, results for short interval tests consistently reveal differences in RpT between male and female vets. These results suggest that disease reporting could vary considerably simply because of the gender of the vet conducting disease surveillance.

Primarily, these results have a number of implications for the quality control of disease surveillance. The presence of systematic biases in the data questions the use of RpT as a performance indicator and means of behavioural change. A key aim of any performance monitoring system is to allow comparisons between individual scores and the overall distribution of scores, such as in a league table, in order to drive behaviour change by establishing, and making visible, social norms. However, this analysis questions whether this is desirable for disease surveillance. Firstly, it seems that regional versions of RpT are required to allow vets to make meaningful comparisons with their colleagues' performance. However, the grouping of statistics into spatial units provides no guarantee of avoiding ecological fallacies. Vets' own knowledge of local epidemiological variations within counties may also contribute to the rejection of RpT as an accurate measure of performance by vets.

The need for a range of different versions of RpT will add to the cost of production and dissemination, as well as making comparisons less than straightforward and potentially out of date.

Secondly, whilst RpT may have succeeded in identifying variations in performance between different groups of vets – a key role for any performance indicator – the difference between male and female vets is both highly problematic and interesting for social scientistsics interested in gender and rural studies. The results raise the question of why such variations exist and question the notion that gender has no explanatory power by itself. In presenting these findings to vets in government and private practice[4], one response has been to use them to justify concerns about the feminisation of the profession and female vets' suitability for farm animal practice. But despite these arguments, and similar findings in other studies (Wilkins et al, 2009), *a priori* there should be no logical reason for variations in the data to exist, nor can male or female RpT be said to be any more or less "right". Given the work of gender theorists particularly in rural studies (Little, 1987; Whatmore, 1990), it seems implausible to suggest that there is something inherent to female or male vets that makes them more or less likely to find reactors without considering the underlying social conditions and structures in which female vets work.

One explanation may lie within the power relations within veterinary practices. The disparity between male and female RpT could arise through the deliberate allocation of bTB tests by the principal vet in each practice. This may result in female vets being sent to tests which are perceived to be 'easier' whilst those seen to be 'difficult' or 'important' tests (such as short interval tests) are allocated to male vets[5]. So-called "easy" tests may be those with good handling facilities, friendly farmers and stock that are easier to manage. This kind of classification of work and customers into easy/difficult groupings is an established coping mechanism amongst service workers (Mennerick, 1974) and also in veterinary practices (Sanders, 1994a; Sanders, 1994b). Studies of policing (Martin,

[4] The results have been discussed with government vets in a series of seminars and workshops and with private vets as part of a related project examining vets' attitudes towards the bTB testing protocol.
[5] This has been suggested in meetings with vets, but is also evident in Enticott (2012) and Wilkins et al (2009).

1999) also show how gender is associated with certain skills which affects the kinds of police work allocated to female police officers. There is certainly some evidence of a different testing profile between female and male vets. On average, female vets test smaller herds: the average herd size for a routine test for female vets is 87 compared to 95 for male vets; and 167 compared to 185 for short interval tests. Male vets are also slightly more likely to conduct short interval tests than female vets (OR 1.153 CI 1.114 – 1.193). However, for this explanation to hold, the pattern of allocating bTB tests must occur consistently across all practices, and relies on the same foresight and knowledge of what constitutes an 'easy' test. Whilst it is likely that there are some biases in the way tests are distributed in a practice, the results presented here suggest that in terms of size at least, they do not have a significant impact upon disease surveillance: gender differences remain even when controlling for these factors.

Another explanation put forward by vets in response to these findings is that female vets are likely to be younger and may be more likely to be influenced by farmers to not record reactors. Whilst this may be possible, such an explanation is also highly reductionist. Nevertheless, other research does find gender differences in the practices of medical doctors. In a study of breast cancer patients, Silliman et al. (1999) found that female surgeons provide better standard of care than their male counterparts; Glaesmer and Deter (2002) found that male doctors write prescriptions more frequently; Boulis and Long (2004) found that male and female surgeons have different referral rates for different illnesses; whilst Huston et al. (2001) revealed that male doctors of similar age and training are more likely to recommend hormone replacement therapy than female doctors see also (Beran et al., 2007; but see Coulter et al., 1995; Rathore et al., 2001).

