

**Attitudes of veterinarians to the changes in provision of bovine
tuberculosis testing in England**

by

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Declaration of originality

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- My Heavenly Father who reminds me daily of His peace that passes all understanding.

Abstract

The number of cattle herds in the UK newly infected with bovine tuberculosis (*Mycobacterium bovis*) has doubled every nine years since 1979. Controlling bovine tuberculosis (bTB) currently costs the British taxpayer an estimated £100 million each year and the disease has been named 'the most pressing animal health problem in the UK'. Routine intradermal tuberculin testing of cattle for bTB has mostly been carried out by private veterinarians trained as official veterinarians; however in July 2014 the English government announced its intention to tender for the supply of taxpayer-funded tuberculin testing. England was divided into five geographical lots and the new delivery partners were to commence their services by May 2015. Such a significant change resulted in mixed reactions from the veterinary community. There were concerns about whether providing these services would remain viable for veterinarians and what the subsequent impact would be on disease control as well as the critical relationship between veterinarians and farmers. Measures to control disease are unlikely to be successful if they are not practical or if the people expected to implement them have not been involved in their development. Social science can be used to measure attitudes and provide information on the acceptability and cost-effectiveness of disease control measures, as well as be a tool for monitoring effectiveness and identifying areas for their improvement.

This research aimed to measure the attitudes to the changes of veterinarians and farmers in England using a questionnaire sent to veterinarians. The responses to the questions were compared among various demographic groups. The results showed consistent differences between the experiences of veterinarians working as delivery partners compared to those working as subcontractors, with significant differences in 15 of the 17 questions, and between veterinarians who work in larger practices (>15 veterinarians) compared to those in smaller practices (≤ 15 veterinarians) with significant differences for 16 of the questions. Subcontractors and respondents from smaller practices indicated that the changes had a negative impact on them and their clients emotionally and negatively affected their and their clients' attitudes towards the government. No positive or negative financial impact was reported. The delivery partners and respondents from larger practices showed a positive attitude towards the government and the financial impact of the changes for both them and their clients; they also indicated a positive impact on them and their clients emotionally. All four of these groups affirmed the importance of a trusting relationship between veterinarian and farmer. Five of the questions showed significant differences in responses between some of the age groups and five of the questions showed significant differences between the risk zones for bTB, although no clear pattern emerged. There were no significant differences in the responses according to gender; those in mixed compared to exclusively large animal practice; UK graduates compared to European graduates or those practising in the South West of England, where bTB is the most prevalent, compared to the rest of the country. The differences observed between the groups were noted particularly in how the changes affected veterinarians emotionally and financially as well as how veterinarians perceived the effects on farmers emotionally.

List of abbreviations

APHA	Animal and Plant Health Agency
bTB	Bovine tuberculosis
BCVA	British Cattle Veterinary Association
BVA	British Veterinary Association
DEFRA	Department for Environment, Food and Rural Affairs
EU	European Union
HRA	High Risk Area
γ -IFN	Gamma interferon assay
IR	Inconclusive reactor
LRA	Low Risk Area
LVI	Local Veterinary Inspector (previous term for official veterinarian)
OTF	Officially bovine tuberculosis free
OV	Official veterinarian (previously LVI)
PCR	Polymerase chain reaction
QA	Quality assurance
SICCT	Single intradermal comparative cervical tuberculin test
TB	Tuberculosis
UK	United Kingdom of Great Britain and Northern Ireland

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1. CHAPTER 1: JUSTIFICATION

1.2. Literature review

1.2.1. Bovine tuberculosis

Mycobacterium bovis is a pathogen affecting predominantly cattle, but with the potential to infect other species including wildlife and humans (Brooks-Pollock & Keeling 2009, Michel, Müller & Van Helden 2010). It causes bovine tuberculosis (bTB), a chronic disease characterised by the development of granulomatous lesions with necrosis and calcification. Infection may occur by inhalation resulting in lesions in the lungs, or by ingestion. Systemic dissemination of infection can occur affecting other organ systems, with lesions often localising in lymph nodes. Advanced disease in animals is usually only seen in countries where active control measures are not employed, where significant production losses can be seen in infected animals (Michel *et. al* 2010). Humans may become infected by direct contact with diseased animals or inhalation of the pathogen, but the most important route of infection is through ingestion of unpasteurised milk obtained from an infected animal (De la Rúa-Domenech 2006, Michel *et. al* 2010). The risk to public health in England is usually low as most milk is pasteurised and sale of raw milk is only allowed from herds that are officially free of bTB (DEFRA 2014a, De la Rúa-Domenech 2006).

Cattle infected with bTB can transmit the infection long before disease is apparent. Identification of infected individuals and prevention of spread in a herd relies on detecting disease using diagnostic tests. *M. bovis* is an intracellular pathogen of macrophages and monocytes, the main composition of the granulomas characteristic of the disease, and induces primarily a cell-mediated immune response. High levels of circulating antibodies to *M. bovis* are only generated in advanced and chronic infection or if an animal is challenged with very high infective doses, therefore tests measuring cellular immunity are used as early indicators of infection. The intradermal tuberculin test detects a delayed hypersensitivity reaction to an injection of tuberculin, a purified protein derivative of products of the growth and lysis of *M. bovis* bacteria. Animals that have been infected with *M. bovis* or exposed to cross-reacting antigens will develop a swelling at the injection site that reaches its maximum intensity 48-72 hours after the injection. The single intradermal comparative cervical tuberculin test (SICCT) involves the use of bovine and avian tuberculin. Animals infected with *M. bovis* should show a greater reaction to the bovine tuberculin than the avian, which helps to distinguish animals that have been exposed to *M. avium* complex or non-pathogenic environmental mycobacteria (De la Rúa-Domenech *et. al* 2006). The proportion of infected individuals correctly identified and detected (sensitivity) by the skin test is estimated to lie between 70% and 90% (Brooks-Pollock, Roberts & Keeling 2014). The intradermal tuberculin test is the primary test used in England, although the gamma interferon assay (γ -IFN) is also available to detect cell-mediated immune response to bTB. The γ -IFN assay is considered to be at least as sensitive as the intradermal tuberculin test. No single test can identify every infected

herd and every single infected animal in these herds, but sequential testing increases the chances of detecting more infected individuals (De la Rúa-Domenech *et. al* 2006, Brooks-Pollock *et. al* 2014). Swift *et. al* (2016) demonstrated a promising new technique where bacteriophages were used in combination with PCR to detect *M. bovis* in peripheral blood mononuclear cells in cattle testing positive by SICCT using a single blood sample. Detecting bTB reliably from a single sample has the potential to speed up detection of infected cases, as well as requiring fewer resources if a herd only needs to be visited once.

The British Secretary of State of the Department for Environment, Food and Rural Affairs (DEFRA) stated in April 2014 that bTB was 'the most pressing animal health problem in the UK' (DEFRA 2014b). This view has been upheld in subsequent publications and statements issued by DEFRA and in a December 2015 publication it was stated that the government remains 'determined to tackle it (bTB) using all available means' (DEFRA 2015e). Compulsory bTB testing was enforced across the whole of England by 1960. In 1961, 16984 positive reactors were slaughtered across the whole UK, which reduced to 633 in 1979 when disease was at its lowest prevalence (De la Rúa-Domenech *et. al* 2006). In 1979 only 0.01% of British cattle tested positive for bovine tuberculosis and the disease was isolated to small pockets of infection in the South West, where herd incidence remained about three times higher than it was in the rest of the country (De la Rúa-Domenech *et. al* 2006, DEFRA 2014b). The situation in England has changed greatly in the past decades, with the amount of newly infected herds doubling every nine years since 1979 (DEFRA 2014b). In 2014 there were over 3000 new herd breakdowns in England, with each breakdown costing the taxpayer £20000 and the farmer £10000 (DEFRA 2015b). Controlling bTB is costing the taxpayer an estimated £100 million each year (DEFRA 2015c). The British bTB situation is the worst in the developed world and threatens trade within the European Union and internationally (DEFRA 2014b). The costs to a farm of a bTB breakdown include financial losses due to loss of milk sales and increased cost of rearing replacement animals, loss of genetics if animals are slaughtered, additional testing requiring the farmer's time and placing stress on the animals by repeated handling, not to mention the stress and its impact on the farmers' livelihoods (Warren, Lobley & Winter 2013). Although farmers are compensated when cattle are slaughtered due to bTB; all these other factors mean that costs are not fully recovered (DEFRA 2014a).

1.2.2. Control of bTB in England

The government aims to eradicate bTB in order to reduce costs to farmers and taxpayers and also as a measure to support the farming industry (DEFRA 2014a). The goal has been set to achieve officially bovine tuberculosis free (OTF) status by 2038 for the whole of England and for some of the northern areas by 2025. The plan for eradication is outlined in the document 'The strategy for achieving officially bovine tuberculosis free status for England' published in April 2014. The country was divided into three management zones where control measures are applied that are proportionate to the risk of bTB infection and spread, while still allowing the livestock industry to operate. The High Risk Area (HRA), Low Risk Area (LRA) and the Edge Area (buffer) in between are shown in Figure 1 (DEFRA 2014b, DEFRA 2015e). The disease is endemic in the HRA, while the Edge Area is considered to have the greatest risk of becoming endemic (Lawes *et. al* 2016).

The current control strategies for bTB involve routine and targeted intradermal tuberculin testing of animals with slaughter of positive reactors, movement controls placed on infected herds and post mortem surveillance for lesions at slaughter facilities (DEFRA 2014b, Lawes *et. al* 2016). Countries that adopt a test and slaughter strategy for bTB control usually can achieve very low levels of the disease, but where a wildlife vector exists, this is not the case. The European badger (*Meles meles*) acts as a wildlife reservoir of *M. bovis* in the British Isles, making control and eradication of the disease more difficult (Michel *et al.* 2010). It is poorly understood how the bacterium is transferred between badgers and cattle, partly because badgers are nocturnal animals and difficult to observe. Woodroffe *et. al* (2016) demonstrated that badgers prefer cattle pasture as a habitat, but prefer land that is 50 metres away from cattle. Their study using GPS collars and proximity-sensing contact collars showed that badgers generally avoid cattle. This study concluded that indirect contact through contamination of the environment is highly likely as the primary route of transmission between badgers and cattle. Although other wildlife species can host bTB, evidence shows that the badger is Britain's only wildlife maintenance host (DEFRA 2014b).

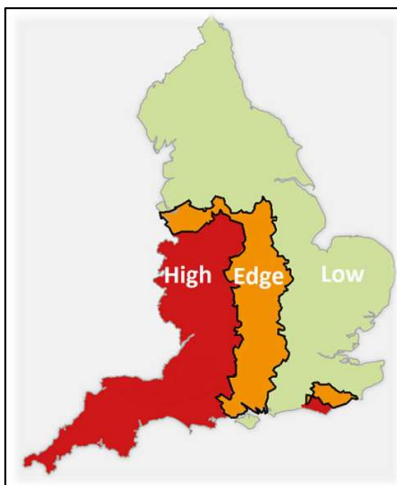


Figure 1. Zoning of England into High Risk, Low Risk and Edge Areas for bovine tuberculosis (DEFRA 2014a).

All cattle must be tested routinely for bTB, which is paid for by the government. Routine testing is carried out yearly in the HRA and Edge Area and four yearly in the LRA (DEFRA 2015d). Since 1 January 2015 the Edge Area parishes of Cheshire have been tested every six months; the rest of the county is in the HRA and remains on annual testing. The hope is to speed up the detection of infected herds in this area where the incidence of bTB has been increasing. The testing intervals are set by the Animal and Plant Health Agency (APHA) and can be changed throughout the year at their discretion in response to disease events (DEFRA 2015a). Some higher risk industries such as artificial insemination centres, producers of raw milk and those hiring out bulls are required to test yearly, regardless of where the herd is located. When bTB testing is carried out, farmers are required to provide a suitable area for the test to be performed and sufficient staff to assist to handle the animals quickly and safely (DEFRA 2015d).

Compulsory pre-movement testing was introduced in England in 2006. All cattle moving out of an area that has annual or more frequent testing must test negative for bTB within 60 days before being transported. These tests must be arranged and paid for by the owner of the animals. If a reactor is found in a pre-movement test, the herd is put under movement restrictions (APHA 2015). This kind of testing is important because it is estimated that 50% of breakdowns in the LRA are caused by purchases of cattle from higher risk areas (DEFRA 2016a). On 6 April 2016 compulsory post-movement testing came into force where farmers in the LRA have to arrange testing of any animals purchased from regions outside the LRA (Anon 2016a). This will help to limit spread of disease into the LRA (DEFRA 2015e). The Environment Secretary announced in December 2016 that England would apply for OTF status for the LRA for the north and east of England during 2017. This would be the first time that any area in England would attain this status (DEFRA 2016b). The LRA of England applied for OTF status in July 2017, which is possible only if the incidence of bTB in cattle does not exceed 0.1% for six years consecutively. This application has not been hampered by a localised bTB hotspot in east Cumbria, where recurring outbreaks have been identified since November 2014 with *M. bovis* being identified in badgers during August 2017, the first time since the 1980s. This discovery has initiated six-monthly testing, surveillance of badger setts and encouragement to farmers to step up biosecurity (Anon 2017).

OTF is bestowed if a farm is up to date with bTB testing and there is no reason to suspect bTB infection in the cattle. A bTB breakdown is defined as suspension or withdrawal of bTB free status because one or more of the animals on the premises fail a bTB test (reactor). An inconclusive reactor has neither a clear negative nor a positive test. If an inconclusive reactor is found, the bTB restrictions will depend on what the herd's bTB status was when the inconclusive reactor was found. When OTF for a farm is suspended, movement controls are put in place and no cattle may move on or off the premises. All positive reactors will be slaughtered and post mortem examinations will be carried out. The free status is withdrawn if lesions are found at post mortem or if *M. bovis* is isolated. Farmers will be instructed to clean and disinfect all areas after the reactors have been removed. As soon as affected animals are removed or isolated, all animals are tested every 60 days (short interval testing). If OTF status was suspended, the status can be reinstated after a single clear short interval test. Two clear tests are required after suspension if bTB free status has been withdrawn in the last 3 years and the herd is next door to a farm that had OTF status withdrawn. Two clear tests are also required for any herd that has status withdrawn and all herds in the Edge Area that experience a breakdown. After OTF status is reinstated, routine herd testing may be required more frequently before the legislated testing intervals are resumed. Compensation is paid for animals slaughtered because of bTB. The animals are valued by the APHA and DEFRA publishes monthly values of cattle according to age, sex, pedigree status and type (beef or dairy). All reactors, animals that are repeat inconclusive reactors and direct contacts are slaughtered (DEFRA 2015d).

Routine testing of cattle for bTB has mostly been carried out by private veterinarians trained as official veterinarians (OVs), with the APHA responding to breakdowns and performing the short interval testing.

On the 11th of July 2014, an invitation to tender was issued by the government for the supply of taxpayer-funded veterinary services that were to include tuberculin testing. Those who won the tenders would be responsible for official veterinarian services as well as be expected to respond to incidents. England was divided into five geographical lots and tendering was to run until September the 9th. Contracts were to be awarded by the end of 2014 and the new delivery partners up and running by spring 2015. When this measure was announced, the Animal Health and Veterinary Laboratories Agency (AHVLA subsequently replaced by the APHA on 1 October 2014) stated that it recognised the important relationship between farmers and their veterinarians, and for this reason local delivery partners were required to subcontract work to local veterinary businesses, provided that practices could deliver the required quality assurance standards and could offer a competitive price. Farmers were to be allowed to choose their preferred practice from those subcontracted, with the AHVLA stating that this preference would be “respected wherever possible”. The AHVLA stated that its key priorities were the quality of the tuberculin testing and value for money for the taxpayer. It was said that this new model would better assure the quality of bTB testing and other services, thereby enhancing their efficacy as tools for disease control, whilst recognising and supporting the partnership that exists between livestock keepers and their local veterinary surgeons (Anon 2014a).

By late January 2015 the results of the tender had not been announced. The British Veterinary Association (BVA) placed pressure on the government to make an announcement, conscious that the new service providers were to commence their services on 1 May (Anon 2015c). The announcement of the successful delivery partners was made on the 16th of February and it was disclosed that legal proceedings had delayed the announcement. Each successful bidder in England is an independent business that is made up of a consortium of practices from that region. Consideration was given to quality assurance, efficiency and total savings in costs. One of the representatives of the delivery partner XL Farmcare North felt that veterinarians would feel positive about the outcome as the delivery of testing stayed with veterinarians and privately owned practices (Anon 2015a). Contracts for subcontractors for most regions were issued from the middle of April, although some contract revisions were only received by veterinary practices on 22 April. The due date for signing of contracts prior to commencement of duties in May was 24 April (Anon 2015e). Devon and Cornwall region received an extension until 12 May for the finalisation of their contracts as uptake for applications to become subcontractors had been low in these areas and the delivery partner wanted to provide opportunities to improve this (Anon 2015f).

Controlling bTB in wildlife is key to controlling the disease in cattle in England with strategies including vaccination of badgers, licensed culling of badgers in certain areas and promoting good biosecurity on farms (Lawes *et. al* 2016). Licences have been granted by Natural England to farmers and local landowners to carry out targeted badger culls in Somerset and Gloucestershire since 2013, areas of Dorset from 2015 and Cornwall, Devon and Herefordshire from 2016. Minimum and maximum levels for culling were set for each county with the aim of achieving a 70% reduction in badger numbers, without compromising the survival of the badger population (DEFRA 2015f, Natural England 2016).

Vaccination of badgers has been trialled in Wales, but was suspended in 2015 due to a worldwide shortage of the BCG (Bacille Calmette-Guérin) vaccine, which has now been prioritised for human use (Anon 2015b, Chambers *et. al* 2014). Vaccination of badgers has been shown to slow the progression and severity of disease and reduce the excretion of *M. bovis* organisms, but it is not 100% effective and does not benefit animals that are already infected. Administering the vaccine to wild animals also presents logistical challenges, as an oral vaccine has not been produced successfully at this stage. Cattle are not currently vaccinated against bTB because it is not permitted by European law due to the lack of an internationally validated test that can distinguish vaccinated from infected cattle (Anon 2015d). Although there is evidence that vaccination reduces disease in vaccinated badgers and cattle, there is currently no data to show that vaccination of either species will result in reduced transmission of disease to cattle or between cattle (Chambers *et. al* 2014).

Farmers are recommended to adopt principles of biosecurity to prevent infection entering or spreading on their farms (TBhub 2016). In November 2014 the website tbhub.co.uk was launched as a joint initiative by the government and private sector to provide a hub for information and guidance with regards to bTB. The website includes extensive advice regarding biosecurity principles, as well as providing a portal to all of the current legislation (Woodmansey 2015). The basic principles that are advocated include restricting contact between badgers and cattle, managing cattle feed and water to prevent access to and contamination by badgers, preventing infected cattle entering the herd, reducing the risk from neighbouring farms by taking care with shared boundaries and equipment and minimising infection from cattle manure (*M. bovis* can survive in manure for up to six months) (TBhub 2016). In January 2016 the TB Advantage genetic index was launched to help farmers select bulls for breeding that have a greater degree of resistance to bTB. This is something that is likely to be of benefit in the long term and is part of an integrated approach to combating bTB (Anon 2016b).

1.2.3. The role of social science in disease control

Social science is the study of people or groups of people and their behaviours (Bhattacharjee 2012). Social science research can be used to measure attitudes and provide information on the acceptability and cost-effectiveness of disease control measures, as well as identifying areas for their improvement (Vlassoff 1992).

Techniques commonly used to conduct social research are largely the same as for biomedical research and include surveys, experiments, field research and secondary data analysis (Little 2014, Thrusfield 2007). Surveys use questionnaires or interviews to collect data from people who respond to questions about behaviours, opinions, attitudes, preferences or factual information (Little 2014). Experiments can be performed in a laboratory or in the field. The subjects of study are randomly assigned to groups: the treatment group where an experimental stimulus is administered and the control group where this treatment is not administered (Bhattacharjee 2012). Observations are made and relationships investigated to test a hypothesis. Field research involves the gathering of data from a natural environment without performing a laboratory experiment or doing a survey. It is useful for observing how people behave rather than looking for causes of why they behave in a certain way. There are three main methods of field research: participant observation, ethnography and case studies. Participant observation involves the researcher joining a group and participating in its activities in order to observe the group within that context. Observations made can lead to hypotheses that can form the basis of further research. Ethnography is the extended observation of an entire community, observing its social and cultural values, while a case study is an in depth study of a particular individual, case or event. Case studies are able to provide detailed information about an individual case, but do not allow for generalisations about the wider community to be made from this data (Little 2014). Field research in biomedical research differs from that in social science. Biomedical field research includes collection of data about the ecology of disease, patterns of distribution of disease as well as testing of hypotheses regarding disease causality (Thrusfield 2007). Secondary data analysis involves the analysis and interpretation of data that has been generated by other researchers or agencies such as government departments or international agencies (Little 2014). Much of the social research in the field of bTB has been undertaken using surveys (Enticott 2008, Enticott 2014, Fisher 2013, Warren *et. al* 2013) or secondary data analysis (Enticott 2012).

1.2.4. Questionnaires as a research tool

Questionnaires are a set of questions used to collect data from a sample of the population. A questionnaire contains questions that the respondent is required to answer which may measure parameters such as knowledge, attitude or emotion. The responses are converted to numerical data and analysed. Asking questions seems a simple way to gather data, but if it is not done with adequate design, the results may not be meaningful and this may not be obvious until it is attempted to interpret the results. It is critical to ensure that the questions work towards answers that will contribute to proving or disproving the hypotheses. Questionnaires have the advantage that they are a fairly quick, inexpensive way of gathering data and are easy to analyse if designed well. There is, however, an

assumption that the researcher and the respondents interpret the questions in the same way (Ratray & Jones 2007). In designing a questionnaire, the objectives of the study should be decided first by stating which theories are to be investigated. These should be translated into a statement of variables that are to be measured. Questions are designed that will gather this data. The researcher should be able to justify why each question is there and how it relates to the aims (Oppenheim 1992).

Types of questions

Questions can be closed, where respondents select an answer from a range of options, or open where they are free to respond in their own words. Open questions are useful if more depth is desired from respondents' answers and this can give interesting data, but may be difficult to interpret and analyse. Closed questions may not give answers with as much depth, but are easier to analyse and interpret. Closed questions can also be easier for the respondent as they are quicker to answer and no writing is required (Oppenheim 1992, Ratray & Jones 2007).

Attitude scales

Attitudes and opinions are very subjective and they are seldom a product of rational analysis of evidence, but are rather shaped by absorbing or reacting to the attitudes of other people or other key experiences (Oppenheim 1992.) In trying to measure something as subjective as an attitude, scales can be used to quantify responses. Likert-type scales assume that the strength of an experience is linear. Respondents are presented with a statement and a range of responses to choose from which range from strongly agreeing to strongly disagreeing, always with a middle-ground response offering an option to neither agree nor disagree. It is not assumed that the intervals between the different points on the scale are equal, but this scaling does allow the ranking of a respondent's responses to various items (Ratray & Jones 2007). Scaling allows responses to be given a numerical score as merely recording experiences makes comparison impossible. The statements that the respondents are asked to respond to are called attitude statements and the collection of statements is called the item pool. Attitudes are rooted in emotion, so statements that evoke an emotional response should be selected. The item pool should be balanced with equal numbers of positive and negative statements about attitudes (Oppenheim 1992).

Improving questionnaire response rates

The proportion of respondents answering the questionnaire is the response rate, which can be maximised by good questionnaire design. The title should be short and accurate to the content and a letter introducing the research and justification for it should be included (Thrusfield 2007). Response rates can be improved by assuring respondents of confidentiality, making the questionnaire look attractive and keeping it short as well as taking extreme care with the wording and the order of the questions (Oppenheim 1992). To prevent boredom, demographic information should be collected at the end; if the respondent has taken the time to read the cover letter and justification for the research, then these questions may be perceived as boring or too personal to start the questionnaire and may stop them from continuing. They should be preceded with a statement that the following questions will help

the classification of data and statistical interpretation (Oppenheim 1992, Rattray & Jones 2007). When wording questions, one should avoid double negatives, unfamiliar abbreviations, jargon, technical terms and long sentences. It is important to include 'not applicable' and 'don't know' as options for multiple choice questions so that respondents do not feel forced to choose an answer that they do not agree with (Oppenheim 1992). It is important to be polite and to thank the respondent at the end of the questionnaire (Thrusfield 2007). Care should be taken to include only one idea in each question (Oppenheim 1992, Thrusfield 2007). When questions are non-factual, they are dealing with aspects of the respondent's state of mind or opinion and the answers are much more difficult to verify. Sets of questions about the same issue can be more reliable to build a picture of the respondent's underlying attitude (Oppenheim 1992).

Pilot work

It is important to test a questionnaire prior to gathering the data to ensure that it will work and be fit for purpose. Although pilot work may be time consuming, not doing it may be more costly to the research process. A question that is poorly worded may not cause the respondents difficulty in answering the question, but may result in them answering with meaningless answers or answering a totally different question to what was intended (Oppenheim 1992).

Evaluation of the questionnaire

Before the results of the survey can be interpreted, the questionnaire itself needs to be evaluated critically. One can look at the demographic breakdown of the respondents and evaluate whether it is representative of the population in question, if it is not this may indicate the introduction of bias (Oppenheim 1992).

Answering a questionnaire can require a great amount of thought from respondents, with the reward for this effort seldom more than knowing that they are contributing to a research process. It is the hope of the researcher that the respondent will produce data that is true and of high quality so that the results can be trusted. To produce high quality answers, respondents must interpret the questions, remember any past situations that are introduced by the questions, summarise the recalled information and report the information in the format that the question requires. If respondents become fatigued during the process of answering a set of questions, they may settle for giving satisfactory answers and satisficing can occur. Satisficing occurs when a respondent merely gives a satisfactory answer rather than expending cognitive effort to respond to the question optimally; it may be weak or strong and can occur in several scenarios. Weak satisficing may occur if respondents select the first answer from a list that seems reasonable, which can result in items earlier in the list being over-selected or if the respondents agree with any attitude statements made in the questionnaire, regardless of the truth of the statement. Respondents may be inclined to agree with the statement due to confirmation bias – only seeking reasons why the statement may be true. Examples of strong satisficing include selecting to maintain the status quo when asked to evaluate potential changes, a lack of differentiation when required to rate an item on a scale, responding 'don't know' to a question and choosing a random response to a question

without giving the selection any thought (Krosnick n.d.). Krosnick (n.d.) describes three conditions that can cause a respondent to opt for satisficing when answering a question: a greater degree of difficulty, a low ability to perform the required functions in order to answer a question optimally and low motivation to optimise a response.

Data gathering and interpretation

A population is all of the individuals who fit in the category that the researcher is concerned with. The sample is a smaller group within the population that is selected for study. If the sample is to have the same characteristics as the wider population, every member of the population should have an equal probability of being selected (representative sample). Selecting a random sample from a population is made easier if there is a list from which a sampling frame can be drawn. Random sampling using a table or computer-generated set of random numbers can be employed (Oppenheim 1992).

It is inevitable that not every respondent will answer every question of a questionnaire. It is important to treat missing data systematically as it is more important to prevent bias than to be concerned about a reduced sample size. Bias can exist even with a high response rate (Oppenheim 1992). Oppenheim (1992) describes two ways to deal with missing data. The first is listwise deletion where the entire entry is removed from the dataset if any part of it is incomplete. The decision to perform this deletion should not be taken lightly as bias can be introduced. Pairwise deletion involves removing that particular case from the analysis temporarily just for the question that is not answered.

Data gathered from open questions or those allowing a free text option will need to be categorised. Oppenheim (1992) advises that it is wiser to place a response in a 'miscellaneous' category than to force it into another category. It may become necessary to create a new category from these responses if the 'miscellaneous' group approaches 15% of the total responses. Accuracy is, however, more important than having neat categories and it is important not to assume to know what the respondent really meant; the data must be read as it is.

The method of data gathering will determine the type of data that is generated and how that data can be interpreted. Quantitative research methods measure numerical values and can yield discrete data, where only a specified set of values is allowed, or continuous data, where any value within a defined range is possible (Thrusfield 2007). The values yielded are linear with known interval values (Oppenheim 1992). Qualitative research describes individuals by classifying them into categories and generates nominal or ordinal data (Thrusfield 2007). Nominal data is the type where a respondent's answers fit into a category, but there is no order or scale to the categories. Examples include gender or location. Members of each category can be counted, so frequency data can be generated. Subsets can be compared and percentages may be used (Oppenheim 1992). With nominal data equivalence can be demonstrated, namely that those in the same category must have the same properties (Thrusfield 2007). Ordinal data can be ranked, but there are no interval values. The appropriate measure of central tendency is the median (Thrusfield 2007). The median is the central value if the data are arranged in

numerical order (McCluskey & Lalkhen 2007a). Respondents may be grouped and these groups can be compared using comparisons such as greater than or less than and equal to. The Chi-squared test can be used to compare observations with chance (Oppenheim 1992, Thrusfield 2007).

Tests for statistical significance measure the probability that differences observed between groups are due to chance. Tests can be parametric or non-parametric. Parametric tests assume normally distributed data and can be applied to interval data. Parametric tests are more powerful than non-parametric tests if the assumptions about the data's normal distribution hold true. They are more robust to deviations in distribution than non-parametric tests are to deviations from data symmetry. Parametric tests also require a smaller sample size to detect a difference between populations. Most non-parametric tests do not assume a normal distribution, but they do assume data symmetry. Non-parametric tests can be used for nominal and ordinal data. With ordinal data, the median is compared and with nominal data, proportions are compared. Related samples may be obtained if, for example, the same respondent completes the same questionnaire on more than one separate occasion. Paired tests are performed on related samples, whilst unpaired tests are performed on independent samples (Thrusfield 2007).

1.3. Problem statement

Changes in bTB policy

Measures to control disease are unlikely to be successful if they are not practical or if the people expected to implement them have not been involved in their development and have not bought into the concept. The attitudes of farmers and of the public can have a significant impact on how disease control measures are implemented; this should be taken into account when developing disease control policy (Anon 2014b). Enticott *et. al* (2015) state that social and cultural factors cannot be left out of policy development when it comes to bTB. Major changes were made to the provision of bTB testing in England during 2014 and 2015 when tenders were awarded to delivery partners.

Expected implications for veterinary practices

From the outset the BVA was concerned about whether providing these services would still be viable for veterinarians and what the impact would consequently be on disease control. The competition of tendering would drive down the fees paid by government for the provision of these services and, whilst this would allow the government to cut its spending, it would mean that veterinary businesses are making less revenue from providing these services (Dessent 2014b). The veterinary community was concerned about the increased costs that they would incur, including set up costs for registering as a subcontractor, increased costs of indemnity insurance and more time required for paperwork and quality control. One practitioner stated an envisaged reduction in revenue of 30% to 50% in a letter to the *Veterinary Record* (Seymour 2015). In addition, from June 2014 the training of official veterinarians was outsourced to a private company and veterinary practices or individuals were now required to pay for the compulsory training to become an official veterinarian. This training had previously been funded by the AHVLA. Existing OVs were able to register with the new provider without repeating their training, but would still be required to do periodic revalidation (Anon 2014c). There was criticism from the industry that only one provider had been appointed as it was felt that this could drive up costs to veterinary practices (Dessent 2014a). The new measures had potentially very significant economic impact on veterinary businesses.

Another concern highlighted by the BVA was the impact that the new arrangements might have on the relationship between farmers and their veterinarians. It was stated that information sharing between local veterinarians, farmers and the AHVLA (APHA) is critical for the control and eradication of bTB. If routine testing came from a provider whose role was merely functional, the BVA expressed concern that valuable knowledge transfer about wider disease control measures could be lost due to the potential breakdown of this critical relationship between veterinarian and farmer (Dessent 2014b).

Delays to the tender process

Successful tenders were scheduled to be announced by the end of 2014, but this was delayed to the middle of February 2015 without any adjustment to the proposed commencement of new services on 1 May 2015 (Anon 2014a). As a result of this, the delivery partners were still negotiating their network of subcontractors at the beginning of April (Seymour 2015). Only a few weeks were given to veterinary

practices to consider and sign the contracts for subcontracting to a delivery partner. The BVA and British Cattle Veterinary Association (BCVA) expressed their concern that practices did not have enough time to consider the contracts, ask questions and seek legal advice if required. They requested a month's extension for the contract deadline as they felt that without this, practices would not have enough time to scrutinise the contracts and evaluate the impact on their businesses (Anon 2015e). This extension was not granted. The APHA stated that the relationship with subcontractors exists between delivery partners and practices and that it is the prerogative of the delivery partners to define what is reasonable regarding the signing of contracts. The delivery partners were contractually obligated to start providing services on the 1st of May and were unable to defer the commencement of their duties (Anon 2015f).

1.4. Aim and Objectives

1.4.1. Aim of the project

Determine how changes in provision of bovine tuberculosis testing have affected veterinarians and farmers in England.

1.4.2. Objectives

1. Determine how the process of changing bTB testing provision through awarding of tenders and subcontracts affected veterinarians financially and emotionally.
2. Determine how the process of changing bTB testing provision affected farmers emotionally as perceived by veterinarians.
3. Determine farmer attitude to veterinary surgeons providing bTB services on their farms.
4. Examine farmers' relationship with the government.

1.5. Hypotheses

The changes to bTB testing provision have negatively impacted veterinary businesses. Practices have lost an income stream or it has been devalued.

Farmers place greater value on advice about bTB provided by veterinarians with whom they have an established relationship than with professionals that are unknown to them.

1.6. Benefits arising from this study

- Social research may be used to monitor disease control measures and identify areas for improvement (Vlassoff 1992). The results of this project will evaluate how key stakeholders responded to changes made to bTB control measures. Sharing of the findings will contribute to stakeholder awareness of the effects of these interventions and will contribute to the body of social research that is being carried out regarding bTB.
- This mini-dissertation is submitted in partial fulfilment in accordance with the requirements for the MSc (Animal/Human/Ecosystem Health).

2. CHAPTER 2: MATERIALS AND METHODS

2.1. Study design

A survey of cattle veterinarians in England – a questionnaire designed to describe veterinarians' and farmers' responses to the 2015 changes in provision of bTB testing in England.

2.2. Experimental design

2.2.1. Questionnaire development

The questionnaire was developed according to the guidelines described by Oppenheim (1992), Rattray & Jones (2007) and Thrusfield (2007). Objectives were identified and variables set to measure the objectives. The variables identified for this project are listed in Table 2.1 with the corresponding question numbers designed to measure each variable. Statements made by veterinarians and farmers in the press prior to the implementation of the new bTB testing system were used as a basis for attitude statements in the design of the questions. This questionnaire consists of closed questions with one optional open question inviting respondents' opinions. The responses from the open question gave valuable insights into individual opinions and may form a basis for further social research in this field.

Table 2.1 Variables measured in the questionnaire

Objective	Variables	Questions relating to this variable
Determine how the process of changing bTB testing provision affected veterinary surgeons emotionally and financially.	Stress or anxiety as a result of the changes	2, 3, 5
	Concern about financial sustainability as a result of the changes	7, 8, 9
	Attitude towards the government's decision to change bTB testing provision	1, 4, 6
Determine how the process of changing bTB testing provision affected farmers emotionally as perceived by veterinarians.	Emotional impact of changes to bTB testing provision on farmers	10, 11, 12
Determine farmer attitude to veterinary surgeons providing bTB services on their farms.	Level of trust in veterinarians' knowledge and skills	13, 14, 15, 16
Examine farmers' relationship with the government		17

Once the questionnaire was written it was submitted to the BCVA board for approval, an essential element of piloting the questions. The questions were also submitted to other veterinary surgeons familiar with practising with cattle in the UK as part of the pilot work. Revisions were made to the questions based on the feedback supplied by the pilot group. The covering letter providing justification for this research project can be found in Appendix A and a copy of the questionnaire in Appendix B.

2.2.2. Selection of sample

During the design of the study, it was hoped that a list of veterinarians working with livestock could be obtained from the BCVA and a random sample selected of those practitioners working in England. This was not possible, and the questionnaire was circulated via email to all of its members. Those who chose to respond included a small number of veterinarians practising in Wales and Scotland, but the majority were veterinary surgeons practising in England. The sample obtained was, however, not randomly selected.

2.2.3. Sample size

The equation $n = \frac{Z^2 \times p(1-p)}{L^2}$ is used to calculate the sample size required.

n = sample size

Z = 1.96 for a confidence level of 95%, an expression of how sure one can be of the results obtained

p = the percentage of respondents selecting a particular choice in a questionnaire. In order to ensure the largest sample size, p is set at 0.5 (50%).

L = error margin set to 7% (0.07) (Datastar 2008, MaCorr Research 2014, Thrusfield 2007). Datastar (2008) states that an acceptable error margin for survey research can be between 4% and 8% at the 95% confidence level.

$$n = \frac{1.96^2 \times 0.5 \times 0.5}{0.07^2} = 196$$

A total of 196 veterinarians needed to be sampled.

2.2.4. Experimental procedures

Practitioners were contacted via email by the BCVA and invited to participate in the survey. A link to an electronic survey was included in the communication. A survey software programme, Smartsurvey, was used to make the questionnaire available electronically, which allowed the researcher access to the responses once they had been submitted.

2.2.5. Ethical considerations

The University of Pretoria Animal Ethics Committee was unable to provide ethical approval as the study was conducted outside the borders of South Africa. Ethical approval for the study was obtained from the Royal Veterinary College, London. Letters from the ethics committees from both the University of Pretoria and the Royal Veterinary College are included in Appendix C.

Participation in the survey was voluntary and respondents willing to fill in the questionnaire provided consent for their answers to be used in the research by ticking a 'consent' box. They were unable to proceed with the questionnaire if this box was not ticked. Raw data was password protected on the researcher's computer to protect the demographic details of respondents and their anonymity.

2.2.6. Evaluation of the questionnaire

The responses to the demographic questions were inspected to assess whether the respondents' demographic breakdown was representative of veterinary surgeons in UK. The responses to the questions measuring the first objective were also examined to determine if there was evidence of confirmation bias.

