

Seasonal calving UK dairy herds: a farmer survey of fertility and veterinary services

George Giles^{1,2}, Emma Fishbourne², Robert Frank Smith² and Helen Mary Higgins^{2*}

¹Giles & Parsons Farm Vets, West Roose, Camelford, Cornwall, UK.

²Institute of Infection, Veterinary and Ecological Sciences, Department of Livestock and One Health, University of Liverpool, Neston, Cheshire, UK

*** Correspondence:**

Helen Mary Higgins

h.higgins@liverpool.ac.uk

ABSTRACT

Background: There is a lack of literature concerning dairy farmers' use of veterinary services and how satisfied they are with them. This study aimed to fill this gap for seasonal calving UK herds, with a focus on fertility, and included farmer perceived barriers to veterinary involvement. **Methods:** A cross-sectional questionnaire (convenience sample), with 166 useable responses. **Results:** Opportunities exist for further veterinary involvement in seasonal herds. Areas vets are least involved in currently are nutrition, breeding and genetics, growth rate monitoring and infra-structure changes. Current veterinary input was rated neutral or poor value by 21% of respondents. Over 90% of farmers want vets to ask questions to elicit their needs. Frequently mentioned barriers were: "lack of veterinary knowledge of our system", "not enough cost-benefit of veterinary involvement" and "we get our fertility information elsewhere". Along with clinical ability and being approachable, "understanding our system" and being "proactive" were qualities participants most valued in a vet. After cost, "pushing sales and interventions" were the least liked. **Conclusion:** Findings highlight the critical importance of clearly demonstrating the full cost benefits of veterinary services to farmers. The results contain many details concerning farmer perceptions and values that can help veterinary businesses to strengthen existing services and develop new services.

1. INTRODUCTION

This research concerned seasonal (or block) calving UK dairy herds. The proportion of dairy farmers identifying as seasonal calving, as opposed to all-year-round calving (AYR), has increased from 19% in 2016 to 28% in 2019 (CHAWG, 2020). There are several key differences between seasonal and AYR herds, and in particular, achieving high levels of fertility is critical for seasonal herds in order to successfully maintain the tight calving pattern. Although there appears to be a trend towards more seasonal production patterns, in general, there is a relative paucity of research literature directly relating to these herds in the UK. The majority of our knowledge pertaining to this production system has been adapted to UK conditions from work conducted in Australia and New Zealand, particularly the 'InCalf' Programme (McDougall et al., 2014; AHDB, 2019).

In addition, the veterinary profession is currently experiencing rapid changes in the environment in which it operates, and the marketplace is becoming increasingly competitive. A landmark report by Lowe (2009) recommended that in order to “remain competitive and profitable”, private veterinarians and those who provide veterinary services to farmers “must become more aware of the changing business needs of their customers and provide more specialised and value-added services”. On a similar note, a more recent study investigating the challenges faced by the farm animal veterinary profession in England, called for farms vets to “realign their veterinary expertise to the demands of the market”, “improve their skills in preventive medicine” and “develop entrepreneurial skills to demonstrate their market value if they are to avoid becoming marginalised” (Ruston et al., 2016).

For the veterinary profession, a starting point for having an awareness of farmers’ business needs, is knowledge relating to which veterinary services farmers are currently using and how these services are valued, particularly those services and activities that are more preventative in nature. Furthermore, for seasonal calving herds, fertility related veterinary services are of particular interest because as previously noted, fertility is of paramount importance. However, to our knowledge, no published data exists regarding how seasonal calving UK farmers are using their vet for fertility related services, or how these services are valued. There also appear to be two other gaps in the literature. Firstly, regarding why seasonal calving UK dairy farmers use their current veterinary provider and veterinary attributes considered desirable or undesirable. And secondly, regarding any barriers that may restrict veterinary involvement in the fertility management of seasonal calving herds.

Overall, information relating to these gaps in the literature has the potential to highlight business opportunities for vets and facilitate improvement in their services. It may help vets to identify opportunities for further engagement with seasonal calving dairy farmers, including other areas of preventative medicine, bringing benefits for both parties and animal welfare. The aims of this study were therefore to: (i) describe how fertility related veterinary services are currently being utilised and valued on a sample of seasonal calving UK dairy herds, (ii) describe how seasonally calving dairy farmers value a range of different veterinary services and activities (iii) report barriers that may limit the use of veterinary fertility services for seasonal calving herds, (iv) to understand why seasonal calving dairy farmers use their current veterinary provider and report characteristics of their vet that they perceive as desirable or undesirable.

2. METHODS

The cross-sectional questionnaire was designed in collaboration with clinical academics at the University of Liverpool and vets in private practice. The target population was UK seasonal calving dairy herds. Assuming that approximately 28% of UK dairy herds in 2019 -2020 were seasonal calving (CHAWG, 2020), and with an estimated 11,909 dairy producers in the UK (AHDB, 2021), the target population was estimated to be 3,334 farms. There were two eligibility criteria for inclusion, participants had to work on, or manage, herds from the target population, and have responsibility, or involvement with, the fertility management of the adult dairy herd. The survey contained an initial participant information page followed by an informed consent message and the two inclusion criteria. There were 25 questions although 2 questions had several parts, and a mixture of formats were utilized, mainly tick box or Likert type scales, but also some free text responses. The questionnaire is provided as **supplementary material, S1**. The questions explored the 4 main topics: (i) current use of veterinary fertility services and their perceived value, (ii) how different types of veterinary services/activities are valued, (iii) barriers to veterinary involvement with fertility, (iv) why farmers use their current vet practice and veterinary characteristics they found desirable or undesirable. Questions concerning demographic information and two key performance fertility indicators were also included. The survey was piloted on 5 eligible dairy farmers from the target population. This pre-testing helped to reduce non-response bias by improving the questions for the target population. Pilot data were

not included in the analysis. The research was approved by the University of Liverpool's veterinary research ethics committee (reference VREC084).