In medical research, gender differences are often explained by different styles of communication between male and female doctors. In patient consultations, female doctors appear to pay more attention to the history of disease presentation than male doctors (Adams et al., 2008). A meta-analysis of gender effects in medical communication (Roter et al., 2002) found that female doctors communicate in a different way, using more positive and emotional talk and spend more time with their patients (see also Roter et al., 1991). For example, Roter et al. (1999) found that female doctors were more likely to engage emotionally with patients such as through laughter. These styles of behaviour have been famously referred to as 'emotional labour' (Hochschild, 1983) and whilst it has been associated with female jobs such nursing (Smith, 1992), its commercialisation throughout the service sector means its association with gender is disputed. Sanders (1994b) for example, shows how emotional labour is practiced by all members of a veterinary practice, regardless of gender. Similarly, research into different styles of environmental regulation (Hutter, 1988; Lowe et al., 1997; Marsden et al., 2000) also fails to find an association between gender and persuasive and emotional styles of regulation as opposed to more formal legalistic approaches. Indeed, in relation to bTB testing, emotional labour may manifest itself more in other activities after the bTB test – such as helping farmers complete paperwork and taking time to explain how the farmer can manage their herd – rather than affect the way the disease is diagnosed.

An alternative explanation is that variations in RpT are due to the 'relational distance' (Black, 1976) between vets and farmers. Studies of regulation show that strict interpretation of laws and rules occurs when regulators are physically and culturally distant from the people and organisations they are regulating. Where there are similarities or previous working relationships, approaches to regulation are less formal and more negotiated (Grabosky and Braithwaite, 1986; Hood et al., 1999). As vets are allowed to test their own clients, relational distance is low meaning there is potential for negotiated decision making, particularly where vets have known farmers for many years. Accordingly, the theory of relational distance would suggest that high levels of RpT may be the result of longstanding close relationships with their clients which leads to classifying more cattle as reactors when they are only inconclusive reactors. For the management of the farm and the disease this practice may make sense to both vet and farmer[6], but as it constitutes false certification is likely

[6] Vets may reclassify inconclusive test result as positive tests according to the farm's disease status and/or if the reaction is borderline or close to being a reactor. For the farmer, this will avoid having a potentially

to occur only when a relationship of trust exists between the vet and the farmer (Enticott, 2012). The most recent analysis of the structure of the veterinary profession (Institute of Employment Studies, 2010) shows that the average age of male vets is 53 and 38 for female vets. Moreover, the results from the logistic regession offer some support for this explanation: the probability of a male vet finding a large breakdown is much greater than are the chances for a female vet. These indications of lower relational distance may therefore help to explain to explain the higher levels of RpT amongst male vets. It is conceivable that gender may act as a proxy for a set of other social characteristics, including age, attitudes towards testing and relationships with farmers. The absence of information on veterinarian's age in this dataset prevents confirmation of this hypothesis[7].

More generally it is worth noting that low levels of relational distance have been encouraged by an increasing proportion of bTB tests being handed to the private sector in the three counties studied. In 2004, 9.9% of all herd tests were undertaken by vets working directly for the government. By 2009, this figure had almost halved, standing at 5.2% of all herd tests. Moreover, the share of different types of test has also changed. The majority of tests undertaken by government vets are short interval (88% in 2004, 78% in 2009) but their share of short interval tests has dramatically declined. In 2004 31% of all short interval tests were undertaken by government vets, but this had slumped to 6.6% in 2008 before rising again in 2009 to 11.1%. These data suggest a decreasing relational distance at a time when concerns about the quality of bTB testing by private vets have been increasing. If relational distance accounts for variations in RpT, then quality control efforts may work better by focussing on the organisational structures of bTB testing in order to reduce the possibilities of conflict of interest. As organisational research reveals, failure and deviance results from the pressures and cultural norms of membership of social groups (Janis, 1972; Vaughan, 2005).

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infected animal on the farm which could spread the disease and/or the cost and time of isolating the animal from the rest of the herd.

[7] Information on the age of veterinarians is available from the Royal College of Veterinary Surgeons. However, due to data protection requirements, it has not been possible to link this dataset to that analysed here.