2.3. Data analysis

2.3.1. Initial data processing

After respondents had completed the survey, the data was stored online and accessible by the author through a password-protected account with Smartsurvey. The data was imported into Microsoft Excel once the survey was closed. The questionnaire software split the data into complete and incomplete responses and each was saved in a separate spreadsheet. If all of the pages of the questionnaire had been viewed by the respondent, the response was deemed complete by Smartsurvey, irrespective of whether all of the questions had been answered. The spreadsheet shows a designated start time and end time for these entries. The responses classified as incomplete had no recorded end time. Some of these had been completed fully, although most of them show that the respondent had only read the introduction and, in some cases, the question requesting consent for the answers to be used in research. The raw data was saved in a password protected Microsoft Excel document. Any information that could identify individual respondents (some left an email address for possible correspondence) was separated from the answers and stored separately in a password protected file.

Before commencing data analysis, it was essential to make decisions about how the data would be handled so that each response was included or excluded based on the same criteria. The first 17 questions are the Likert scale questions that were used to measure the variables set prior to embarking on the research and they were deemed of higher importance. If more than two of these were left unanswered, the entire response was discarded (listwise deletion). Any other unanswered questions were handled using pairwise deletion.

The Likert scale questions generated ordinal data as respondents ranked their responses to various attitude statements. The subsequent questions requesting classifying demographic information generated ordinal data. The total number of responses for each rank was determined for each question using the 'countif' function in Microsoft Excel. The results were plotted on a bar graph to visualise the spread of responses for each question. The totals for each category were added together for each question to ensure they totalled 202 (the total number of respondents). If the total was less than 202, that question was checked for non-responses to ensure that the sum of category totals and the number of non-responses for each question equalled 202. This was the first stage of data cross-checking to prevent errors and was done after evaluation of all of the Likert type questions and demographic questions.

Some of the demographic questions allowed a free text option (other), which meant that some of the responses needed to be coded and placed into categories. This principle was applied to question 20, in which respondents described the capacity in which they work with bTB. Based on the responses from the 'other' category, a new category was created for those practitioners performing private bTB testing, such as pre- or post-movement tests which farmers requesting the tests will pay for. The responses that could not be reclassified remained in the 'other' category.

Question 19 asked respondents to indicate how many veterinarians worked in their practice. The answers were divided into categories before data analysis commenced. Text answers were converted to numbers and any answers that were not specific, for example 'N/A' or 'many' were included in the 'no answer' category. If the answer was written as β^+ or $>\beta$ (where β represents any positive integer), that number was used in analysis, but 0.5 was added to ensure that the number assigned reflected that the true number was greater than the whole number indicated. Question 24, which asked respondents how long they had been practising as veterinary surgeons, was handled in a similar way. All data in text format was converted to a number and respondents qualified for a few months had their response expressed as a decimal so that they fit into the category of 'less than one year'. Answers stating, for example, 'more than 10' or '30+' were converted to 10.5 and 30.5 respectively to ensure that they fell in the correct category (namely >10-20 and >30 years respectively).

Once all of the classifying data had been cleaned and coded, the demographic information and attitude statement responses were evaluated together. The 'countifs' function in Microsoft Excel was used to determine the Likert scale responses for each demographic category. The tables detailing this data can be found in Appendix D. The data was cross checked by adding the total number of responses for each category and ensuring that the total came to 202, the total sample size. Missing answers for each question were cross checked in the raw data to ensure that their omission was reflected in the correct demographic category.

2.3.2. Determining medians

As ordinal data was collected, responses to questions could be ranked and The Likert scale responses were coded into numerical values so that the data could be expressed numerically and analysed. Values were assigned to each of the response categories as detailed in Table 2.2. The median was determined for the responses to each question as well as for each demographic category within each question, which allowed demographic groups to be compared to each other.

Table 2.2. Numerical codes for Likert scale responses

Likert scale response	Code
Strongly disagree	-2
Disagree	-1
Neither agree nor disagree	0
Agree	1
Agree strongly	2

The Chi-squared test can be used to compare observations with chance (Oppenheim 1992, Thrusfield 2007). This was done for each question using the Excel function 'chitest'. This function gives a probability of the observed values being obtained by chance. The categories of 'agree' and 'agree strongly' were added together to give the positive answers and the categories 'disagree' and 'strongly disagree' were added together to yield the negative answers. This Chi-squared related probability, therefore, only refers to the likelihood of positive and negative responses to each question occurring by chance (Henry 2017).

2.3.3. Comparing medians in demographic groups

For each question asked, the responses of each demographic group were inspected and groups were compared to ascertain if significant differences existed. The medians of each group were compared using the Wilcoxon-Mann-Whitney test (a non-parametric test performed on ordinal data). Groups were compared even if their medians were identical. The data is prepared by listing all of the responses to each question and ranking them. Where the same response occurs, the average rank is obtained. The ranks for each group are added together to obtain the sum of the ranks, which are used to calculate the Wilcoxon-Mann-Whitney statistic using the following formula:

$$z = \frac{W_x + 0.5 - m(N+1)/2}{\sqrt{mn(N+1)/12}}$$

W_x = the sum of the average ranks for the smaller group.

m = the size of the smaller group.

n = the size of the larger group.

$N = m + n$.

The calculations were performed using the software Social Science Statistics (Social Science Statistics 2017) and checked by performing them manually in Microsoft Excel. The significance level was set at 0.05 and a two-tailed hypothesis was investigated. The Wilcoxon-Mann-Whitney statistic, z , was determined for each comparison as well as the value of p . The p -value represents the probability of the differences between the groups being due to chance (McCluskey & Lalkhen 2007b). If the value of p is greater than 0.05, the result is not deemed statistically significant (Thrusfield 2007).

The largest groups of respondents identified from the demographic questions were compared with each other using the Wilcoxon-Mann-Whitney test. For the majority of questions two large groups were identified and compared; the exception was bTB risk zone where three groups were identified and compared with each other pairwise. The following groups were compared with each other: veterinarians working exclusively in large animal practice and those working in mixed practice; respondents working in smaller practices (≤ 15 veterinarians) and larger practices (> 15 veterinarians); respondents working as delivery partners and those subcontracting to delivery partners; practitioners from the South West of England compared to the rest of England; male respondents and female respondents; veterinarians who obtained their degree in the UK and those who qualified in the EU.

2.3.4. Comparing groups using the Kruskal-Wallis test

The Kruskal-Wallis test is a non-parametric test that can be performed on ordinal data to determine whether there is a difference between groups. The first step is stating the null hypothesis (H_0), which is that there is no difference between the groups. The alternative hypothesis (H_1) is that there is a difference between the groups that are being compared, that at least one of the populations has a different distribution to the others (The math student 2013). The critical value, H , is obtained by reading from a Chi-squared table for the selected value of α and the calculated degrees of freedom. Degrees of freedom is determined by taking the number of groups being compared less one. The significance level designated as α (P in some texts) is the probability that the computed value of H will be greater than a value read from a chi squared table for the calculated degrees of freedom. The probability is set at 0.05 (5% probability). If the calculated value H is greater than the critical value, H_0 is rejected and the alternative H_1 is adopted (Anon 2011).

The first step to calculate the value of H is to rank the values being compared. If many of the values are the same, average ranks are obtained. The following formula is used:

$$H = \frac{12}{N(N+1)} \left(\sum \frac{T_i^2}{n} \right) - 3(N+1)$$

N = the total number of individuals (the sum of the value of n for each group)

T = the sum of the average ranks for each group

n = number of individuals in each group being compared

The sum function is performed by adding the quotient of the square of the sum of the average ranks and the size of each group. (Anon 2011). The XLStat computer software package was used to calculate the value of H where more than two groups were compared with each other (XLStat 2017). Results were also checked by performing the calculations manually in Microsoft Excel.

2.3.5. Demonstrating associations between groups using the chi-squared test

The χ^2 (chi-squared) test can be performed to demonstrate whether there is an association between groups of respondents and certain characteristics. The χ^2 statistic is calculated and the χ^2 table is consulted. The null hypothesis is that there is no association between the groups; if the calculated statistic is larger than the value in the χ^2 table then the null hypothesis is rejected and an association is assumed.

The values from a 2x2 contingency table (Table 2.3) are used in the formula below.

$$\chi^2 = \frac{n(ad-bc-\frac{n}{2})^2}{(a+b)(c+d)(a+c)(b+d)} \text{ (Thrusfield 2007)}$$

Table 2.3. Example of 2x2 contingency table

	Characteristic 1	Characteristic 2	<i>Totals</i>
Group 1	A	b	a+b
Group 2	C	d	c+d
<i>Totals</i>	a+c	b+d	n=a+b+c+d

2.3.6. Evaluation of study objectives

Each of the four objectives was assessed in terms of the variables that were created to measure them. The responses were evaluated by looking at the sample as a whole and then the responses of the demographic groups showing consistent differences were compared. The answers to each question were examined and it was determined whether the overall response was neutral or showed agreement or disagreement. The median was used as a measure, as well as a comparison of the number of positive responses versus negative responses. Positive responses indicated the respondents who answered 'agree strongly' and 'agree'; negative responses indicated those who answered 'strongly disagree' or 'disagree'. The positive and negative responses were tabulated and expressed as the number of respondents and the percentage of each group making that selection. Depending on how each question was phrased, agreement or disagreement with each question would result in a score of +1, 0 or -1 for the variable that the question was measuring. The scores were added together for each variable and used to interpret the responses in the context of the variables and objectives. Table 2.1 shows which questions were used to measure each variable.

3. CHAPTER 3: RESULTS

3.1. Response rate

Full responses were obtained from 202 veterinary surgeons and a further 169 incomplete responses were logged. All of the full responses were included in the dataset. Some respondents skipped one or two questions, others left out whole sections (for example the questions on demographics) and others did not complete any questions. The majority of unanswered questions occurred from question 18 onwards, which were the classifying demographic questions.

The results of the demographic questions (questions 18 – 27) are presented first, followed by the results of the Likert scale questions (questions 1 – 17).

3.2. Results of demographic questions

3.2.1. Summary of results of demographic questions

The majority of respondents worked with farm animals only or in mixed practice with most a part of a team of more than four to ten veterinarians in the practice. For the purposes of comparison respondents were grouped into those from smaller practices (≤ 15 veterinarians) and those from larger practices (> 15 veterinarians). The majority of respondents had performed bTB testing prior to the implementation of the changes. More than half of the respondents worked in the HRA and nearly a quarter in the South West of England. The largest group of respondents had been practising for more than 10 up to 20 years and the largest age group was respondents between 31 and 40 years. More than half of the respondents were male. The vast majority of respondents had obtained their veterinary qualification in the UK or Ireland. The results are tabulated in this chapter and represented graphically in Appendix E.

The results of the demographic questions include statistical comparisons of groups' responses to the Likert-type questions. More detailed analyses are presented in Appendix F.

3.2.2. Practice environment of respondents (Question 18)

Eight categories are distinguished, which include six specific types of veterinary practice, those who provided no answer (3.47%) and the category 'other' (0.99%), summarised in Table 3.1 and Figure 20. The two largest groups were those practitioners only performing farm work (54.45%) and those engaged in mixed practice with an even mix of species (34.65%). These two groups made up the majority of the sample and were compared statistically. The other categories of 'mixed, but mostly large animal' (2.97%), 'farm and equine' (1.49%), 'mostly small animal with some large animal work' (1.49%) and 'academic' (0.49%) were very small and not evaluated statistically. The value of the smaller categories is to show the breadth of the practitioners engaged in the research.

Table 3.1 Practice environment of respondents

Practice environment	Number of respondents in category	Percentage of total sample
Farm work only	110	54.45%
Mixed practice (fairly even mix)	70	34.65%
Mixed, but mostly large animal	6	2.97%
Farm and equine	3	1.49%
Mostly small animal with some large animal work	3	1.49%
Academic	1	0.49%
Other	2	0.99%
No answer	7	3.47%
Total	202	100.00%

The two largest groups, namely veterinarians working in exclusively large animal practice and those working in mixed practice with a fairly even mix of species, were compared using the Wilcoxon-Mann-Whitney test. The full results are shown in Table 6.1. There was no significant difference between these two groups for any of the questions.

3.2.3. Practice size (Question 19)

Practice size was divided into seven categories, one of which included respondents who provided no answer (10.40%). The results are detailed in Table 3.2 and Figure 21. Two respondents (0.99%) worked as sole practitioners, forming the smallest category. The largest group (mode) was practices with more than four to ten veterinarians (33.66%). The remaining categories were more evenly distributed: 12.87% worked in >1 to 4 veterinarian practices, 19.31% in >10 to 15 veterinarian practices, 9.40% in >15 to 20 veterinarian practices and 13.37% in practices with more than 20 veterinarians.

Table 3.2 Size of respondents' veterinary practices measured by the number of veterinarians employed

Number of veterinarians	Number of respondents in category	Percentage of total sample
One	2	0.99%
>1 to 4	26	12.87%
>4 to 10	68	33.66%
>10 to 15	39	19.31%
>15 to 20	19	9.40%
More than 20	27	13.37%
no answer	21	10.40%
Total	202	100.00%

A category median was calculated for each group (other than one person practices as there were only two of these represented); results are tabulated in Appendix D. Inspecting the medians made it apparent that respondents working in the larger practices were consistently scoring different medians to those

working in smaller practices. The respondents were divided into two groups: more than 1 to 15 veterinarians in the practice and greater than 15 veterinarians in the practice. The comparisons between smaller and larger practices using the Wilcoxon-Mann-Whitney test are shown in Table 6.2. A significant difference existed between the medians of smaller and larger practices for all but one of the questions. The value of p for question 15 was 0.051118 which is not significant at the 5% level, although it is very close to the 0.05 cut off value. The medians, although different (between 'agree' and 'agree strongly' for larger practices and 'agree strongly' for smaller practices), were both on the agreement side of the answer scale and the groups had the same mode, 'agree strongly'.

3.2.4. Capacity in which respondents work with bTB (Question 20)

Seven categories, shown in Figure 22 and Table 3.3, were distinguished to show the capacity in which respondents worked with bTB. The majority of respondents (mode) worked as subcontractors to delivery partners (59.40%) or in practices that are delivery partners (28.71%) and these two groups were compared statistically. A small number of practitioners that did not carry out bTB testing at the time of the survey (1.49%) as well as a few that carried out private bTB testing (1.49%) responded. Private bTB testing would include the tests that farmers request and pay for, such as voluntary pre-movement testing prior to sale of animals. Several respondents could not be classified into groups as they did not specify their involvement with bTB (3.96%) or did not provide an answer (4.95%). They are referred to in Table 3.3 as 'other' and 'no answer' respectively. No government veterinarians completed the questionnaire. The smaller categories, although not examined statistically, give a broader view of the scope of the respondents' involvement with bTB.

Table 3.3. Respondents' capacity in which they work with bTB

Capacity working with bTB	Number of respondents in category	Percentage of total sample
Delivery partner	58	28.71%
Subcontractor to delivery partner	120	59.40%
Government	0	0.00%
Don't currently carry out work with bTB	3	1.49%
Other (please specify):	8	3.96%
No answer	10	4.95%
Private, not as subcontractor	3	1.49%
Total	202	100.00%

Comparison of the responses of the delivery partners and the subcontractor groups using the Wilcoxon-Mann-Whitney test showed significant differences for 15 of the 17 questions, as shown in Table 6.4.

On inspection of the results, it became apparent that the delivery partner group and larger practices (>15 veterinarians) consistently had similar responses; this was also noted with the subcontractor group and smaller practices (≤15 veterinarians). The relationship between capacity working with bTB and

practice size was investigated. The dynamics of working in a practice with many veterinarians differs greatly from working in a smaller practice and this could have contributed to respondents' opinions and, therefore, responses to the questions. It was, however, important to ascertain whether the results were more likely to be related to a respondent's capacity with which they worked with bTB.

Table 3.4 shows that the vast majority of subcontractors work in smaller practices, whereas close to half of the delivery partners work in each size group of practices. It is very possible that the significant difference found between responses compared between small and large practices was a reflection of the practitioner's capacity in which he or she worked with bTB. A χ^2 test was applied to this table to investigate whether there was an association between the capacity with which a practitioner worked with bTB and the size of the practice they worked for.

Table 3.4. Proportions of subcontractors and delivery partners working in smaller and larger practices

	>1 and ≤15 veterinarians	>15 veterinarians
Subcontractors	96 (84.96%)	17 (15.04%)
Delivery partners	30 (54.55%)	25 (45.45%)

Table 3.5 is a 2x2 contingency table used to calculate the χ^2 statistic for investigating the relationship between capacity working with bTB and practice size.

Table 3.5. 2x2 contingency table to determine association between capacity with working with bTB and practice size

	>1 and ≤15 veterinarians	>15 veterinarians	Totals
Subcontractors	96 (a)	17 (b)	113 (a+b)
Delivery partners	30 (c)	25 (d)	55 (c+d)
Totals	126 (a+c)	42 (b+d)	168 (n)

$$\chi^2 = \frac{168(|(96 \times 25) - (17 \times 30)| - \frac{168}{2})^2}{113 \times 55 \times 126 \times 42}$$

$$= 16.66$$

This value for χ^2 was greater than 3.841, which is the critical value at the 5% significance level in the χ^2 table for one degree of freedom. The result was also significant at the 1% level (>6.635) and the 0.1% level (>10.83). This calculation showed that it was highly likely that the differences observed between respondents from small and large practices were likely to be due to the respondents' roles in working with bTB.

3.2.5. Respondent involvement with bTB prior to the implementation of changes in testing (Question 21)

Respondents were asked to indicate whether they had provided bTB testing services prior to the implementation of the changes. The aim of this question was to gauge if many respondents had ceased providing bTB testing once the changes were implemented. As shown in Table 3.6 and Figure 23,

85.64% of respondents provided testing prior to the changes, 10.40% did not do bTB testing and 3.96% provided no answer. Of the 173 respondents that did test before the changes, three indicated that they have stopped testing entirely; three only undertake private bTB testing and four classified their involvement in bTB testing as 'other'.

One hundred and eleven of the 173 respondents (61.16%) that provided testing prior to the changes now work as subcontractors to delivery partners and 50 (28.90%) are working as delivery partners. Eight of the 21 respondents (38.10%) who did not provide testing prior to the changes now work as subcontractors and eight work as delivery partners. Not all of the respondents that answered this question answered the full set of demographic questions, so not every response was able to be classified for inclusion in Figure 2 showing respondents' current involvement with bTB testing. Eleven respondents were not included in this figure, eight which had not provided a response to question 21 (designated 'no answer' in Table 3.6) and three who had not responded to the question classifying the capacity in which they work with bTB.

Table 3.6. Response to the question of whether respondents performed bTB testing prior to the implementation of the changes

Did respondent perform bTB testing prior to the changes	Number of respondents in category	Percentage of total sample
Yes	173	85.64%
No	21	10.40%
No answer	8	3.96%
Total	202	100.00%

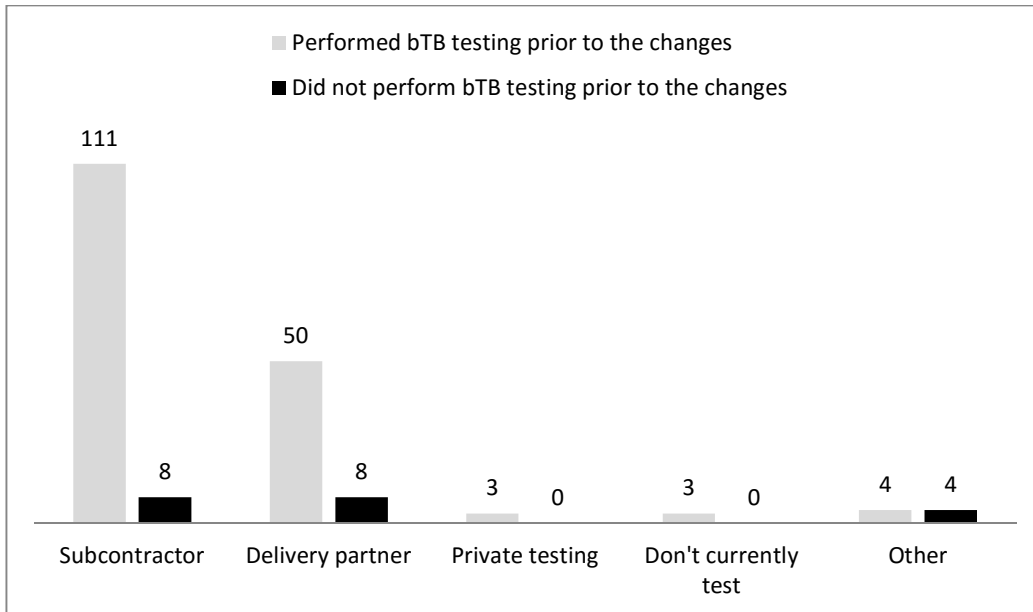


Figure 2. Bar chart showing respondents' current involvement with bTB testing

3.2.6. Risk zone for bTB where the respondent works the most (Question 22)

Table 3.7 and Figure 24 show the distribution of respondents according to bTB risk zone. The majority of respondents (mode) were located in the HRA (56.93%), while much lower numbers responded from the LRA (21.78%) and the Edge Area (15.84%). A small percentage did not provide an answer (5.45%) and were not able to be classified (shown as 'no answer' in Table 3.7 and Figure 24). Some respondents did indicate that they worked in more than one risk zone, but the question did specify that they indicate where they spend the most time.

Table 3.7. Risk zone for bTB where respondent works the most

bTB risk zone	Number of respondents in category	Percentage of total sample
Low Risk Area (LRA)	44	21.78%
High Risk Area (HRA)	115	56.93%
Edge Area	32	15.84%
No answer	11	5.45%
Total	202	100.00%

The bTB risk zones were compared to each other in pairs for each question to see if significant differences existed (Table 6.6). No significant difference existed between the respondents from the different bTB risk zones for 12 of the 17 questions. Significant differences occurred between some of the groups for five of the questions, although no clear pattern emerged. The Edge area differed significantly from both the HRA and LRA for questions 10 and 17; the LRA and Edge Area differed in questions 6 and 14, and there was a significant difference between responses from the LRA and HRA in Question 16.

3.2.7. County where respondent's veterinary practice is located (Question 23)

Respondents were asked to indicate in which county their veterinary practice was located. Some respondents provided the name of the county where they most frequently performed their work, whilst others indicated a region (for example Yorkshire, or South West) that may consist of several counties or even a whole country. When bTB prevalence was at its lowest in 1979, the disease was confined to the South West of England (Devon, Cornwall, Somerset), from where it has spread in subsequent years (DEFRA 2014b). Responses, detailed in Table 3.8 and Figure 25, were classified into those from the South West of England (23.76%), other counties of England (49.01%), other countries of the UK (6.44%) and those which could not be classified (20.79%).

Table 3.8. Location of respondent's veterinary practice

Location of veterinary practice	Number of respondents in category	Percentage of total sample
South West = Devon, Cornwall & Somerset	48	23.76%
Other England	99	49.01%

UK other	13	6.44%
Unclassifiable answer	42	20.79%
Total	202	100.00%

Veterinarians practising in the South West were compared to those from the rest of England using the Wilcoxon-Mann-Whitney test; the other two groups (UK other and Unclassifiable answer) were not compared statistically. The results are shown in Table 6.7. There were no significant differences between the groups compared for 16 of the 17 questions. For most of the questions living in the South West was not associated with a significant difference in responses.

3.2.8. Length of time practising as a veterinary surgeon (Question 24)

Respondents were asked to indicate how many years they had been practising as a veterinary surgeon. Table 3.9 and Figure 26 detail the responses for each of the seven categories and show that the smallest groups were those who had been practising for less than one year (2.97%) and those who provided no answer (9.40%). The mode for this question was veterinarians who had been practising for more than 10 and up to 20 years (22.77%). Similar group sizes were represented by those practising for more than one year up to five years (19.80%) and more than 5 years up to 10 years (19.31%). The group sizes of the more experienced veterinary surgeons were slightly smaller with 15.35% practising for more than 20 up to 30 years and 10.40% qualified for more than 30 years.

Table 3.9. Length of time practising as a veterinary surgeon

Years after qualification	Number of respondents in category	Percentage of total sample
1 year or less	6	2.97%
>1-5 year	40	19.80%
>5-10 years	39	19.31%
>10-20 years	46	22.77%
>20-30 years	31	15.35%
>30 years	21	10.40%
no answer	19	9.40%
Total	202	100.00%

The Kruskal-Wallis test was used to determine whether there was a difference between the groups for each question. The critical value was 11.07 for five degrees of freedom (six groups were compared) and α equal to 0.05. The value of H calculated using the Kruskal-Wallis test was less than the critical value of 11.07 for all of the questions for number of years in practice as shown in Table 6.8. The amount of time working as a veterinarian was not associated with a significant difference in response to the questions.

3.2.9. Gender of respondents (Question 25)

Table 3.10 and Figure 27 show that 39.11% of respondents were female, 53.47% were male and 7.42% provided no response.

Table 3.10. Gender of respondents

Gender	Number of respondents in category	Percentage of total sample
Female	79	39.11%
Male	108	53.47%
No answer	15	7.42%
Total	202	100.00%

The responses of male and female respondents were compared using the Wilcoxon-Mann-Whitney test. Table 6.9 shows that the value of p was greater than 0.05 for all of the questions and, therefore, gender was not associated with a significant difference in responses. Even when the medians varied, the Wilcoxon-Mann-Whitney test did not show statistically significant differences between the groups.

3.2.10. Age of respondents (Question 26)

Although a previous question asked how long respondents had been practising veterinary medicine, it was decided to ask their age as well. Not all practitioners would have entered university directly from school and some may have had other career paths prior to embarking on their veterinary training. Table 3.11 and Figure 28 show that the mode for this question was 31-40 years (30.69%) and the next largest group was those aged 22-30 years (23.76%). Similar group sizes represented the 41-50 year group (14.36%), 51-60 year group (14.85%) and those who chose not to answer (12.38%). The smallest group was practitioners aged 61 years or older (3.96%).

Table 3.11. Age of respondents

Age of respondent	Number of respondents in category	Percentage of total sample
22-30	48	23.76%
31-40	62	30.69%
41-50	29	14.36%
51-60	30	14.85%
61+	8	3.96%
Prefer not to say	25	12.38%
Total	202	100.00%

The Kruskal-Wallis test was used to determine whether there was a significant difference between the groups. The critical value for α set as 0.05 and four degrees of freedom (five groups are compared) is 9.488. The value of H exceeded the critical value for five of the questions, as shown in Table 6.10. Where differences were found, the groups were compared with each other using the Wilcoxon-Mann-

Whitney test. No clear pattern emerged for the differences between age groups. The results are tabulated and described fully in Appendix F.

3.2.11. Country of qualification (Question 27)

The aim of this question was to determine in which country the veterinarian had obtained his/her qualification, to determine whether there was a difference between the experiences of graduates from the UK and EU countries. This question was phrased fairly vaguely, merely asking respondents to indicate where they obtained their veterinary qualification. The aim of the question was not made clear to respondents because the questionnaire was sent out very soon after the UK voted to leave the EU, making this a potentially sensitive issue. Some respondents indicated the country of qualification, whereas some indicated the institution. Well known abbreviations were considered (e.g. RVC for Royal Veterinary College London or UCD for University College Dublin). One respondent had indicated “UoB”, which could be presumed to be University of Bristol, but was classified as no answer as it is not a recognised abbreviation in veterinary literature. Answers, detailed in Table 3.12 and Figure 29, were classified into UK and Ireland (78.22%), EU (3.96%), those qualifying outside the EU (0.49%) and those providing no answer (17.33%).

Table 3.12. Country where respondents obtained their veterinary qualification

Country of qualification	Number of respondents in category	Percentage of total sample
UK and Ireland	158	78.22%
EU	8	3.96%
Outside EU	1	0.49%
No answer	35	17.33%
Total	202	100.00%

The EU graduates were compared to the UK graduates using the Wilcoxon-Mann-Whitney test. The results are shown in Table 6.16. The responses of those providing no answer and the one graduate from outside the EU were not evaluated statistically. In all of the questions the p value was greater than 0.05, indicating that there was no significant difference between the responses of UK graduates and EU graduates. The size of the EU group was, however, very small, so there is a chance that the outcome may have been different had the group been larger.

3.3. Results of Likert scale questions

3.3.1. Summary of results of Likert scale questions

The results of the seventeen Likert scale questions are presented in a table for each question with an accompanying bar chart. The median for each question has been determined, as well as the probability of obtaining the distribution of positive and negative responses using the 'chitest' function in Microsoft Excel.

The questions evaluating the impact of the changes on stress and anxiety in veterinarians (questions 2, 3 and 5) showed that the group as a whole indicated that some aspects of the changes had contributed to stress and anxiety. Those questions measuring the financial impact on veterinarians (questions 7, 8 and 9) showed that the respondents felt that the changes did not have a negative financial impact on their businesses. Measuring respondents' attitude towards the government in response to the changes (questions 1, 4 and 6) showed a positive response if considering the sample as a whole. The questions measuring the emotional impact of the changes on farmers (questions 10, 11 and 12) showed that the sample as a whole responded neutrally. The questions exploring farmers' level of trust in veterinarians' knowledge and skills (questions 13, 14, 15 and 16) affirmed the importance of a trusting relationship between veterinarian and farmer. The question (question 17) examining the attitude of farmers to the government in response to the changes showed that respondents as a whole felt the changes had a negative effect on farmers' trust in the government. If demographic groups are considered separately differences were noted in many of the variables, particularly when comparing the responses of subcontractors compared to delivery partners and respondents from smaller practices compared to larger practices.

3.3.2. Respondents' perceptions of how the government values their relationships with their clients (Question 1)

Question one recalled a statement made by the government during the tendering process that the vital partnership between livestock farmers and their veterinarians was recognised (Anon 2014a) and asked respondents to state whether they had felt during the process that their client relationships were of value to the government. Of the 202 respondents that answered this question, 89 (44.05%) gave a negative answer, 26 (12.87%) were neutral and 70 (34.65%) gave a positive answer. Although the mode of 'disagree' (26.24%) is clear from the bar chart in Figure 3, it can also be noted that the distribution of responses is fairly even. The probability of obtaining this distribution of positive and negative responses by chance is 0.13 as calculated by the 'chitest' function in Microsoft Excel. This is a low to medium probability and likely reflects the relatively even spread of responses to this question reflected in the calculated median of 'neither agree nor disagree'.

Table 3.13 details the responses for each category for this question. The categories 'strongly disagree' (17.82%), 'agree' (17.33%) and 'strongly agree' (17.33%) had very similar numbers of respondents,

with 'neither agree nor disagree' (12.87%) not far behind. The categories 'don't know' (4.95%) and 'not applicable' (3.46%) were small in number.

Table 3.13. Responses to the statement: “When the government invited tenders for TB testing services, it emphasised the importance of the vital partnership between livestock farmers and their vets. The way the changes took place made you feel that your relationships with your clients were valued by the government.”

Response to question	Number of respondents in category	Percentage of total sample
Strongly Disagree	36	17.82%
Disagree	53	26.24%
Neither agree nor disagree	26	12.87%
Agree	35	17.33%
Agree strongly	35	17.33%
Don't know	10	4.95%
Not applicable	7	3.46%
Total	202	100.00%

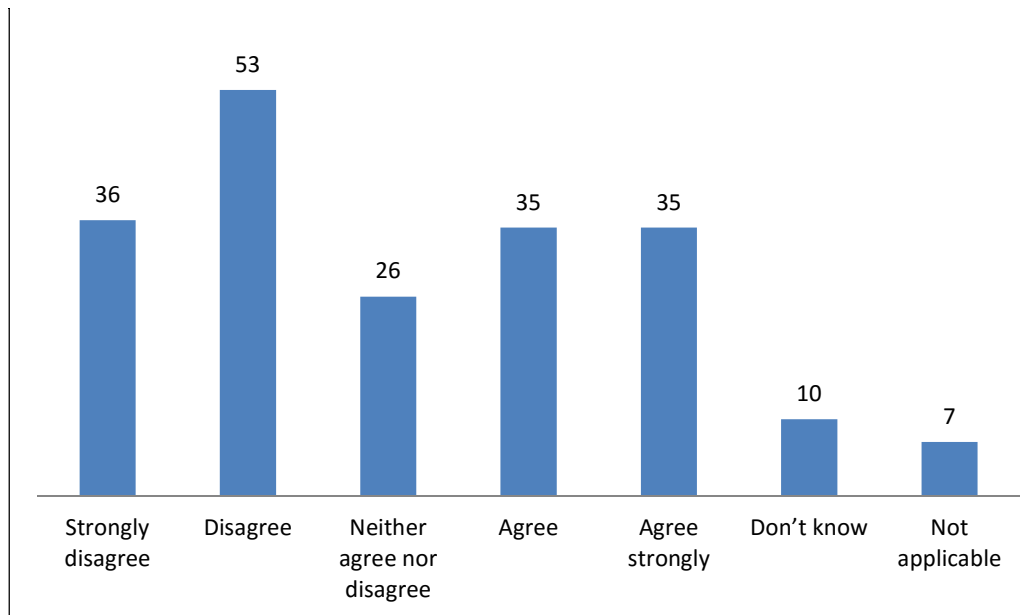


Figure 3. Bar chart showing responses to the statement: “When the government invited tenders for TB testing services, it emphasised the importance of the vital partnership between livestock farmers and their vets. The way the changes took place made you feel that your relationships with your clients were valued by the government.”

Table 3.14. Question 1 response scores

Group	Score (Attitude towards the government's decision to change bTB testing provision)	Positive response (agree, agree strongly)	Negative response (strongly disagree, disagree)
Overall	0	70 (34.65%)	89 (44.05%)
Delivery partners	+1	31 (53.45%)	13 (22.41%)
Subcontractors	-1	31 (25.83%)	70 (58.33%)

Smaller practices (≤15 veterinarians)	-1	38 (28.57%)	75 (56.39%)
Larger practices (>15 veterinarians)	+1	22 (47.83%)	10 (21.74%)

Agreement with the attitude statement in question 1 was assigned a positive score for the variable measuring the attitude towards the government. The overall score was neutral as shown in Table 3.14, but if the demographic groups are inspected separately, the picture changes. The delivery partner group and respondents from the larger practices (>15 veterinarians) scored +1 for this variable, while the subcontractor group and those working in smaller practices (≤15 veterinarians) scored -1.

3.3.3. Organisational process of making changes to bTB testing (Question 2)

Question two asks respondents to consider whether they thought that the process of changing how bTB testing was done was poorly organised. The median for this question was 'neither agree nor disagree' and the mode was 'strongly disagree' (23.76% of responses). Figure 4 shows the relatively even distribution of responses that reflect the neutral median. 37.62% (76) of respondents answered this question positively ('agree' or 'strongly agree') and 38.11% (77) answered negatively ('disagree' or 'strongly disagree'). Overall there was no strong positive or negative response to this question. Using the 'chitest' function in Excel, the probability of this distribution of answers occurring by chance was 0.94. This is a very high probability and reflects the very even distribution of positive versus negative responses.

Table 3.15 details the responses to this question; 9.90% of respondents indicated that they did not know how to respond to the question and none indicated that the question was not applicable to them. Although the mode was 'strongly disagree' (23.76%), this category did not score considerably higher than the other categories. The 'disagree' and 'neither agree nor disagree' categories had the same number of responses (14.36%) and 'agree' (19.30%) and 'strongly agree' (18.32%) were very similar.

Table 3.15. Responses to the statement: “The process of tendering, subcontracting and initiating the new system for delivering TB testing was poorly organised.”

Response to question	Number of respondents in category	Percentage of total sample
Strongly Disagree	48	23.76%
Disagree	29	14.36%
Neither agree nor disagree	29	14.36%
Agree	39	19.30%
Agree strongly	37	18.32%
Don't know	20	9.90%
Not applicable	0	0.00%
Total	202	100.00%

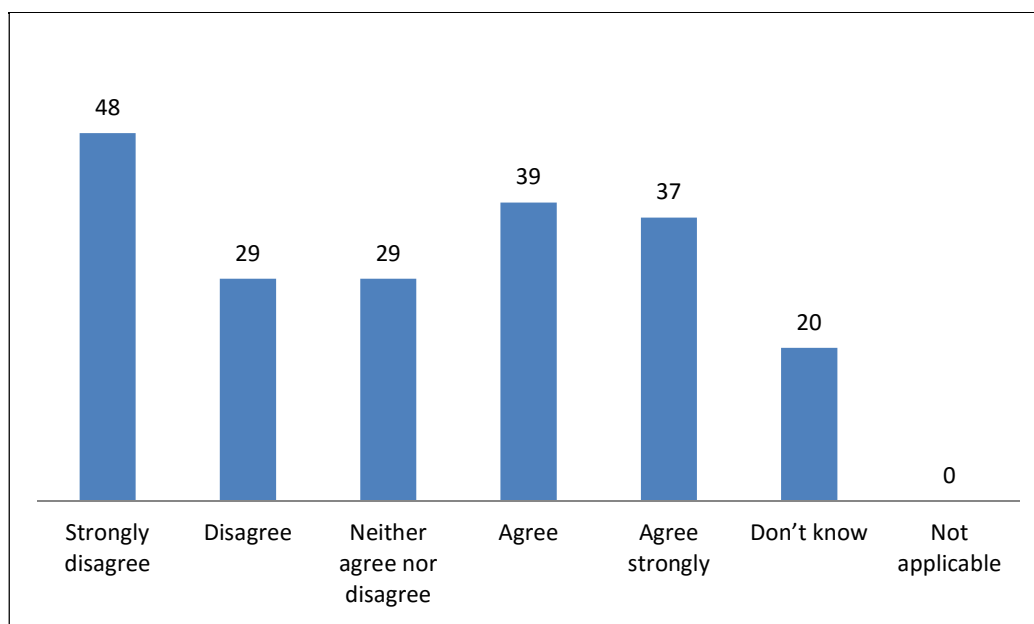


Figure 4. Bar chart showing responses to the statement “The process of tendering, subcontracting and initiating the new system for delivering TB testing was poorly organised.”

Table 3.16. Question 2 response scores.

Group	Score (Stress or anxiety)	Positive response (agree, agree strongly)	Negative response (strongly disagree, disagree)
Overall	0	76 (37.62%)	77 (38.11%)
Delivery partners	-1	11 (18.97%)	33 (56.90%)
Subcontractors	+1	61 (50.83%)	35 (29.17%)
Smaller practices (≤15 veterinarians)	+1	62 (50.82%)	41 (33.61%)
Larger practices (>15 veterinarians)	-1	12 (27.91%)	24 (55.81%)

The responses were given a score, shown in Table 3.16, for their contribution to the variable measuring stress or anxiety in veterinarians as a result of the changes. Agreement with the statement was assigned a positive score. The sample as a whole scored 0 for this question, showing an even distribution of answers across the response categories. Delivery partners and larger practices disagreed with the statement and scored -1 for this variable. Subcontractors and smaller practices agreed with this statement and scored +1 for this variable.