The questionnaire was available online through the software package Qualtrics® (Provo, Utah, USA). Multiple participation by the same person was reduced by the software, which only allowed the same IP address to complete the survey once. It was assumed that an IP address corresponded to a unique participant, although by using a different device, the same person could have completed the survey more than once. Convenience sampling was deployed. The survey was advertised through targeted emailing to organisations that included semen companies, seasonal calving grazing discussion groups, Tesco Sustainable Dairy Group and the University of Nottingham Dairy Herd Health Group. Veterinary practices known through the professional networks of the authors were also asked to send the questionnaire to their eligible clients. A printed version of the survey was also offered to each organisation contacted. A total of 60 hard copies were handed out, of which 13 were returned, and each included a postage paid return envelope. No postal reminders were sent. Social media advertising of the survey link occurred via the personal and professional networks of one author (GG). As there were multiple channels used to distribute the survey, and due to the cascading nature of social media circulation, it was not possible to track the number of eligible farmers receiving the survey, or to calculate a survey response rate.

The survey was open from July 2019 to February 2020. This long data collection period helped to reduce non-response bias, as did offering an incentive to participate via a prize draw for a £100 gift voucher. Participants wishing to enter the prize draw were asked to provide contact details. However, to reduce non-response bias, participants were made aware that these details would be used solely to award the gift. After the survey closed, the data was imported into Microsoft Office Excel (Microsoft 2016). Missing questions and dropouts (i.e. participants who did not finish the entire questionnaire) were examined and if they met the inclusion criteria described previously, answers prior to drop out were included. Free text answers were manually collated into categories to facilitate reporting by GG. The data was exported into Minitab® Statistical Software (Minitab 19, PA, USA) and underwent descriptive analysis. In keeping with the aims of the study which were descriptive in nature, statistical hypothesis testing was not conducted and a sample size calculation was not undertaken. The aim was to obtain the largest sample possible, within the timeframe of the study. The survey is reported in keeping with CROSS, the Consensus-Based Checklist for Reporting of Survey Studies, guidelines (Sharma et al., 2021).

3. RESULTS

3.1 Number of responses to the questionnaire

There were 196 responses in total. The initial eligibility question removed 21 participants due to them not being involved in a seasonal calving herd, and a further 5 were removed due to not being involved in fertility management of the adult dairy herd. A further 3 responses were from the Republic of Ireland and 1 response was from New Zealand which were removed because the target population was the UK. This resulted in 166 responses in full or part to the questionnaire. Of these 166 respondents, 112 people reached the end of the questions, albeit some free text options were not answered by all people. Apart from the two initial eligibility criteria questions, participants were not forced to answer questions, which meant that the number of responses varied to some of the questions. In the following sections, the number responding to each question is indicated.

3.2 Demographic information and 2 key performance fertility indicators

There were 112 respondents who answered the question relating to their age, with the distribution as follows: 18-25 years (7%), 25-34 years (30%), 35-44 years (29%), 45-54 years (19%), 55-64 years (12%), 65-74 years (4%). No farmers were aged over 75. All of the participants (i.e. 100%) confirmed that they were “one of the people on the farm that interacts and makes decisions with the farm vet”. There was a gender bias with 86% (96/112) of respondents’ male, compared to 13% (15/112) female, and 1% (1/112) preferred not to specify. A total of 112 respondents reported their geographical location with 72% from England, 22% from Wales, and 3% each from Scotland and Northern Ireland. Those from England (n=81), were divided by region as follows, from largest: South West (53%), Midlands (24%), North West (12%), South East (9%) and North East (2%). The size of the dairy herd reported by participants (n=112) was distributed as follows: <150 cows (11%), 150 to less than 300 cows (37%), 300 to less than 450 cows (30%), 450 to less than 600 cows (16%), 600 to less than 750 cows (2%), over 750 cows (4%).

A majority of respondents, 70% (n=78/112), had been a seasonal calving herd for at least 5 years, with 18% seasonal calving for between 3 and 5 years, 11% for between 1 and 3 years, and 1% had been seasonal for less than 1 year. The target total number of weeks participants (n=116) said they “planned to calve for” was: < 9 weeks (9%), >9 to 12 weeks (66%), >12 to 15 weeks (15%), >15 to 18 weeks (5%), >18 to 21 weeks (2%), > 21 to 24 weeks (<1%), and > 24 weeks (3%). In the last 12-month period, 36% (n=42/116) of participants had been calving cows in 3 months out of the 12 months, with 4% (n=5/116) calving cows for less than 3 months, 24% (n=28/116) calving for 4 months, 14% (n=16/116) for 5 months, 13% (n=15/116) for 6 months, 7% (n=8/116) for 7 months and 2% (n=2/116) for 8 months. The majority, 88% (n=102/116), reported that the last 12-month period had been a typical season for their farm, with 12% saying it was not typical. More of the respondents used sexed semen 62% (69/111 responses) compared to those that did not use sexed semen at 38% (42/111).

A total of 77% (n=85/110) of respondents provided their 6-week in-calf rate for the last breeding season, with 19% stating that they did not know their 6-week in-calf rate and 4% answering that they would prefer not to say. For those who provided a value, the median self-reported 6-week in-calf rate was 75%, with an inter-quartile range of 68% to 81% (see Figure 1).