Clearly, there are no satisfactory explanations to the differences found between male and female vets, particularly without access to further social variables such as age and experience. This raises questions about the way data from bTB tests are held by AHVLA. If concerns about the standard of bTB testing are real, then a data management system capable of easily producing analysis of the testing results for counties and individual vets is required. Limitations of this analysis include the inability to include the interpretation applied to test results. The database should also accurately collect information on vets' practice to allow analysis of variations in RpT between practices, as well as hold some limited personal data such as age or date of qualification. Clearly, ongoing analysis of these data is essential for a performance management regime designed to assess veterinary standards and assist their improvement.

Finally, even with up to date and accurate information, the meaning of these indicators needs to be checked with those vets who regularly test for bTB. What would they make of them? How frequently would they want to see them? How would they affect their behaviour? What would farmers think of them? Would this knowledge affect their choice of vet to conduct their bTB test? The best performance indicators are usually drawn up in conjunction with those people they are assessing. There can be little point in producing a set of performance indicators if those people believe they can do little about their performance, think they are powerless to do anything about their level of performance, do not trust their meaning or their publisher (see Driver, 2012) or even trust the accuracy of the bTB test itself. Thus, if vets do not connect good testing practices to a range of RpT values deemed to be normal, or if vets believe the number of reactors they find is down to chance, then the publication of RpT is unlikely to bring about any significant changes to bTB testing practices.

6. Conclusion

This paper began calling for rural sociologists to investigate more fully the work and practices of veterinary surgeons. In recent years, geographers and sociologists have begun to investigate animal health and the role of the veterinarian. This aim of this paper has been to contribute to that literature and encourage further analyses of the role and practices of rural vets. The data presented here, although limited, reinforces the theoretical and practical value that a sociology of animal health and the veterinary profession can have. The key practical aim has been to examine the potential role of performance indicators to help assess and improve the quality of bTB tests by private vets. In doing so, the paper revealed how veterinary regulation appears to be undertaken in different ways by male and female vets. These systematic differences vary temporally and spatially, but they do not appear to be related to factors associated with the test, such as herd size.

The findings are interesting – surprising even – in a number of ways. Firstly, they have highlighted how the social and gender is written into the infrastructure of animal health governance. The absence of the social information within animal health datasets reveals an historical lack of concern attached to social factors rather than natural characteristics when it comes to managing animal disease. The sole presence of gender within the dataset also serves to reinforce the veterinary professions concerns about the feminisation of the profession, rather than encouraging a broader debate about skills and training amongst veterinarians.

Secondly, the paper questions the applicability of performance indicators within animal health. Whilst performance indicators can and are undoubtedly useful in animal health (Farm Animal Welfare Committee, 2011), the findings reflect a broader concern about the uncritical use of numerical governance in rural policy (Enticott and Entwistle, 2007). In this case the paper has shown that there may be social dimensions to variations in the regulation of animal health. The data presented here suggests that these variations may be linked to gender. However, the absence of a broader set of social characteristics of animal health regulators, and concerns over the reductionist nature to such an argument, mean that further research is required to unpack these variations.

Certainly, age, geography, length of service, experience and organisational factors need to be taken into account. Whatever, for the moment at least, the paper suggests that pursuing a policy of performance management in animal health may be inappropriate. Indeed, as Roe et al (2011) suggest, successful inspection and regulation of animal health appears to be always more than just following set procedures and dependent on a much broader set of embodied and emotional practices. As this paper has suggested, variations in regulation may be related to different styles of emotional labour: how this is played out in regulatory and non-regulatory veterinary settings, its effect upon concepts of animal health, and its effects upon its participants is deserving of further research (see Law, 2010).

Finally, in exploring the relationship between gender and animal health regulation, the paper has also suggested that much broader organisational factors may be in play, such as differences in relational distance between male vets and their clients. Although these results only relate to one possible PI, they suggest that using performance indicators to assess the quality of veterinary regulation has considerable problems. Rather than seeking to impose a framework of performance management, the results may suggest instead that addressing some of the conflicts of interest that are perpetuated by the governance of bTB testing may prove a better strategy.

Clearly, the implications these findings have for the bTB testing regime and veterinary regulation are such that further analysis should be a priority. Further research should attempt to unpack the meaning of the differences in RpT between male and female vets, as well as other animal health regulatory practices. The aim should be to provide socially nuanced explanations of variations in regulatory practice, rather than settling for reductionist explanations of gender. In this way, invigorating a sociology of the veterinary profession will be of benefit for both animal health and social science.