3.3.4. Stress associated with changes to bTB testing (Question 3)

Question 3 asked respondents to determine whether they found the process of changing to the new bTB testing system stressful. Two hundred and one respondents answered the question with 53 (26.36%) disagreeing and 120 (59.70%) agreeing. Figure 5 gives a visual representation of the dominance of agreement responses to this question. The probability of this distribution of responses occurring by chance was calculated as 3.51×10^{-7} . This is a very low probability and there is a strong likelihood that this indicates difference in opinion rather than merely a chance distribution of responses.

The median for this question was 'agree'; the mode was 'strongly agree' (35.32% of responses). The second largest group was 'agree' with 24.38% of respondents selecting this option (Table 3.17). None of the respondents indicated that this question was not applicable to them and 5.97% indicated that they did not know how to respond. A small group indicated the neutral response 'neither agree nor disagree' (7.96%) and the negative responses were also relatively small with 9.95% of respondents answering 'disagree' and 16.42% 'strongly disagree'.

Table 3.17. Responses to the statement “The process of changing delivery of TB testing was a stressful experience for many veterinary surgeons.”

Response to question	Number of respondents in category	Percentage of total sample
Strongly Disagree	33	16.42%
Disagree	20	9.95%
Neither agree nor disagree	16	7.96%
Agree	49	24.38%
Agree strongly	71	35.32%
Don't know	12	5.97%
Not applicable	0	0.00%
Total	201	100.00%

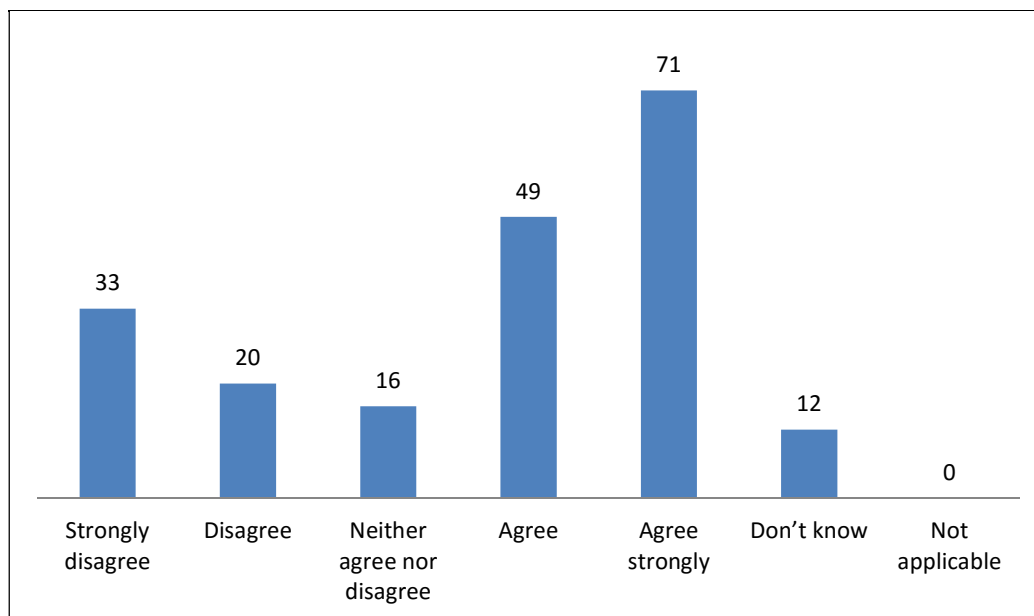


Figure 5. Bar chart showing responses to the statement “The process of changing delivery of TB testing was a stressful experience for many veterinary surgeons.”

Table 3.18. Question 3 response scores

Group	Score (stress or anxiety)	Positive response (agree, agree strongly)	Negative response (strongly disagree, disagree)
Overall	+1	120 (59.70%)	53 (26.36%)
Delivery partners	0	23 (40.35%)	25 (43.86%)
Subcontractors	+1	60 (50.00%)	21 (17.50%)

Smaller practices (≤15 veterinarians)	+1	93 (70.45%)	24 (18.18%)
Larger practices (>15 veterinarians)	+1	23 (50.00%)	17 (36.96%)

Table 3.18 shows the scores for question 3's contribution to the variable measuring stress or anxiety in veterinarians as a result of the changes. Agreement with the question was assigned a positive score. The respondents as a whole as well as subcontractors and smaller and larger practices scored +1 for this variable. The delivery partners, with more equal distribution of positive and negative responses, scored 0.

3.3.5. Information released about the changes to bTB testing (Question 4)

Respondents were asked to evaluate whether they had felt adequately informed during the process of making the changes to bTB testing. Two hundred and two respondents answered the question with 68 (33.66%) disagreeing and 94 (46.53%) agreeing. The median was 'agree' and the mode was 'agree' (24.75% of responses). Although Figure 6 indicates a large proportion of respondents answered 'disagree', the chart also shows that the positive answers dominated in this question. The probability of this distribution of positive and negative answers occurring by chance is 0.04 as calculated by the 'chitest' function in Microsoft Excel. This is a very small probability and shows that there is a polarisation of opinion in response to this question.

Table 3.19 shows that the groups 'disagree' (22.28%) and 'strongly agree' (21.78%) are very similar in size and are not much smaller than the mode group 'agree'. 'Strongly disagree' (11.39%) and 'neither agree nor disagree' (12.38%) are very similar in size. Small proportions of respondents indicated that they did not know how to respond to the question (3.96%) or that the question was not applicable to them (3.46%).

Table 3.19. Responses to the statement: "Adequate information was released about how the changes would be made. You felt informed about the process and how the changes would affect you."

Response to question	Number of respondents in category	Percentage of total sample
Strongly Disagree	23	11.39%
Disagree	45	22.28%
Neither agree nor disagree	25	12.38%
Agree	50	24.75%
Agree strongly	44	21.78%
Don't know	8	3.96%
Not applicable	7	3.46%
Total	202	100.00%

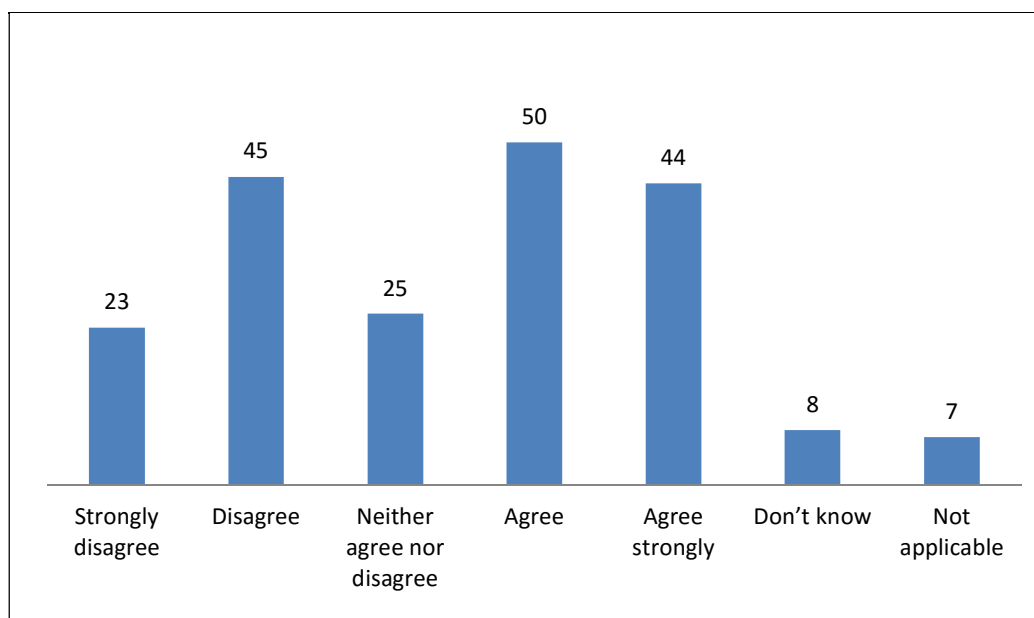


Figure 6. Bar chart showing responses to the statement: “Adequate information was released about how the changes would be made. You felt informed about the process and how the changes would affect you.”

Table 3.20. Question 4 response scores

Group	Score (Attitude towards the government’s decision to change bTB testing provision)	Positive response (agree, agree strongly)	Negative response (strongly disagree, disagree)
Overall	+1	94 (46.53%)	68 (33.66%)
Delivery partners	+1	37 (63.79%)	12 (20.69%)
Subcontractors	0	45 (37.5%)	53 (44.17%)
Smaller practices (≤15 veterinarians)	0	54 (40.60%)	54 (40.60%)
Larger practices (>15 veterinarians)	+1	26 (56.52%)	12 (26.09%)

The scores contributing to the variable measuring veterinarians’ attitudes towards the government after changes to bTB testing provision are shown in Table 3.20. Agreement with the question was assigned a positive score. The sample as a whole as well as delivery partners and those respondents working in larger practices scored +1. Although the subcontractor group had a few more negative than positive responses, this group scored 0. Respondents working in smaller practices provided equal numbers of positive and negative responses; this group also scored 0.

3.3.6. Time scale for finalising subcontractor contracts (Question 5)

Question five required respondents to consider whether the time frame allowed for subcontractors to receive and agree to their contracts occurred within a reasonable time frame. Contracts for most of the regions were issued from the middle of April 2015, with the due date for completion of contracts 24 April

as duties were to commence by 1 May. The BCVA and BVA had expressed concern regarding the time frame for the finalising of these contracts (Anon 2015e).

Two hundred and two respondents answered the question with 69 (34.15%) disagreeing and 82 (40.59%) agreeing. The median was 'neither agree nor disagree' and the mode was 'agree' (21.78%), which is why there are slightly more positive answers for this question. The probability of this distribution of answers occurring by chance was 0.29. Figure 7 shows that respondents selected three responses in relatively similar quantities: 'strongly disagree' (20.79%), 'agree' (21.78%) and 'strongly agree' (18.81%). The rest of the responses, detailed in Table 3.21, showed that a small number responded 'neither agree nor disagree' (7.92%), despite this being the median for this question, 12.38% indicated that they could not answer the question and 4.95% of respondents indicated that this question was not applicable to them.

Table 3.21. Responses to the statement: “Finalising contracts for subcontractors happened very quickly and felt rushed. This did not allow enough time to consider the contracts and seek legal advice if required.”

Response to question	Number of respondents in category	Percentage of total sample
Strongly Disagree	42	20.79%
Disagree	27	13.37%
Neither agree nor disagree	16	7.92%
Agree	44	21.78%
Agree strongly	38	18.81%
Don't know	25	12.38%
Not applicable	10	4.95%
Total	202	100.00%

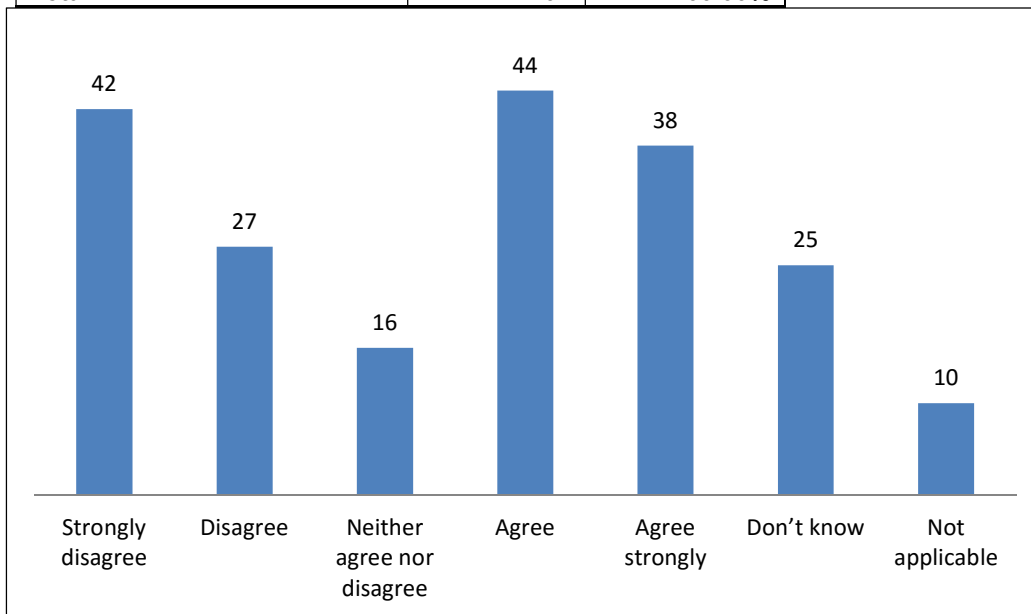


Figure 7. Bar chart showing responses to the statement: “Finalising contracts for subcontractors happened very quickly and felt rushed. This did not allow enough time to consider the contracts and seek legal advice if required.”

Table 3.22. Question 5 response scores

Group	Score (stress or anxiety)	Positive response (agree, agree strongly)	Negative response (strongly disagree, disagree)
Overall	0	82 (40.59%)	69 (34.16%)
Delivery partners	-1	11 (18.97%)	31 (53.45%)
Subcontractors	+1	68 (56.67%)	30 (25.00%)
Smaller practices (≤15 veterinarians)	+1	69 (51.88%)	35 (26.32%)
Larger practices (>15 veterinarians)	-1	11 (23.91%)	22 (47.83%)

Agreement with this question was assigned a positive score for the variable measuring stress or anxiety in veterinarians; scores are summarised in Table 3.22. Considering the respondents as a whole, the score for this variable was 0, but differences appear if different groups of respondents are considered separately. Subcontractors scored +1, compared to -1 for the delivery partner group. A significant difference was also found between the smaller and larger practices, with the smaller practices scoring +1 and the larger practices -1 for this variable.

3.3.7. Quality assurance of bTB testing (Question 6)

Respondents were required to reflect on their opinion of a statement from the APHA that the new system would better assure the quality of tuberculin testing provision (Anon 2014a). Two hundred and two respondents answered the question with 66 (32.67%) disagreeing and 102 (50.49%) agreeing. The median was 'agree' and the mode was 'agree strongly' (26.73% of respondents). Figure 8 clearly indicates a dominance of the 'agree' and 'agree strongly' categories. The probability of this distribution of positive and negative scores occurring by chance was 0.0055 as calculated by the 'chitest' function in Microsoft Excel. This very small probability shows that it is very unlikely that this distribution of responses occurred due to chance.

Table 3.23 shows the respondents' selections for this question and the dominance of the positive responses 'agree' (23.76%) and 'agree strongly' (26.73%). No respondents indicated that this question was not applicable to them and a small percentage (5.44%) indicated that they did not know how to respond. Smaller proportions of respondents selected the options 'strongly disagree' (14.46%), 'disagree' (18.32%) and 'neither agree nor disagree' (11.39%).

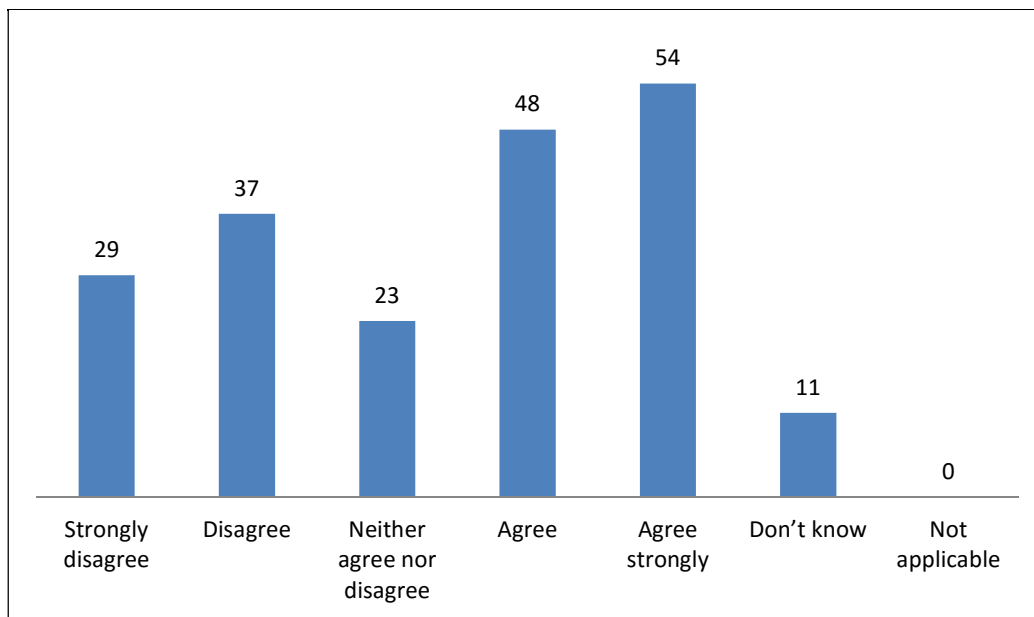


Figure 8. Bar chart showing responses to the question: “The Animal and Plant Health Agency (APHA) has stated that the new system will better assure the quality of tuberculin testing provision. To what extent do you agree with this statement?”

Table 3.23. Responses to the question: “The Animal and Plant Health Agency (APHA) has stated that the new system will better assure the quality of tuberculin testing provision. To what extent do you agree with this statement?”

Response to question	Number of respondents in category	Percentage of total sample
Strongly Disagree	29	14.36%
Disagree	37	18.32%
Neither agree nor disagree	23	11.39%
Agree	48	23.76%
Agree strongly	54	26.73%
Don't know	11	5.44%
Not applicable	0	0.00%
Total	202	100.00%

Table 3.24. Question 6 response scores

Group	Score (Attitude towards the government's decision to change bTB testing provision)	Positive response (agree, agree strongly)	Negative response (strongly disagree, disagree)
Overall	+1	102 (50.49%)	66 (32.67%)
Delivery partners	+1	39 (67.24%)	9 (15.52%)
Subcontractors	0	51 (42.50%)	52 (43.33%)
Smaller practices (≤15 veterinarians)	0	59 (44.36%)	56 (42.11%)
Larger practices (>15 veterinarians)	+1	31 (67.39%)	7 (15.22%)

Agreement with this question was assigned a positive score for the variable measuring veterinarians' attitude towards the government's decision to change bTB testing provision; results are tabulated in Table 3.24. The sample as a whole as well as delivery partners and those veterinarians working in larger practices scored +1. The subcontractors and those working in smaller practices scored 0.

3.3.8. Financial impact of changes to bTB testing (Question 7)

Respondents were asked to indicate whether their practices had suffered financial damage as a result of the changes made to the routine testing for bTB. Of the 202 respondents that answered the question, 36 (17.82%) responded negatively ('disagree' or 'strongly disagree') and 120 (59.40%) responded positively ('agree' or 'agree strongly'). The mode was 'agree strongly' and the median was 'agree'. Figure 9 shows the clear dominance of positive responses (agreement). The probability of this distribution of positive and negative answers occurring randomly by chance is 1.75×10^{-11} as calculated by the 'chitest' function in Microsoft Excel, making it extremely unlikely that this would have occurred.

The responses to this question are detailed in Table 3.25. The two most popular responses were 'agree strongly' (34.16%) and 'agree' (25.25%), followed by a relatively high proportion of respondents that indicated that they did not know how to respond (10.89%). Fairly similar numbers of respondents indicated 'strongly disagree' (9.90%), 'disagree' (7.92%) and 'neither agree nor disagree' (7.43%), while 4.45% indicated that the question was not applicable to them.

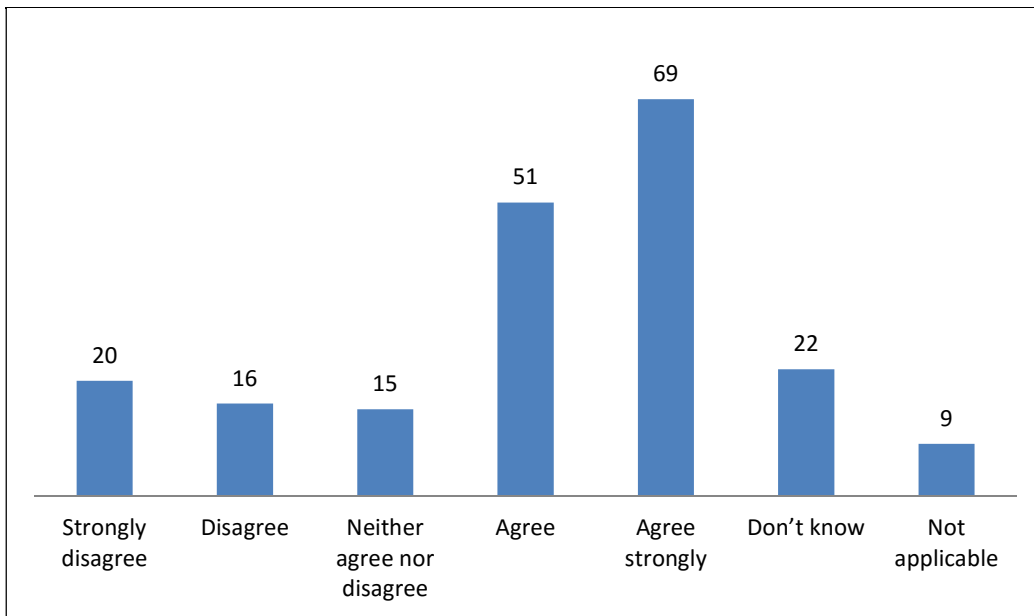


Figure 9. Bar chart indicating responses to the statement: “The process of changing TB testing provision damaged your veterinary practice financially.”

Table 3.25. Responses to the statement: “The process of changing TB testing provision damaged your veterinary practice financially.”

Response to question	Number of respondents in category	Percentage of total sample
Strongly disagree	20	9.90%
Disagree	16	7.92%
Neither agree nor disagree	15	7.43%
Agree	51	25.25%
Agree strongly	69	34.16%
Don't know	22	10.89%
Not applicable	9	4.45%

Strongly Disagree	20	9.90%
Disagree	16	7.92%
Neither agree nor disagree	15	7.43%
Agree	51	25.25%
Agree strongly	69	34.16%
Don't know	22	10.89%
Not applicable	9	4.45%
Total	202	100.00%

Table 3.26. Question 7 response scores

Group	Score (Concern about financial sustainability)	Positive response (agree, agree strongly)	Negative response (strongly disagree, disagree)
Overall	+1	120 (59.41%)	36 (17.82%)
Delivery partners	+1	25 (43.10%)	18 (31.03%)
Subcontractors	+1	91 (75.83%)	11 (9.17%)
Smaller practices (≤15 veterinarians)	+1	89 (66.92%)	19 (14.29%)
Larger practices (>15 veterinarians)	+1	23 (50.00%)	12 (26.09%)

Table 3.26 shows the scores for the variable 'concern about financial sustainability', where agreement with the question was assigned a positive score. All of the groups considered scored +1 for this variable. Even though all groups scored +1, significant differences still existed between the groups. Significant differences were found between the delivery partner and subcontractor groups (Table 6.4) and the respondents from smaller and larger practices (Table 6.2), reflected in Table 3.26 by the differences in distribution of positive and negative responses. Subcontractors showed a greater proportion of positive responses (75.83%) compared to delivery partners (43.10%) and the smaller practices showed a similar pattern (66.92% positive responses) compared to the larger practices (50.00% positive responses).

3.3.9. Impact on client relationships (Question 8)

Question eight required respondents to consider whether the changes to bTB test provision have damaged their relationships with their clients. Two hundred and one respondents answered the question with 119 (59.20%) disagreeing and 37 (18.40%) agreeing. The mode was 'strongly disagree' (30.35%) and the median was 'disagree'. Figure 10 clearly shows the dominance of disagreeing responses. The probability of this distribution of positive and negative responses occurring by chance is 5.19×10^{-11} as calculated by the 'chitest' function in Microsoft Excel. This indicates that the likelihood is very small that this distribution of responses occurred by chance.

The breakdown of responses for this question is detailed in Table 3.27. The largest groups are 'strongly disagree' (30.35%) and 'disagree' (28.86%) and the neutral response 'neither agree nor disagree' (15.42%) and 'agree' (13.93%) had similar numbers of respondents. A very small proportion of respondents agreed strongly with this statement (4.48%), 1.99% were unsure of their response and 4.97% felt that the question was not applicable to them.

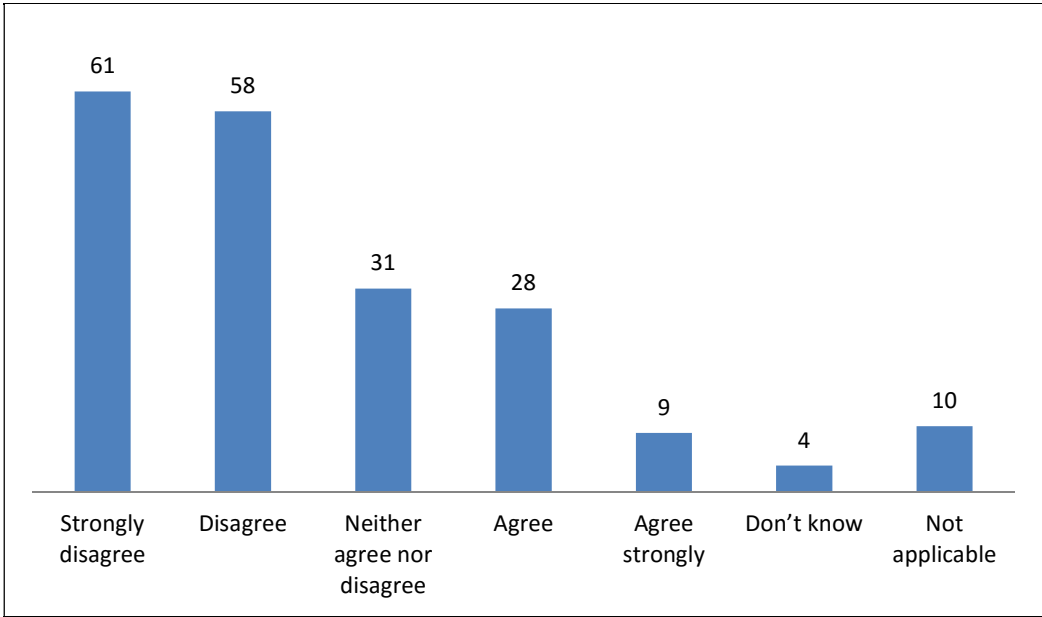


Figure 10. Bar chart showing responses to the statement: “The change to the provision of TB testing has damaged your relationships with your clients.”

Table 3.27. Responses to the statement: “The change to the provision of TB testing has damaged your relationships with your clients.”

Response to question	Number of respondents in category	Percentage of total sample
Strongly Disagree	61	30.35%
Disagree	58	28.86%
Neither agree nor disagree	31	15.42%
Agree	28	13.93%
Agree strongly	9	4.48%
Don't know	4	1.99%
Not applicable	10	4.97%
Total	201	100.00%

Table 3.28. Question 8 response scores

Group	Score (Concern about financial sustainability)	Positive response (agree, agree strongly)	Negative response (strongly disagree, disagree)
Overall	-1	37 (18.41%)	119 (59.20%)
Delivery partners	-1	3 (5.17%)	45 (77.59%)
Subcontractors	-1	30 (25.21%)	62 (52.10%)
Smaller practices (≤15 veterinarians)	-1	33 (26.19%)	72 (57.14%)
Larger practices (>15 veterinarians)	-1	3 (6.82%)	34 (77.27%)

Table 3.28 shows question 8's contribution to the scores for the variable measuring respondents' concern about the financial sustainability of their practices after the changes. Agreement with the question was assigned a positive score. The sample as a whole, as well as subcontractors, delivery partners and those working in smaller and larger practices scored -1. Despite scoring the same for this variable, the delivery partners and subcontractors differed significantly. If one examines the results, one can see that only 5.17% of delivery partner respondents agreed with the question, compared to 25.21% of subcontractor respondents. Table 3.29 shows the scores and positive compared to negative responses for the age groups for question eight. All of the age groups except the 61+ years group scored -1 for this variable. The 61+ age group showed a much lower proportion of negative responses (12.50%) compared to the other age groups.

Table 3.29. Question 8 response scores according to age group of respondent

Age Group	Score (Concern about financial sustainability)	Positive response (agree, agree strongly)	Negative response (strongly disagree, disagree)
23-30	-1	11 (22.92%)	26 (54.17%)
31-40	-1	14 (22.58%)	25 (56.45%)
41-50	-1	1 (3.57%)	21 (75.00%)
51-60	-1	8 (26.67%)	16 (53.33%)
61+	0	3 (37.50%)	1 (12.50%)

3.3.10. Financial viability of bTB testing after the changes (Question 9)

Question nine stated that many veterinary practices would receive less remuneration under the new system and asked respondents to respond to whether this made continuing with testing financially non-

viable for their practices. The median was 'disagree', as well as the mode (29.21%); this is shown in Figure 11. Two hundred and two respondents answered the question with 89 (44.05%) in the categories of 'disagree' or 'strongly disagree' and 49 (24.25%) answering 'agree' or 'agree strongly'. The probability of this distribution of positive and negative answers occurring by chance is 0.00066, calculated by the 'chitest' function in Microsoft Excel. It is very unlikely that this distribution of responses occurred by chance.

Table 3.30 shows the breakdown of responses to this question. Similar numbers of 'strongly disagree' (14.85%), 'neither agree nor disagree' (14.85%) and 'agree' (17.84%) responses were recorded. The 'agree strongly' group was smaller (6.44%), similar in number to those who felt that the question was not applicable to them (5.94%); 10.89% did not know how to respond to the question.

Table 3.30. Responses to the statement: “Under the new delivery system, many veterinary practices have received less remuneration for carrying out TB testing. This change has made TB testing non-viable for your practice.”

Response to question	Number of respondents in category	Percentage of total sample
Strongly Disagree	30	14.85%
Disagree	59	29.21%
Neither agree nor disagree	30	14.85%
Agree	36	17.82%
Agree strongly	13	6.44%
Don't know	22	10.89%
Not applicable	12	5.94%
Total	202	100.00%

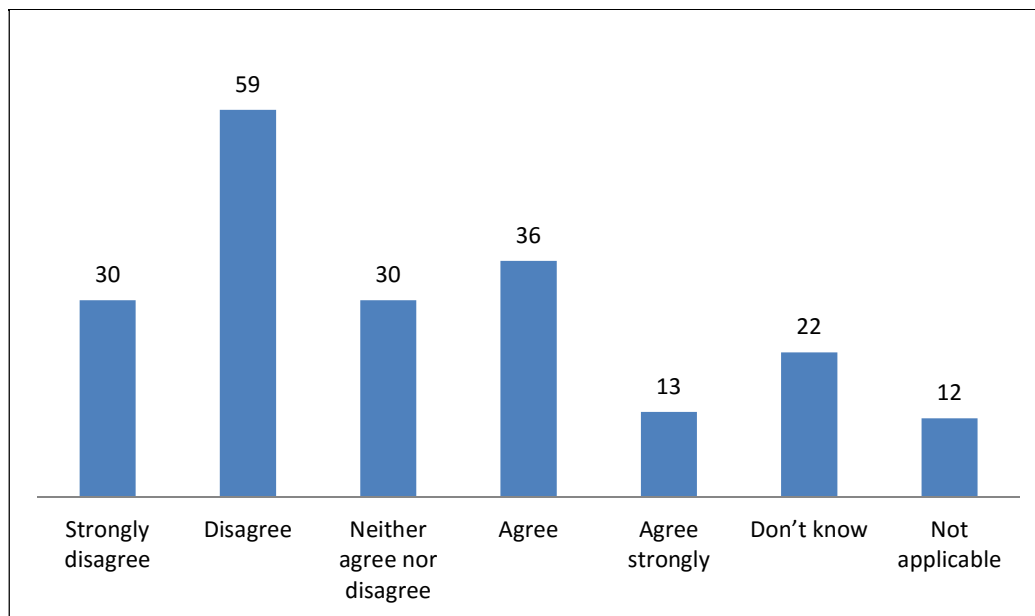


Figure 11. Bar chart showing responses to the statement: “Under the new delivery system, many veterinary practices have received less remuneration for carrying out TB testing. This change has made TB testing non-viable for your practice.”

Table 3.31. Question 9 response scores

Group	Score (Concern about financial sustainability)	Positive response (agree, agree strongly)	Negative response (strongly disagree, disagree)
Overall	-1	49 (24.26%)	89 (44.06%)
Delivery partners	-1	8 (13.79%)	32 (55.17%)
Subcontractors	0	37 (30.83%)	47 (39.17%)
Smaller practices (≤15 veterinarians)	0	41 (30.83%)	49 (36.84%)
Larger practices (>15 veterinarians)	-1	5 (10.87%)	29 (63.04%)

Table 3.31 shows the scores used to measure the variable ‘concern about financial sustainability’. Agreement with question 9 was assigned a positive score. Respondents as a whole, delivery partners and respondents from larger practices scored -1, whilst subcontractors and those from smaller practices scored 0.

3.3.11. Meeting the needs of farmers (Question 10)

Question 10 required respondents to assess whether they felt that their clients’ needs were being met under the new testing system. Of the 201 respondents that answered the question, 38 (18.90%) disagreed and 137 (68.16%) agreed that their clients’ needs are being met. The probability of this distribution of positive and negative answers occurring by chance is 7.23×10^{-14} as calculated by the ‘chitest’ function in Microsoft Excel. This is a very low probability, so the answers are more likely to represent variation in opinion rather than just a chance distribution.

The mode was ‘agree’ (41.79%) as shown in Figure 12; the median was also ‘agree’. Respondents selecting ‘agree strongly’ formed the next largest group (26.37%). Table 3.32 shows that the numbers of respondents selecting responses other than ‘agree’ and ‘agree strongly’ are much fewer. ‘Strongly disagree’ was selected by 6.97% of respondents, ‘disagree’ by 11.94% and ‘neither agree nor disagree’ by 8.46% of respondents. Respondents who felt that the question was not applicable to them represented 2.98% of the sample and those who did not know how to respond 1.49%.

Table 3.32. Responses to the statement: “The needs of your clients are being met under the new TB testing system.”

Response to question	Number of respondents in category	Percentage of total sample
Strongly Disagree	14	6.97%
Disagree	24	11.94%
Neither agree nor disagree	17	8.46%
Agree	84	41.79%
Agree strongly	53	26.37%
Don't know	3	1.49%
Not applicable	6	2.98%
Total	201	100.00%

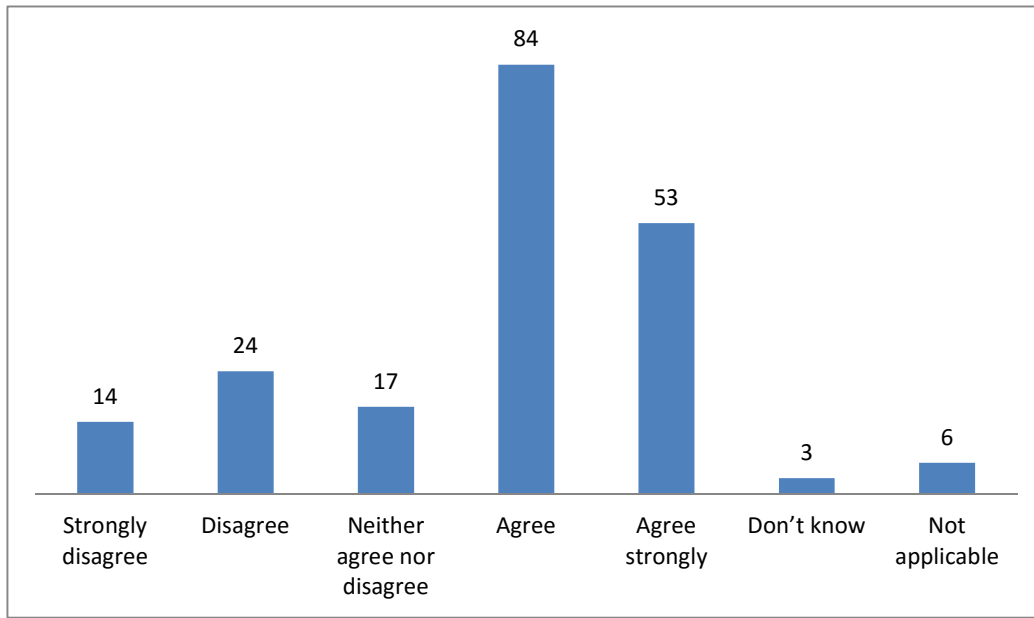


Figure 12. Bar chart showing responses to the statement: “The needs of your clients are being met under the new TB testing system.”

Table 3.33. Question 10 response scores

Group	Score (Emotional impact of changes to bTB testing provision on farmers)	Positive response (agree, agree strongly)	Negative response (strongly disagree, disagree)
Overall	+1	137 (68.16%)	38 (18.90%)
Delivery partners	+1	48 (82.76%)	6 (10.34%)
Subcontractors	+1	76 (63.87%)	29 (24.37%)
Smaller practices (≤15 veterinarians)	+1	86 (64.66%)	30 (22.56%)
Larger practices (>15 veterinarians)	+1	37 (82.22%)	5 (11.11%)

Agreement with this question was assigned a positive score for the variable measuring the emotional impact of the changes on farmers. Table 3.33 shows that all groups indicated as well as the sample as a whole scored +1. The subcontractors provided a greater proportion of negative responses, which accounts for a significant difference between these groups, despite the identical scores. Table 3.34 shows the scores for the bTB risk zones; all scored +1. The Edge Area showed a greater proportion of positive responses (81.25%) compared to the LRA (63.64%) and HRA (66.09%). The 23-30 years and 41-50 years groups differed significantly, but both had the same median. The difference is a reflection of the variation in positive and negative responses between the groups as detailed in Table 3.35.

Table 3.34. Response scores for the bTB risk zones for question 10

	Score (Emotional impact of changes to bTB testing provision on farmers)	Positive response (agree, agree strongly)	Negative response (disagree, strongly disagree)
Edge Area	+1	26 (81.25%)	4 (12.5%)
LRA	+1	28 (63.64%)	7 (15.91%)
HRA	+1	76 (66.09%)	27 (23.48%)

Table 3.35. Positive and negative responses to question 10 for 23-40 years and 41-50 years age groups

	Positive response (agree, agree strongly)	Negative response (disagree, strongly disagree)
23-30 years	30 (62.50%)	9 (18.75%)
41-50 years	22 (78.57%)	3 (10.71%)

3.3.12. Effects of the transition on farmers' stress (Question 11)

Question 11 recalled the uncertainty that existed whilst the changes to bTB testing were being made and asked respondents to assess whether this was stressful for their clients. Two hundred and one respondents answered the question with 78 (38.80%) disagreeing and 86 (42.78%) agreeing. The probability of this distribution of positive and negative answers occurring by chance is 0.53 as measured by the 'chitest' function in Microsoft Excel. This probability is close to 50%, which is the same as flipping a coin. There was a fairly even distribution of responses across the categories, shown in Figure 13, and a neutral ('neither agree nor disagree') median.