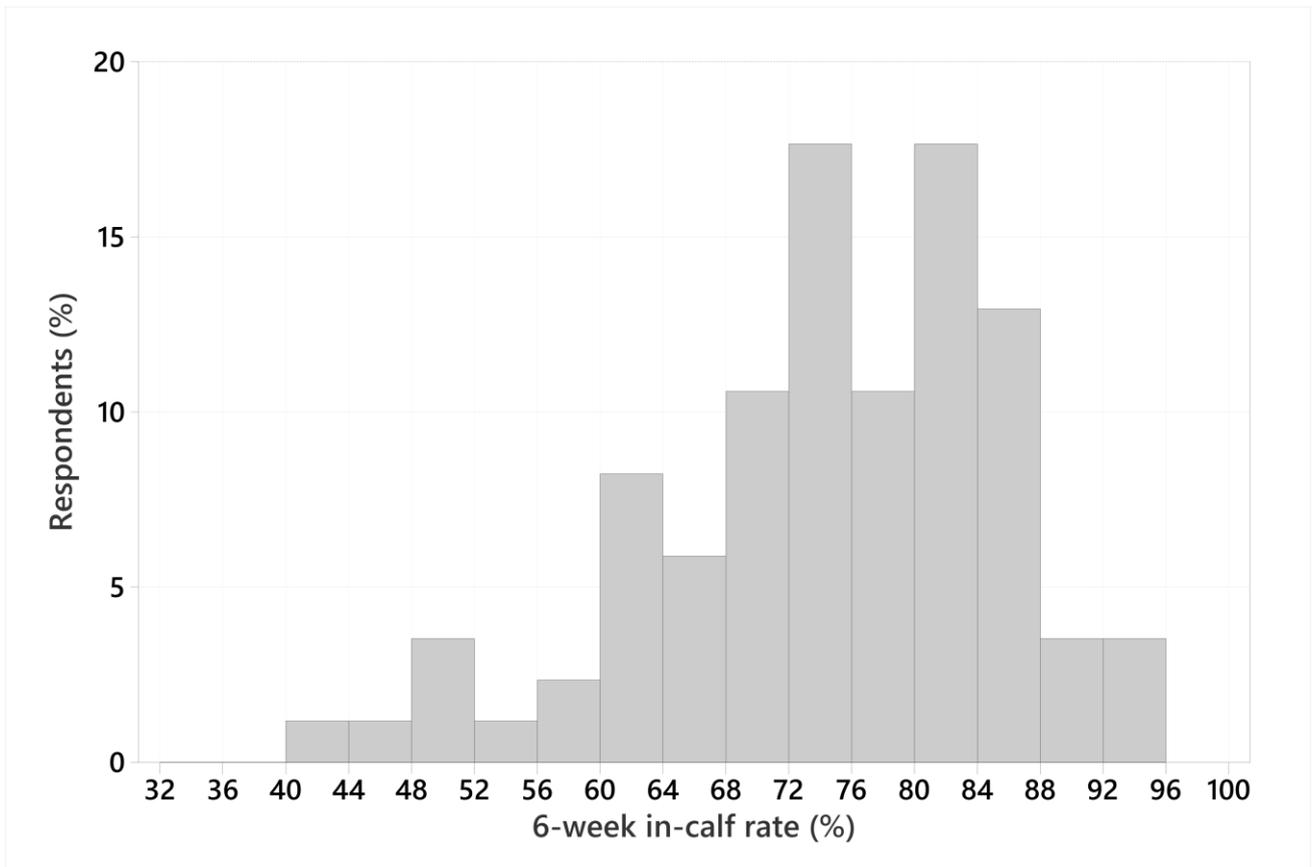


Figure 1: The 6-week in-calf rate for the previous breeding season, for each participant that provided a value in the questionnaire (n=85).

Figure 2 presents the distribution of the herd empty rate (percentage of cows not pregnant) at the end of the last breeding season, for those participants that provided this information (n=97/112; 87%). The median empty rate was 11%, with interquartile range 8-14%. There were 11% (n=12/112) of farmers that stated they did not know their empty rate, whilst 3 farmers indicated that they would prefer not to say.