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Table 1: Characteristics of Vets and bTB tests											
Year of bTB test	Vet gender	Number of Vets	Number of Tests Conducted				Number of Cattle Tested				Test Characteristics	
			Maximum No. Tests	Mean No. Tests	Standard Deviation	Total Tests	Maximum Cattle Tested	Average Cattle Tested	Standard Deviation	Total Cattle Tested	Average Herd Size	Mean Test RpT
2004	Female	127	95	16.94	19.95	2152	12198.00	1705.09	2259.22	216546	101	5.54
	Male	289	196	26.08	25.98	7536	31021.00	2991.39	3696.38	864512	115	5.88
2005	Female	150	88	21.32	21.80	3198	12799.00	2413.22	2870.61	361983	113	4.85 **
	Male	303	222	27.21	28.17	8245	43278.00	3287.20	4197.80	996023	121	6.69
2006	Female	168	90	20.24	20.35	3400	14631.00	2080.24	2454.68	349481	103	3.79 **
	Male	308	168	28.33	28.58	8727	35308.00	3504.30	4308.77	1079323	124	5.25
2007	Female	179	113	21.43	21.41	3836	11889.00	2252.22	2617.45	403147	105	3.95 ***
	Male	319	134	28.59	29.03	9121	34696.00	3429.56	4249.39	1094031	120	6.49
2008	Female	203	93	23.56	22.31	4783	18279.00	2582.53	3040.93	524253	110	5.81 ***
	Male	331	143	30.05	30.85	9945	36863.00	3684.34	4584.61	1219518	123	8.41
2009	Female	220	109	24.18	22.88	5320	16669.00	2746.32	3206.02	604191	114	5.17 **
	Male	335	188	32.87	32.70	11012	47721.00	4230.75	5393.32	1417301	129	6.39
All Tests	Female	373	113	21.67	21.69	22689	18279.00	2349.19	2821.74	2459601	108	4.88 ***
	Male	500	222	28.96	29.44	54586	47721.00	3538.84	4469.01	6670708	122	6.57

Notes:

Comparison of RpT between male and female vets.

*** *p<0.001*
** *p<0.05*
* *p<0.1*

Table 2: Outcomes of bTB tests in different counties

			bTB Tests	Inconclusive Reactors	Reactors	Adverse test	RpT
			Total N	Total N	Total N	Total N	Mean
short interval tests	Devon	female	3800	6884	3816	1864.00	7.90 **
		male	8782	18720	12368	4526.00	9.70
	Dyfed	female	1768	4345	2300	941.00	6.40 ***
		male	4532	18491	10325	2543.00	11.25
	Gloucestershire	female	584	825	738	243.00	11.27
		male	3069	6520	4234	1504.00	10.46
Routine tests	Devon	female	8204	6257	3035	2328.00	4.63
		male	17069	15006	7229	4900.00	5.12
	Dyfed	female	6943	5358	1505	1664.00	2.22 ***
		male	15235	16734	5562	3903.00	3.53
	Gloucestershire	female	1390	515	545	270.00	6.81
		male	5899	3613	3411	1538.00	8.32
short interval tests		female	6152	12054	6854	3048.00	7.79 ***
		male	16383	43731	26927	8573.00	10.27
Routine tests		female	16537	12130	5085	4262.00	3.80 ***
		male	38203	35353	16202	10341.00	4.98

Notes:

Comparison of RpT between male and female vets.

*** $p<0.001$

** $p<0.05$

* $p<0.1$

Table 3: Differences in RpT across counties and years for male and female vets (2004-9)