The mode for this question was 'agree' (23.38% of responses). The 'strongly disagree' (20.40%), 'agree strongly' (19.40%), and 'disagree' (18.41%) responses were very close in number to the mode as shown in Table 3.36. The neutral 'neither agree nor disagree' response was selected by 11.94% of respondents while 3.98% indicated that they did not know how to answer and 2.49% felt that the question was not applicable to them.

Table 3.36. Responses to the statement: "The time of transition to the new TB testing delivery system led to uncertainty about who would be providing bTB testing. This was stressful for your farmer clients."

Response to question	Number of respondents in category	Percentage of total sample
Strongly Disagree	41	20.40%
Disagree	37	18.41%
Neither agree nor disagree	24	11.94%
Agree	47	23.38%
Agree strongly	39	19.40%
Don't know	8	3.98%
Not applicable	5	2.49%
Total	201	100.00%

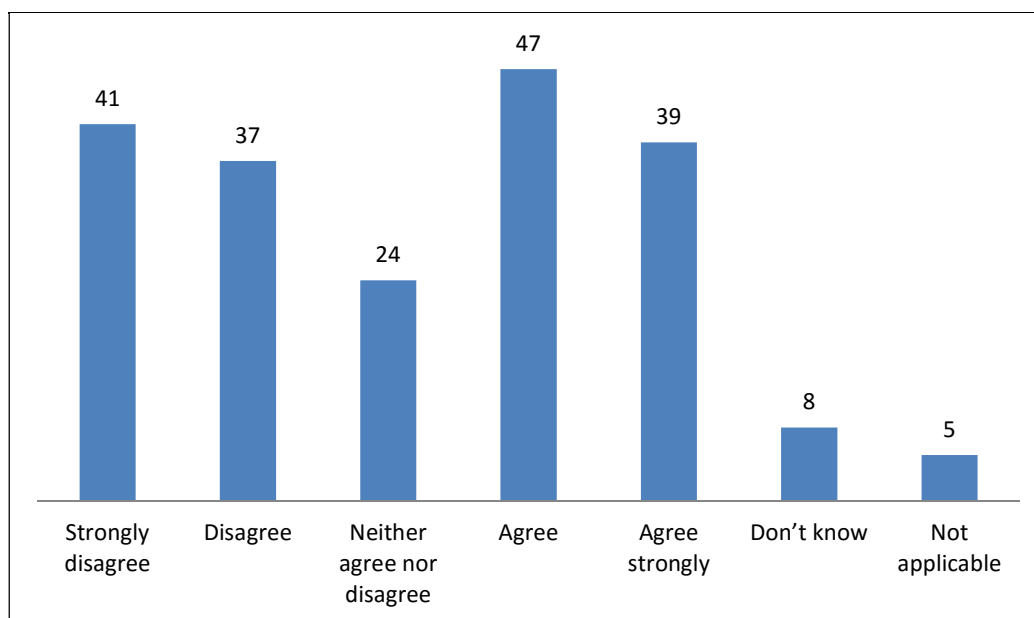


Figure 13. Bar chart showing responses to the statement: “The time of transition to the new TB testing delivery system led to uncertainty about who would be providing bTB testing. This was stressful for your farmer clients.”

Table 3.37. Question 11 response scores

Group	Score (Emotional impact of changes to bTB testing provision on farmers)	Positive response (agree, agree strongly)	Negative response (strongly disagree, disagree)
Overall	0	86 (42.78%)	78 (38.80%)
Delivery partners	+1	14 (24.14%)	33 (56.90%)
Subcontractors	-1	66 (55.46%)	35 (29.41%)
Smaller practices (≤15 veterinarians)	-1	70 (52.63%)	43 (32.33%)
Larger practices (>15 veterinarians)	+1	10 (22.22%)	24 (53.33%)

Agreement with question 11 was assigned a negative value for the variable measuring the emotional impact of the changes to bTB testing on farmers. Table 3.37 shows that the sample as a whole scored 0 for this question. Delivery partners and respondents from larger practices scored +1 and subcontractors and respondents from smaller practices scored -1.

3.3.13. Testing for bTB by unfamiliar veterinarians (Question 12)

This question required respondents to indicate whether their clients had expressed concern that bTB testing may not be carried out by their own veterinarians any longer. Two hundred and two respondents answered the question with 57 (28.21%) disagreeing and 116 (57.42%) agreeing. The probability of this distribution of positive and negative values occurring by chance is 7.27×10^{-6} as calculated by the 'chitest' function in Microsoft Excel. It is very unlikely that this distribution of responses was due to chance.

Figure 14 shows that the mode is 'agree strongly' (29.70%), with the second largest number of responses 'agree' (27.72%) very similar in value to the mode. The median was 'agree'. Table 3.38 shows that fewer respondents selected 'strongly disagree' (17.33%), 'disagree' (10.89%) and 'neither agree nor disagree' (6.44%). A small percentage (2.97%) indicated that they did not know how to answer the question and 4.95% felt that the question was not applicable to them.

Table 3.38. Responses to the statement: “During the transition farmers expressed their concern to you that future TB tests would not be carried out by their own vets.”

Response to question	Number of respondents in category	Percentage of total sample
Strongly Disagree	35	17.33%
Disagree	22	10.89%
Neither agree nor disagree	13	6.44%
Agree	56	27.72%
Agree strongly	60	29.70%
Don't know	6	2.97%
Not applicable	10	4.95%
Total	202	100.00%

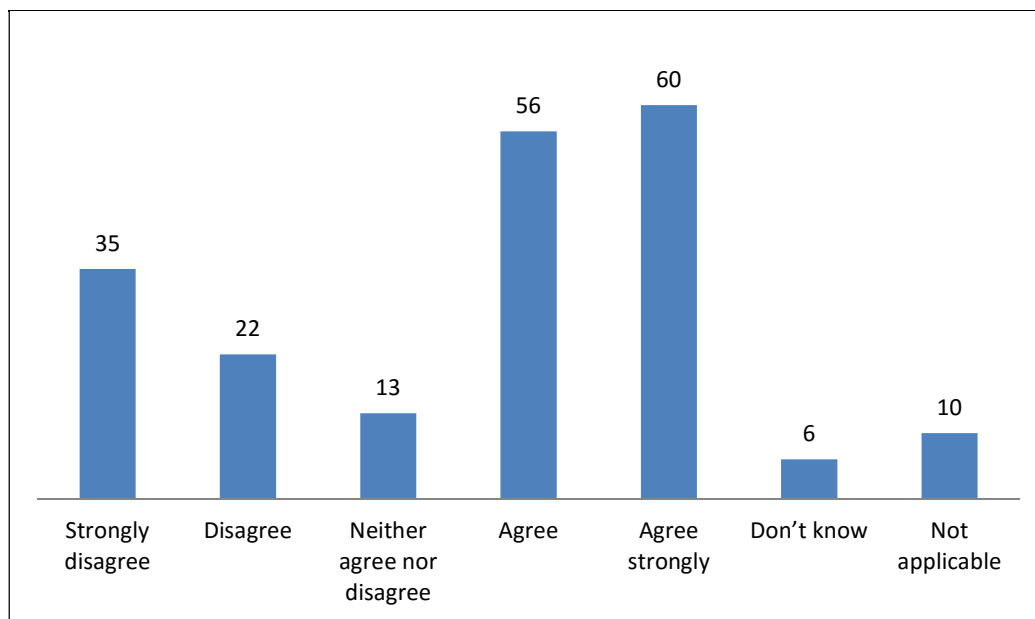


Figure 14. Bar chart showing responses to the statement: “During the transition farmers expressed their concern to you that future TB tests would not be carried out by their own vets.”

Table 3.39. Question 12 response scores

Group	Score (Emotional impact of changes to bTB testing provision on farmers)	Positive response (agree, agree strongly)	Negative response (strongly disagree, disagree)
Overall	-1	116 (57.42%)	57 (28.21%)
Delivery partners	0	24 (41.38%)	26 (44.83%)
Subcontractors	-1	85 (70.83%)	23 (19.17%)
Smaller practices (≤15 veterinarians)	-1	92 (69.17%)	26 (19.55%)

Larger practices (>15 veterinarians)	+1	17 (36.96%)	22 (47.83%)
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Agreement with question 12 was assigned a negative score for the variable measuring the emotional impact of the changes to bTB testing on farmers. Table 3.39 shows that the sample overall as well as the subcontractors and respondents working in smaller practices scored -1. Delivery partners scored 0 and respondents working in larger practices scored +1.

3.3.14. Farmer confidence in familiar veterinarians (Question 13 and question 14)

Question 13 requested that respondents consider whether farmers have more confidence in bTB testing if it is carried out by a veterinarian of their choice. Two hundred and two respondents answered the question with 38 (18.81%) answering negatively ('strongly disagree' or 'disagree') and 131 (64.85%) answering positively ('agree' or 'agree strongly'). The probability of this distribution of positive and negative answers occurring by chance was 8.44×10^{-13} as calculated by the 'chitest' function in Microsoft Excel. The probability of this response distribution having occurred by chance is very small and therefore unlikely.

Figure 15 shows that the mode for this question is 'agree strongly' (34.65% of responses), with the second largest group of responses, 'agree' (30.30%) very close in value to the mode. The median for this question was 'agree'. The full results are detailed in Table 3.40, showing that similar numbers of respondents indicated 'strongly disagree' (9.41%), 'disagree' (9.41%) and 'neither agree nor disagree' (12.38%). A small number (1.48%) indicated that this question was not applicable to them and 2.47% felt that they did not know the answer to this question.

Table 3.40. Responses to the statement: "Farmers have most confidence in TB testing if carried out by the veterinarian of their choice."

Response to question	Number of respondents in category	Percentage of total sample
Strongly Disagree	19	9.41%
Disagree	19	9.41%
Neither agree nor disagree	25	12.38%
Agree	61	30.20%
Agree strongly	70	34.65%
Don't know	5	2.47%
Not applicable	3	1.48%
Total	202	100.00%

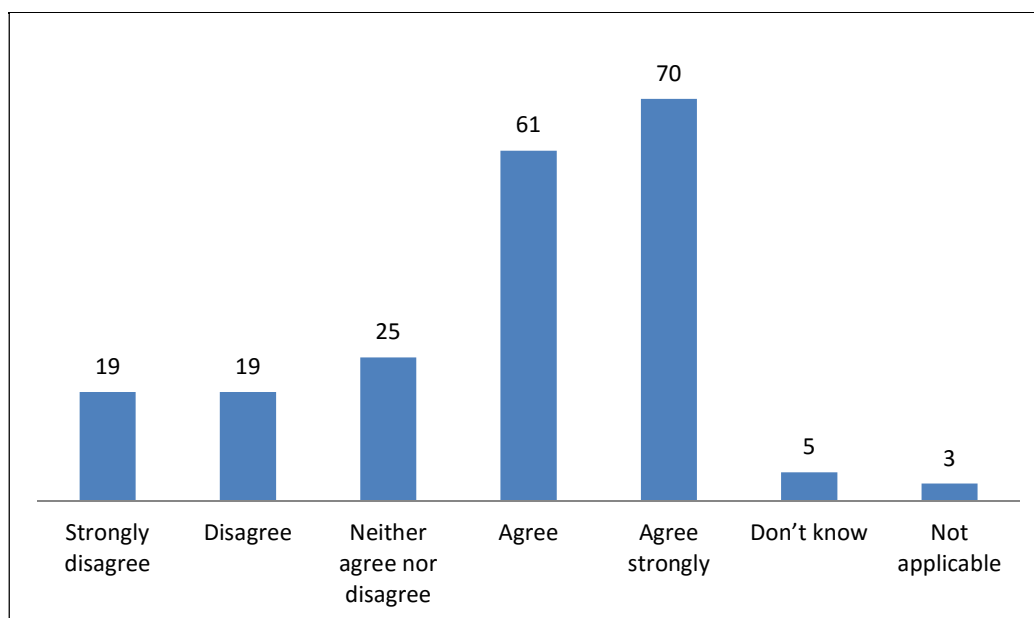


Figure 15. Bar chart showing responses to the statement: “Farmers have most confidence in TB testing if carried out by the veterinarian of their choice.”

Table 3.41 shows the scores for question 13 for the variable measuring farmers’ level of trust in veterinarians’ knowledge and skills. Agreement with the question was assigned a positive value. The sample overall, as well as delivery partners, subcontractors and respondents working in smaller practices scored +1 for this variable. The group of respondents working in larger practices scored 0. Despite both scoring +1, the subcontractor group gave a higher proportion (75.00%) of positive responses than the delivery partner group (55.17%).

Table 3.41. Question 13 response scores

Group	Score (Level of trust in veterinarians’ knowledge and skills)	Positive response (agree, agree strongly)	Negative response (strongly disagree, disagree)
Overall	+1	131 (64.85%)	38 (18.81%)
Delivery partners	+1	32 (55.17%)	17 (29.31%)
Subcontractors	+1	90 (75.00%)	15 (12.50%)
Smaller practices (≤15 veterinarians)	+1	102 (76.69%)	16 (12.03%)
Larger practices (>15 veterinarians)	0	22 (47.83%)	16 (34.78%)

Question 14 asked respondents to gauge whether they felt that farmers had more confidence in their ability to perform bTB testing if they had visited a farm before. Two hundred and two respondents answered the question with 59 (29.20%) disagreeing and 109 (53.96%) agreeing. The probability of this distribution of positive (agree) and negative (disagree) responses occurring by chance is 0.00012 as calculated using the ‘chitest’ function in Microsoft Excel. The small probability makes it very unlikely that this distribution of responses occurred by chance.

Figure 16 shows the responses as a bar chart and clearly indicates the mode is 'agree' (37.62% of responses). The median for this question was also 'agree'. Table 3.42 shows that the other four Likert scale response categories had similar numbers of respondents: 12.87% selected 'strongly disagree', 16.34% selected 'disagree', 12.38% selected 'neither agree nor disagree' and 16.34% selected 'agree strongly'. Smaller numbers indicated that they did not know the answer to the question (2.47%) and that the question was not applicable to them (1.98%).

Table 3.42. Responses to the statement: “Farmers are unsure of your competence if you have not visited their farm before. This affects the confidence they have in you performing TB testing.”

Response to question	Number of respondents in category	Percentage of total sample
Strongly Disagree	26	12.87%
Disagree	33	16.34%
Neither agree nor disagree	25	12.38%
Agree	76	37.62%
Agree strongly	33	16.34%
Don't know	5	2.47%
Not applicable	4	1.98%
Total	202	100.00%

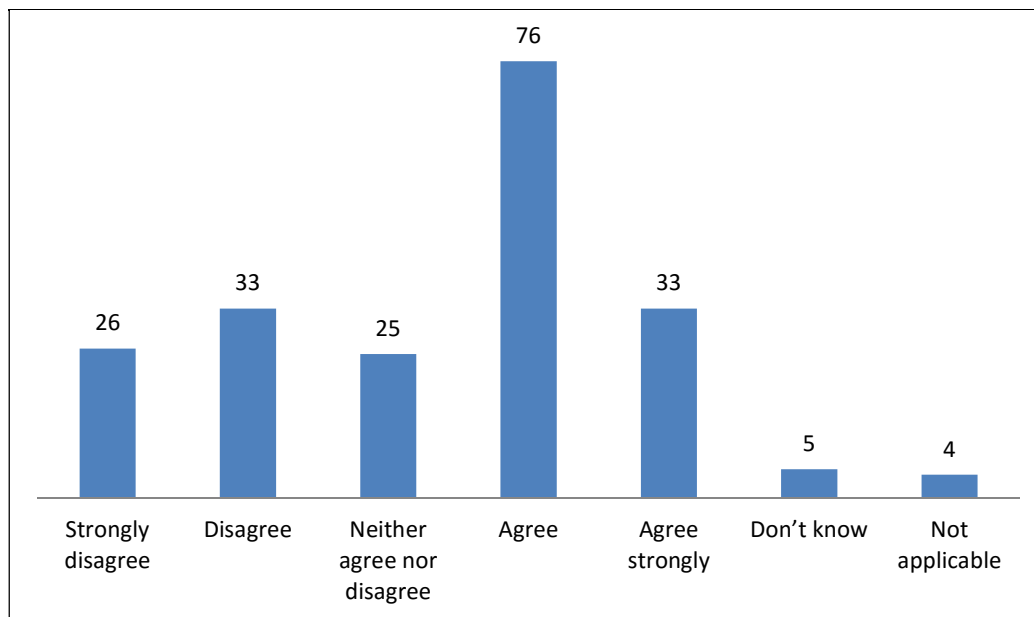


Figure 16. Bar chart showing responses to the statement “Farmers are unsure of your competence if you have not visited their farm before. This affects the confidence they have in you performing TB testing.”

Table 3.43. Question 14 response scores

Group	Score (Level of trust in veterinarians' knowledge and skills)	Positive response (agree, agree strongly)	Negative response (strongly disagree, disagree)
Overall	+1	109 (53.96%)	59 (29.20%)
Delivery partners	0	23 (39.66%)	27 (46.55%)

Subcontractors	+1	78 (65.00%)	24 (20.00%)
Smaller practices (≤15 veterinarians)	+1	87 (65.41%)	29 (21.80%)
Larger practices (>15 veterinarians)	0	16 (34.78%)	21 (45.65%)

Table 3.43 shows the scores for question 14 contributing to the variable examining farmers' level of trust in veterinarians' knowledge and skill. Agreement with the question was assigned a positive score. The sample overall, as well as subcontractors and those respondents working in smaller practices scored +1. Delivery partners and those respondents working in larger practices scored 0. The LRA and Edge area differed significantly for this question; the Edge Area scored 0 and the LRA scored +1 as seen in Table 3.44.

Table 3.44. Comparison of Edge Area and LRA responses for question 14

	Score (Level of trust in veterinarians' knowledge and skills)	Positive response (agree, agree strongly)	Negative response (disagree, strongly disagree)
Edge Area	0	14 (43.75%)	15 (46.88%)
LRA	+1	30 (68.18%)	8 (18.18%)

3.3.15. Value of long term relationships with clients (Question 15)

Question 15 required respondents to reflect on whether their long term relationships with clients have been successful because of the trust that has developed between the parties and the value that the farmers subsequently place in their veterinarians. Two hundred respondents answered the question with two (1.00%) disagreeing and 182 (91.00%) agreeing. The probability of this distribution of responses occurring by chance is 3.47×10^{-40} as calculated by the 'chitest' function in Microsoft Excel. This very small value indicates that it is highly unlikely that this distribution of responses could have occurred by chance.

Figure 17 shows that the mode for this question was 'agree strongly', with 59.50% of respondents selecting this option. The median was also 'agree strongly'. The next largest group selected 'agree' (31.50%). Table 3.45 shows that the other response categories only had a few responses: 1.00% selected 'strongly disagree', no respondents selected 'disagree' and 3.00% selected 'neither agree nor disagree'. A small number indicated that the question did not apply to them (2.50%) or that they did not know how to respond (2.50%).

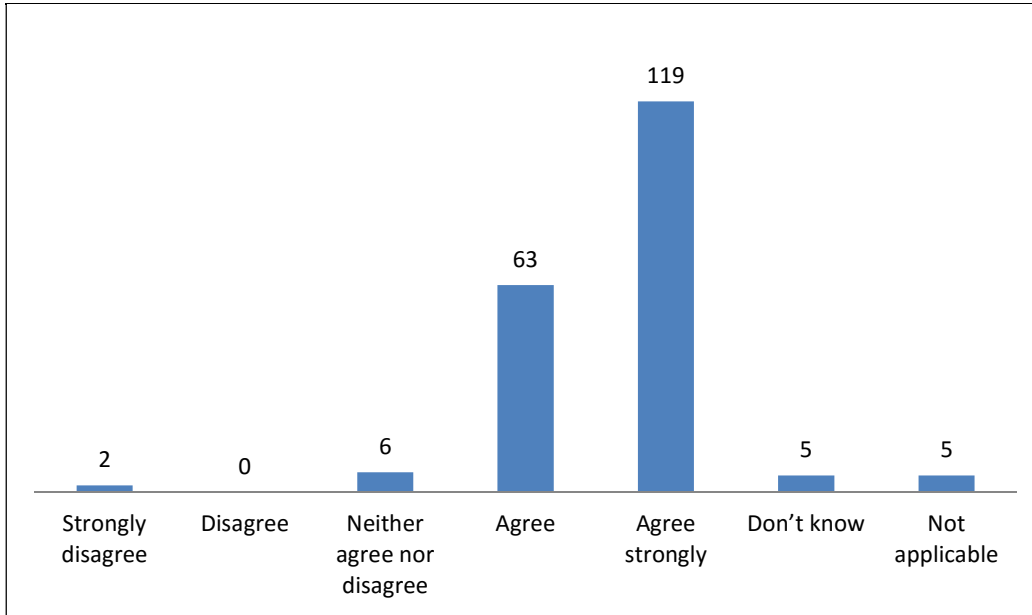


Figure 17. Bar chart showing responses to the statement: “Your long term relationships with clients have been successful primarily because they trust you as a professional and a valuable part of their enterprises.”

Table 3.45. Responses to the statement: “Your long term relationships with clients have been successful primarily because they trust you as a professional and a valuable part of their enterprises.”

Response to question	Number of respondents in category	Percentage of total sample
Strongly Disagree	2	1.00%
Disagree	0	0.00%
Neither agree nor disagree	6	3.00%
Agree	63	31.50%
Agree strongly	119	59.50%
Don't know	5	2.50%
Not applicable	5	2.50%
Total	200	100.00%

Table 3.46. Question 15 response scores

Group	Score (Level of trust in veterinarians' knowledge and skills)	Positive response (agree, agree strongly)	Negative response (strongly disagree, disagree)
Overall	+1	182 (91.00%)	1 (1.00%)
Delivery partners	+1	53 (92.98%)	2 (3.51%)
Subcontractors	+1	113 (94.96%)	0
Smaller practices (≤15 veterinarians)	+1	127 (96.95%)	0
Larger practices (>15 veterinarians)	+1	40 (86.96%)	2 (4.35%)

Agreement with question 15 was assigned a positive score for the variable measuring farmers' level of trust in veterinarians' knowledge and skills. Table 3.46 shows that respondents overall, as well all the

groups represented scored +1. The subcontractors and respondents from smaller practices provided no negative responses to this question.

3.3.16. The value of veterinary advice to farmers (Question 16)

This question asked respondents to reflect on whether their clients felt that their advice could help them to overcome bTB. Of the 201 respondents that answered the question, 40 (19.90%) answered negatively ('strongly disagree' or 'disagree') and 116 (57.71%) answered positively ('agree' or 'agree strongly'). The probability of this distribution of positive and negative responses occurring by chance is 1.17×10^{-9} , showing that there is a very small likelihood of this distribution occurring by chance.

The mode (41.29% of responses) for this question was 'agree' and Figure 18 shows that this response was selected much more frequently than the other responses. The median for this question was also 'agree'. Table 3.47 shows that similar numbers of respondents selected 'disagree' (14.43%), 'neither agree nor disagree' (16.42%) or 'agree strongly' (16.42%), whereas a smaller number selected 'strongly disagree' (5.47%), 'don't know' (2.49%) or 'not applicable' (3.48%).

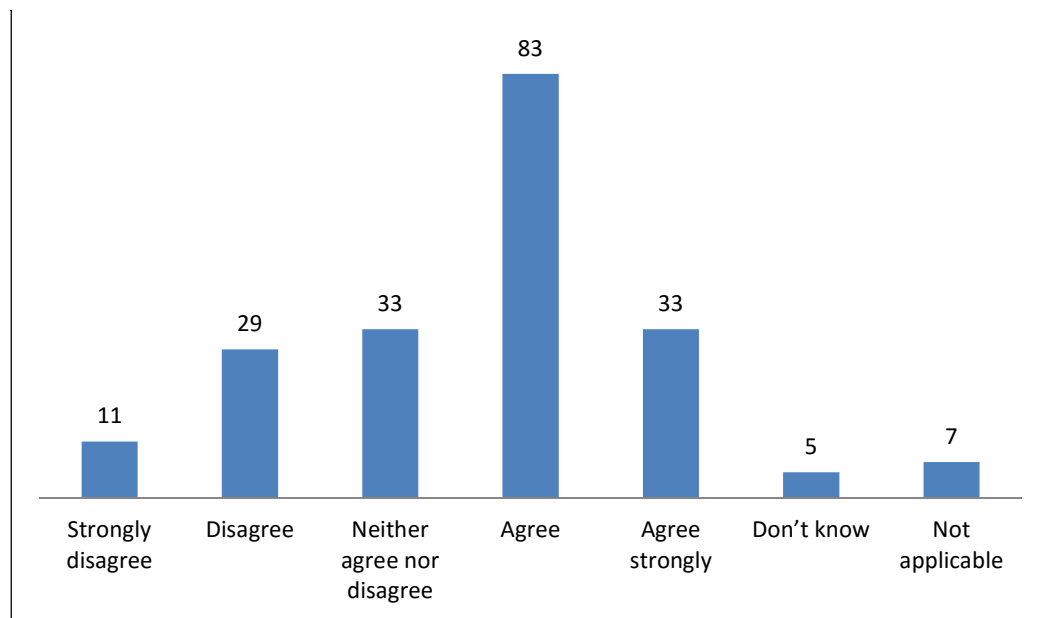


Figure 18. Bar chart showing responses to the statement: "Your clients feel that your advice can help them overcome TB."

Table 3.47. Responses to the statement: "Your clients feel that your advice can help them overcome TB."

Response to question	Number of respondents in category	Percentage of total sample
Strongly Disagree	11	5.47%
Disagree	29	14.43%
Neither agree nor disagree	33	16.42%
Agree	83	41.29%
Agree strongly	33	16.42%

Don't know	5	2.49%
Not applicable	7	3.48%
Total	201	100.00%

Table 3.48. Question 16 response scores

Group	Score (Level of trust in veterinarians' knowledge and skills)	Positive response (agree, agree strongly)	Negative response (strongly disagree, disagree)
Overall	+1	116 (57.71%)	40 (19.90%)
Delivery partners	+1	29 (50.00%)	15 (25.86%)
Subcontractors	+1	75 (62.50%)	23 (19.17%)
Smaller practices (≤15 veterinarians)	+1	82 (61.65%)	24 (18.05%)
Larger practices (>15 veterinarians)	0	21 (45.65%)	14 (30.43%)

Agreement with question 16 was assigned a positive score for the variable measuring farmers' level of trust in veterinarians' knowledge and skill. The sample overall as well as subcontractors, delivery partners and veterinarians from smaller practices scored +1, as shown in Table 3.48. Respondents from larger practices scored 0. Table 3.49 shows the scores and breakdown of positive compared to negative responses for respondents from the South West compared to the rest of England. Although both groups scored +1, a significant difference was found between the groups. A greater proportion of respondents from the South West responded negatively (27.08%) to this question when compared with those from the rest of England (14.14%). Respondents from the LRA and HRA are compared in Table 3.50, where a difference in distribution of positive and negative responses accounted for the significant difference between the groups. The respondents from the LRA gave a greater proportion of positive responses (75.00%) than those from the HRA (50.43%).

Table 3.49. Comparison of responses from the South West compared to the rest of England for question 16

	Score (Level of trust in veterinarians' knowledge and skills)	Positive response (agree, agree strongly)	Negative response (disagree, strongly disagree)
South West	+1	23 (47.92%)	13 (27.08%)
Other England	+1	67 (67.68%)	14 (14.14%)

Table 3.50. Comparison of HRA and LRA responses for question 16

	Score (Level of trust in veterinarians' knowledge and skills)	Positive response (agree, agree strongly)	Negative response (disagree, strongly disagree)
HRA	+1	58 (50.43%)	26 (22.61%)
LRA	+1	33 (75.00%)	4 (9.09%)

3.3.17. Effects of the changes on DEFRA’s relationship with farmers (Question 17)

This question asked respondents to consider whether they thought that the process of changing bTB testing provision had damaged farmers’ relationships with the government. Two hundred and one respondents answered the question with 44 (21.89%) disagreeing and 102 (50.75%) agreeing. The probability of this distribution of responses occurring by chance is 1.59×10^{-6} as calculated by the ‘chitest’ function in Microsoft Excel. This is a very low probability; the chance of these responses being due to chance is negligible.

Both the median and mode for this question were ‘agree’. Figure 19 indicates that ‘agree’ was the most popular response (27.37%), but that ‘agree strongly’ was close in value (23.38%). The number of responses in each category is detailed in Table 3.51. The response ‘strongly disagree’ was selected by 7.46% of respondents, which was close in value to the 5.97% who indicated that they did not know how to answer. The ‘disagree’ (14.43%) responses and ‘neither agree nor disagree’ (19.40%) were close in value and a small number (1.99%) indicated that the question was not applicable to them.

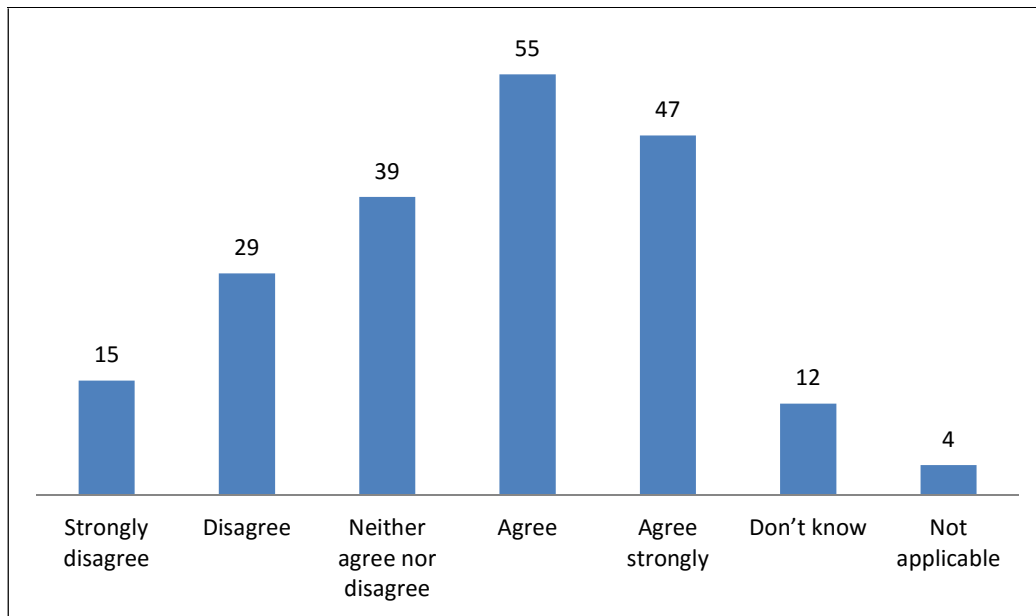


Figure 19. Bar chart showing responses to the statement: “The uncertainty surrounding the provision of testing while the tenders were being finalised negatively affected DEFRA’s relationship with farmers.”

Table 3.51. Responses to the statement: “The uncertainty surrounding the provision of testing while the tenders were being finalised negatively affected DEFRA’s relationship with farmers.”

Response to question	Number of respondents in category	Percentage of total sample
Strongly Disagree	15	7.46%
Disagree	29	14.43%
Neither agree nor disagree	39	19.40%
Agree	55	27.37%
Agree strongly	47	23.38%

Don't know	12	5.97%
Not applicable	4	1.99%
Total	201	100.00%

Table 3.52. Question 17 response scores

Group	Score (Farmers' relationship with the government)	Positive response (agree, agree strongly)	Negative response (strongly disagree, disagree)
Overall	-1	102 (50.75%)	44 (21.89%)
Delivery partners	0	21 (36.21%)	18 (31.03%)
Subcontractors	-1	77 (64.17%)	18 (15.00%)
Smaller practices (≤15 veterinarians)	-1	83 (62.41%)	19 (14.29%)
Larger practices (>15 veterinarians)	0	16 (34.78%)	16 (34.78%)

Table 3.52 shows the scores assigned to examine farmers' relationship with the government. Agreement with question 17 was assigned a negative score. The sample as a whole, as well as subcontractors and veterinarians working in smaller practices, scored -1. The delivery partners and respondents working in larger practices scored 0. The scores for the bTB risk zones are shown in Table 3.53. The Edge Area scored 0 and the HRA and LRA scored -1.

Table 3.53. Comparison of bTB risk zone responses for question 17

	Score (Farmers' relationship with the government)	Positive response (agree, agree strongly)	Negative response (disagree, strongly disagree)
Edge Area	0	10 (31.25%)	11 (34.38%)
HRA	-1	68 (59.13%)	24 (20.34%)
LRA	-1	24 (54.55%)	5 (11.36%)

3.4. Results of open ended question

Many respondents left comments about their experiences of changes to the bTB testing arrangements and portions of these comments are quoted in chapter 4. Thirty two of the 202 respondents (15.84%) left comments about the structure of the questions, with most mentioning that they felt that too many of the questions were worded negatively.

3.5. Response scores related to study variables

The scores for the questions measuring each variable were added together to indicate an overall result for each study variable. Objective 4 was investigated with a single question and the results are discussed in chapter 4.

3.5.1. Objective 1

The first variable assessing veterinarians' stress or anxiety as a result of the changes was measured by questions two, three and five. The scores are represented in Table 3.54.

Table 3.54. Total scores for 'stress or anxiety' variable

Stress or anxiety as a result of the changes.	
	Total
Overall	+1
Delivery partners	-2
Subcontractors	+3
Smaller practices (≤15 veterinarians)	+3
Larger practices (>15 veterinarians)	-1

The second variable, concern about financial sustainability as a result of the changes, was measured by questions seven, eight and nine and the scores are represented in Table 3.55.

Table 3.55. Total scores for 'concern about financial sustainability' variable

Concern about financial sustainability	
	Total
Overall	-1
Delivery partners	-1
Subcontractors	0
Smaller practices (≤15 veterinarians)	0
Larger practices (>15 veterinarians)	-1

The third variable of the first study objective assessed veterinarians' attitude towards the government's decision to change bTB testing provision and was measured using questions one, four and six. The scores are shown in Table 3.56.

Table 3.56. Total scores for the variable 'attitude towards the government's decision to change bTB testing provision'

Attitude towards the government's decision to change bTB testing provision	
	Total
Overall	+2
Delivery partners	+3
Subcontractors	-1
Smaller practices (≤15 veterinarians)	-1
Larger practices (>15 veterinarians)	+3

3.5.2. Objective 2

The second objective assessed the emotional impact of the changes to bTB testing provision on farmers and was measured using questions ten, eleven and twelve. The combined scores for the three questions are shown in Table 3.57.

Table 3.57. Total scores for the variable ‘emotional impact of changes to bTB testing provision on farmers’

Determine how the process of changing bTB testing provision affected farmers emotionally - Emotional impact of changes to bTB testing provision on farmers	
	Total
Overall	0
Delivery partners	+2
Subcontractors	-1
Smaller practices (≤15 veterinarians)	-1
Larger practices (>15 veterinarians)	+3

3.5.3. Objective 3

The third study objective determined farmers’ level of trust in their veterinarians’ knowledge and skill and was measured by questions thirteen, fourteen, fifteen and sixteen. The combined scores of the questions are tabulated in Table 3.58.

Table 3.58. Total scores for objective 3

Determine farmer attitude to veterinary surgeons providing bTB services on their farms - Level of trust in veterinarians’ knowledge and skills	
	Total
Overall	+4
Delivery partners	+3
Subcontractors	+4
Smaller practices (≤15 veterinarians)	+4
Larger practices (>15 veterinarians)	+1

4. CHAPTER 4: DISCUSSION

4.1. Introduction

Social research was conducted to examine the attitudes of veterinarians to the changes made to provision of bTB testing in England during 2014 and 2015. An electronic questionnaire was sent to members of the British Cattle Veterinary Association during November 2016; 371 respondents viewed the questionnaire, with 202 responses considered valid for analysis.

The discussion of the findings commences with an evaluation for the potential of bias. The vulnerabilities of the questionnaire are discussed and the results are analysed to determine whether bias may have occurred because of these. The demographic breakdown of the respondents is examined to determine whether the population is representative of veterinarians in the UK. Oppenheim (1992) states that a sample that is not representative of the population being studied can indicate the introduction of bias. The questions measuring each objective are analysed to determine the outcomes of each objective for the sample as a whole, as well as the demographic groups showing significant differences, for each question.

The most consistent finding is that the delivery partner groups differed significantly in their responses to the veterinarians acting as subcontractors. There were also marked differences between the responses from veterinarians working in larger practices (>15 veterinarians) and smaller practices (≤15 veterinarians). A strong association was found, using the χ^2 test, between respondents identifying as delivery partners and those working in larger practices as well as those identifying as subcontractors and those working in smaller practices. It would appear that the differences between practitioners from larger and smaller practices are largely due to their capacity working with bTB. Other differences were found between some demographic groups, but they were not as consistent as these differences. The study sought to examine the effects of the changes to bTB testing on veterinarians and found that the experiences were not uniform across the study population. The differences in opinion and experience relate directly to bTB and the capacity in which respondents work with bTB.

4.2. Evaluation for bias

4.2.1. Questionnaire

Although great effort was made to deliver a balance of positive and negative statements according to questionnaire theory, some respondents indicated that they perceived the wording of the questionnaire to be negative. This had been highlighted during piloting by the BCVA board and the researcher did propose to change some of the questions to positive wording, but the board indicated that it was satisfied with the questionnaire as it was. The chief executive of the company that secured the tenders for delivering bTB testing commissioned a review by a market research company to evaluate the questionnaire. The matter of negative tone was raised as a concern, with the risk that this may result in

confirmation bias. Confirmation bias occurs when data is gathered to support a particular belief and not seeking to disprove a preferred point of view. It is important to be mindful of the potential for bias and to interpret results in light of this (Glick 2017). One safeguard against bias was that more than one question was generally used to measure a single variable. Due to the tone of the questionnaire, the commissioned review also warned that the questions may project that the writer of the questionnaire had a particular opinion, which could lead to non-response bias. More than half (54.45%) of the veterinarians that viewed the questionnaire completed it fully; the 202 respondents make up roughly one sixth of the BCVA's membership of approximately 1200 veterinarians (Little 2017). It is not possible to conclude from the results why those who did not complete the questionnaire chose not to. Evaluation for non-response bias was restricted to assessment of the demographic breakdown of the sample obtained, covered in section 4.2.2, to look for evidence of bias.