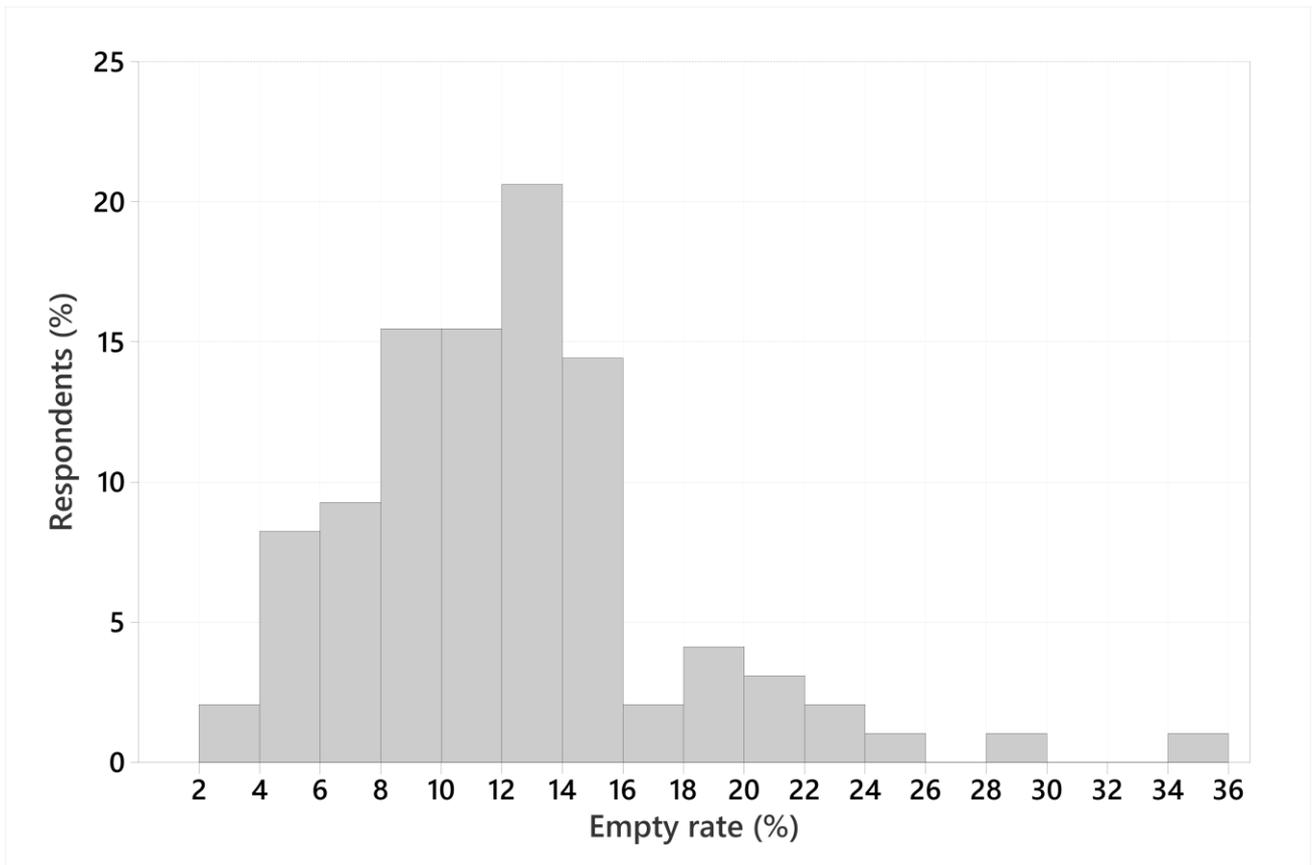


Figure 2. The empty rate (percentage of cows not pregnant) at the end of the last breeding season, for each participant that provided a value in the questionnaire (n=97).

3.3 The current use of veterinary fertility services by seasonal calving dairy farmers and the perceived value

Figure 3 shows a list of the ways that vets were reported by participants to be involved in the fertility management on their farms, at the present time. Multiple options could be selected by each participant. The number of farmers who answered was 127 and the total number of responses was 1,146.

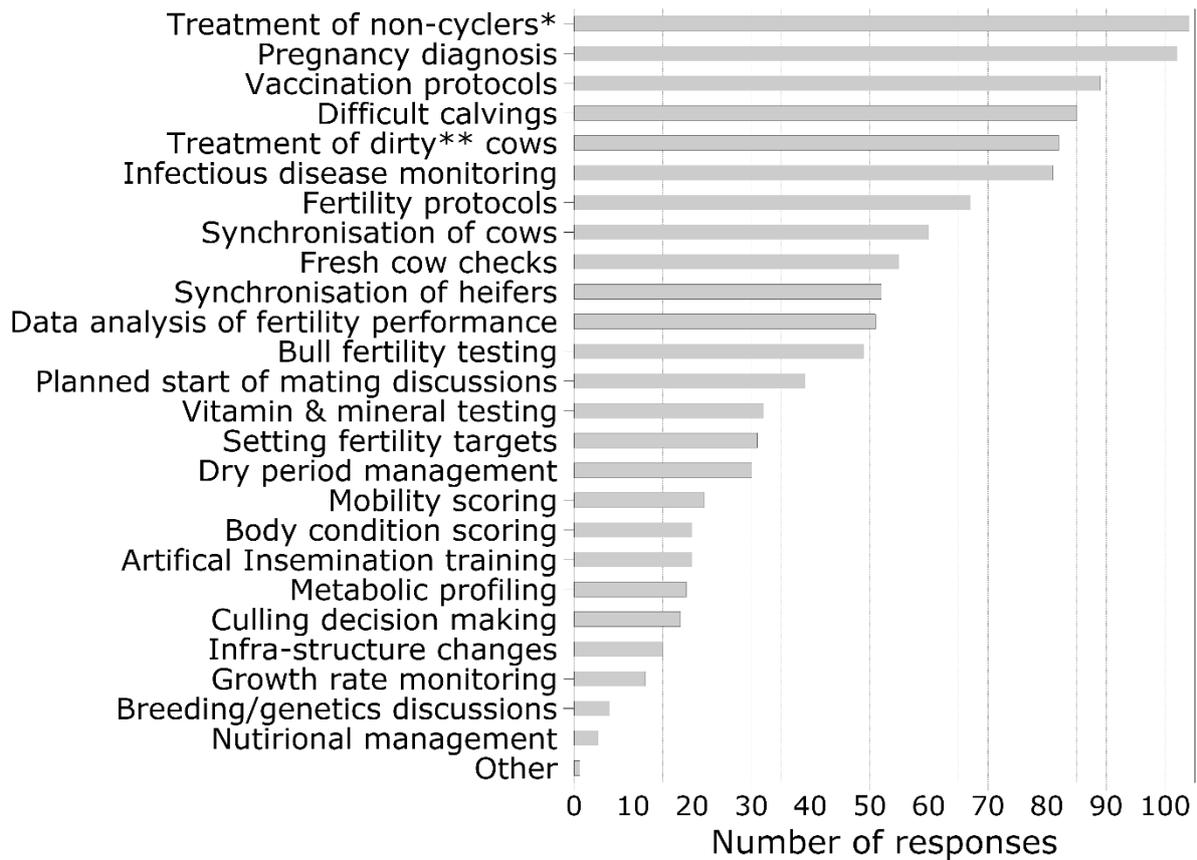


Figure 3: Current veterinary involvement in herd fertility management as reported by n=127 farmers. Multiple options could be selected by each farmer, with n=1,146 responses in total. 'Other' was a free text reply option, for which 'pre-calving training' was given. *includes cows not seen in oestrus **defined as retained foetal membranes, metritis or endometritis

In reply to who tends to initiate conversations about herd fertility planning, most participants 59% (n=70/118) answered that it was jointly between themselves and their vet, followed by 33% of participants who stated that they themselves initiated the conversation about herd fertility planning. A much smaller number, 6%, stated that neither themselves nor their vet brought up a conversation about herd fertility planning, and 2% said that it was their vet who would initiate a conversation about herd fertility planning.

Participants were also asked to reflect on the current level of veterinary involvement in the fertility management on their farms, and rate how they valued it on a 5-point scale. There were 114 farmers who answered the question, distributed as follows: excellent value (20%), good value (59%), neutral (14%), poor value (7%) and terrible value (0%). Farmers also asked how likely they would be to recommend their vet to a friend (assuming they were also a seasonal calving herd), with 112 replies as follows: extremely likely (60%), somewhat likely (25%), neutral (10%), somewhat unlikely (3%), extremely unlikely (2%).