			Testyear						All years
			2004	2005	2006	2007	2008	2009	
			rpt	rpt	rpt	rpt	rpt	rpt	rpt
			Mean	Mean	Mean	Mean	Mean	Mean	Mean
DEVON	short interval test	female	8.73	6.20**	4.41**	5.34***	8.95	10.74	7.90**
		male	10.22	9.27	7.80	9.79	11.27	9.71	9.70
	routine test	female	6.17	4.79	3.99	3.92	4.58	4.77	4.63
		male	4.71	5.89	4.12	5.37	5.83	4.77	5.12
DYFED	short interval test	female	4.88**	4.81**	7.28	6.63**	7.65***	5.62**	6.40***
		male	11.41	11.82	11.34	11.71	14.13	8.54	11.25
	Routine test	female	1.63	2.37	2.44	2.28	2.81***	1.66**	2.22***
		male	3.93	3.18	2.28	2.57	6.59	2.56	3.53
GLOUCESTERSH	short interval test	female	7.80	10.92	9.13	8.04	17.55	9.54	11.27
		male	9.28	8.44	9.40	8.85	13.26	10.93	10.46
	Routine test	female	7.91	8.82	3.50**	4.70**	9.00	7.42	6.81
		male	6.03	8.89	8.31	9.38	7.72	9.48	8.32
All Tests	short interval test	female	7.82	6.33***	5.55**	6.01***	9.35**	9.01	7.79***
		male	10.35	9.75	8.93	10.17	12.50	9.58	10.27
	Routine test	female	4.93	4.35	3.33	3.28**	4.12**	3.41**	3.80***
		male	4.63	5.39	3.95	4.92	6.42	4.56	4.98

Notes:

Comparison of RpT between male and female vets.

*** *$p<0.001$*
** *$p<0.05$*
* *$p<0.1$*

Table 4: OLS Regression. Dependent Variable: No. Reactors per Test. N - 77,275

	Standardized Coefficients	t	Sig.	Collinearity Statistics	
	Beta			Tolerance	VIF
(Constant)		-3.525	.000		
No. Inconclusive Reactors	.209	57.012	.000	.843	1.186
No. Cattle tested	.172	45.409	.000	.788	1.269
Gender (dummy variable)	.019	5.583	.000	.981	1.020
Short interval tests (dummy variable)	.070	19.268	.000	.873	1.146
County: Devon (dummy variable)	-.029	-5.728	.000	.434	2.302
County: Dyfed (dummy variable)	-.028	-5.469	.000	.431	2.321
Year: 2005 (dummy variable)	.012	2.672	.008	.537	1.863
Year: 2006 (dummy variable)	-.002	-.340	.734	.525	1.904
Year: 2007 (dummy variable)	.007	1.470	.142	.512	1.955
Year: 2008 (dummy variable)	.035	7.176	.000	.486	2.059
Year: 2009 (dummy variable)	.010	2.035	.042	.466	2.148

Adjusted R Square: 0.122
F – 974.572
sig. 0.000

Table 5: Test results by type of bTB test.

		Number of tests	Tests with Reactors	Tests with >5 Reactors	Tests with >10 Reactors
short interval test	female	6152	1848	424	139
	male	16383	5400	1683	697
	Total	22535	7248	2107	836
Routine Tests	female	16537	1481	300	103
	male	38203	4001	1036	393
	Total	54740	5482	1336	496
All Tests	female	22689	3329	724	242
	male	54586	9401	2719	1090
	Total	77275	12730	3443	1332

Table 6: Results of Logistic Regressions

		Wald	Sig.	Odds Ratio	Confidence Interval	
					Lower	Upper
Tests with 1 or more reactors	Male Vet	46.332	.000	1.167	1.116	1.221
	Short Interval Test	5143.275	.000	4.246	4.081	4.417
	constant	11232.025	.000	.100		
Tests with >5 reactors	Male Vet	97.990	.000	1.531	1.407	1.665
	Short Interval Test	1531.673	.000	4.085	3.807	4.383
	constant	8512.012	.000	.018		
Tests with >10 reactors	Male Vet	68.358	.000	1.810	1.573	2.083
	Short Interval Test	618.554	.000	4.157	3.715	4.651
	constant	4916.993	.000	.006		
Tests with 1 or more reactors & >118 herd size	Male Vet	13.801	.000	1.119	1.055	1.187
	Short Interval Test	1501.483	.000	2.835	2.690	2.989
	constant	2392.593	.000	.231		
Tests with >5 reactors & >118 herd size	Male Vet	65.519	.000	1.487	1.351	1.637
	Short Interval Test	441.263	.000	2.401	2.213	2.606
	constant	3472.661	.000	.050		
Tests with >10 reactors & >118 herd size	Male Vet	53.842	.000	1.781	1.526	2.078
	Short Interval Test	171.342	.000	2.285	2.019	2.587
	constant	2471.213	.000	.017		

Notes:

Confidence Interval is 95%
Average herd size for all tests is 118