The three variables measuring the first study objective were potentially vulnerable to confirmation bias because all of the questions measuring each variable were worded either positively or negatively, rather than a combination of each. If confirmation bias were significant in the first variable measuring stress and anxiety, one would expect respondents to agree with the attitude statements in the questions stating that the process had been stressful. The delivery partner group indicated that they did not find the process stressful, which shows that these respondents were able to detach themselves from the negative wording of the questions for this variable. Looking at the second variable measuring concern about financial impact, one may expect responses indicating a detrimental financial impact if confirmation bias was significant for these questions. The sample as a whole as well as the delivery partners indicated a positive financial impact and the responses were neutral for the subcontractors (0 score). These responses are more likely representative of the respondents' true opinions rather than being led by the negative wording of the questions. The questions making up the third variable measuring respondents' attitude towards the government were all worded positively. If confirmation bias was significant for these questions, one would expect a dominance of positive attitudes towards the government. The subcontractors indicated a negative attitude, showing that this portion of the sample was not swayed by positive wording of the questions.

Some of the questions were at risk of being 'double-barrelled', introducing more than one concept which may have left respondents confused as to which concept they had to rate their agreement with (Dean 2017). The nature of some of the questions, particularly when they could be seen as 'double-barrelled' did increase their difficulty and increase the chance of satisficing. Respondents with higher cognitive ability are less likely to satisfice (Krosnick, n.d.); veterinarians are required to practise higher cognitive functions on a daily basis and were considered to fit into this ability category. Respondents who think often about a given topic and who have a strong opinion about this topic are also less likely to satisfice (Krosnick, n.d.). The topic of bTB and its control in England is controversial and most veterinarians are required to think about it often due to its importance to animal and human health. The very nature of this subject and its importance to veterinarians in the UK makes it more likely that truthful answers will be provided.

4.2.2. Assessing demographic breakdown of respondents

The demographic groups were inspected to determine whether the respondents were representative of veterinarians in England. Oppenheim (1992) states that if a sample is not representative of the population in question, this may indicate the introduction of bias. The assumption was made that bias was less likely if the respondents appear representative of veterinarians in England.

In 2015 there were 20 571 practising veterinary surgeons in the UK, of which 41.68% were male and 58.32% female (Royal College of Veterinary Surgeons 2015). The majority of veterinary surgeons that opt for farm animal practice are men (Allen 2016). Just over half the respondents were male, so taking into account the gender distribution across the sectors of veterinary practice in the UK, this is likely to be representative.

54.45% of the respondents were aged 40 years or younger. As this questionnaire was available electronically only, there is a possibility that a greater number of younger respondents completed it as they may have been more comfortable with the format. Looking at the number of years that respondents have been qualified as a veterinarian, the breakdown reflects an even distribution between >1 to 5 years (40), >5 to 10 years (39) and >10 to 20 years (46) qualified. A small number of respondents (6) were in their first year of practice. It is not unexpected to find that few in this category responded as these veterinarians were still students whilst the changes were taking place and less likely to have experienced them first hand. The groups became smaller as the years after graduating increased, with 31 respondents in the >20 to 30 years group and 21 qualified more than 30 years. One would expect this trend as veterinarians may start to retire at this age. This breakdown does not appear obviously skewed.

There are currently no published figures indicating how many veterinary practices are operating as delivery partners or subcontractors in each region of England. The delivery partners are a group of practices in each area that have secured the government tender to provide bTB testing and one would expect there to be more subcontractors within each region that provide services to the delivery partners. This breakdown seems to be a reasonable representation of the breakdown of cattle veterinarians in the UK.

The majority of respondents (57%) indicated that they work in the HRA of England. It is expected that veterinarians working in this risk zone would consider bTB a high priority and may, therefore, have had more interest in responding to a questionnaire about this topic.

Eight respondents (3.96%) identified as having qualified in the EU. An RCVS report published in 2015 indicated that 20% of veterinarians in clinical practice in the UK qualified in the EU (RCVS 2015). A 2017 report carried out by the Institute for Employment Studies showed that two thirds of EU veterinarians are working in small animal or exotic practice (Robinson, Everett & Williams 2017). A

small percentage of EU veterinarians work in the farm animal sector; the number of EU respondents to this questionnaire is likely representative of the general veterinarian population.

The demographic breakdown of the respondents largely appears representative of the veterinary community of the United Kingdom, however the data may be more representative of veterinarians from areas where bTB has a higher prevalence.

4.3. Evaluation of study objectives

4.3.1. Objective 1 - Determine how the process of changing bTB testing provision affected veterinary surgeons emotionally and financially.

Objective 1 was investigated the most extensively. It was divided into three variables, which were each measured by three questions.

4.3.1.1 Variable 1: Stress or anxiety as a result of the changes

The Health and Safety Executive (HSE) which is involved with all aspects of worker safety in the UK defines stress as “the adverse reaction people have to excessive pressures or other types of demand placed on them at work”. Stress can affect people in many ways and prolonged and excessive stress can contribute to physical or mental illness (HSE n.d.). Significant changes can often contribute to stress and anxiety and this effect on veterinarians was selected as an important variable to measure the effects of the changes to bTB testing on veterinarians.

All three questions (numbers 2, 3 and 5) for this variable showed significant differences between the answers of delivery partners compared with subcontractors as well as larger practices compared with smaller practices. No significant differences in responses were shown between age groups or respondents from different bTB risk zones.

The three questions measuring this variable investigated different elements that could have contributed to stress or anxiety. Question 2 asked respondents to comment on how well the process had been organised, as a poorly organised process could contribute to stress for practitioners. The scores in Table 3.16 show that the sample as a whole responded neutrally and felt that this aspect of making changes to bTB testing did not add to or protect against stress. Delivery partners and larger practices indicated that they did not feel that the process was poorly organised, indicating that this aspect did not contribute to stress for these groups, whereas subcontractors and smaller practices indicated the opposite. The outcomes of the tenders were announced in February 2015 and contracts for subcontractors were issued from the middle of April (Anon 2015a, Anon 2015e), with the new service commencing on 1 May (Anon 2015c). The shorter timeframe for preparation for subcontractors may have left some veterinarians feeling unprepared, which may have contributed to a more negative attitude towards the organisational process of making changes to bTB testing.

The second question for this variable (question 3) asked respondents to indicate whether they had found the process of changing bTB testing stressful. Overall the respondents agreed that the changes did contribute to stress (Table 3.18). The subcontractors, smaller practices and larger practices also indicated that the transition was stressful, whilst the delivery partners gave a neutral response showing that they neither agreed nor disagreed that the process was stressful. The delivery partner group gave a greater range of responses, accounting for this neutral response.

Question 5 required respondents to consider whether the process of making the changes to bTB testing had felt rushed. The scores in Table 3.22 show that the respondents as a whole responded neutrally, suggesting neither a positive nor negative contribution to their stress. Subcontractors and veterinarians from smaller practices felt that the process of finalising contracts was rushed, indicating that this contributed to stress for this group of respondents. The delivery partners and those working in larger practices responded that they felt that the process had allowed adequate time, thus not contributing further to stress.

If the scores for the three questions are added together as shown in Table 3.54, a picture can be built of the impact of these changes on veterinarian emotions and stress levels. The respondents as a whole indicated that the process did impact negatively on them as indicated by the +1 score. This is to be expected as any change can be stressful, even if it is welcomed. The scores for subcontractors and smaller practices were the same at +3. The similarity is likely because most subcontractors work in smaller practices as demonstrated earlier with a χ^2 test. The subcontractors scored the maximum possible for this variable and, using this crude scale, it could be stated that they found the process most stressful of all the groups of veterinarians surveyed. Delivery partners scored -2 and larger practices -1. Whilst their scores were not identical, both these groups indicate using this scale that stress was not increased as a result of this process. One can hypothesise that delivery partners had time during the tendering process to put proposals together and were able to familiarise themselves with the changes potentially more quickly than those acting as subcontractors. It is also possible that being part of a larger organisation that seeks to support its members (XLVets 2017) provides emotional security to the delivery partners.

4.3.1.2. Variable 2: Concern about financial sustainability as a result of the changes

Questions number seven, eight and nine were used to investigate the variable 'concern about financial sustainability as a result of the changes'. Significant differences were found for all three questions between the answers of delivery partners compared with subcontractors as well as larger practices compared with smaller practices. Question eight also showed significant differences between some of the age groups of practitioners. No significant differences were shown between practitioners from different bTB risk zones.

Question 7 asked respondents whether the changes to bTB testing provision had damaged their practices financially. The respondents as a whole as well as all demographic groups indicated that

losses had been incurred as a result of the changes (Table 3.26). Prior to the implementation of the changes concerns were raised about the financial losses faced by veterinarians (Dessent 2014b, Seymour 2015) and this appears to have occurred based on the responses.

Respondents were asked in question 8 to gauge whether the changes to bTB testing provision had damaged their relationships with their clients. Practices are able to retain clients by providing service that is consistently good. If any problems occur, clients are more likely to stay with a practice if a good relationship exists between them. Customers who have a stronger relationship with a business are more socially bonded and more committed to the relationship (Venetis & Ghauri 2004). If relationships are damaged, clients may move to other practices and, therefore, less income may be derived from them. As shown in Table 3.28, the respondents did not feel that their client relationships were compromised as a result of the changes, with all groups scoring the same for this question. This would indicate that veterinarians were able to maintain working relationships with their clients and continue to contribute to their efforts to manage bTB on their farms. There was a significant difference among the age groups for question eight, with the 41-50 years age group differing from most of the other groups. More respondents in this group disagreed (75.00%) that their relationships with their clients had been affected negatively. It is not clear why this particular age group appears to differ from the others. The results need to be interpreted with caution due to the small sizes of these groups being compared with each other.

Question 9 asked whether performing bTB testing had become financially non-viable for veterinary practices because of the reduced remuneration available for providing these services. Providing a service has a cost, including professional time, travel time and consumables. Testing for bTB can be a time consuming undertaking and, if performing testing were to be less profitable, one may conjecture that some practices would prefer to stop providing these services. On the other hand, some may feel that providing this service is very valuable for cultivating a relationship with farmer clients and that not providing these services would be financially damaging. Overall the respondents did not feel that the reduced remuneration made bTB testing non-viable for their businesses (Table 3.31). The delivery partners echoed this positive attitude about the financial viability of bTB testing. The subcontractors with a neutral response did not feel as optimistic about the financial viability of the new arrangements, but were not negative about the impact. It is not known whether the profit margin for subcontractors differs from that of delivery partners or whether the delivery partners incurred significant set up costs as the winners of the tenders. The results for the smaller and larger practices largely mirror that of the delivery partners compared to the subcontractors.

Very few respondents who indicated that they provided bTB testing prior to the changes stopped providing these services (see Figure 2); supporting the results of question 9 where respondents mostly indicated that bTB testing had remained financially viable. Of the three respondents that had stopped bTB testing altogether, all were under the age of 40 years, so have not retired and must have stopped this work for other reasons. It must also have been a financially advantageous move to become a delivery partner, as some respondents were not providing any services before the changes and then

became delivery partners. Changes to a respondent's capacity working with bTB may also have occurred due to moving to a different practice, which could have been unrelated to the changes in bTB testing provision.

The variable considering veterinarians' concerns about the financial implications of the changes to the bTB testing system show that if one considers the questions together, the respondents were not concerned about the financial impacts, despite reduced income (Table 3.55), as indicated by the negative accumulated score of -1. It is understandable that the delivery partner group (score -1) should feel positive about their financial outlook as these practices have seen opportunity for growth and financial gain in this area of veterinary practice and are optimistic that they will see returns on their investments. The larger practices presumably mirror the results of the delivery partners because most of these respondents are delivery partners themselves. One could also argue that being part of a larger practice provides some sort of financial security: if it is not only up to one practitioner to provide income for the business, then individuals may feel less pressure to generate the practice's income. Being part of the larger delivery partner network may also allow respondents to feel more financially secure.

The subcontractor group does not feel as positive as the delivery partner group, but they equally do not feel negative about their financial security after the changes. The subcontractor group has a wide range of responses to this question, likely reflecting a wide range of experiences rather than a strong group opinion. The smaller practices, who are mostly subcontractor respondents, also scored a neutral 0. This is likely a reflection of the subcontractor perspective, but may also be due to increased financial vulnerability of a smaller business. A subcontractor practising in the HRA left the following comment: "At the moment we can still afford to do our own TB testing under the new delivery system, however with the increased costs associated with the delivery partners and the OV re-validation [every] 2 years, and the massively reduced remuneration (especially when dealing with small holders - like many of our clients are) the future is questionable... so a more detailed answer to this question is no - it is not currently a non-viable service for our practice, however I can see it becoming so in the future. "

Respondents were not asked to indicate whether they were employees or practice owners, but knowing this data may have provided an additional interesting perspective to questions about financial perceptions. The priorities of employees will be different to those of practice owners – employees may be more concerned about work-life balance, budget for continuing professional development and their salaries, whereas employers will be concerned with the profitability, work flow and growth of the practice. Practice owners will be more acutely aware of the financial position of the business, whilst employees may remain completely oblivious to this.

4.3.1.3 Variable 3: Attitude towards the government's decision to change bTB testing provision

Questions number one, four and six were used to investigate the variable measuring veterinarians' attitudes towards the government's decision to change bTB testing provision. The questions

investigated three aspects of the changes to bTB provision that could have affected a veterinarian's attitude towards the government: whether they felt that their relationships with their clients were valued, communication from the government during the process and whether they agreed that the new measures would better assure quality assurance of testing. Significant differences were found between delivery partners and subcontractors and smaller practices (≤ 15 veterinarians) and larger (> 15 veterinarians) practices for all three questions. A significant difference was also found between the LRA and Edge Area respondents in question six. No significant changes were shown between the age groups.

Question 1 gauged whether respondents felt that their relationships with their clients were valued by the government. The sample as a whole responded neutrally showing neither a positive nor negative attitude towards the government (Table 3.14), compared to the delivery partners who showed a positive attitude. It would make sense that the group that won the tender for bTB testing provision and who is, therefore, driving the process of bTB testing delivery in England should feel that the government who awarded the tender values their relationships with their clients. In contrast, the subcontractor group indicated a negative attitude towards the government. It is not known from the collected data whether any of the respondents who are acting as subcontractors currently may have applied to tender as delivery partners and were perhaps unsuccessful in their application. If such a situation occurred, it may give rise to negative attitudes purely because of the disappointment of an unsuccessful business venture. It does seem unlikely, however, that all of the respondents identifying as subcontractors would fall into this category. The subcontractor group may feel less connected with the government as they are working with a government appointed company rather than directly with APHA as in the past. The respondents from the larger practices showed the same attitude as the delivery partners and those from smaller practices scored the same as the subcontractors, likely reflecting the strong association between these groups as demonstrated by χ^2 test.

Communication from the government was evaluated in question 4. The sample as a whole felt that they were adequately informed throughout the process (Table 3.20). The subcontractor group's score reflected an overall neutral feeling, whereas the delivery partners' score reflected a positive attitude towards the way the government communicated during the tendering process. It would make sense that the delivery partner group would feel more informed as one would assume that they would have received more communications from the government during the process of tendering. A similar picture is seen with the comparison between the smaller and larger practices.

Question 6 addressed quality assurance of bTB testing under the new measures. The respondents as a whole agreed that bTB testing quality would improve as a result of the changes (Table 3.24), indicating a positive attitude towards the government. Delivery partners responded positively to this question, with over two thirds of this group indicating that they felt that the quality of testing would improve. The new measures include quality assurance measures that one would expect to have a positive effect on bTB testing quality. The delivery partners would be intimately acquainted with the procedures for quality

assurance and would no doubt have great confidence in them. They are also accountable to the APHA for ensuring bTB testing quality. This is likely why such a positive response was seen to this question from this group. The subcontractor group showed a wider range of responses, resulting in a neutral score. The smaller and larger practices and their results mirrored those of the delivery partners compared to the subcontractors. The Edge Area and LRA differed significantly for this question. The respondents from the Edge Area mirrored the general consensus to this question that the quality of bTB testing would improve, whereas the LRA respondents disagreed that this would be the case. The LRA group has the least frequent bTB testing and is seeing the greatest success in seeing bTB incidence reduced. Improved quality of testing may be of lower priority for these respondents as they are already seeing good results from routine bTB control measures.

Comments from respondents shown in Table 4.1 communicate that the standard of bTB testing was perceived by some not to have been of uniform quality in the past and imply that not all practitioners perform testing to the same standard. It is possible that the approach to bTB testing may have varied among respondents as well as the perception of whether bTB testing standards required improving. The comments in Table 4.1 were very positive about the impact that the changes have had on the quality of bTB testing. These respondents felt that the auditing measures and standards provided by APHA and the delivery partners have improved the quality of bTB testing. The matter of on farm facilities for bTB testing was also raised – one practitioner felt that the new required standards have enabled practices to request that their clients improve facilities on farms which results in safer working conditions for veterinarians. When dealing with an emotive subject, differences of opinion are inevitable. Some respondents indicated that they found the new system laborious and did not see the benefits of improved testing quality as others had. One subcontractor from the HRA felt sure that “...many vets will feel somewhat aggrieved that they are jumping through more hoops, filling in more paperwork, being paid less for doing so, and knowing that this will make not a blind bit of difference to the TB situation.”

Table 4.1. Comments from respondents indicating positive effects on quality of bTB testing since implementation of the changes

<p>“There is now far more robust quality control in place than ever before, which in terms of control of TB can only be of benefit.” Subcontractor from LRA</p>
<p>“Quality of testing and a culture of testing to required standard has significantly improved since new tender implementation. Has allowed practices to request and implement better testing facilities on farm with improved H&S [health and safety] and less pressure from farmers on the vet to cut corners. QA [quality assurance] audits spread useful info[rmation] and for OV [official veterinarian] to share knowledge and practical tips.” Subcontractor from HRA</p>
<p>“I think the standard of testing has improved with increased training auditing and focus from APHA and XLFarmcare. - Attitudes are changing across the board with farmers as well as vets recognising the need for high standard of testing and advice.” Practitioner identifying as a veterinary assistant in the HRA</p>

“From watching TB testing as a student the quality of testing has improved and they are many more vets now doing the correct procedure, mainly younger vets. And I feel the training/manuals/auditing process provided from Improve and XLfarmcare has been a huge part of this.” Subcontractor from Edge Area

If the scores for the three questions used to evaluate this variable are added together, a semi-quantitative assessment (shown in Table 3.56) can be made of the various groups' attitudes towards the government as a result of the changes to the bTB testing in England. Overall the respondents felt positive towards the government and the process of making changes. Delivery partners and larger practices (>15 veterinarians) scored the maximum +3; they show the most positive attitude towards the government as a result of the changes made. This group of practitioners has just partnered with the government by committing to tenders to provide the bTB testing for England, and it would make sense that these respondents feel positive towards the government having entered into this partnership. It would be interesting to follow this in more depth as the partnership progresses to see if the good relationship is maintained. The subcontractors' scores indicate a negative attitude towards the government. This group has not entered into a partnership with the government and their responses are much more varied. Two of the questions for this variable had neutral scores and one scored -1 and it is possible that these scores represent the uncertainty felt during the process. If this group could be interviewed in more depth once the system is well established, one could measure whether this attitude improves or worsens. A subcontractor from the HRA made the following comment: “We have felt like technical employees of APHA as a result of this change. Not respected as professionals. It is not the fault of private veterinary surgeons that bovine Tb is out of control - it is politics.” This respondent clearly feels that the fault for lack of progress with bTB control is a matter of policy rather than science. Another subcontractor from the HRA expressed concern about communication and cooperation between the various stakeholders regarding bTB as well as whether the government's focus during making the changes has been helpful: “A mechanism must be found to close the gaps between apha [APHA] farmer and local vet regarding information and management of bovine tb [TB]. The changes have made that harder to attain but overemphasis on cost reduction by government and apha [APHA] will not have that as a priority.” This comment shows that the respondent interprets the motives of the government to be largely focused on cutting costs rather than the control of bTB for the benefit of all stakeholders involved.

4.3.1.4 Evaluation of objective 1

The three variables in the first research objective sought to measure some of the emotional and financial impact that the changes to the bTB testing system had on the respondents. Examining the sample as a whole, the respondents indicated that the process of changing bTB testing provision had a negative impact on them emotionally. The changes did not have a negative impact on them financially or on their attitude towards the government. The emotional impact in terms of stress and anxiety was felt most by the subcontractor group, scoring the highest score possible (+3) for this variable. The delivery partner group indicated that stress was not a significant factor in their experience of the changes to the new system, scoring -2 for this variable. The smaller and larger practices echoed the results of the delivery

partners and subcontractors with some variation seen. On this semi-quantitative scale the financial impact score was neutral for the subcontractors and smaller practices. Some of the comments left by these respondents are detailed in Table 4.2, most of which are very negative. They cannot be presumed to be representative of the whole, but do give interesting insights into the individual's experience. The respondents as a whole, as well as the delivery partners and larger practices indicated that they were not concerned about the financial impact (score -1), it could even be interpreted as optimism about the financial rewards that bTB testing could continue to offer. Certainly for the delivery partners this area of the business would be evolving and growing as processes are improved. The final effect measured in this objective is the attitude towards the government, which can be classified as another emotional parameter. Delivery partners and larger practices scored the maximum +3 showing a positive attitude towards the government. This would indicate that the respondents have had a positive experience initiating and carrying out the work in partnership with APHA. The subcontractors and smaller practices scored -1, showing a negative attitude towards the government.

Comments relevant to this variable were mainly left by subcontractors, yielding a fairly one-sided range of opinions in Table 4.2. Respondents highlight frustrations with communication between practices and the delivery partners and the government, the use of government resources during the process of changing the bTB testing system as well as financial concerns for veterinary practices and farmers.

Table 4.2. Comments from respondents relevant to objective 1

<p>"The transition has been very stressful" Subcontractor from LRA.</p> <p>"The whole exercise in TB tendering wasted lots of valuable resources for no long term tangible gain. TB is out of control and until the GOVERNMENT acknowledges this and takes proper efforts to control the disease ITSELF then it is a very depressing disease. NOT the fault of the farmer and NOT the fault of the Vet." Subcontractor from HRA.</p> <p>"The whole experience has been a nightmare and we are still living with it. It would seem that it is not working as a strategy as we are seeing an increase of TB in our area." Subcontractor from Edge Area.</p> <p>"...communication with xl farmcare and defra [DEFRA] is a nightmare with differing information/not knowing who to contact or being constantly passed from one to another." Subcontractor from Edge Area.</p> <p>"TB control in the UK is an embarrassment to be associated with - As a practising veterinary surgeon we are continually at conflict with our own client, whilst we do try to give advice about legal measures to try to reduce the incidence of TB in their herds, given the current financial climate in agriculture it is difficult to get clients to spend money on badgerproofing their yards/buildings/pastures. We receive little or no communication from APHA about what progress is being made on TB control, don't even get pm [post-mortem] results on animals that we have condemned as reactors, in an easily obtainable form.</p>
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Just a spreadsheet with holding numbers and tag numbers from XL. The reduction in remuneration for TB testing has made it debatable as to whether we will continue to do it or not. There is now more needless paperwork involved for less remuneration, with fines for any late submissions etc. APHA must be pleased with the system that they have managed to create, from our point of view it is not really financially sustainable, and certainly will not be if there is any further reduction in remuneration.”
Subcontractor from HRA.

4.3.2. Objective 2 - Determine how the process of changing bTB testing provision affected farmers emotionally as perceived by veterinarians.

Objective 2 has one variable that is measured by three questions.

4.3.2.1 Variable: Emotional impact of changes to bTB testing provision on farmers

Questions 10, 11 and 12 were used to evaluate the single variable measuring the second objective of the study. Significant differences were found in the responses of the smaller practices (≤ 15 veterinarians) compared to larger practices (> 15 veterinarians) and the subcontractors compared to the delivery partners for all three questions. The Edge Area responses differed significantly from the LRA and HRA for question 10 and there were significant differences between the responses of some of the age groups in questions 10 and 11.

Respondents were asked to comment on three aspects investigating the emotional impact of the changes on their clients: whether farmers' needs were being met under the new system, whether uncertainty about who would be providing bTB testing had been stressful for farmers and whether farmers had been concerned that testing may not be performed by their own veterinarians.

In response to question 10, all groups indicated that they felt that their clients' needs were being met by the new system (Table 3.33), indicating that this factor was not perceived to impact farmers' emotions negatively. Despite many differences of opinion, the majority of respondents felt that farmers are being looked after under the new system. The differences between the age groups can be challenging to interpret as there is not one group that stands out clearly as being different from all of the rest of the groups. The group sizes were also very small, so it is not clear whether the findings are representative of the rest of the population. The older veterinarians had a higher proportion of positive answers which may reflect their confidence in their own abilities compared to their younger colleagues (Table 3.35). All three bTB risk zones indicated that their clients' needs were being met, but the Edge Area differed significantly from the LRA and HRA for this question. Table 3.34 shows a much higher proportion of positive responses from the respondents in the Edge Area compared to the LRA and HRA. In the period between March 2016 and March 2017 the number of new bTB herd incidents decreased in the HRA (-3%) and LRA (-24%), but increased in the Edge Area (+12%) (DEFRA 2017). This questionnaire was completed during November 2016, towards the end of this period. A greater proportion of negative responses rather than positive responses would have been expected from the Edge Area if the statistics

are considered. The Edge Area has much more stringent testing in some areas and it may be that this is the reason for the positive attitude towards bTB control in this risk zone, despite an increase in new herd incidents.

In question 11, the sample as a whole responded neutrally as to whether uncertainty regarding which veterinarian would be delivering bTB testing was a source of stress for farmers (Table 3.37). The subcontractors and respondents from smaller practices felt that the uncertainty during the changes to bTB testing delivery had a negative emotional impact on their clients. Conversely, a greater proportion of delivery partners and those from larger practices disagreed that there had been a significant negative emotional impact on their clients as a result of uncertainty surrounding the changes. This echoes the results from question 4 where delivery partners had indicated that they themselves had felt adequately informed regarding the changes being made to bTB testing provision and subcontractors had indicated a neutral response. It can be postulated that if delivery partners felt informed regarding the changes, that they would have passed relevant information on to their clients in order to manage expectations and aid them through the transition. It is important to note that these are opinions and perceptions being measured and that it is entirely possible that the information was available at appropriate times to the relevant people. The scores for larger practices and smaller practices likely reflect the differences between the responses of delivery partners and subcontractors.

Question 11 showed differences between the responses for some of the age groups. The 41-50 years age group differed significantly from the 23-30, 51-60 and 61+ age groups. It would appear that the 41-50 years group did not agree that the communication about the changes to bTB testing negatively affected their farmer clients' emotions. The group was examined further to determine how many respondents in this category were delivery partners compared to subcontractors. Of the 29 respondents in this age category, 8 are delivery partners and 17 are subcontractors. It appears unlikely, therefore, that this group is merely reflecting the results of the delivery partner group. As the groups are small, it is also possible that the result is not representative of the general cattle veterinarian population of this age group.

The sample as a whole indicated in response to question 12 that the majority felt that their clients were concerned that their own veterinarians would not be carrying out their bTB testing (Table 3.39), thus impacting farmer emotions negatively. The subcontractors and respondents from smaller practices echoed this sentiment, whilst the delivery partners responded neutrally. The respondents from the larger practices indicated that their clients were not concerned that their own veterinarian may not carry out their bTB testing. For this question it is possible that the difference between smaller and larger practices' responses is truly due to practice size. It is the author's personal experience in small animal practice that clients that attend larger practices are more used to seeing a range of veterinarians as there are more available. These clients are more comfortable with seeing a variety of veterinarians compared with smaller or single veterinarian practices, where a new face may be less welcome. It is possible that farmers that use these larger practices have other concerns regarding bTB rather than which veterinarian attends their herd for bTB testing.

If the whole sample is considered, the totalled scores for this objective equals zero, indicating no positive or negative effect on farmer emotions. Evaluation of this variable more accurately requires closer examination of the demographic groups, as opposite experiences are identified within the sample. Table 3.57 shows that the larger practices and delivery partners scored +3 and +2, respectively. These scores imply that these veterinarians have observed a positive effect on their farmer clients in response to the bTB testing changes. It is possible that this perception originates from positive interactions whilst keeping their clients abreast of changes and managing expectations well. The subcontractors and smaller practices scored -1, showing that these practitioners recognised a detrimental impact on their farmer clients emotionally. It is not known whether respondents' own personal opinions or anxieties have affected how they perceive the emotional impact on their clients. It is possible that those respondents who identified a negative impact on themselves as a result of the changes could project these negative thoughts onto their clients, making them less objective assessors of their clients' emotional states. Complementary projection is the assumption that other people have the same thoughts and responses that you have and can lead one to assume that other people are more like you than they are in reality (Changingminds.org 2016). It is possible that complementary projection caused some respondents to answer these questions in a biased way, which is a risk of asking people to assess how they perceive the experiences of others.

4.3.3. Objective 3 - Determine farmer attitude to veterinary surgeons providing bTB services on their farms.

Objective 3 is measured by one variable: Level of trust in veterinarians' knowledge and skills. This variable is investigated using questions 13, 14, 15 and 16. Significant differences were found between smaller and larger practices for questions 13, 14 and 16 and between delivery partners and subcontractors for questions 13 and 14. There were some differences in responses when comparing bTB risk zones, with differences between the Edge Area and LRA for question 14 and the LRA and HRA for question 16. The responses from those practitioners in the South West differed significantly from those of the rest of England for question 16. Significant differences between the 41-50 year age group and 23-30, 31-40 and 61+ years were found only for question 14.

4.3.3.1 Variable: Level of trust in veterinarians' knowledge and skills

Farmers' trust in their veterinarians' skills was assessed by examining the confidence farmers have in bTB testing if performed by a familiar veterinarian, whether respondents felt that their advice could help their clients overcome bTB as well as the value of long term relationships with clients.

In question 13 the sample as a whole agreed that familiarity with a veterinarian correlated with a client's confidence in bTB testing (Table 3.41). Delivery partners, subcontractors and respondents working in smaller practices felt the same, whilst those from larger practices responded neutrally. Although nearly half of the respondents from larger practices did agree that clients have more confidence in bTB testing done by a familiar veterinarian, this is a lower proportion than for the other groups considered for this

question. It appears, similar to question 12, that there is a lower value placed on individual veterinarian relationships with a client rather than the practice's relationship with a client, accounting for the neutral score for this group.

One veterinarian from the HRA (no capacity with working with bTB identified) left a comment detailing a personal experience of bTB testing from their perspective as a cattle farmer: "our farm is just outside the area where recent badger culling took place in Cornwall. I was an LVI [Local Veterinary Inspector] and have done TB testing on many farms in the Bodmin practice area in the past. I firmly believe that the full impact of coping with the disease cannot be appreciated until you have experienced it from the farmer's side. As far as testing itself is concerned we have had our short interval tests conducted by our local practice, DEFRA vets and a DEFRA lay tester. Once you find that the tester is doing the job itself well and efficiently, then the next consideration is how they can relate to us humans. That side of it should not be underestimated as we really appreciate continuity and will request that the same person continues to do our subsequent tests if possible." This respondent emphasises the importance of the relationship between the farmer and the person performing the bTB testing. Another respondent, a private bTB tester working in the HRA felt strongly about the value of a familiar person performing the testing due to the inherent stress that bTB testing causes on the farm. "Tb [sic] testing is an extremely stressful time and to have a complete stranger or worse a vet who they have already had a relationship break down with... on their farm to do their test makes the situation unbearable." This respondent highlights an issue where a farmer was unable to have their own veterinarian perform their testing because of a "contractual issue".

A subcontractor from the LRA introduces a problem that they have been struggling with: "Normal vets have to go out and retest IRs [inconclusive reactors] - strains relationships as before a DEFRA vet used do this but if there is a problem it [is] now the normal vet who has to still maintain a working relationship while condemning a farm due to reactors. Have lost clients over this." This respondent highlights how they have found responding to bTB breakdowns on their clients' farms a challenge. Placing a farm under movement restrictions and condemning animals to slaughter would cause financial loss to the farmer and it is understandable that the veterinarian would find that this strains relationships.

The majority of respondents agreed, in response to question 14, that farmers had more confidence in their bTB testing competence if they were familiar to these clients (Table 3.43). The subcontractors and respondents working in smaller practices as well as those in the LRA echoed this result. There was a wide range of responses for the delivery partners and those working in larger practices resulting in a neutral response, likely reflecting individual opinions and practice environments rather than a unifying factor affecting this group as a whole. The Edge Area also showed a neutral response (Table 3.44). The Edge Area is subject to frequent testing, which may make it less likely that the same veterinarian will arrive on the farm at each occasion for routine herd testing. This may be why the practitioners in the Edge Area had more diverse responses to this question. There is a significant difference between the responses of the 41-50 years age group, who gave a neutral response to this question, and some

of the other age categories who agreed that farmers were more confident in familiar veterinarians. It is not clear why the 41-50 years age group would differ from the others for this question. The group sizes are relatively small, so these differences may be coincidental.

The matter of bTB testing quality is explored by a delivery partner in the Edge Area who shares their experience of farmers demanding the highest quality of service, irrespective of who delivers this: “Ref [sic] the question regarding whether farmers think their own vet will do the best job of TB testing, that entirely depends on how testing is conducted by that vet. We have had a strong culture of testing to high standards for many years, and have often had comments from non-clients that their vets were not as stringent. Once TB reactors have been found, our experience is that farmers want the testing done as stringently as possible so as not to leave infected animals on farm, and not all farmers believe their own vets will do that job properly.” Another respondent, a delivery partner from the HRA, had concerns about when it could be disadvantageous for a farmer’s owner veterinarian to perform bTB testing. “Although I understand why farmers like to have their own vet doing TB tests and for some farms it’s there [sic] only contact with their vet, I think it can have a negative impact on the quality of the test as we have a vested interest.” It appears that the respondent implies that the desired outcome of the test would affect the way the veterinarian would perform the test. This possibly implies that this respondent sees a risk of confirmation bias occurring if veterinarians perform bTB testing on farms with which they are familiar.

There were no significant differences between any of the groups for question 15; all respondents agreed that the trust between a veterinarian and a farmer client is an important part of a successful professional relationship (Table 3.46).

Table 3.48 shows that the sample as a whole, as well as delivery partner and subcontractor groups and respondents from smaller practices, agreed that their clients did feel that their veterinarians’ advice would help them to overcome bTB (question 16). This shows confidence in the knowledge and skills of the veterinarians. The larger practices showed a neutral attitude to this statement. It is possible that veterinarians in larger practices have less personal relationships with individual farmers and feel less like a key member of the team working to combat bTB. This is the only question where a significant difference exists for the South West compared to the rest of the country. Table 3.49 shows that a greater proportion of respondents from the South West disagreed that their clients felt that their advice could help them to overcome bTB. The South West has historically had the highest incidence of bTB, with pockets of infection remaining when the rest of England was virtually free of disease in the 1970s (DEFRA 2014b). The HRA, which includes the South West, has seen continued increased incidence and prevalence of disease, although this has slowed since 2012. The infection is also endemic in the local wildlife population (DEFRA 2017). It is not surprising that there is a degree of despondence regarding overcoming bTB in the South West compared to the rest of England. The greater proportion of negative responses in the larger practices does not appear to be connected to the location of the practice as relatively equal numbers of respondents from practices with more than 15 veterinarians

responded from the South West compared to the rest of England (South west n = 17, rest of England n= 18). The LRA and HRA differed significantly in their responses to question 16. Although both groups were positive about their role, a far higher proportion of respondents from the LRA indicated that they felt that they could help their clients overcome bTB compared to the respondents from the HRA (Table 3.50). This is not surprising and would reflect the optimism of the LRA respondents that are facing imminent OTF status in some areas (Anon 2017). Equally, those respondents from the HRA may feel frustrated and in some cases unable to help their clients to reduce bTB incidence or breakdowns.

This objective aimed to evaluate the attitude of farmers to veterinarians performing bTB testing on their farms as perceived by the veterinarians performing the testing. On the whole the attitudes towards the veterinarians were very positive and veterinarians largely felt that they are trusted by their clients and that farmers have confidence in their skills, particularly if they are familiar to them. This scale is subjective and semi-quantitative, so the weightings of the scores in Table 3.58 cannot be over-interpreted. The respondents evaluated as a whole scored the maximum positive score of +4. The subcontractors and smaller practices scored the same. Delivery partners scored +3, with a neutral score for question 14. The larger practices only scored +1 for this objective. The difference in accumulated scores between the larger practices and delivery partners indicates that these groups did not mirror each other for these questions as they appeared to have for the previous variables measured. It appears that the dynamics of working in a larger practice had more influence on the responses than in other questions. It is possible that veterinarians in smaller practices have more of an opportunity to develop closer personal relationships with their farmer clients and, therefore, felt more positive about their roles in helping farmers to maintain the health of their livestock.

4.3.4. Objective 4 - Examine farmers' relationship with the government

This objective was measured by a single question, question 17. One cannot measure a whole population group's attitudes about a complex matter using one question, but this was included to add to the picture regarding the effects of the changes to bTB testing on farmers. Significant differences were found between smaller and larger practices, delivery partners compared to subcontractors as well as the Edge Area compared to the LRA and HRA. Significant differences between some of the age groups were also found.

The response of the sample as a whole to question 17 reflected a perceived negative attitude of farmers towards the government (Table 3.52). The results of the subcontractors and smaller practices echoed this result. One can argue that a negative attitude toward the government may foster scepticism in its ability to control bTB. There was a high variation of responses among the delivery partners and respondents from larger practices, resulting in a neutral score for this question. The subcontractor result reflects what has been found by previous researchers (Enticott *et. al* 2012) that farmer levels of trust in the government are poor. The difference between the responses of the delivery partners and the

subcontractors may indicate the respondents' own opinions rather than that of the farmers, which is unavoidable when asking a respondent to indicate another person's attitude or opinion.