3.4 How seasonal calving dairy farmers value different types of veterinary services and activities

This section explored how seasonal calving dairy farmers valued a range of different veterinary services or activities that could be offered and used (i.e. irrespective of whether they were currently used or offered).

Figure 4 shows the value that respondents placed on each of a range of services and activities that their vet could do, in order to assist them.

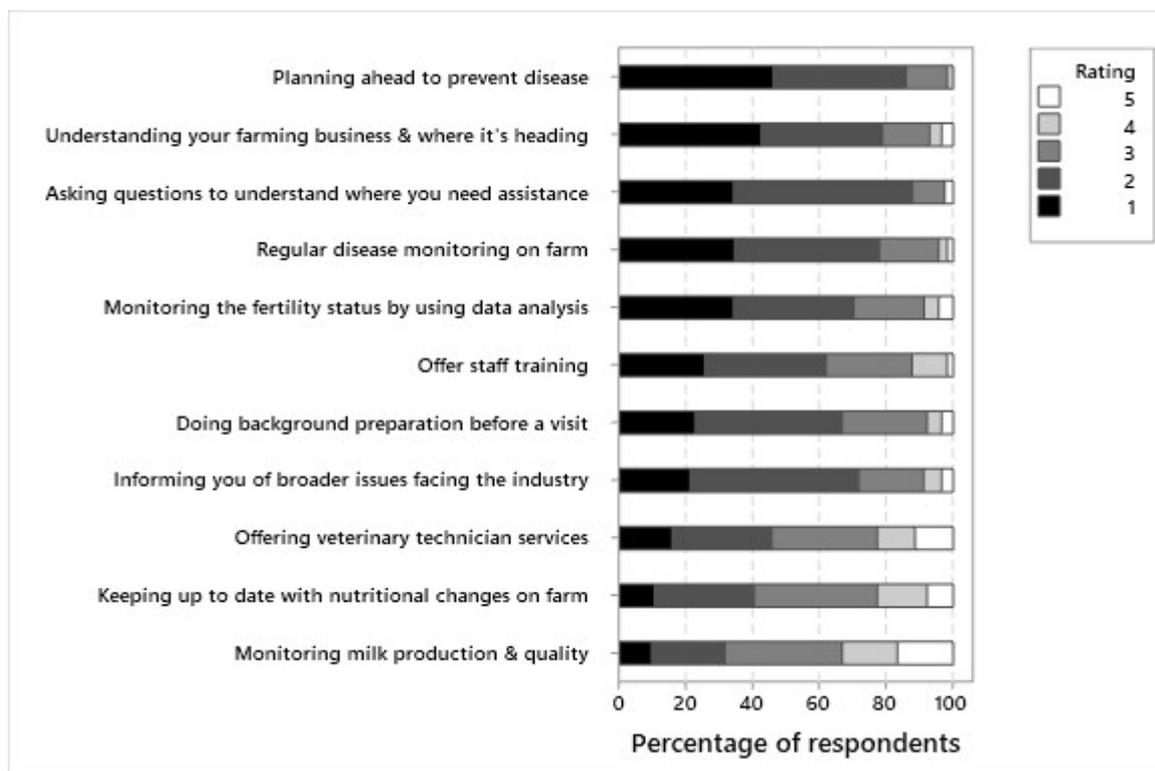


Figure 4: Farmers views on how important each of the topics listed are for their veterinary surgeon to do or offer. Key: 1= highly valuable, 2=somewhat valuable, 3 =neutral, 4= somewhat invaluable, 5 = highly invaluable. N= 114 respondents

With regard to offering staff training, farmers were also asked about whether they could think of any fertility related training courses that were offered, or could be offered, by their veterinary practice that would be particularly useful for them. It was a free text question where answers were collated into themes and common themes grouped. The results from those farmers who provided a response (n=61) are summarised in Figure 5.