The respondents in the LRA and HRA indicated that their farmer clients, on the whole, perceive the government more negatively than those respondents in the Edge Area who showed a neutral response (Table 3.53). Between June 2016 and June 2017 the HRA and Edge Area have seen an increase in herd incidence and prevalence. The Edge Area has also seen a 1% rise in new herd incidents, whilst the HRA saw a 1% drop. The bTB incidence and prevalence in the HRA is consistently higher than in the Edge Area and LRA (DEFRA 2017). These statistics would explain why those in the HRA viewed the government negatively. This could also explain why those in the Edge Area showed a range of responses, resulting in a neutral score. The LRA continued to experience a low herd incidence and prevalence and a 23% reduction in new herd incidents between June 2016 and June 2017 (DEFRA 2017). The negative score for the LRA respondents may reflect a general despondency or negative attitude to bTB rather than being a reflection of progress in combating the disease in that area. A subcontractor from the LRA left the following comment: "Many farm clients felt that the tender was not done with them in mind and rather for business reasons. They have little faith in APHA advice and find it hard to get in touch with relevant people." This respondent highlights several practical problems that can affect farmer confidence in the government, as well as a perception of the motivation for the changes. Another respondent, identifying as a veterinarian from the HRA introduces an important angle of the government's relationship with farmers: "Defra's relationships re[garding] tb and farmers is poor regarding TB not because of the tender but because of the core issue of Badger control..." Badger control is a very polarising topic that was not investigated in this study, but is very important in bTB control, particularly in the HRA.

There were several age groups that differed significantly from one another, but there is no clear pattern with the differences between these groups and it is not clear whether these statistical differences are meaningful. It is important to remember that this question requires veterinarians to relay what they think their clients are feeling or what they may have expressed to them, rather than a true measure of farmer attitude.

4.4. Conclusions relating to the hypotheses

4.4.1. Hypothesis 1: The changes to bTB testing provision have negatively impacted veterinary businesses. Practices have lost an income stream or it has been devalued

Investigation of this hypothesis relates to the second variable ('Concern about financial sustainability as a result of the changes') of the first objective, which was measured using questions seven, eight and nine. Table 3.55 shows that the sample as a whole disagreed that they had experienced a detrimental financial impact as a result of the changes to bTB testing. The delivery partner group and larger practices also disagreed that there was a negative financial impact. The subcontractor group, who consistently differed from the delivery partner group, and the smaller practices, who consistently differed

from the larger practices, had a neutral response for this variable. This shows that, although they did not feel positive regarding the financial impact of the changes, they did not rate the financial impact as detrimental. The results do not support this hypothesis.

One respondent, a delivery partner from the HRA, clearly saw the opportunity to grow and adapt despite changes and challenges: “The world changed and the veterinary profession as a whole did not so instead of moaning about the situation, vets just need to get on with it, and, if necessary, adjust their business to the changing market. Since when were vets a protected species when it comes to business? Their farming clients certainly are not protected and have to adjust all the time.” An important matter is raised - any business needs to adapt to a changing market.

4.4.2. Hypothesis 2: Farmers place greater value on advice about bTB provided by veterinarians with whom they have an established relationship than with professionals that are unknown to them

The third objective provided most of the evidence to examine the second hypothesis. Questions 11 and 12 were also considered relevant, which meant that six of the questions related to the second hypothesis. Each question is considered individually below to determine whether the hypothesis is accepted or rejected.

Table 3.37 shows the scores for question 11, where respondents indicated whether uncertainty about which veterinarian would be performing bTB testing was stressful for farmers. The sample as a whole provided a neutral response. Question 12 required respondents to assess whether farmers had expressed concern that their bTB testing would not be performed by their own veterinarians. Table 3.39 shows that the respondents as a whole felt that this was a concern for farmers. Respondents were asked in question 13 whether they agreed that farmers had the most confidence in bTB tests performed by a familiar veterinarian. Table 3.41 shows that the respondents agreed that this was the case. Table 3.43 shows the responses for question 14, which requested that respondents indicate whether farmers had more confidence in their ability to perform bTB testing if they had visited a farm before. The sample as a whole agreed that this was their experience. Table 3.46 shows the response scores for question 15, indicating that the respondents agreed that their long term relationships with clients were successful due to the trust built between parties over that time. Question 16 required respondents to indicate whether they felt that their advice would help their clients overcome bTB. The results in Table 3.48 showed that veterinarians felt that their advice was valuable.

Table 4.3. Scores measuring hypothesis 2 - Farmers place greater value on advice about bTB provided by veterinarians with whom they have an established relationship than with professionals that are unknown to them

	Overall	Delivery partners	Subcontractor	Larger practices	Smaller practices
Question 11	0	-	+	-	+
Question 12	+	0	+	-	+
Question 13	+	+	+	0	+
Question 14	+	0	+	0	+

Question 15	+	+	+	+	+
Question 16	+	+	+	0	+
Totals	+5	+3	+6	+1	+6

The responses of each question were given a score, which is represented in Table 4.3. If the response supported the hypothesis a positive score was assigned, if the response did not support the hypothesis a negative score was assigned and if the response was neutral the score assigned was zero. The scores are shown for the sample overall, as well as for the groups that consistently differed. All of the scores are positive, showing agreement with the hypothesis, which is accepted. The larger practices scored the lowest +1. In a larger practice one is more likely to have fluidity with regards to which veterinarian will see a client, so these practitioners would naturally place less emphasis on the relationship of the farmer with the individual familiar veterinarian. The maximum scored (+6) was obtained by respondents from smaller practices (of which most work as subcontractors), further supporting the idea that veterinarians from smaller practices are more likely to develop closer and more personal relationships with their clients.

4.5. Conclusions and recommendations

The changes made to bTB testing provision significantly altered how testing is delivered to farms in England. This study sought to examine the effects of the changes on veterinarians and found that the experiences were not uniform across the study population. The results of this questionnaire showed consistent differences between the experiences of veterinarians working as delivery partners compared to those working as subcontractors as well as between those who are part of larger practices (>15 veterinarians) compared to those in smaller practices (≤ 15 veterinarians). The differences were noted particularly in how the changes affected veterinarians emotionally and financially as well as how veterinarians perceived the effects on farmers emotionally. Despite the differences, the hypothesis that the changes negatively affected veterinary businesses was rejected. The relationship between farmers and veterinarians was also examined, showing much more uniform responses across the sample. The hypothesis that farmers place greater value on advice about bTB provided by veterinarians with whom they have an established relationship was upheld.

Social research such as this can highlight potential shortcomings of a policy change and allow for recommendations for improvements to be made for potential future changes. This study shows that the changes were experienced more negatively by veterinarians working as subcontractors. These respondents perceived that the changes had been poorly organised and that insufficient time had been allowed to implement them. They also felt that their clients had experienced stress and uncertainty as a result of the changes. This group did not feel that their relationships with their clients were valued by the government and indicated an overall negative attitude towards the government. During the process the BVA and BCVA had highlighted the perceived short timeframe for the changes and had requested that the government allow a one month extension before their implementation (Anon 2015e). The results

of this questionnaire show that had this request been granted, some aspects of the process perceived negatively by subcontractors may have been avoided. The veterinary associations seek to represent their members and greater cooperation between the government and these associations may aid future changes to animal health legislation. This study showed that veterinarians place great value on their relationships with their clients and the perception that the government did not value these partnerships exposed some negative emotions. Greater investment in communications that reinforce the importance of all veterinarians in the future of bTB control may have resulted in subcontractor veterinarians feeling more valued with a more positive attitude towards the government. Identifying if any potential changes to animal health policy pose a risk of disadvantaging a particular sector of the veterinary community can help to develop a preventative communication strategy and seek to minimise negative experiences for veterinarians.

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6. APPENDICES

6.1. Appendix A – Letter of invitation to survey participants

49 Old Turnpike
Fareham
Hampshire
PO16 7HB
01329 220059
07762249061
kgerbervet@gmail.com

Dear colleague,

Questionnaire for MSc research about bovine TB

I am a veterinary surgeon undertaking an MSc (Animal/human/ecosystem health) degree through the University of Pretoria, South Africa. As I practise in the UK I chose to investigate an issue relevant to our veterinary community for the research component of the course. I have elected to investigate how the 2015 changes to provision of bovine tuberculosis testing have affected veterinarians and farmers in England. As part of this investigation, I am seeking the opinions of veterinarians who work with cattle through the use of a questionnaire.

Bovine tuberculosis is arguably the biggest challenge faced by the agricultural sector in Britain. Despite strict control measures, this disease continues to spread and cripple farming enterprises. New tools are required to complement those already in use to combat this often feared disease. Social research is being used increasingly in this field to understand the factors that govern decision making and success or failures regarding implementation of tuberculosis control measures on farms. The aim of this research is to contribute to this knowledge to aid the fight against bovine tuberculosis.

Below is a link to an electronic survey. It would be greatly appreciated if you could complete this survey by clicking on the link below. It should take no longer than fifteen minutes to complete. If you would prefer a paper copy, please do not hesitate to contact me and I shall send one by post. Your confidentiality will be protected and no responses will be linked to you personally in the publication of the results. If you wish to receive an electronic copy once it has been accepted for publication, please indicate this at the end of the questionnaire.

Thank you very much for your assistance, it is greatly appreciated.

Kind regards,

Karen Gerber

Researcher: Karen Gerber

Supervisor: Prof. Anita Michel (Department of Veterinary Tropical Diseases +2721 529 8269)

Co-supervisor: Prof. Dirk Pfeiffer (Royal Veterinary College)

<http://www.smartsurvey.co.uk/s/8YBKC/>

6.2. Appendix B – Questionnaire

Informed consent

Information that you provide while answering this questionnaire will only be used for the purposes of this project. The results will be used for the investigator's MSc thesis and may lead to publication of findings in a scientific journal.

All survey answers will be stored securely in a password-protected electronic database that will only be accessible to the researchers. Any personal information held will be destroyed once the study has been concluded. No personal information will be disseminated in any written or oral publication or presentation.

Participation in this questionnaire is voluntary and you are able to withdraw from answering further questions or abstaining from answering certain questions at any time.

Please tick this box to agree to the above terms and to provide consent to the use of your answers in this research.

Provision of tuberculosis testing for cattle in England

In May 2015 significant changes were made to the way that bovine TB testing services are delivered in England. **Tenders** were awarded for the delivery of these services through **delivery partners** in five geographical lots. After the invitation to tender was announced in July 2014, the successful applicants were announced in mid February 2015 with services commencing on 1 May.

Practices not part of the delivery partner consortium of practices could become **subcontractors**, paid directly by the delivery partners.

How would you respond to the following statements?

1. When the government invited tenders for TB testing services, it emphasised the importance of the vital partnership between livestock farmers and their vets. The way the changes took place made you feel that your relationships with your clients were valued by the government.
 - Strongly disagree
 - Disagree
 - Neither agree nor disagree
 - Agree
 - Agree strongly
 - Don't know
 - Not applicable

2. The process of tendering, subcontracting and initiating the new system for delivering TB testing was poorly organised.
 - Strongly disagree
 - Disagree
 - Neither agree nor disagree
 - Agree
 - Agree strongly
 - Don't know

3. The process of changing delivery of TB testing was a stressful experience for many veterinary surgeons.
 - Strongly disagree
 - Disagree
 - Neither agree nor disagree
 - Agree
 - Agree strongly
 - Don't know

4. Adequate information was released about how the changes would be made. You felt informed about the process and how the changes would affect you.
- Strongly disagree
 - Disagree
 - Neither agree nor disagree
 - Agree
 - Agree strongly
 - Don't know
 - Not applicable
5. Finalising contracts for subcontractors happened very quickly and felt rushed. This did not allow enough time to consider the contracts and seek legal advice if required.
- Strongly disagree
 - Disagree
 - Neither agree nor disagree
 - Agree
 - Agree strongly
 - Don't know
 - Not applicable
6. The Animal and Plant Health Agency (APHA) has stated that the new system will better assure the quality of tuberculin testing provision. To what extent do you agree with this statement?
- Strongly disagree
 - Disagree
 - Neither agree nor disagree
 - Agree
 - Agree strongly
 - Don't know
7. The process of changing TB testing provision damaged your veterinary practice financially.
- Strongly disagree
 - Disagree
 - Neither agree nor disagree
 - Agree
 - Agree strongly
 - Don't know
 - Not applicable
8. The change to the provision of TB testing has damaged your relationships with your clients.
- Strongly disagree
 - Disagree
 - Neither agree nor disagree
 - Agree
 - Agree strongly
 - Don't know
 - Not applicable

9. Under the new delivery system, many veterinary practices have received less remuneration for carrying out TB testing. This change has made TB testing non-viable for your practice.
- Strongly disagree
 - Disagree
 - Neither agree nor disagree
 - Agree
 - Agree strongly
 - Don't know
 - Not applicable
10. The needs of your clients are being met under the new TB testing system
- Strongly disagree
 - Disagree
 - Neither agree nor disagree
 - Agree
 - Agree strongly
 - Don't know
 - Not applicable
11. The time of transition to the new TB testing delivery system led to uncertainty about who would be providing bTB testing. This was stressful for your farmer clients.
- Strongly disagree
 - Disagree
 - Neither agree nor disagree
 - Agree
 - Agree strongly
 - Don't know
 - Not applicable
12. During the transition farmers expressed their concern to you that future TB tests would not be carried out by their own vets.
- Strongly disagree
 - Disagree
 - Neither agree nor disagree
 - Agree
 - Agree strongly
 - Don't know
 - Not applicable
13. Farmers have most confidence in TB testing if carried out by the veterinarian of their choice
- Strongly disagree
 - Disagree
 - Neither agree nor disagree
 - Agree
 - Agree strongly
 - Don't know
 - Not applicable

14. Farmers are unsure of your competence if you have not visited their farm before. This affects the confidence they have in you performing TB testing.
- Strongly disagree
 - Disagree
 - Neither agree nor disagree
 - Agree
 - Agree strongly
 - Don't know
 - Not applicable
15. Your long term relationships with clients have been successful primarily because they trust you as a professional and a valuable part of their enterprises.
- Strongly disagree
 - Disagree
 - Neither agree nor disagree
 - Agree
 - Agree strongly
 - Don't know
 - Not applicable
16. Your clients feel that your advice can help them overcome TB.
- Strongly disagree
 - Disagree
 - Neither agree nor disagree
 - Agree
 - Agree strongly
 - Don't know
 - Not applicable
17. The uncertainty surrounding the provision of testing while the tenders were being finalised negatively affected DEFRA's relationship with farmers.
- Strongly disagree
 - Disagree
 - Neither agree nor disagree
 - Agree
 - Agree strongly
 - Don't know
 - Not applicable

Finally, we'd like to understand more about you and your practice.

1. Please describe your practice environment.
 - Farm work only
 - Mixed practice (fairly even mix)
 - Mostly small animal with some large animal work
 - Mostly equine with some small animal and farm work
 - Academic
 - Government
 - Other (please specify) _____

2. How many veterinarians (full time equivalent) work in your practice? _____

3. Which best describes the capacity in which you work with bovine TB?
 - Delivery partner
 - Subcontractor to delivery partner
 - Government
 - Don't currently carry out work with TB
 - Other (please specify) _____

4. Did you perform testing for bovine TB on farms in England prior to the changes in TB testing delivery in 2015?
 - Yes
 - No

5. In which risk zone for bovine TB do you work most often?
 - Low Risk Area (LRA)
 - High Risk Area (HRA)
 - Edge Area

6. In which county is your practice located? _____

7. How many years have you been practising as a veterinary surgeon? _____

8. Are you
 - Male?
 - Female?

9. What is your age?
 - 23-30
 - 31-40
 - 41-50
 - 51-60
 - 61+
 - Prefer not to say

10. Where did you obtain your veterinary qualification? _____

11. **OPTIONAL** If you have any further comments to add, please use the space provided below.

12. This research may lead to publication of findings in a scientific journal. Would you like to receive a copy of the findings? If you answer yes, please include an email address.

Yes

No

Email address: _____

This is the end of the questionnaire. Thank you again for your participation.

6.3. Appendix C – Letters from Ethics Committees



**UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA**

ANIMAL ETHICS COMMITTEE

Private Bag X04
0110 Onderstepoort

Tel +27 12 529 8434 / Fax +27 12 529 8300
e-mail: aec@up.ac.za

Ref: V043-16

Prof A Michel

Department of Veterinary Tropical Diseases

Faculty of Veterinary Sciences

Dear Prof Michel

V043-16 : Changes to the provision of bovine tuberculosis testing in England and the effects on veterinarians and farmers (K Gerber)

Noted, but no certificate can be issued, since the study is done in the UK. In addition, since no animals are involved in the study, the committee cannot grant approval. Approval may to be required from medical ethics

Kind regards

A handwritten signature in black ink, appearing to read 'John V Naidoo', enclosed in a simple oval scribble.

Prov V Naidoo Deputy Dean: Research and

Postgraduate Studies Director: Biomedical

Research Centre

Faculty of Veterinary Sciences

Karen Gerber
Uni of Pretoria

09 August 2016

Dear Karen

URN 2016 1577 - Project Title: Changes to the provision of bovine tuberculosis testing in England and the effects on veterinarians and farmers

Duration: 2016 August - 4 months

Location: Online/postal


I am pleased to advise that this project has been ethically reviewed by the Clinical Research Ethical Review Board (CRERB) and that ethical approval has been granted. Please ensure that you put your reference (URN) number on any documentation relating to the study and indicate that ethics approval has been given by the Clinical Research and Ethical Review Board at the Royal Veterinary College. You also need to keep a copy of this letter in the study file.

One of the conditions of approval is that reports are provided to the Clinical Research Ethical Review Board on how the project is progressing. If the study is less than 12 months, the report should be submitted upon completion of the study. Please e-mail the report to me upon completion.

I note that your project is anticipated to take 4 months. I have therefore scheduled your report for the January 2017 meeting. This means I will need your written report by late December 2016. I have attached a template for the report so that you can see the type of information the Board is interested in hearing about.

We hope that your project goes well and look forward to hearing about it. If you need to make any changes to the project, then please contact me for an amendment form.

Yours sincerely



Liz Wilkinson
Secretary: Clinical Research Ethical Review Board

cc - Dirk Pfeiffer

Enc: progress report template

6.4. Appendix D – Tabulated results for questions 1 – 17

Question 1

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
Practice type							
Farm work only	21	27	18	19	16	7	2
Mixed (even)	12	20	7	14	15	0	2
Mixed mostly large	0	3	1	1	0	0	1
Farm and equine	1	1	0	1	0	0	0
Mostly small animal	2	1	0	0	0	0	0
Academic	0	1	0	0	0	0	0
Other	0	0	0	0	0	1	1

Working with TB							
Delivery partner	5	8	10	20	11	3	1
Subcontractor	27	43	15	12	19	2	2
Private only	2	1	0	0	0	0	0
Don't currently	0	1	0	1	0	1	0
Other	1	0	0	2	1	2	2

Test prior to change?							
Yes	34	48	23	28	31	6	3
No	2	4	3	7	0	2	3

Risk zone							
HRA	19	33	14	24	17	5	3
LRA	11	13	7	7	4	1	1
Edge Area	6	7	3	4	9	2	1

Gender							
Male	26	27	13	15	23	1	3
Female	9	25	12	19	6	5	3

Age							
22-30	9	12	8	12	0	4	3
31-40	7	21	7	12	13	1	1
41-50	7	5	6	4	6	1	0
51-60	9	8	2	4	6	0	1
61+	3	5	0	0	0	0	0
Prefer not to say	0	0	1	2	4	0	1

Place of qualification							
UK	32	47	19	29	21	5	5

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
EU not UK	1	2	2	2	0	1	0
Outside EEA	0	1	0	0	0	0	0

Years in practice							
1 year or less	0	1	2	1	0	1	1
>1-5 year	8	10	5	9	4	3	1
>5-10 years	3	12	5	11	5	0	3
>10-20 years	8	15	8	7	6	2	0
>20-30 years	10	6	3	3	9	0	0
>30 years	7	7	1	3	2	0	1

Size of practice							
1 person	1	1	0	0	0	0	0
>1-4	5	10	3	3	3	2	0
>4-10	16	27	7	10	7	0	1
>10-15	10	7	4	7	8	1	2
>15-20	1	2	6	5	4	1	0
>20	3	4	5	7	6	1	1

County classification							
South West	7	12	6	10	7	4	2
Other England	23	29	12	21	12	1	1
UK other	2	5	2	2	0	0	2
Not classified	4	7	6	2	16	5	2

Question 2

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
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Practice type							
Farm work only	22	19	17	19	22	11	0
Mixed (even)	21	10	10	14	12	3	0
Mixed mostly large	0	0	1	3	1	1	0
Farm and equine	1	0	0	1	1	0	0
Mostly small animal	0	0	0	2	1	0	0
Academic	0	0	1	0	0	0	0
Other	0	0	0	0	0	2	0

Working with TB							
Delivery partner	18	15	10	7	4	4	0
Subcontractor	23	12	16	30	31	8	0
Private only	0	1	0	1	1	0	0
Don't currently	0	1	0	0	1	1	0

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
Other	2	0	1	1	0	4	0

Test prior to change?							
Yes	41	27	24	37	33	11	0
No	3	2	5	2	3	6	0

Risk zone							
HRA	25	17	16	25	20	12	0
LRA	6	7	6	12	9	4	0
Edge Area	11	5	5	2	8	1	0

Gender							
Male	31	15	17	15	24	6	0
Female	10	14	9	23	13	10	0

Age							
23-30	5	8	7	13	5	10	0
31-40	18	11	6	8	16	3	0
41-50	8	4	4	4	7	2	0
51-60	6	2	4	10	7	1	0
61+	0	1	3	2	2	0	0
Prefer not to say	4	2	2	0	0	0	0

Place of qualification							
UK	31	25	21	32	33	16	0
EU not UK	0	0	4	2	2	0	0
Outside EEA	0	0	0	0	1	0	0

Years in practice							
1 year or less	2	1	1	0	1	1	0
>1-5 year	7	5	5	12	3	8	0
>5-10 years	7	11	5	5	8	3	0
>10-20 years	11	5	8	8	12	2	0
>20-30 years	9	4	4	5	8	1	0
>30 years	2	2	3	8	5	1	0

Size of practice							
1 person	0	0	0	1	0	1	0
>1-4	2	3	2	5	11	3	0
>4-10	12	8	13	16	15	4	0
>10-15	10	6	4	7	8	4	0
>15-20	7	4	5	3	0	0	0

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
>20	7	6	2	6	3	3	0

County classification							
South West	6	11	7	9	10	5	0
Other England	22	12	12	23	24	6	0
UK other	0	2	4	3	1	3	0
Not classified	20	4	6	4	2	6	0

Question 3

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
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Practice type							
Farm work only	17	10	12	28	39	3	0
Mixed (even)	11	10	4	18	24	3	0
Mixed mostly large	0	0	0	1	4	1	0
Farm and equine	1	0	0	0	2	0	0
Mostly small	0	0	0	1	2	0	0
Academic	0	0	0	1	0	0	0
Other	0	0	0	0	0	2	0

Working with TB							
Delivery partner	13	12	7	13	10	2	0
Subcontractor	14	7	8	31	57	3	0
Private only	0	0	0	2	1	0	0
Don't currently	0	0	0	2	1	0	0
Other	1	1	0	1	1	4	0

Test prior to change?							
Yes	27	17	15	44	65	4	0
No	2	3	1	5	5	5	0

Risk zone							
HRA	17	9	9	29	45	6	0
LRA	4	6	2	13	17	2	0
Edge Area	6	4	4	7	9	1	0

Gender							
Male	19	14	7	29	37	2	0
Female	8	6	8	19	31	6	0

Age							

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
23-30	3	6	1	16	18	4	0
31-40	12	5	7	12	24	1	0
41-50	6	3	4	8	6	2	0
51-60	2	4	1	9	13	1	0
61+	0	0	1	2	5	0	0
Prefer not to say	4	1	1	1	1	0	0

Place of qualification							
UK	20	17	13	41	58	8	0
EU not UK	0	0	1	2	5	0	0
Outside EEA	0	0	0	0	1	0	0

Years in practice							
1 year or less	2	1	0	0	2	1	0
>1-5 year	4	4	3	11	16	2	0
>5-10 years	6	4	5	11	10	2	0
>10-20 years	7	3	2	12	20	2	0
>20-30 years	4	7	2	7	11	0	0
>30 years	2	1	1	6	10	1	0

Size of practice							
1 person	0	0	0	2	0	0	0
>1-4	2	0	3	6	14	1	0
>4-10	7	3	6	15	36	0	0
>10-15	6	6	2	11	11	3	0
>15-20	5	3	3	4	4	0	0
>20	3	6	0	10	5	3	0

County classification							
South West	4	4	3	18	16	3	0
Other England	14	11	6	23	42	2	0
UK other	0	2	0	4	4	3	0
Not classified	15	3	7	4	9	4	0

Question 4

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
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Practice type							
Farm work only	15	19	18	30	21	5	2
Mixed (even)	6	19	7	17	19	0	2
Mixed mostly large	1	3	0	1	0	0	1

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
Farm and equine	0	2	0	0	1	0	0
Mostly small	1	1	0	1	0	0	0
Academic	0	1	0	0	0	0	0
Other	0	0	0	0	0	1	1

Working with TB							
Delivery partner	6	6	7	19	18	1	1
Subcontractor	16	37	16	26	19	3	3
Private only	1	0	0	2	0	0	0
Don't currently	0	2	0	1	0	0	0
Other	0	0	1	1	2	2	2

Test prior to change?							
Yes	21	41	22	43	38	6	2
No	2	4	2	6	3	0	4

Risk zone							
HRA	12	28	17	30	20	3	5
LRA	5	11	7	11	6	3	1
Edge Area	6	6	1	6	13	0	0

Gender							
Male	15	23	10	30	27	1	2
Female	8	22	13	18	10	4	4

Age							
23-30	4	13	6	14	5	2	4
31-40	8	16	10	12	15	0	1
41-50	5	2	4	7	8	3	0
51-60	5	11	0	9	4	0	1
61+	1	2	2	3	0	0	0
Prefer not to say	0	0	1	2	5	0	0

Place of qualification							
UK	20	41	19	39	28	5	6
EU not UK	2	1	2	3	0	0	0
Outside EEA	0	1	0	0	0	0	0

Years in practice							
1 year or less	1	1	0	2	2	0	0
>1-5 year	3	9	5	13	5	2	3
>5-10 years	4	11	7	8	7	0	2

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
>10-20 years	5	11	7	11	11	1	0
>20-30 years	6	6	2	8	7	2	0
>30 years	4	7	1	6	2	0	1

Size of practice							
1 person	0	1	0	1	0	0	0
>1-4	6	10	3	5	1	1	0
>4-10	8	18	10	21	9	1	1
>10-15	6	6	5	8	10	1	3
>15-20	1	4	1	4	9	0	0
>20	2	5	4	7	6	2	1

County classification							
South West	3	15	8	14	4	1	3
Other England	19	24	11	20	21	4	0
UK other	1	3	2	4	0	0	3
Not classified	0	3	4	12	19	3	1

Question 5

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
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Practice type							
Farm work only	24	13	10	23	19	19	2
Mixed (even)	14	13	6	15	15	3	4
Mixed mostly large	0	0	0	2	2	0	2
Farm and equine	1	0	0	2	0	0	0
Mostly small	0	0	0	1	2	0	0
Academic	0	0	0	1	0	0	0
Other	0	0	0	0	0	1	1

Working with TB							
Delivery partner	20	11	5	7	4	9	2
Subcontractor	15	15	9	36	32	10	3
Private only	0	0	0	1	1	0	1
Don't currently	0	0	1	0	1	1	0
Other	2	0	0	0	0	3	3

Test prior to change?							
Yes	36	24	13	40	36	20	4
No	3	2	3	3	2	3	5

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
Risk zone							
HRA	18	16	11	29	22	14	5
LRA	4	6	5	8	10	7	4
Edge Area	13	4	0	7	6	2	0

Gender							
Male	25	18	6	22	29	6	2
Female	11	6	9	22	9	15	7

Age							
23-30	5	2	6	12	5	15	3
31-40	16	9	4	13	13	4	3
41-50	7	4	2	6	7	2	1
51-60	4	5	0	9	10	0	2
61+	0	0	2	3	3	0	0
Prefer not to say	4	3	1	0	0	0	0

Place of qualification							
UK	26	19	12	40	34	18	9
EU not UK	0	3	1	1	2	1	0
Outside EEA	0	0	0	0	1	0	0

Years in practice							
1 year or less	2	1	1	2	0	0	0
>1-5 year	5	3	5	7	5	13	2
>5-10 years	10	3	4	10	3	5	4
>10-20 years	7	10	1	12	14	2	0
>20-30 years	7	5	2	6	8	1	2
>30 years	2	2	1	7	8	0	1

Size of practice							
1 person	0	0	0	1	0	1	0
>1-4	1	1	4	6	11	3	0
>4-10	10	8	4	19	19	6	2
>10-15	10	5	2	7	7	6	2
>15-20	8	3	2	4	0	2	0
>20	6	5	2	6	1	3	4

County classification							
South West	4	7	4	16	8	6	3
Other England	20	12	8	20	26	11	2
UK other	0	1	1	4	2	1	4

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
Not classified	18	7	3	4	2	7	1

Question 6

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
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Practice type							
Farm work only	18	20	9	30	30	3	0
Mixed (even)	10	14	10	14	20	2	0
Mixed mostly large	1	1	2	1	0	1	0
Farm and equine	0	0	1	2	0	0	0
Mostly small	0	2	0	1	0	0	0
Academic	0	0	1	0	0	0	0
Other	0	0	0	0	0	2	0

Working with TB							
Delivery partner	5	4	7	15	24	3	0
Subcontractor	22	30	15	31	20	2	0
Private only	1	1	0	1	0	0	0
Don't currently	0	1	1	1	0	0	0
Other	1	1	0	0	3	3	0

Test prior to change?							
Yes	24	34	22	43	46	4	0
No	5	3	1	4	4	4	0

Risk zone							
HRA	16	20	16	32	26	5	0
LRA	8	13	4	11	6	2	0
Edge Area	5	4	3	4	15	1	0

Gender							
Male	18	20	12	26	30	2	0
Female	11	17	9	22	16	4	0

Age							
23-30	6	13	4	16	6	3	0
31-40	12	8	8	10	23	1	0
41-50	4	5	1	10	8	1	0
51-60	5	7	7	5	5	1	0
61+	2	3	1	2	0	0	0
Prefer not to say	0	0	0	4	4	0	0

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
Place of qualification							
UK	24	35	19	42	33	5	0
EU not UK	2	1	1	2	1	1	0
Outside EEA	1	0	0	0	0	0	0

Years in practice							
1 year or less	1	1	0	2	2	0	0
>1-5 year	5	10	2	15	6	2	0
>5-10 years	7	5	8	5	12	2	0
>10-20 years	6	10	2	14	13	1	0
>20-30 years	6	6	4	7	8	0	0
>30 years	4	5	5	4	2	1	0

Size of practice							
1 person	1	1	0	0	0	0	0
>1-4	7	6	3	7	3	0	0
>4-10	13	21	8	15	11	0	0
>10-15	5	4	5	12	11	2	0
>15-20	1	2	1	6	9	0	0
>20	1	3	4	7	9	3	0

County classification							
South West	4	9	8	15	9	3	0
Other England	19	24	9	24	22	1	0
UK other	4	2	3	2	0	2	0
Not classified	2	2	3	7	23	5	0

Question 7

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
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Practice type							
Farm work only	8	12	10	29	38	12	1
Mixed (even)	10	4	4	18	25	7	2
Mixed mostly large	0	0	0	2	2	1	1
Farm and equine	0	0	0	1	2	0	0
Mostly small	0	0	0	1	2	0	0
Academic	0	0	0	0	0	0	1
Other	0	0	0	0	0	1	1

Working with TB							
Delivery partner	10	8	7	19	6	6	2

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
Subcontractor	6	5	6	30	61	11	1
Private only	0	1	0	1	1	0	0
Don't currently	1	0	0	0	1	1	0
Other	1	1	0	0	0	3	3

Test prior to change?							
Yes	18	10	13	50	64	15	3
No	0	6	1	1	4	6	3

Risk zone							
HRA	10	11	9	29	43	10	3
LRA	4	3	1	9	15	9	3
Edge Area	3	1	4	13	9	2	0

Gender							
Male	12	8	6	29	45	5	3
Female	6	7	6	19	24	14	3

Age							
23-30	4	4	2	13	13	11	1
31-40	8	5	4	13	23	6	3
41-50	3	3	2	8	10	2	1
51-60	1	0	3	9	16	0	1
61+	0	0	0	3	5	0	0
Prefer not to say	1	3	1	1	2	0	0

Place of qualification							
UK	11	11	8	44	61	17	6
EU not UK	0	2	2	1	3	0	0
Outside EEA	0	0	0	0	1	0	0

Years in practice							
1 year or less	1	1	1	0	2	1	0
>1-5 year	4	7	1	9	11	8	0
>5-10 years	4	3	4	9	11	4	4
>10-20 years	6	3	2	11	19	5	0
>20-30 years	2	1	3	10	13	1	1
>30 years	0	0	1	7	12	0	1

Size of practice							
1 person	0	0	0	1	0	1	0
>1-4	1	2	1	5	14	3	0

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
>4-10	4	4	5	16	32	5	2
>10-15	3	5	4	10	12	4	1
>15-20	4	2	2	5	5	1	0
>20	4	2	1	9	4	5	2

County classification							
South West	1	6	2	14	18	5	2
Other England	10	6	9	22	42	10	0
UK other	0	1	0	1	4	3	4
Not classified	9	3	4	14	5	4	3

Question 8

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
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Practice type							
Farm work only	30	35	14	18	9	2	1
Mixed (even)	25	20	13	8	0	0	4
Mixed mostly large	1	2	2	0	0	0	1
Farm and equine	1	0	1	1	0	0	0
Mostly small	0	1	1	1	0	0	0
Academic	0	0	0	0	0	0	1
Other	0	0	0	0	0	1	1

Working with TB							
Delivery partner	26	19	8	3	0	1	1
Subcontractor	26	36	22	22	8	1	4
Private only	0	0	0	2	1	0	0
Don't currently	0	1	1	1	0	0	0
Other	2	2	0	0	0	1	3

Test prior to change?							
Yes	53	49	29	26	8	2	5
No	4	9	2	2	0	1	3

Risk zone							
HRA	30	36	22	18	4	0	4
LRA	9	17	3	7	3	1	4
Edge Area	14	5	6	3	2	2	0

Gender							
Male	34	29	19	15	5	0	5

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
Female	18	28	12	13	4	1	3

Age							
23-30	8	18	7	9	2	1	3
31-40	23	12	11	7	7	0	2
41-50	11	10	5	1	0	0	1
51-60	5	11	4	8	0	0	2
61+	0	1	4	3	0	0	0
Prefer not to say	4	4	0	0	0	0	0

Place of qualification							
UK	42	48	28	25	6	0	8
EU not UK	0	4	1	2	0	1	0
Outside EEA	0	0	0	0	1	0	0

Years in practice							
1 year or less	3	1	0	1	0	1	0
>1-5 year	5	17	6	8	2	0	2
>5-10 years	14	10	8	2	2	0	3
>10-20 years	13	14	8	5	5	0	0
>20-30 years	12	9	2	6	0	0	2
>30 years	2	6	6	6	0	0	1

Size of practice							
1 person	0	0	1	1	0	0	0
>1-4	1	8	5	9	2	1	0
>4-10	14	22	10	12	6	0	4
>10-15	15	12	6	3	1	0	1
>15-20	11	5	2	1	0	0	0
>20	8	10	5	2	0	0	2

County classification							
South West	9	18	8	8	2	0	3
Other England	25	31	20	15	6	1	1
UK other	1	5	1	2	0	0	4
Not classified	26	4	2	3	1	3	2

Question 9

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
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Practice type						
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	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
Farm work only	15	36	16	16	9	15	3
Mixed (even)	12	20	11	16	3	5	3
Mixed mostly large	0	0	1	2	1	0	2
Farm and equine	0	2	1	0	0	0	0
Mostly small	0	0	1	2	0	0	0
Academic	0	0	0	0	0	0	1
Other	0	0	0	0	0	1	1

Working with TB							
Delivery partner	14	18	9	8	0	5	4
Subcontractor	10	37	21	27	10	12	3
Private only	0	0	0	1	2	0	0
Don't currently	0	1	0	0	1	1	0
Other	1	1	0	0	0	3	3

Test prior to change?							
Yes	25	51	30	34	12	17	4
No	2	7	0	2	0	4	6

Risk zone							
HRA	14	36	17	25	9	10	4
LRA	4	9	8	6	4	7	6
Edge Area	7	11	5	5	0	4	0

Gender							
Male	17	36	17	21	6	7	4
Female	8	18	13	15	7	12	6

Age							
23-30	5	11	6	9	2	11	4
31-40	12	16	11	9	6	5	3
41-50	4	12	4	6	1	1	1
51-60	2	9	5	9	2	1	2
61+	0	1	2	3	2	0	0
Prefer not to say	2	5	0	0	0	1	0

Place of qualification							
UK	18	44	28	33	11	14	10
EU not UK	0	3	0	1	2	2	0
Outside EEA	0	0	0	1	0	0	0

Years in practice							

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
1 year or less	1	1	1	1	0	1	1
>1-5 year	5	10	6	7	2	8	2
>5-10 years	4	10	6	8	3	4	4
>10-20 years	8	15	7	7	4	5	0
>20-30 years	3	13	6	5	1	1	2
>30 years	1	4	4	8	3	0	1

Size of practice							
1 person	0	0	0	0	1	1	0
>1-4	1	8	2	6	5	3	1
>4-10	3	19	17	16	4	6	3
>10-15	7	11	6	8	2	3	2
>15-20	7	7	1	2	0	2	0
>20	5	10	3	3	0	3	3

County classification							
South West	2	15	11	9	2	6	3
Other England	12	27	15	23	9	10	3
UK other	1	3	1	2	0	2	4
Not classified	15	14	3	2	2	4	2

Question 10

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
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Practice type							
Farm work only	11	18	10	40	29	0	1
Mixed (even)	3	4	5	36	20	0	2
Mixed mostly large	0	2	0	3	0	0	1
Farm and equine	0	0	1	1	1	0	0
Mostly small	0	0	1	2	0	0	0
Academic	0	0	0	1	0	0	0
Other	0	0	0	0	0	1	1

Working with TB							
Delivery partner	1	5	3	22	26	0	1
Subcontractor	12	17	13	58	18	0	1
Private only	1	2	0	0	0	0	0
Don't currently	0	0	1	1	1	0	0
Other	0	0	0	0	4	1	3

Test prior to change?							