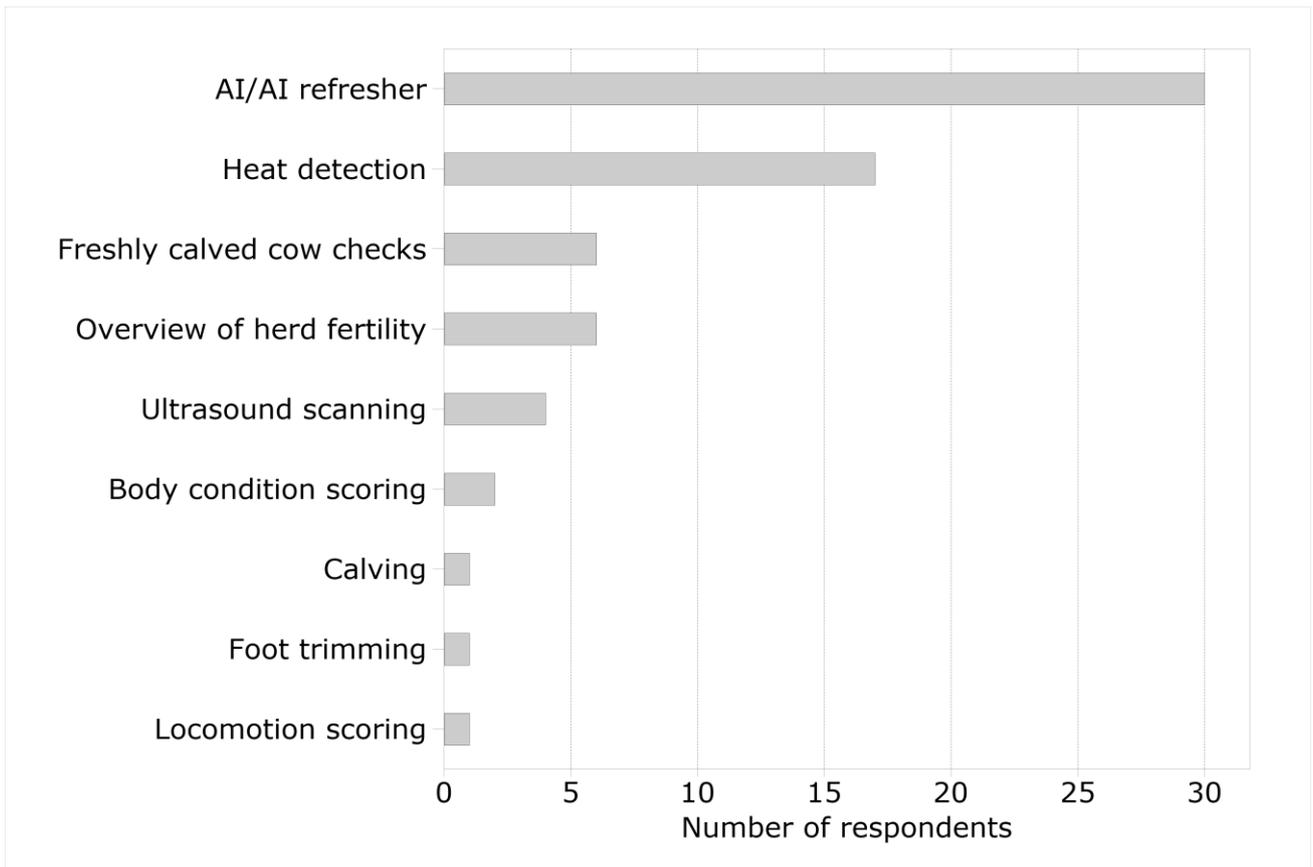


Figure 5: The type of training courses that respondents would find ‘particularly useful’ for their veterinary practice to offer. N=61 farmer replied, with 68 suggestions in total. AI = artificial insemination

In addition, Figure 6 shows the value that seasonal calving dairy farmers would place on each of three different topics, if their vet were to ‘initiate a conversation about them’.

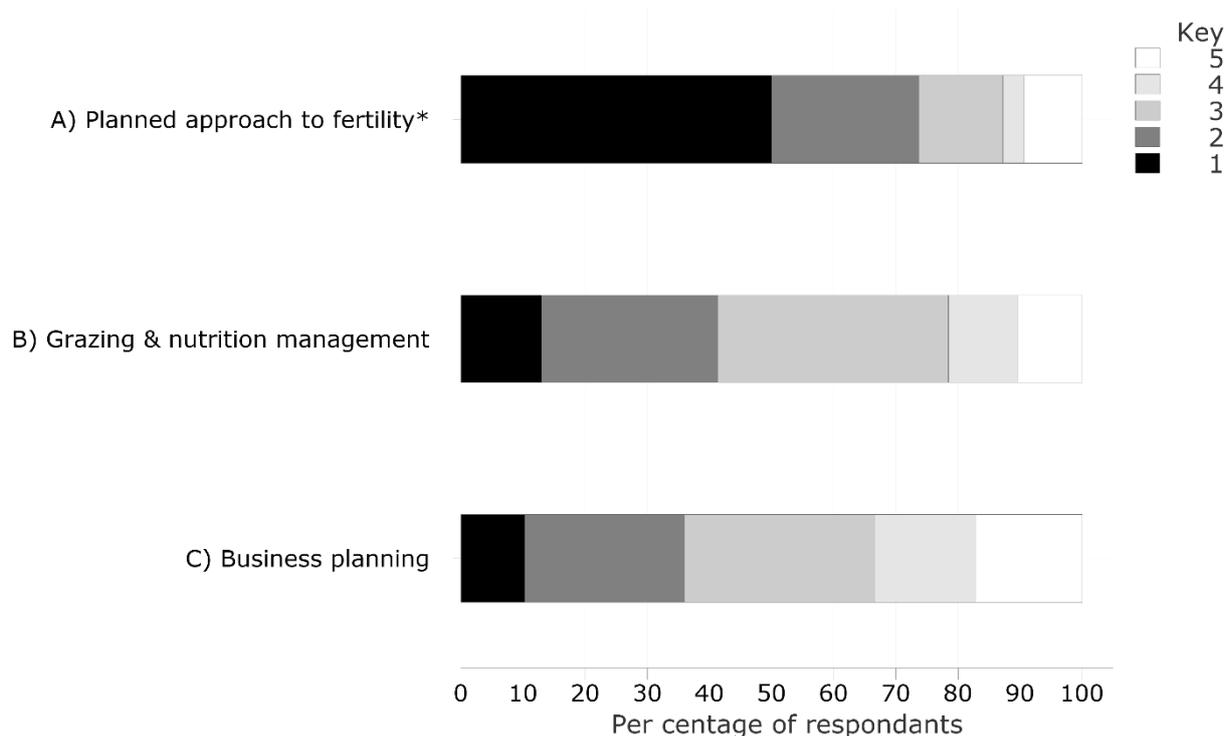


Figure 6: Farmers views of how they would value each of the stated conversation topics if their vet initiated a conversation about them. Key: 1 = highly valuable, 2= somewhat valuable, 3 =neutral, 4=somewhat invaluable, 5= highly invaluable. Number of respondents: A= 118; B=116; C= 117. * i.e. separate from emergency call outs

3.5 Farmer reported barriers to veterinary involvement with fertility

Figure 7 is a summary of factors that farmers believed were barriers that decrease the amount of veterinary fertility involvement on their farm. The options listed were pre-formulated for farmers to read, and an option of 'other' was also given with a free text option for farmers to expand on any areas that were not listed in the questionnaire. Participants could tick more than one option. Free text answers (n=7) can be summarised into vet factors (too busy, high staff turnover, distance and timings of visits) and farm/farmer factors (needing to see a cost/benefit, no perceived fertility improvements to be made).