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
Yes	14	20	14	75	47	1	1
No	0	3	3	8	3	0	4

Risk zone							
HRA	8	19	10	49	27	0	2
LRA	3	4	6	21	7	1	2
Edge Area	3	1	1	12	14	0	1

Gender							
Male	9	11	9	48	28	0	2
Female	5	13	8	32	18	0	3

Age							
23-30	3	6	7	23	7	0	2
31-40	7	7	5	22	20	0	1
41-50	1	2	2	12	10	0	1
51-60	3	5	1	16	4	0	1
61+	0	4	2	2	0	0	0
Prefer not to say	0	0	0	3	5	0	0

Place of qualification							
UK	13	21	15	68	36	0	4
EU not UK	0	3	0	4	0	0	1
Outside EEA	0	0	1	0	0	0	0

Years in practice							
1 year or less	0	1	0	3	1	0	1
>1-5 year	3	4	6	20	7	0	0
>5-10 years	1	4	3	16	13	0	2
>10-20 years	6	5	4	19	11	0	0
>20-30 years	2	4	1	13	10	0	1
>30 years	2	6	2	9	1	0	1

Size of practice							
1 person	0	1	1	0	0	0	0
>1-4	5	7	4	7	2	0	1
>4-10	7	9	6	34	11	0	1
>10-15	1	1	4	21	11	0	1
>15-20	0	2	1	5	10	0	0
>20	1	2	1	11	11	0	1

County classification							

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
South West	2	10	3	23	9	0	1
Other England	9	11	10	45	23	0	1
UK other	2	1	2	4	1	0	3
Not classified	1	2	2	12	20	3	1

Question 11

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
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Practice type							
Farm work only	21	22	12	25	27	3	0
Mixed (even)	17	12	9	18	9	2	2
Mixed mostly large	0	0	2	1	2	0	1
Farm and equine	1	0	1	1	0	0	0
Mostly small	0	1	0	1	1	0	0
Academic	0	0	0	1	0	0	0
Other	0	0	0	0	0	1	1

Working with TB							
Delivery partner	21	12	9	9	5	2	0
Subcontractor	14	21	14	35	31	3	1
Private only	0	0	0	2	1	0	0
Don't currently	0	1	0	1	1	0	0
Other	2	1	0	0	1	1	3

Test prior to change?							
Yes	36	32	21	44	35	3	1
No	3	3	3	3	3	3	3

Risk zone							
HRA	18	21	14	33	22	4	2
LRA	5	10	6	10	9	2	2
Edge Area	12	4	4	4	8	0	0

Gender							
Male	24	23	9	26	23	1	2
Female	11	11	14	20	16	4	2

Age							
23-30	5	9	5	12	12	4	1
31-40	14	11	7	15	14	0	1
41-50	9	6	5	5	2	1	1
51-60	4	4	3	8	9	0	1

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
61+	0	0	2	5	1	0	0
Prefer not to say	3	3	1	0	1	0	0

Place of qualification							
UK	26	27	19	41	35	5	4
EU not UK	0	2	3	1	2	0	0
Outside EEA	0	0	0	0	1	0	0

Years in practice							
1 year or less	2	1	1	1	1	0	0
>1-5 year	4	8	5	10	9	4	0
>5-10 years	8	8	5	11	5	0	2
>10-20 years	10	7	4	11	13	1	0
>20-30 years	7	7	4	5	6	0	1
>30 years	2	3	3	7	5	0	1

Size of practice							
1 person	0	0	0	2	0	0	0
>1-4	0	4	4	6	12	0	0
>4-10	9	12	6	25	13	2	1
>10-15	8	10	4	7	7	2	1
>15-20	10	2	5	1	1	0	0
>20	7	5	4	4	4	1	1

County classification							
South West	4	9	6	15	10	2	1
Other England	19	17	14	23	24	2	0
UK other	0	3	1	3	2	1	3
Not classified	18	8	3	6	3	3	1

Question 12

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
Practice type							
Farm work only	19	12	8	30	36	3	2
Mixed (even)	13	9	5	23	17	0	3
Mixed mostly large	0	0	0	2	2	0	2
Farm and equine	1	0	0	1	1	0	0
Mostly small	0	0	0	0	3	0	0
Academic	0	0	0	0	0	0	1
Other	0	0	0	0	0	1	1

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
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Working with TB							
Delivery partner	14	12	4	14	10	1	3
Subcontractor	15	8	7	39	46	2	3
Private only	0	0	0	1	2	0	0
Don't currently	1	0	0	2	0	0	0
Other	2	0	1	0	1	1	3

Test prior to change?							
Yes	32	18	12	51	54	2	4
No	1	3	1	5	4	2	5

Risk zone							
HRA	15	14	6	35	37	3	5
LRA	6	1	4	14	14	1	4
Edge Area	9	5	3	7	8	0	0

Gender							
Male	22	13	6	29	32	2	4
Female	9	6	5	26	27	1	5

Age							
23-30	4	2	3	17	15	3	4
31-40	13	7	2	15	23	0	2
41-50	10	2	4	5	7	0	1
51-60	2	4	0	12	11	0	1
61+	0	0	1	5	2	0	0
Prefer not to say	2	4	0	0	1	0	1

Place of qualification							
UK	22	18	7	46	55	2	8
EU not UK	0	0	1	4	1	1	1
Outside EEA	0	0	0	0	1	0	0

Years in practice							
1 year or less	0	1	1	4	0	0	0
>1-5 year	4	4	2	11	13	3	3
>5-10 years	7	4	2	10	13	0	3
>10-20 years	8	5	4	13	16	0	0
>20-30 years	9	1	1	9	9	0	2
>30 years	0	4	0	8	8	0	1

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
Size of practice							
1 person	0	0	0	2	0	0	0
>1-4	3	1	1	8	12	0	1
>4-10	7	4	3	26	24	2	2
>10-15	7	4	3	10	12	0	3
>15-20	9	3	1	4	2	0	0
>20	5	5	3	5	6	1	2

County classification							
South West	1	8	3	12	17	3	4
Other England	16	7	8	35	32	0	1
UK other	0	0	0	4	5	0	4
Not classified	18	7	2	5	6	3	1

Question 13

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
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Practice type							
Farm work only	7	12	14	34	41	2	0
Mixed (even)	10	6	10	20	23	0	1
Mixed mostly large	0	0	0	3	2	0	1
Farm and equine	0	0	1	1	1	0	0
Mostly small	0	0	0	1	2	0	0
Academic	0	0	0	1	0	0	0
Other	0	0	0	0	1	1	0

Working with TB							
Delivery partner	8	9	9	19	13	0	0
Subcontractor	7	8	12	38	52	2	1
Private only	0	0	1	0	2	0	0
Don't currently	0	0	1	1	1	0	0
Other	1	1	0	2	2	1	1

Test prior to change?							
Yes	16	17	23	51	63	3	0
No	1	1	2	8	7	0	2

Risk zone							
HRA	10	9	14	38	42	1	1
LRA	2	6	4	14	15	2	1
Edge Area	4	2	5	8	13	0	0

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
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Gender							
Male	10	14	16	29	37	1	1
Female	4	3	8	30	32	1	1

Age							
23-30	2	2	4	18	20	1	1
31-40	7	5	6	21	22	0	1
41-50	2	6	6	7	7	1	0
51-60	2	3	3	8	14	0	0
61+	0	0	1	4	3	0	0
Prefer not to say	0	1	3	1	3	0	0

Place of qualification							
UK	9	13	19	51	63	1	2
EU not UK	0	1	1	2	3	1	0
Outside EEA	0	0	0	0	1	0	0

Years in practice							
1 year or less	1	1	1	1	2	0	0
>1-5 year	3	2	3	13	18	1	0
>5-10 years	3	1	5	18	10	0	2
>10-20 years	3	7	6	11	18	1	0
>20-30 years	4	3	4	10	10	0	0
>30 years	0	1	4	5	11	0	0

Size of practice							
1 person	0	0	1	1	0	0	0
>1-4	0	1	2	8	14	1	0
>4-10	3	4	4	26	31	0	0
>10-15	5	3	7	12	11	0	1
>15-20	4	3	4	5	3	0	0
>20	3	6	3	7	7	0	1

County classification							
South West	2	3	7	18	18	0	0
Other England	6	8	11	32	41	1	0
UK other	0	1	0	5	5	0	2
Not classified	11	7	7	6	6	4	1

Question 14

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
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Practice type							
Farm work only	13	17	16	40	23	1	0
Mixed (even)	10	15	7	27	9	1	1
Mixed mostly large	0	0	0	5	0	0	1
Farm and equine	1	0	0	2	0	0	0
Mostly small	0	0	0	2	1	0	0
Academic	0	0	1	0	0	0	0
Other	0	0	0	0	0	1	1

Working with TB							
Delivery partner	12	15	8	17	6	0	0
Subcontractor	10	14	15	54	24	2	1
Private only	0	0	0	2	1	0	0
Don't currently	0	1	0	0	2	0	0
Other	2	1	0	2	0	1	2

Test prior to change?							
Yes	23	28	21	70	27	3	1
No	1	4	2	6	6	0	2

Risk zone							
HRA	12	18	17	46	19	1	2
LRA	3	5	3	20	10	2	1
Edge Area	7	8	3	10	4	0	0

Gender							
Male	17	20	9	42	18	1	1
Female	5	12	13	31	15	1	2

Age							
23-30	2	8	5	23	9	0	1
31-40	6	12	7	23	13	0	1
41-50	6	5	6	10	1	1	0
51-60	4	6	3	9	7	0	1
61+	0	0	0	4	3	1	0
Prefer not to say	3	0	2	3	0	0	0

Place of qualification							
UK	15	25	22	62	30	1	3
EU not UK	0	1	1	3	2	1	0
Outside EEA	0	0	0	1	0	0	0

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
Years in practice							
1 year or less	1	3	0	0	2	0	0
>1-5 year	4	3	4	22	7	0	0
>5-10 years	4	6	6	18	3	0	2
>10-20 years	2	11	6	15	11	1	0
>20-30 years	9	4	4	10	4	0	0
>30 years	0	3	2	8	6	1	1

Size of practice							
1 person	0	0	0	1	1	0	0
>1-4	0	3	3	11	8	1	0
>4-10	7	7	7	32	14	1	0
>10-15	5	7	4	16	6	0	1
>15-20	5	6	5	3	0	0	0
>20	5	5	3	10	3	0	1

County classification							
South West	2	8	9	21	6	1	1
Other England	12	15	9	41	21	1	0
UK other	0	1	2	3	5	0	2
Not classified	12	9	5	11	1	3	1

Question 15

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
Practice type							
Farm work only	2	0	3	32	70	0	1
Mixed (even)	0	0	1	24	43	1	1
Mixed mostly large	0	0	1	1	3	0	1
Farm and equine	0	0	0	3	0	0	0
Mostly small	0	0	0	1	2	0	0
Academic	0	0	0	1	0	0	0
Other	0	0	0	0	0	1	1

Working with TB							
Delivery partner	2	0	1	23	30	1	0
Subcontractor	0	0	4	32	81	0	2
Private only	0	0	0	1	2	0	0
Don't currently	0	0	0	2	1	0	0
Other	0	0	0	3	2	1	2

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
Test prior to change?							
Yes	2	0	6	51	108	2	2
No	0	0	0	10	9	0	2

Risk zone							
HRA	1	0	6	35	68	1	3
LRA	0	0	0	12	29	1	1
Edge Area	1	0	0	14	17	0	0

Gender							
Male	2	0	4	33	66	1	1
Female	0	0	1	27	47	0	3

Age							
23-30	0	0	3	17	26	0	2
31-40	2	0	1	15	42	0	1
41-50	0	0	1	10	16	1	0
51-60	0	0	0	12	17	0	1
61+	0	0	0	3	5	0	0
Prefer not to say	0	0	0	2	6	0	0

Place of qualification							
UK	2	0	4	45	101	1	3
EU not UK	0	0	0	4	3	0	1
Outside EEA	0	0	0	0	1	0	0

Years in practice							
1 year or less	0	0	0	4	2	0	0
>1-5 year	1	0	3	12	23	0	1
>5-10 years	1	0	1	12	22	0	2
>10-20 years	0	0	0	15	30	1	0
>20-30 years	0	0	1	9	20	0	0
>30 years	0	0	0	6	14	0	1

Size of practice							
1 person	0	0	0	2	0	0	0
>1-4	0	0	1	7	16	0	1
>4-10	0	0	1	20	46	0	0
>10-15	0	0	0	13	25	0	1
>15-20	1	0	1	9	8	0	0
>20	1	0	1	9	14	1	1

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
County classification							
South West	0	0	2	18	26	0	2
Other England	0	0	1	33	62	1	0
UK other	0	0	0	3	8	0	2
Not classified	2	0	3	9	23	4	1

Question 16

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
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Practice type							
Farm work only	5	18	19	47	18	2	1
Mixed (even)	5	9	12	30	11	0	3
Mixed mostly large	0	1	1	1	2	0	1
Farm and equine	1	0	0	2	0	0	0
Mostly small	0	0	1	1	1	0	0
Academic	0	0	0	1	0	0	0
Other	0	0	0	0	0	1	1

Working with TB							
Delivery partner	4	11	11	22	7	0	3
Subcontractor	7	16	20	53	22	1	1
Private only	0	0	0	1	1	1	0
Don't currently	0	2	0	1	0	0	0
Other	0	0	1	3	1	1	2

Test prior to change?							
Yes	11	27	29	72	28	2	4
No	0	2	4	9	3	1	2

Risk zone							
HRA	5	21	26	46	12	1	4
LRA	1	3	3	24	9	2	2
Edge Area	4	5	2	11	10	0	0

Gender							
Male	6	14	20	47	18	0	3
Female	4	14	13	31	12	2	3

Age							
23-30	2	9	10	20	4	1	2

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
31-40	5	12	8	26	8	1	2
41-50	2	3	6	10	7	0	1
51-60	0	4	9	11	5	0	1
61+	0	0	0	5	3	0	0
Prefer not to say	1	0	0	6	1	0	0

Place of qualification							
UK	8	22	29	68	25	2	4
EU not UK	0	2	2	3	1	0	0
Outside EEA	0	0	0	1	0	0	0

Years in practice							
1 year or less	0	1	1	3	1	0	0
>1-5 year	2	6	9	16	5	1	1
>5-10 years	3	6	7	18	2	1	2
>10-20 years	2	7	5	24	7	0	1
>20-30 years	2	4	8	9	7	0	1
>30 years	0	2	3	8	7	0	1

Size of practice							
1 person	0	0	0	2	0	0	0
>1-4	0	6	1	11	8	0	0
>4-10	2	7	16	29	11	2	1
>10-15	3	6	5	14	9	0	2
>15-20	4	3	3	8	0	0	1
>20	1	6	6	11	2	0	1

County classification							
South West	1	12	9	20	3	1	2
Other England	5	9	15	44	23	1	2
UK other	0	1	1	7	2	0	2
Not classified	5	7	8	12	5	3	1

Question 17

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
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Practice type							
Farm work only	9	14	24	27	30	5	1
Mixed (even)	4	15	10	24	13	3	1
Mixed mostly large	0	0	2	2	0	1	1
Farm and equine	1	0	0	1	1	0	0
Mostly small	0	0	1	0	2	0	0
Academic	0	0	0	0	1	0	0
Other	0	0	0	1	0	1	0

Working with TB							
Delivery partner	5	13	14	7	14	4	1
Subcontractor	5	13	23	45	32	1	1
Private only	0	0	0	2	1	0	0
Don't currently	1	0	0	0	0	2	0
Other	1	2	0	1	0	3	1

Test prior to change?							
Yes	13	26	35	51	40	7	1
No	0	3	3	3	7	3	2

Risk zone							
HRA	6	18	18	37	31	3	2
LRA	3	2	7	13	11	7	1
Edge Area	4	7	11	5	5	0	0

Gender							
Male	10	21	17	30	26	2	2
Female	1	6	19	24	21	7	1

Age							
23-30	2	4	4	14	18	5	1
31-40	5	10	13	14	15	3	2
41-50	3	7	6	9	3	1	0
51-60	0	3	8	12	7	0	0
61+	0	0	0	4	4	0	0
Prefer not to say	1	3	4	0	0	0	0

Place of qualification							
UK	7	21	31	47	42	8	2

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Agree strongly	Don't know	N/A
EU not UK	0	0	3	3	2	0	0
Outside EEA	0	0	0	0	1	0	0

Years in practice							
1 year or less	0	1	2	1	2	0	0
>1-5 year	1	4	5	11	15	4	0
>5-10 years	4	5	9	10	7	1	3
>10-20 years	3	10	6	14	10	3	0
>20-30 years	3	5	7	9	6	1	0
>30 years	0	1	5	8	7	0	0

Size of practice							
1 person	0	0	0	1	0	1	0
>1-4	1	1	5	7	11	1	0
>4-10	3	4	13	27	18	3	0
>10-15	2	8	6	9	11	1	2
>15-20	4	4	4	4	2	1	0
>20	1	7	6	6	4	2	1

County classification							
South West	1	7	10	17	10	3	0
Other England	6	12	21	28	27	4	1
UK other	0	0	0	4	5	2	2
Not classified	8	10	8	6	5	3	1

6.5. Appendix E - Bar charts showing responses to demographic questions

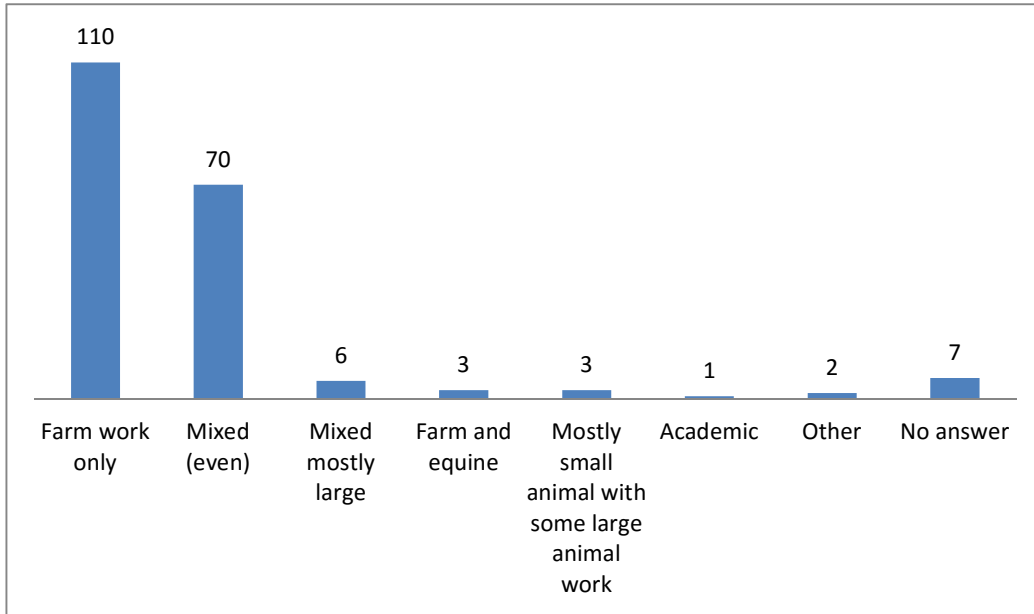


Figure 20. Bar chart detailing respondents' practice environment

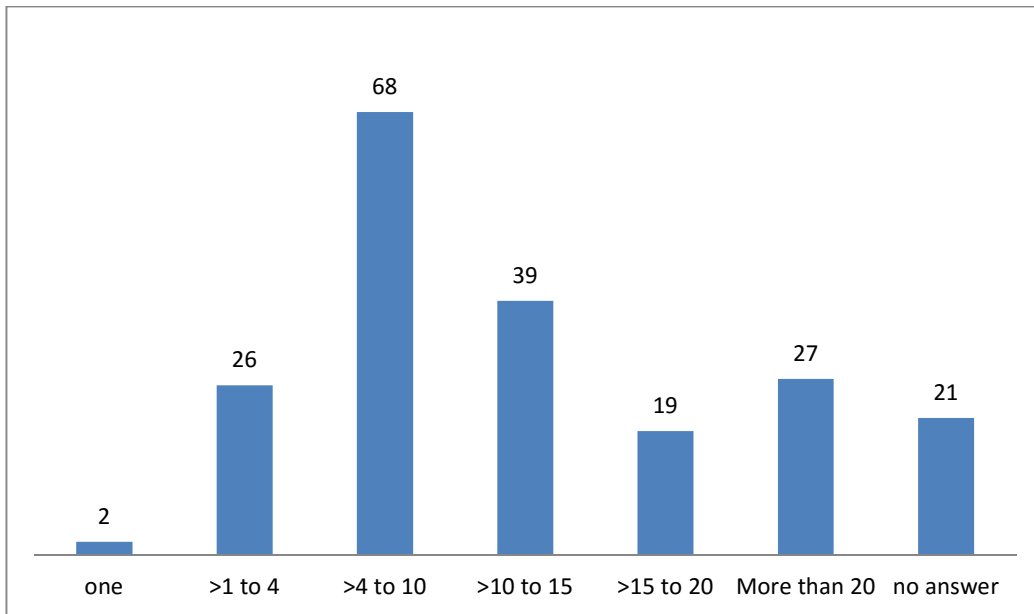


Figure 21. Bar chart indicating the number of veterinarians (full time equivalent) employed in respondents' veterinary practices.

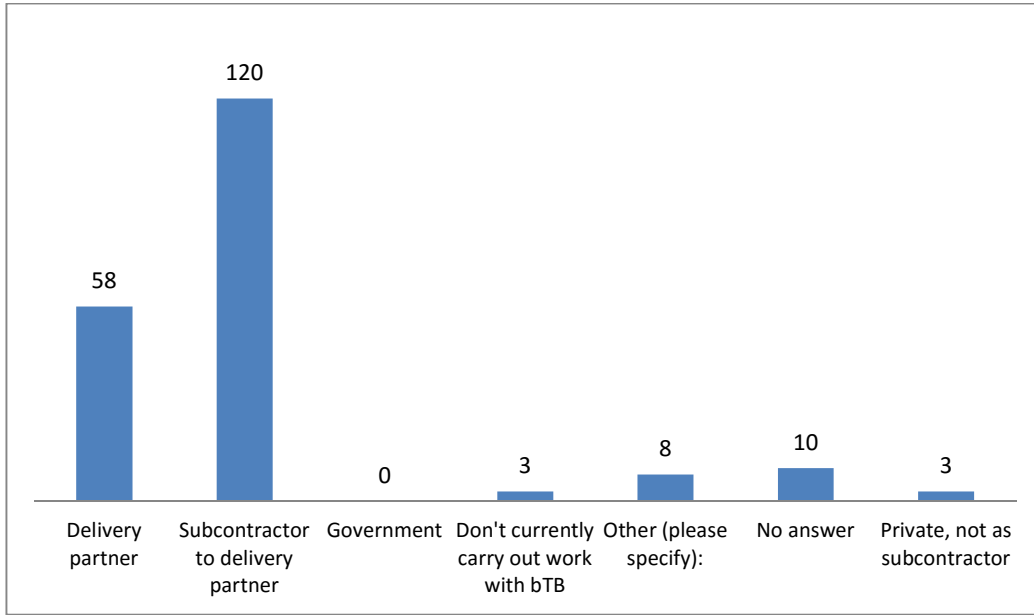


Figure 22. Bar chart showing the capacity in which respondents work with bTB

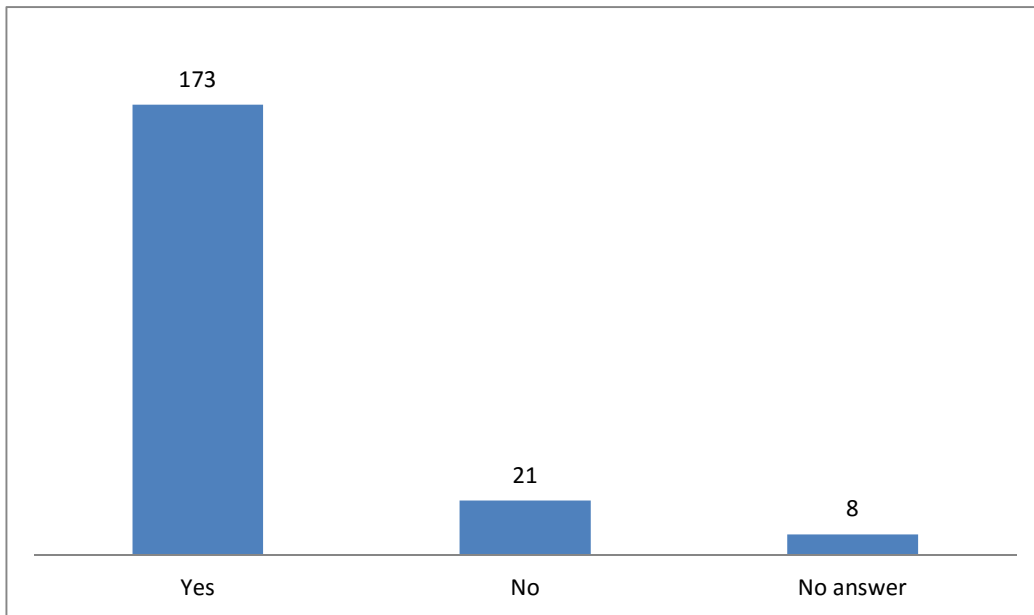


Figure 23. Bar chart indicating whether respondents performed bTB testing prior to the implementation of the changes to bTB testing

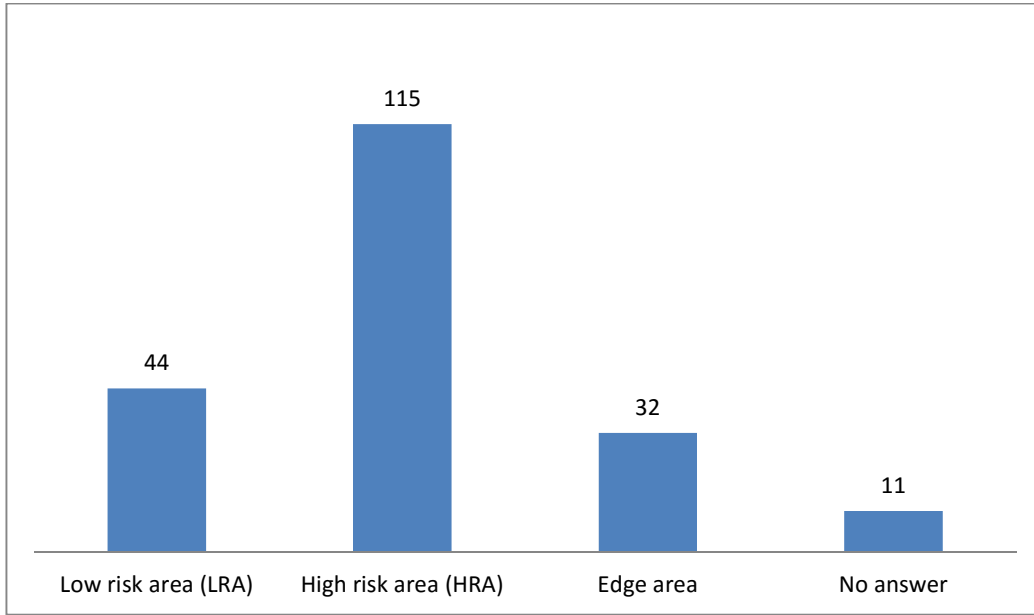


Figure 24. Bar chart showing the bTB risk zone where respondents work the most often

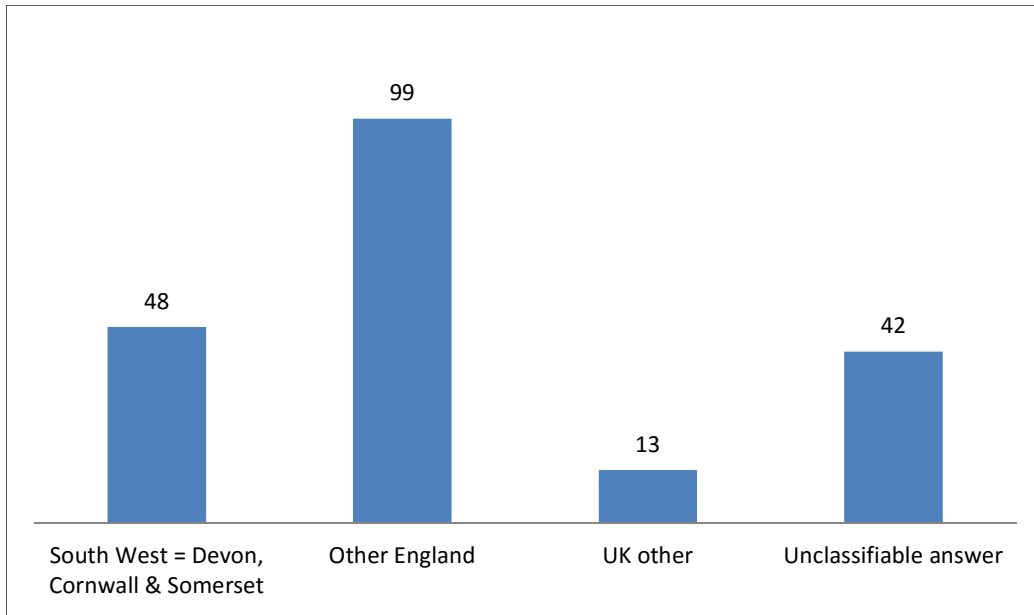


Figure 25. Bar chart showing location of veterinary practice

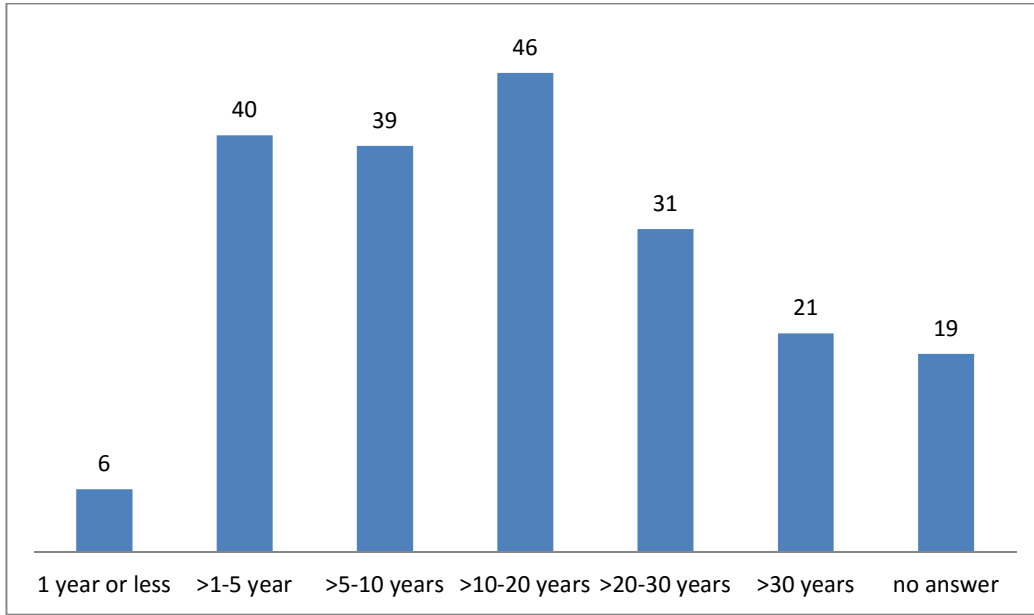


Figure 26. Bar chart detailing the number of years respondents have practised as veterinary surgeons

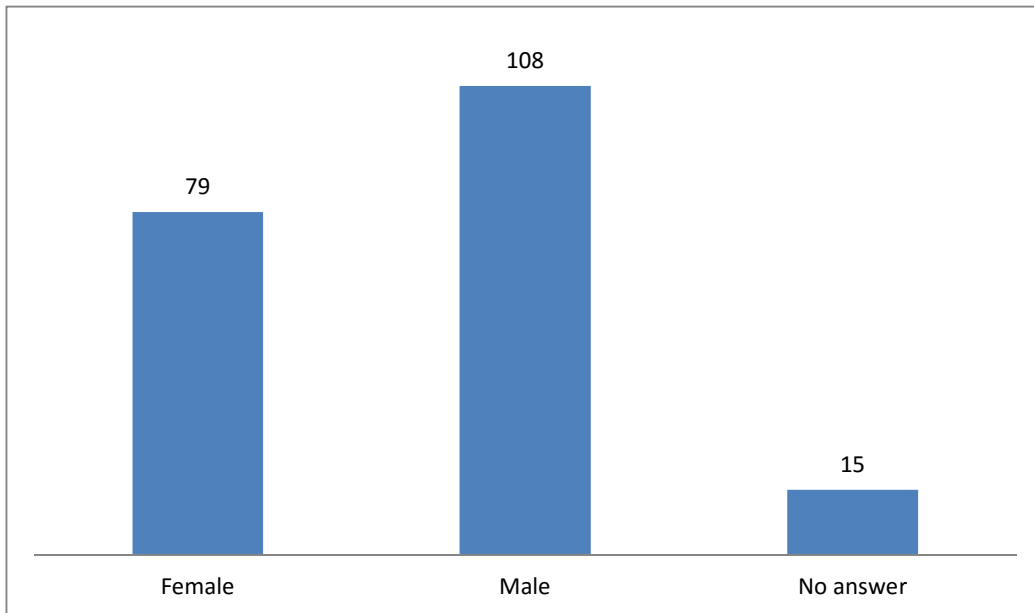


Figure 27. Bar chart showing gender of respondents

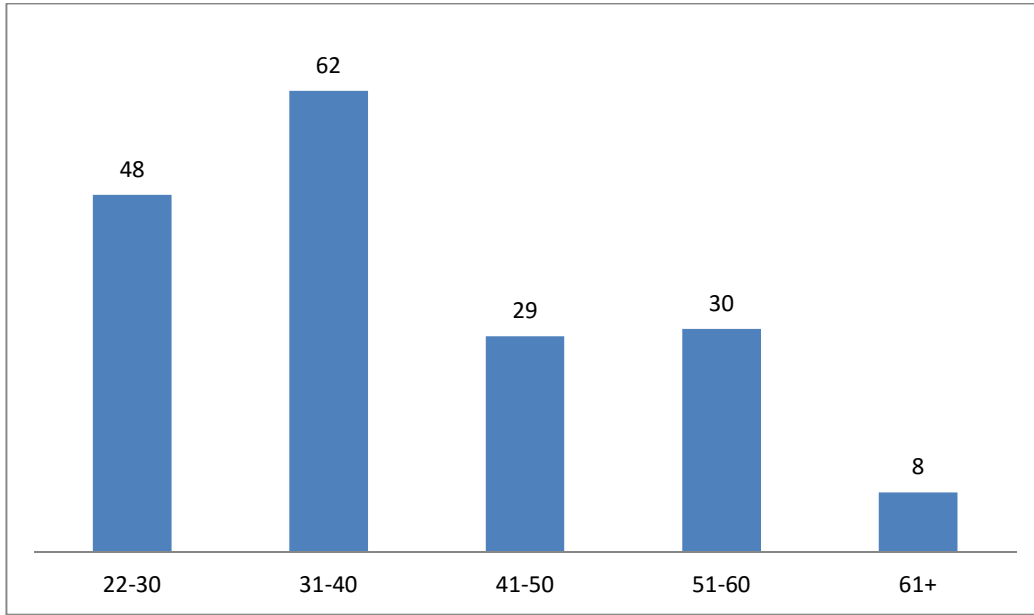


Figure 28. Bar chart showing age of respondents

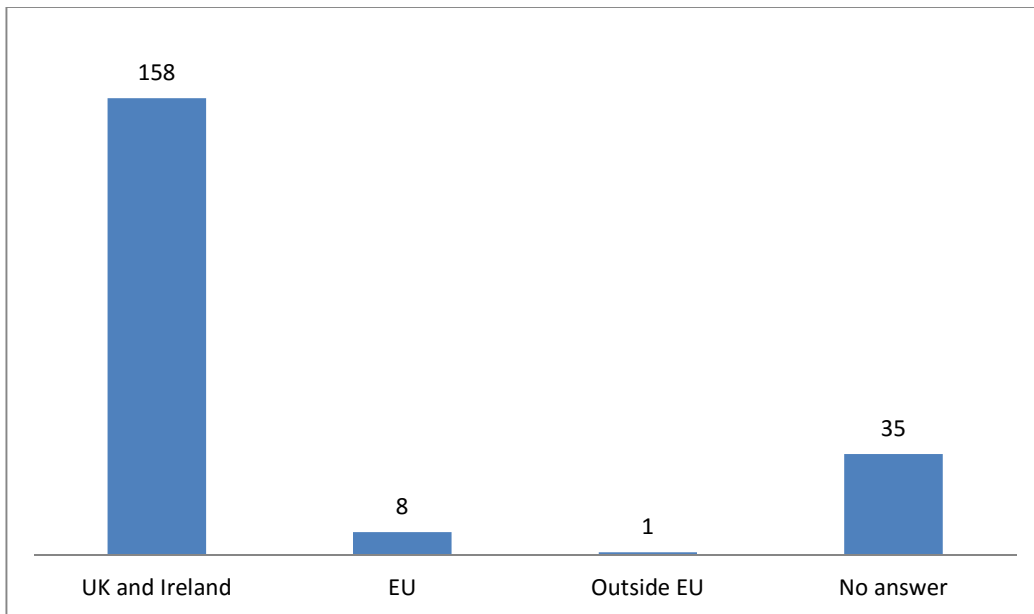


Figure 29. Bar chart showing where respondents obtained their veterinary qualification

6.6. Appendix F – Comparison of demographic groups

6.6.1. Practice environment of respondents (Question 18)

The medians for the responses to this question were compared for veterinarians working in mixed practice and those working with farm animals only. The results are tabulated in Table 6.1; W_x refers to the mixed practice group and W_y refers to the group working with farm animals only. The medians for the two groups were identical in 15 of the 17 questions. There was a difference in median for questions 4 and 6, however, calculation of p values resulted in $p > 0.05$ for all of the questions. There was no significant difference between these two groups for any of the questions.