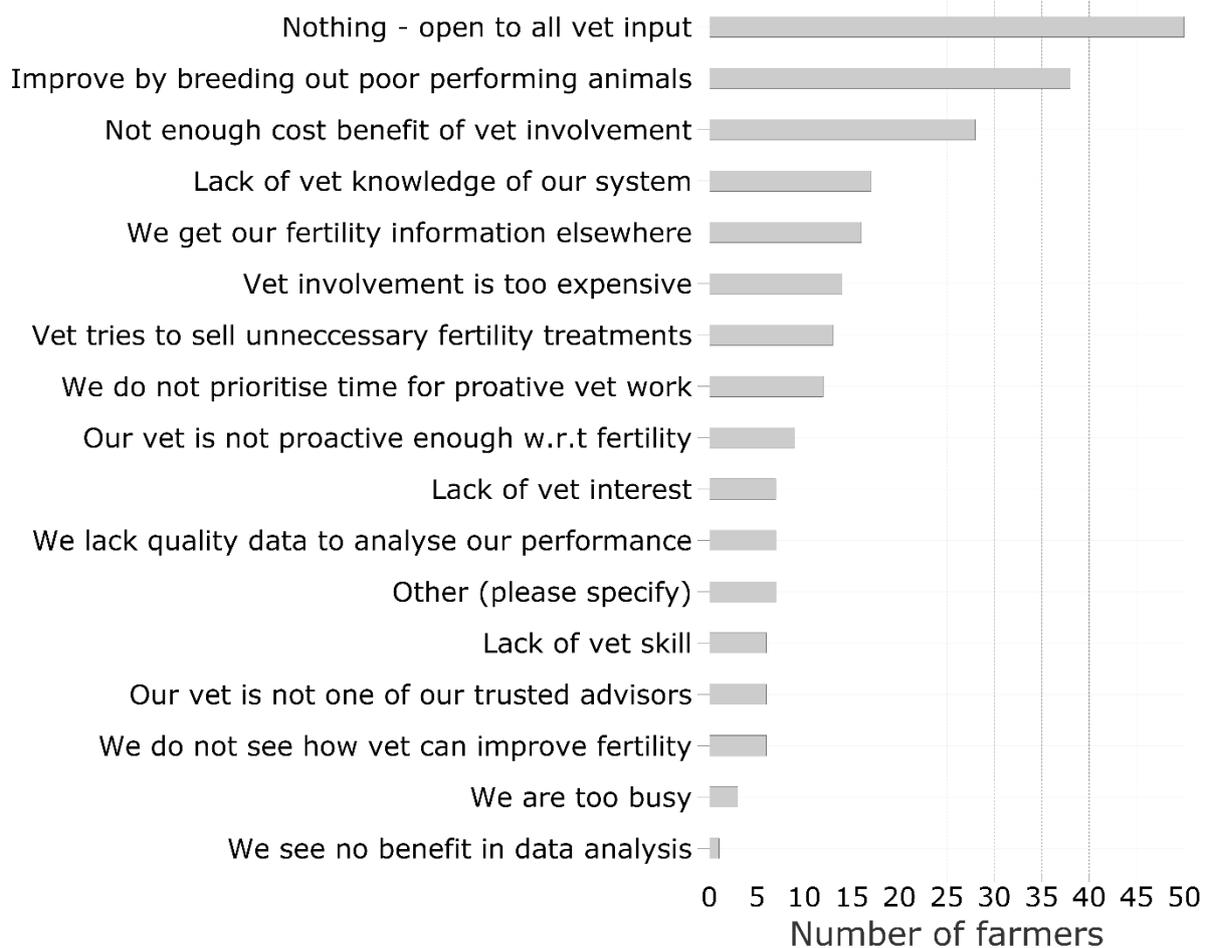


Figure 7: Barriers that currently exist that decrease the amount of veterinary fertility involvement within respondents' herds (n= 107 farmers)

3.6 Why seasonal calving dairy farmers use their current vet practice, and characteristics of their vet that farmers found desirable and undesirable

Figure 8 displays the reasons why respondents said they use their current veterinary practice. Multiple options per participant could be included, and farmers could also specify answers not listed via a free text reply option. There were 111 farmers who answered this question, with 461 responses in total.