Table 6.1. Comparing veterinarians working in mixed practice with veterinarians working with farm animals only

Median - mixed practice	Median - farm work only	W_x	W_y	z	p
Question 1					
Neither agree nor disagree	Neither agree nor disagree	6013	8352	-0.74537	0.45326
Question 2					
Neither agree nor disagree	Neither agree nor disagree	5320	5841	0.90184	0.36812
Question 3					
Agree	Agree	5753.5	9297.5	0.23372	0.8181
Question 4					
Agree	Neither agree nor disagree	6054	8652	-0.64858	0.5157
Question 5					
Neither agree nor disagree	Neither agree nor disagree	4902.5	6725.5	-0.30856	0.75656
Question 6					
Between neither agree nor disagree and agree	Agree	5961	9439	0.06888	0.9442
Question 7					
Agree	Agree	4838	7723	0.03929	0.9681
Question 8					
Disagree	Disagree	5176	9702	1.67673	0.09296
Question 9					
Disagree	Disagree	4814.5	7120.5	-0.03316	0.97606
Question 10					
Agree	Agree	6606.5	8969.5	-1.78655	0.07346
Question 11					
Neither agree nor disagree	Neither agree nor disagree	5205	9673	1.31691	0.18684
Question 12					
Agree	Agree	5522.5	9355.5	0.85566	0.38978
Question 13					
Agree	Agree	5800.5	9952.5	1.02264	0.30772
Question 14					
Agree	Agree	5659	10094	1.18373	0.238
Question 15					
Agree strongly	Agree strongly	5949.5	9450.5	0.10408	0.92034
Question 16					
Agree	Agree	5849.5	9375.5	0.03866	0.9681
Question 17					

Median - mixed practice	Median - farm work only	W _x	W _y	z	p
Agree	Agree	5428	9107	0.68585	0.4902

W_x = the sum of the average ranks for the smaller group, W_y = the sum of the average ranks for the larger group, z = Wilcoxon-Mann-Whitney statistic, p = probability of the differences between the groups being due to chance.

6.6.2. Practice size (Question 19)

The comparisons between smaller and larger practices using the Wilcoxon-Man-Whitney test are shown in Table 6.2; W_x refers to the larger practices and W_y refers to the smaller practices. The medians differed for 13 of the 17 questions (1, 2, 4, 5, 6, 9, 11, 12, 13, 14, 15, 16, 17). Some of the questions showed very small p-values, with differences significant at the 0.1% level (p<0.001). Four questions had the same median, but still showed significant differences between the groups. In question 3 the median for both groups was 'agree'. The mode for larger practices was 'agree' and the mode for smaller practices was 'agree strongly'. This difference in mode will account for the difference between the groups, which was significant at the 1% level (p=0.00288). Differences in mode also account in part for the significant differences between the groups for questions 7, 8 and 10. Table 6.3 details the modes for the four questions where the medians were identical, but significant differences existed between the groups.

Table 6.2. Comparing veterinarians working in smaller practices with veterinarians working in larger practices

Median - Larger practices (>15 vet)	Median - Smaller practices (≤15 vets)	W _x	W _y	z	p
Question 1					
Agree	Disagree	4596	9939	-3.29437	0.001
Question 2					
Disagree	Agree	2773.5	10921.5	2.95114	0.00318
Question 3					
Agree	Agree	2861.5	11844.5	2.97641	0.00288
Question 4					
Agree	Neither agree nor disagree	4343	10022	-2.48153	0.01314
Question 5					
Disagree	Agree	1939.5	9536.5	3.77252	0.00016
Question 6					
Agree	Neither agree nor disagree	4783.5	10441.5	-3.56053	0.00038
Question 7					
Agree	Agree	2323	9923	2.72284	0.00652
Question 8					
Disagree	Disagree	2932.5	11602.5	2.94941	0.00318
Question 9					
Disagree	Neither agree nor disagree	2008	9773	3.87432	0.0001
Question 10					
Agree	Agree	4834.5	10390.5	-3.40697	0.00064
Question 11					
Disagree	Agree	2685.5	11849.5	3.55068	0.00038

Median - Larger practices (>15 vet)	Median - Smaller practices (≤15 vets)	W_x	W_y	z	p
Question 12					
Disagree	Agree	2639	11389	3.55943	0.00038
Question 13					
Neither agree nor disagree	Agree	2982.5	12593.5	3.38957	0.0007
Question 14					
Neither agree nor disagree	Agree	2899	12501	3.62049	0.0003
Question 15					
Between agree and agree strongly	Agree strongly	3269	11782	1.94678	0.05118
Question 16					
Neither agree nor disagree	Agree	3063	11815	2.60575	0.00906
Question 17					
Neither agree nor disagree	Agree	2646.5	11549.5	3.30403	0.00096

W_x = the sum of the average ranks for the smaller group, W_y = the sum of the average ranks for the larger group, z = Wilcoxon-Mann-Whitney statistic, p = probability of the differences between the groups being due to chance.

Table 6.3. Medians and modes for smaller compared to larger practices for questions where significant differences existed between the groups, but medians were the same

Question	Median for both groups	Mode: large practices (>15 vets)	Mode: smaller practices (≤15 vets)
3	Agree	Agree	Agree strongly
7	Agree	Agree	Agree strongly
8	Disagree	Strongly disagree	Disagree
10	Agree	Agree strongly	Agree

6.6.3. Capacity in which respondents work with bTB (Question 20)

The subcontractor and delivery partner groups were compared using the Wilcoxon-Mann-Whitney test. The results are shown in Table 6.4; W_x refers to the delivery partners and W_y refers to the subcontractor group.

The medians differed between the two groups for 12 of the 17 questions (1, 2, 3, 4, 5, 6, 7, 9, 11, 12, 14, 17) and the differences between the groups were statistically significant for all of these questions. The medians for the two groups were identical for five of the questions (8, 10, 13, 15, 16). In question 8, the value of p was 0.00014, indicating that the difference between the groups was significant at the 0.1% level. Considering the observed medians, this result is not expected. If the results are examined, one can see that the mode for delivery partners was 'strongly disagree' and the mode for subcontractors was 'disagree'. In the delivery partner group, 77.59% (45 of 58 respondents) answered negatively and 5.17% (3 of 58) answered positively. In the subcontractor group, 52.10% (62 of 119 respondents) answered negatively and 25.21% (30 of 119) answered positively. Although the medians were the same, the Wilcoxon-Mann-Whitney test reflected the difference in distribution of responses between the groups. Question 10 also showed a marked difference between the groups despite them having the

same median. The value of p was 0.00008, indicating a difference that was significant at the 0.1% level. The mode for delivery partners was 'agree strongly'; 10.34% (6 of 58 respondents) answered negatively and 82.76% (48 of 58) answered positively. The mode for subcontractors was 'agree'; 24.37% (29 of 119) answered negatively and 63.87% (76 of 119) answered positively. This distribution of answers, along with the differing modes explains the difference between the groups in the presence of identical medians. The groups also had different modes in question 13, indicating a difference in distribution of responses between the groups despite the medians being the same. The value of p (0.00124) showed a difference significant at the 1% level.

Questions 15 and 16 had identical medians and the modes for the groups were also the same. No significant difference existed between the groups for these questions. Table 6.5 shows that for the questions where the medians were the same and differences between the groups existed, the modes differed between the groups. Where no difference was present between the groups, the modes were the same.

Table 6.4. Comparing veterinarians working as delivery partners with veterinarians working as subcontractors

Median - delivery partners	Median - subcontractors	W_x	W_y	z	p
Question 1					
Agree	Disagree	5707	8828	-3.64665	0.00026
Question 2					
Disagree	Agree	3405	10456	3.80363	0.00014
Question 3					
Neither agree nor disagree	Agree	3479	11398.5	4.19425	<0.00001
Question 4					
Agree	Neither agree nor disagree	5717	8818	-3.07842	0.00208
Question 5					
Disagree	Agree	2461	9474	4.63376	<0.00001
Question 6					
Agree	Neither agree nor disagree	5989	9062	-3.92319	0.00008
Question 7					
Between neither agree nor disagree and agree	Agree strongly	2544	10017	5.3479	<0.00001
Question 8					
Disagree	Disagree	3639	10896	3.80783	0.00014
Question 9					
Disagree	Neither agree nor disagree	2977.5	8957.5	3.17893	0.00148
Question 10					
Agree	Agree	6264	9136	-3.97188	0.00008
Question 11					
Disagree	Agree	3511	11195	4.29366	<0.00001
Question 12					
Neither agree nor disagree	Agree	3537	10828	3.54848	0.00038
Question 13					
Agree	Agree	4084	11316	3.23158	0.00124
Question 14					

Median - delivery partners	Median - subcontractors	W_x	W_y	z	p
Neither agree nor disagree	Agree	4030	11370	3.40275	0.00068
Question 15					
Agree strongly	Agree strongly	4353	10698	1.6822	0.09296
Question 16					
Agree	Agree	4360	10691	1.38379	0.16758
Question 17					
Neither agree nor disagree	Agree	3878.5	10827.5	2.26787	0.0232

W_x = the sum of the average ranks for the smaller group, W_y = the sum of the average ranks for the larger group, z = Wilcoxon-Mann-Whitney statistic, p = probability of the differences between the groups being due to chance.

Table 6.5. Medians and modes for delivery partners compared to subcontractors for questions where medians did not differ

Question	Median for both groups	Mode for delivery partners	Mode for subcontractors
8	Disagree	Strongly disagree	Disagree
10	Agree	Agree strongly	Agree
13	Agree	Agree	Agree strongly
15	Agree strongly	Agree strongly	Agree strongly
16	Agree	Agree	Agree

6.6.4. Risk zone for bTB where the respondent works the most (Question 22)

The bTB risk zones were compared to each other in pairs for each question to see if significant differences existed. The results in Table 6.6 show the median for each bTB risk zone and the calculated p-values for comparisons between the LRA and HRA, Edge Area and HRA and Edge Area and LRA.

No significant difference existed between the respondents from the different bTB risk zones for 12 of the 17 questions. Five questions (3, 7, 8, 13, 15) had the same median for each group, while seven questions (1, 2, 4, 5, 9, 11, 12) had different medians for some of the groups. The calculated median for the Edge Area for question 5 differed from the HRA and LRA. Although there was no significant difference between the groups, the p-value was lower when comparing the Edge Area to the LRA ($p=0.05486$) and HRA ($p=0.09492$) than when comparing the LRA with the HRA (0.4777).

Significant differences occurred between some of the groups for five of the questions, although no clear pattern emerged. In question 6 the LRA had a different median to the HRA and Edge Areas, which was reflected in a significant difference between the LRA and Edge Area ($p=0.02382$) and a relatively lower p-value ($p=0.09894$) for a comparison between the HRA and LRA. The median ('agree') for all three risk zones was the same for question 10, but the Edge Area differed significantly from both the HRA ($p=0.03236$) and the LRA ($p=0.03$). The median for the Edge Area in question 14 differed from that of the LRA and the HRA. There was a statistically significant difference between the medians of the Edge Area group and the LRA ($p=0.0151$). Although the medians for all three bTB risk zones were the same for question 16, there was a significant difference between the LRA and the HRA ($p=0.00288$). The difference was significant at the 1% level ($p<0.01$). Although these two groups had the same median

and mode, the HRA group had a greater proportion of respondents that gave a negative or neutral response. For question 17 the median for the Edge Area differed from the medians for the HRA and LRA. The differences between the Edge Area and the LRA ($p=0.01278$) and HRA ($p=0.0139$) were statistically significant at the 5% level.

Table 6.6. Comparing responses of veterinarians working in the different risk zones for bTB

Question 1			
Median			
LRA	HRA	Edge Area	
Disagree	Neither agree nor disagree	Neither agree nor disagree	
W_x	W_y	z	p
LRA (x) and HRA (y)			
2822	8353	1.38178	0.16758
Edge Area (x) and HRA (y)			
2116	7200	-0.68538	0.4902
Edge Area (x) and LRA (y)			
1171	1385	-1.47976	0.13888

Question 2			
Median			
LRA	HRA	Edge Area	
Agree	Neither agree nor disagree	Disagree	
W_x	W_y	z	p
LRA (x) and HRA (y)			
3112.5	7183.5	-1.0434	0.29834
Edge Area (x) and HRA (y)			
1936	7109	0.82309	0.41222
Edge Area (x) and LRA (y)			
990.5	1565.5	1.44918	0.14706

Question 3			
Median			
LRA	HRA	Edge Area	
Agree	Agree	Agree	
W_x	W_y	z	p
LRA and HRA			
3241	8235	-0.20141	0.84148
Edge Area and HRA			
1849	7881	1.28251	0.20054
Edge Area and LRA			
980	1648	1.30782	0.1902

Question 4			
Median			
LRA	HRA	Edge Area	
Neither agree nor disagree	Neither agree nor disagree	Agree	
W_x	W_y	z	p
LRA (x) and HRA (y)			
2849.5	8028.5	0.47877	0.63122
Edge Area (x) and HRA (y)			
2461.5	7268.5	-1.10574	0.267
Edge Area (x) and LRA (y)			

1277.5	1350.5	-1.23524	0.21498
Question 5			
Median			
LRA	HRA	Edge Area	
Agree	Agree	Disagree	
W_x	W_y	z	p
LRA (x) and HRA (y)			
2276.5	6108.5	-0.70713	0.4777
Edge Area (x) and HRA (y)			
1612.5	6388.5	1.67254	0.09492
Edge Area (x) and LRA (y)			
820	1196	1.91981	0.05486
Question 6			
Median			
LRA	HRA	Edge Area	
Between neither agree nor disagree and disagree	Agree	Agree	
W_x	W_y	z	p
LRA (x) and HRA (y)			
2811	8817	1.65428	0.09894
Edge Area (x) and HRA (y)			
2499	7512	-1.481	0.13888
Edge Area (x) and LRA (y)			
1350	1351	-2.25993	0.02382
Question 7			
Median			
LRA	HRA	Edge Area	
Agree	Agree	Agree	
W_x	W_y	z	p
LRA (x) and HRA (y)			
2228	6817	-0.35225	0.72634
Edge Area (x) and HRA (y)			
1896	6856	0.51043	0.61006
Edge Area (x) and LRA (y)			
889.5	1063.5	0.77472	0.4413
Question 8			
Median			
LRA	HRA	Edge Area	
Disagree	Disagree	Disagree	
W_x	W_y	z	p
LRA (x) and HRA (y)			
2965	8210	-0.17057	0.86502
Edge Area (x) and HRA (y)			
1884	7986	1.17056	0.242
Edge Area (x) and LRA (y)			
953	1462	1.16809	0.242
Question 9			
Median			
LRA	HRA	Edge Area	
Neither agree nor disagree	Neither agree nor disagree	Disagree	

W_x	W_y	z	p
LRA (x) and HRA (y)			
2143	6635	-0.43482	0.6672
Edge Area (x) and HRA (y)			
1497	6888	1.84251	0.06576
Edge Area (x) and LRA (y)			
718.5	1051.5	1.83671	0.06576

Question 10

Median

LRA	HRA	Edge Area
Agree	Agree	Agree

W_x	W_y	z	p
LRA (x) and HRA (y)			
3123	8812	0.22074	0.82588
Edge Area (x) and HRA (y)			
2688.5	7751.5	-2.14108	0.03236
Edge Area (x) and LRA (y)			
1322.5	1305.5	-2.16646	0.03

Question 11

Median

LRA	HRA	Edge Area
Neither agree nor disagree	Agree	Between neither agree nor disagree and disagree

W_x	W_y	z	p
LRA (x) and HRA (y)			
2994	8032	-0.05829	0.95216
Edge Area (x) and HRA (y)			
1988	7882	1.32745	0.18352
Edge Area (x) and LRA (y)			
1058	1570	1.2409	0.21498

Question 12

Median

LRA	HRA	Edge Area
Agree	Agree	Neither agree nor disagree

W_x	W_y	z	p
LRA (x) and HRA (y)			
2949	7782	-0.36286	0.71884
Edge Area (x) and HRA (y)			
1877	7853	1.81371	0.0703
Edge Area (x) and LRA (y)			
996.5	1559.5	1.79122	0.07346

Question 13

Median

LRA	HRA	Edge Area
Agree	Agree	Agree

W_x	W_y	z	p
LRA (x) and HRA (y)			
3170	8765	0.02861	0.97606
Edge Area (x) and HRA (y)			
2319	8266	0.07867	0.93624
Edge Area (x) and LRA (y)			

1179.5	1521.5	0.04447	0.9681
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Question 14

Median

LRA	HRA	Edge Area
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Agree	Agree	Neither agree nor disagree
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W_x	W_y	z	p
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LRA (x) and HRA (y)			
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3524.5	8256.5	-1.5118	0.13104
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Edge Area (x) and HRA (y)			
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1963.5	8476.5	1.7107	0.08726
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Edge Area (x) and LRA (y)			
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965	1736	2.42918	0.0151
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Question 15

Median

LRA	HRA	Edge Area
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Agree strongly	Agree strongly	Agree strongly
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W_x	W_y	z	p
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LRA (x) and HRA (y)			
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3359	8117	-1.01459	0.3125
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Edge Area (x) and HRA (y)			
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2163.5	7989.5	0.60544	0.54186
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Edge Area (x) and LRA (y)			
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1062.5	1638.5	1.34522	0.17702
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Question 16

Median

LRA	HRA	Edge Area
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Agree	Agree	Agree
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W_x	W_y	z	p
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LRA (x) and HRA (y)			
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3722	7603	-2.98128	0.00288
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Edge Area (x) and HRA (y)			
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2558.5	7594.5	-1.3183	0.18684
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Edge Area (x) and LRA (y)			
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1117.5	1510.5	0.56662	0.56868
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Question 17

Median

LRA	HRA	Edge Area
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Agree	Agree	Neither agree nor disagree
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W_x	W_y	z	p
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LRA (x) and HRA (y)			
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2762	7969	-0.5244	0.60306
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Edge Area (x) and HRA (y)			
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1783	8370	2.46327	0.0139
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Edge Area (x) and LRA (y)			
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900.5	1445.5	2.49423	0.01278
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W_x = the sum of the average ranks for the smaller group, W_y = the sum of the average ranks for the larger group, z = Wilcoxon-Mann-Whitney statistic, p = probability of the differences between the groups being due to chance.

6.6.5. County where respondent's veterinary practice is located (Question 23)

Veterinarians practising in the South West were compared to those from the rest of England using the Wilcoxon-Mann-Whitney test, the results are shown in Table 6.7. W_x refers to the South West and W_y refers to the other counties of England. There were no significant differences between the groups compared for 16 of the 17 questions. The medians were different for four of the questions (1, 2, 6, 11), but there was no significant difference between the groups for these questions. For many of the questions the value of p was very close to 1, showing that the groups' responses were very similar. Question 16 ($p=0.01078$) was the only comparison where the value of p was less than 0.05 and a significant difference existed between the two groups. The medians and modes were the same ('agree' for both), but a greater proportion of respondents from the South West answered negatively (27.08% in South West, 14.14% rest of England), which would account for the difference between the groups.

Table 6.7. Comparing responses of veterinarians working in the South West with veterinarians from the rest of England

Median - South West	Median - Other counties of England	W_x	W_y	z	p
Question 1					
Neither agree nor disagree	Disagree	3163.5	6566.5	-1.02287	0.30772
Question 2					
Neither agree nor disagree	Agree	2927.5	6388.5	0.0819	0.93624
Question 3					
Agree	Agree	3190	6821	0.0199	0.98404
Question 4					
Neither agree nor disagree	Neither agree nor disagree	3105.5	6624.5	-0.11321	0.9124
Question 5					
Agree	Agree	2530	5345	-0.38633	0.69654
Question 6					
Agree	Neither agree nor disagree	3475	6821	-1.01937	0.30772
Question 7					
Agree	Agree	2713	5802	-0.13528	0.88866
Question 8					
Disagree	Disagree	3260.5	6892.5	-0.18635	0.8493
Question 9					
Neither agree nor disagree	Neither agree nor disagree	2438.5	5436.5	0.09592	0.92034
Question 10					
Agree	Agree	3343	7242	0.36962	0.71138
Question 11					
Agree	Neither agree nor disagree	3306	6705	-0.80763	0.41794
Question 12					
Agree	Agree	3082	6648	-0.97686	0.32708
Question 13					
Agree	Agree	3481.5	7249.5	0.1916	0.8493
Question 14					
Agree	Agree	3244	7196	0.38776	0.69654
Question 15					
Agree strongly	Agree strongly	3087	7066	0.87838	0.37886

Median - South West	Median - Other counties of England	W_x	W_y	z	p
Question 16					
Agree	Agree	2618.5	7392.5	2.54758	0.01078
Question 17					
Agree	Agree	3113	6617	0.1643	0.87288

W_x = the sum of the average ranks for the smaller group, W_y = the sum of the average ranks for the larger group, z = Wilcoxon-Mann-Whitney statistic, p = probability of the differences between the groups being due to chance.

6.6.6. Length of time practising as a veterinary surgeon (Question 24)

Table 6.8. Comparing responses according to number of years working as a veterinarian

Question	Category medians		H	Comment
1	1 year or less	Neither agree nor disagree	4.951	H<11.07. There was no significant difference between the groups.
	>1-5 years	Between neither agree nor disagree & disagree.		
	>5-10 years	Neither agree nor disagree		
	>10-20 years	Disagree		
	>20-30 years	Disagree		
	>30 years	Disagree		
2	1 year or less	Disagree	4.120	H<11.07. There was no significant difference between the groups.
	>1-5 years	Neither agree nor disagree		
	>5-10 years	Between neither agree nor disagree & disagree		
	>10-20 years	Neither agree nor disagree		
	>20-30 years	Neither agree nor disagree		
	>30 years	Agree		
3	1 year or less	Disagree	5.213	H<11.07. There was no significant difference between the groups.
	>1-5 years	Agree		
	>5-10 years	Agree		
	>10-20 years	Agree		
	>20-30 years	Agree		
	>30 years	Between agree and strongly agree		
4	1 year or less	Agree	2.692	H<11.07. There was no significant difference between the groups.
	>1-5 years	Agree		
	>5-10 years	Neither agree nor disagree		
	>10-20 years	Neither agree nor disagree		
	>20-30 years	Agree		
	>30 years	Disagree		
5	1 year or less	Between neither agree nor disagree & disagree	9.295	H<11.07. There was no significant difference between the groups.
	>1-5 years	Neither agree nor disagree		
	>5-10 years	Neither agree nor disagree		

	>10-20 years	Agree		
	>20-30 years	Between neither agree nor disagree and agree		
	>30 years	Agree		
6	1 year or less	Agree	3.552	H<11.07. There was no significant difference between the groups.
	>1-5 years	Agree		
	>5-10 years	Neither agree nor disagree		
	>10-20 years	Agree		
	>20-30 years	Neither agree nor disagree		
	>30 years	Neither agree nor disagree		
7	1 year or less	Neither agree nor disagree	8.197	H<11.07. There was no significant difference between the groups.
	>1-5 years	Agree		
	>5-10 years	Agree		
	>10-20 years	Agree		
	>20-30 years	Agree		
	>30 years	Strongly agree		
8	1 year or less	Strongly disagree	10.962	H<11.07. There was no significant difference between the groups.
	>1-5 years	Disagree		
	>5-10 years	Disagree		
	>10-20 years	Disagree		
	>20-30 years	Disagree		
	>30 years	Neither agree nor disagree		
9	1 year or less	Between neither agree nor disagree & disagree	7.530	H<11.07. There was no significant difference between the groups.
	>1-5 years	Between neither agree nor disagree & disagree		
	>5-10 years	Neither agree nor disagree		
	>10-20 years	Disagree		
	>20-30 years	Disagree		
	>30 years	Agree		
10	1 year or less	Agree	10.061	H<11.07. There was no significant difference between the groups.
	>1-5 years	Agree		
	>5-10 years	Agree		
	>10-20 years	Agree		
	>20-30 years	Agree		
	>30 years	Between neither agree nor disagree and agree		
11	1 year or less	Between neither agree nor disagree & disagree	4.475	H<11.07. There was no significant difference between the groups.
	>1-5 years	Agree		
	>5-10 years	Neither agree nor disagree		
	>10-20 years	Agree		
	>20-30 years	Neither agree nor disagree		
	>30 years	Agree		
12	1 year or less	Agree	3.159	H<11.07. There was no significant difference between the groups.
	>1-5 years	Agree		

	>5-10 years	Agree		
	>10-20 years	Agree		
	>20-30 years	Agree		
	>30 years	Agree		
13	1 year or less	Between neither agree nor disagree and agree	5.051	H<11.07. There was no significant difference between the groups.
	>1-5 years	Agree		
	>5-10 years	Agree		
	>10-20 years	Agree		
	>20-30 years	Agree		
	>30 years	Agree strongly		
14	1 year or less	Disagree	9.842	H<11.07. There was no significant difference between the groups.
	>1-5 years	Agree		
	>5-10 years	Agree		
	>10-20 years	Agree		
	>20-30 years	Neither agree nor disagree		
	>30 years	Agree		
15	1 year or less	Agree	3.752	H<11.07. There was no significant difference between the groups.
	>1-5 years	Agree strongly		
	>5-10 years	Agree strongly		
	>10-20 years	Agree strongly		
	>20-30 years	Agree strongly		
	>30 years	Agree strongly		
16	1 year or less	Agree	6.738	H<11.07. There was no significant difference between the groups.
	>1-5 years	Agree		
	>5-10 years	Agree		
	>10-20 years	Agree		
	>20-30 years	Agree		
	>30 years	Agree		
17	1 year or less	Between neither agree nor disagree and agree	9.507	H<11.07. There was no significant difference between the groups.
	>1-5 years	Agree		
	>5-10 years	Neither agree nor disagree		
	>10-20 years	Agree		
	>20-30 years	Between neither agree nor disagree and agree		
	>30 years	Agree		

H = Kruskal-Wallis test statistic

6.6.7. Gender of respondents (Question 25)

The responses of male and female respondents were compared using the Wilcoxon-Mann-Whitney test. W_x refers to female respondents and W_y refers to male respondents in Table 6.9.

Table 6.9. Comparing responses of male veterinarians and female veterinarians

Median - Female	Median – Male	W_x	W_y	z	p
Question 1					
Neither agree nor disagree	Disagree	6326	9074	-0.2355	0.81034
Question 2					
Agree	Neither agree nor disagree	6391	8315	-1.43728	0.14986
Question 3					
Agree	Agree	6900	9031	-1.35	0.17702
Question 4					
Neither agree nor disagree	Agree	5807	9769	1.43545	0.14986
Question 5					
Agree	Agree	4498	7905	0.01643	0.98404
Question 6					
Agree	Agree	6663	9808	0.4651	0.63836
Question 7					
Agree	Agree	4868.5	8334.5	0.63404	0.5287
Question 8					
Disagree	Disagree	6945.5	8807.5	-0.80152	0.42372
Question 9					
Neither agree nor disagree	Disagree	5254	7307	-1.44285	0.14986
Question 10					
Agree	Agree	6667	9804	0.7143	0.4777
Question 11					
Between neither agree nor disagree and agree	Neither agree nor disagree	6747.5	9005.5	-1.01232	0.3125
Question 12					
Agree	Agree	6926	8474	-1.51755	0.12852
Question 13					
Agree	Agree	7765	9071	-1.92359	0.05486
Question 14					
Agree	Agree	7364	9289	-1.16831	0.242
Question 15					
Agree strongly	Agree strongly	6845.5	9444.5	-0.16684	0.86502
Question 16					
Agree	Agree	6479.5	9630.5	0.52725	0.59612
Question 17					
Agree	Agree	6857.5	8542.5	-1.85057	0.06432

W_x = the sum of the average ranks for the smaller group, W_y = the sum of the average ranks for the larger group, z = Wilcoxon-Mann-Whitney statistic, p = probability of the differences between the groups being due to chance.

6.6.8. Age of respondents (Question 26)

The Kruskal-Wallis test was used to determine whether there was a significant difference between the groups, the results are shown in Table 6.10.

Table 6.10. Comparing responses of veterinarians of different age groups

Question	Category medians		H	Comment
1	Age 22-30	Disagree	9.281	H<9.488. There was no significant difference between the groups.
	Age 31-40	Neither agree nor disagree		

	Age 41-50	Neither agree nor disagree		
	Age 51-60	Disagree		
	Age 61+	Disagree		
2	Age 22-30	Neither agree nor disagree	2.761	H<9.488. There was no significant difference between the groups.
	Age 31-40	Neither agree nor disagree		
	Age 41-50	Neither agree nor disagree		
	Age 51-60	Agree		
	Age 61+	Between neither agree nor disagree and agree		
3	Age 22-30	Agree	8.266	H<9.488. There was no significant difference between the groups.
	Age 31-40	Agree		
	Age 41-50	Agree		
	Age 51-60	Agree		
	Age 61+	Strongly agree		
4	Age 22-30	Neither agree nor disagree	2.846	H<9.488. There was no significant difference between the groups.
	Age 31-40	Neither agree nor disagree		
	Age 41-50	Agree		
	Age 51-60	Disagree		
	Age 61+	Neither agree nor disagree		
5	Age 22-30	Agree	5.605	H<9.488. There was no significant difference between the groups.
	Age 31-40	Neither agree nor disagree		
	Age 41-50	Between neither agree nor disagree and agree		
	Age 51-60	Agree		
	Age 61+	Agree		
6	Age 22-30	Neither agree nor disagree	6.637	H<9.488. There was no significant difference between the groups.
	Age 31-40	Agree		
	Age 41-50	Agree		
	Age 51-60	Neither agree nor disagree		
	Age 61+	Disagree		
7	Age 22-30	Agree	6.187	H<9.488. There was no significant difference between the groups.
	Age 31-40	Agree		
	Age 41-50	Agree		
	Age 51-60	Agree strongly		
	Age 61+	Agree strongly		
8	Age 22-30	Disagree	11.605	There was a significant difference between the groups.
	Age 31-40	Disagree		
	Age 41-50	Disagree		
	Age 51-60	Disagree		
	Age 61+	Neither agree nor disagree		
9	Age 22-30	Neither agree nor disagree	7.497	H<9.488. There was no significant difference between the groups.
	Age 31-40	Disagree		
	Age 41-50	Disagree		
	Age 51-60	Neither agree nor disagree		
	Age 61+	Agree		

10	Age 22-30	Agree	10.603	There was a significant difference between the groups.
	Age 31-40	Agree		
	Age 41-50	Agree		
	Age 51-60	Agree		
	Age 61+	Between neither agree nor disagree & disagree		
11	Age 22-30	Agree	11.081	There was a significant difference between the groups.
	Age 31-40	Neither agree nor disagree		
	Age 41-50	Disagree		
	Age 51-60	Agree		
	Age 61+	Agree		
12	Age 22-30	Agree	7.389	H<9.488. There was no significant difference between the groups.
	Age 31-40	Agree		
	Age 41-50	Neither agree nor disagree		
	Age 51-60	Agree		
	Age 61+	Agree		
13	Age 22-30	Agree	7.180	H<9.488. There was no significant difference between the groups.
	Age 31-40	Agree		
	Age 41-50	Between neither agree nor disagree and agree		
	Age 51-60	Agree		
	Age 61+	Agree		
14	Age 22-30	Agree	12.360	There was a significant difference between the groups.
	Age 31-40	Agree		
	Age 41-50	Neither agree nor disagree		
	Age 51-60	Agree		
	Age 61+	Agree		
15	Age 22-30	Agree strongly	2.121	H<9.488. There was no significant difference between the groups.
	Age 31-40	Agree strongly		
	Age 41-50	Agree strongly		
	Age 51-60	Agree strongly		
	Age 61+	Agree strongly		
16	Age 22-30	Agree	8.033	H<9.488. There was no significant difference between the groups.
	Age 31-40	Agree		
	Age 41-50	Agree		
	Age 51-60	Agree		
	Age 61+	Agree		
17	Age 22-30	Agree	16.618	There was a significant difference between the groups.
	Age 31-40	Agree		
	Age 41-50	Neither agree nor disagree		
	Age 51-60	Agree		
	Age 61+	Between agree and agree strongly		

H = Kruskal-Wallis statistic

The value of H calculated for question 8 was 11.605, which is greater than the critical value of 9.488. This means that the null hypothesis was rejected and it was concluded that a significant difference existed between the groups for this question. Using the Wilcoxon-Mann-Whitney test to compare each age group to the rest of the sample, it was shown that the groups 41-50 years and 61+ years could be expected to show a difference to the other groups. All of the groups were compared with each other to determine where the significant differences were to be found. The results for this pairwise comparison

are detailed in Table 6.11. When performing the Wilcoxon-Mann-Whitney test the group 'x' is smaller than the group 'y'. The group 31-40 years was the largest group and was never the 'x' group in a comparison; likewise the 61+ years group was the smallest and could never be the 'y' in a comparison. The cells in Table 6.11 where these requirements for 'x' and 'y' are not met are shaded in black. The groups cannot be compared with themselves, so these cells are also shaded in black. Those comparisons where $p < 0.05$, indicating a statistically significant difference, are shaded in grey. The age group 41-50 years differed significantly from the age groups 23-30, 51-60 and 61+ years.

Table 6.11. Pairwise comparisons of age groups for question 8

Question 8					
	y = 23-30	y = 31-40	y = 41-50	y = 51-60	y = 61+
x = 23-30		0.373			
x = 31-40					
x = 41-50	0.0214	0.197		0.0271	
x = 51-60	0.9203	0.4009			
x = 61+	0.0718	0.0601	0.0014	0.1096	

The value of H calculated for question 10 was 10.603, which is greater than the critical value of 9.488, showing that there was a significant difference between the groups. Comparing each age group to the rest of the sample using Wilcoxon-Mann-Whitney test, it was predicted that significant differences would exist between the 61+ years age group and the other age groups. All of the groups were compared with each other to determine where the significant differences were to be found, with the results shown in Table 6.12. The 61+ years age group differed significantly from the 31-40 and 41-50 years groups. The 41-50 years and 23-30 years groups also differed significantly.

Table 6.12. Pairwise comparisons of age groups for question 10

Question 10					
	y = 23-30	y = 31-40	y = 41-50	y = 51-60	y = 61+
x = 23-30		0.2937			
x = 31-40					
x = 41-50	0.0488	0.3472		0.0672	
x = 51-60	0.9203	0.2983			
x = 61+	0.0524	0.0424	0.0063	0.1164	

The value of H calculated for question 11 was 11.081, which is greater than the critical value of 9.488, showing a significant difference between the groups. Comparing each age group to the rest of the sample using Wilcoxon-Mann-Whitney test, it was predicted that significant differences would exist between the 41-50 years age group and the other age groups. All of the groups were compared with each other to determine where the significant differences were to be found, with the results shown in Table 6.13. The 41-50 years age group differed significantly from the 23-30, 51-60 and 61+ years groups.

Table 6.13. Pairwise comparisons of age groups for question 11

Question 11					
	y = 23-30	y = 31-40	y = 41-50	y = 51-60	y = 61+
x = 23-30		0.2801			
x = 31-40					
x = 41-50	0.0083	0.0784		0.0096	
x = 51-60	0.7414	0.2187			
x = 61+	0.5619	0.2301	0.0108	0.8493	

The value of H calculated for question 14 was 12.360, which is greater than the critical value of 9.488; showing that there was a significant difference between the groups. Each age group was compared with the rest of the sample using Wilcoxon-Mann-Whitney test, and it was predicted that significant differences would exist between the 41-50 and 61+ years age group and the other age groups. All of the groups were compared with each other to determine where the significant differences were to be found. Table 6.14 shows that with p-values less than 0.05, the 41-50 years age group differed significantly from the 23-30, 31-40 and 61+ years groups.

Table 6.14. Pairwise comparisons of age groups for question 14

Question 14					
	23-30	31-40	41-50	51-60	61+
23-30		0.5157			
31-40					
41-50	0.0088	0.0444		0.1556	
51-60	0.4715	0.8259			
61+	0.0784	0.0536	0.0029	0.0751	

The value of H calculated for question 17 was 16.618, which is greater than the critical value of 9.488, indicating a significant difference between the groups. Comparing each age group to the rest of the sample using Wilcoxon-Mann-Whitney test, it was predicted that significant differences would exist between the 23-30, 41-50 and 61+ years age group and the other age groups. All of the groups were compared with each other and the results are shown in Table 6.15. The 23-30 years group differed significantly from the 31-40 year group. The 41-50 year group also differed from the 23-30 years group, as well as the 51-60 and 61+ years group. In addition, the 61+ years group differed from those aged 31-40 years.

Table 6.15. Pairwise comparisons of age groups for question 17

Question 17					
	y = 23-30	y = 31-40	y = 41-50	y = 51-60	y = 61+
x = 23-30		0.0257			
x = 31-40					
x = 41-50	0.0021	0.234		0.0366	
x = 51-60	0.177	0.3125			
x = 61+	0.4065	0.0285	0.0041	0.055	

6.6.9. Country of qualification (Question 27)

The EU graduates were compared to the UK graduates using the Wilcoxon-Mann-Whitney test. W_x refers to the EU graduates and W_y refers to the UK graduates in Table 6.16.

Table 6.16. Comparing responses of UK graduates to EU graduates

Median – EU graduates	Median – UK graduates	W_x	W_y	z	p
Question 1					
Neither agree nor disagree	Disagree	557	11533	-0.9048	0.92828
Question 2					
Between neither agree nor disagree and agree	Neither agree nor disagree	741	10887	-1.12496	0.26272
Question 3					
Agree strongly	Agree	820.5	11582.5	-1.50066	0.13362
Question 4					
Neither agree nor disagree	Neither agree nor disagree	536	11554	0.70767	0.4777
Question 5					
Neither agree nor disagree	Agree	490.5	9100.5	-0.03396	0.97606
Question 6					
Neither agree nor disagree	Neither agree nor disagree	496.5	12383.5	0.55476	0.58232
Question 7					
Between neither agree nor disagree and agree	Agree	486.5	9809.5	0.78179	0.4354
Question 8					
Disagree	Disagree	657	11589	-0.91597	0.35758
Question 9					
Neither agree nor disagree	Neither agree nor disagree	504.5	9365.5	-0.83337	0.40654
Question 10					
Agree	Agree	430.5	12449.5	1.10535	0.267
Question 11					
Neither agree nor disagree	Agree	656	11590	-0.22095	0.82588
Question 12					
Agree	Agree	465	11470	0.00467	1
Question 13					
Agree	Agree	578.5	12624.5	-0.06178	0.95216
Question 14					
Agree	Agree	663.5	12377.5	-0.79578	0.42372
Question 15					
Agree	Agree strongly	446.5	12273.5	0.94872	0.34212
Question 16					
Between neither agree nor disagree and agree	Agree	581.5	12298.5	0.4854	0.62414
Question 17					
Agree	Agree	668	11578	-0.31737	0.74896

W_x = the sum of the average ranks for the smaller group, W_y = the sum of the average ranks for the larger group, z = Wilcoxon-Mann-Whitney statistic, p = probability of the differences between the groups being due to chance.