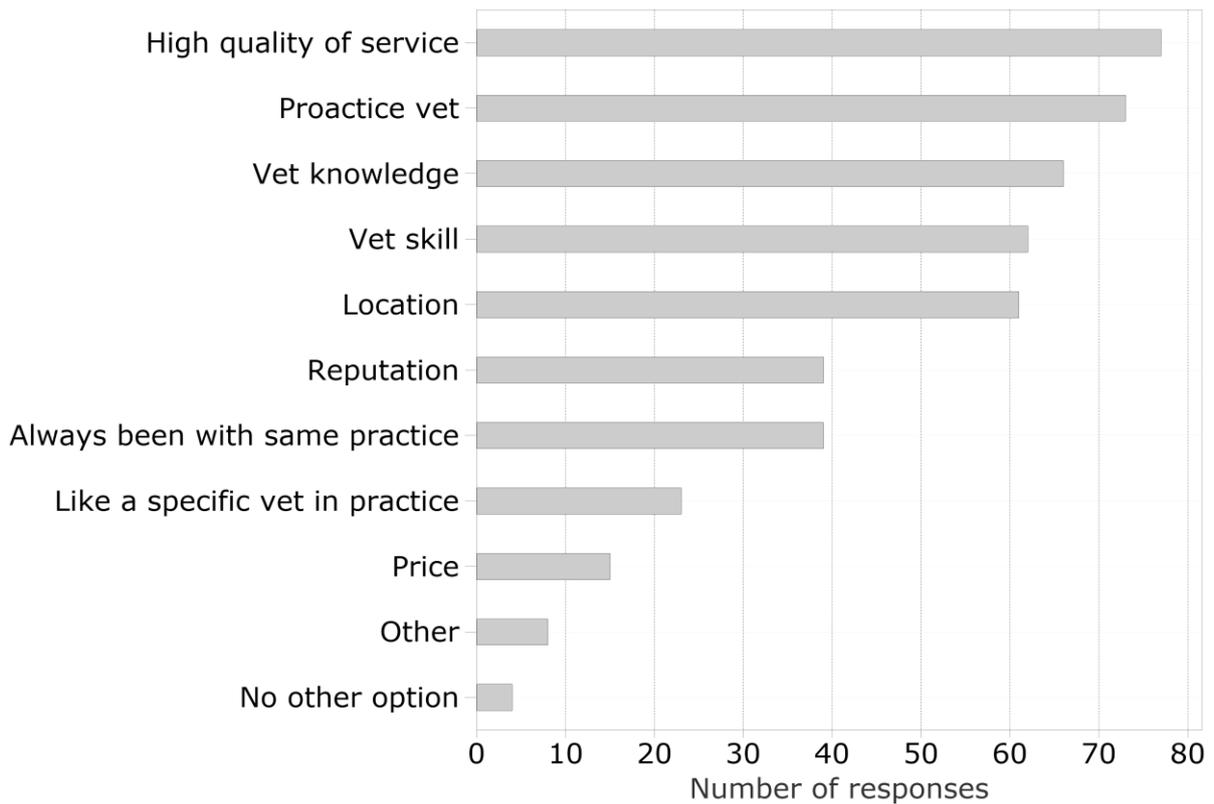


Figure 8: The reasons why respondents use their current veterinary practice, as reported by n=111 farmers with n=461 responses in total. 'Other' included: private practice, one-man practice, unsure, partner works there, block calving specialty, cheerful practice.

Figure 9 shows a graph of the qualities that respondents 'most liked' in their vet. This was a free text reply and answers were collated and common themes identified, resulting in the creation of 20 categories. Multiple qualities could be listed per respondent. The number of respondents who answered the question was 104. The total number of qualities mentioned and graphed was 163.

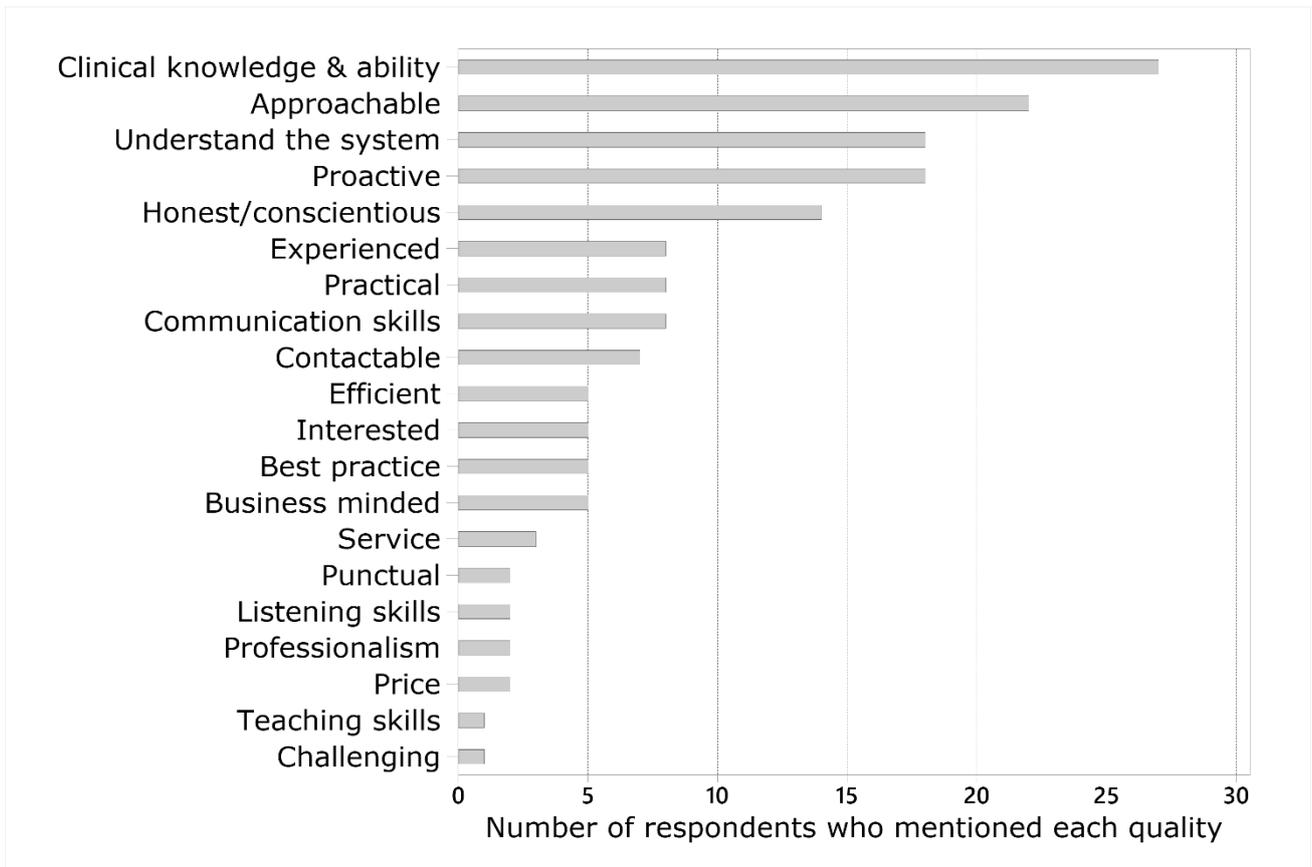


Figure 9: The qualities that respondents most liked in their vet. Number of respondents = 104. Total number of qualities mentioned = 163.

Figure 10 is equivalent to Figure 9, but shows qualities that respondents ‘least liked’ in their vet. There were 64 farmers who answered this question, with 18 categories created and, because multiple qualities could be stipulated per respondent, a total of 67 responses across all categories.

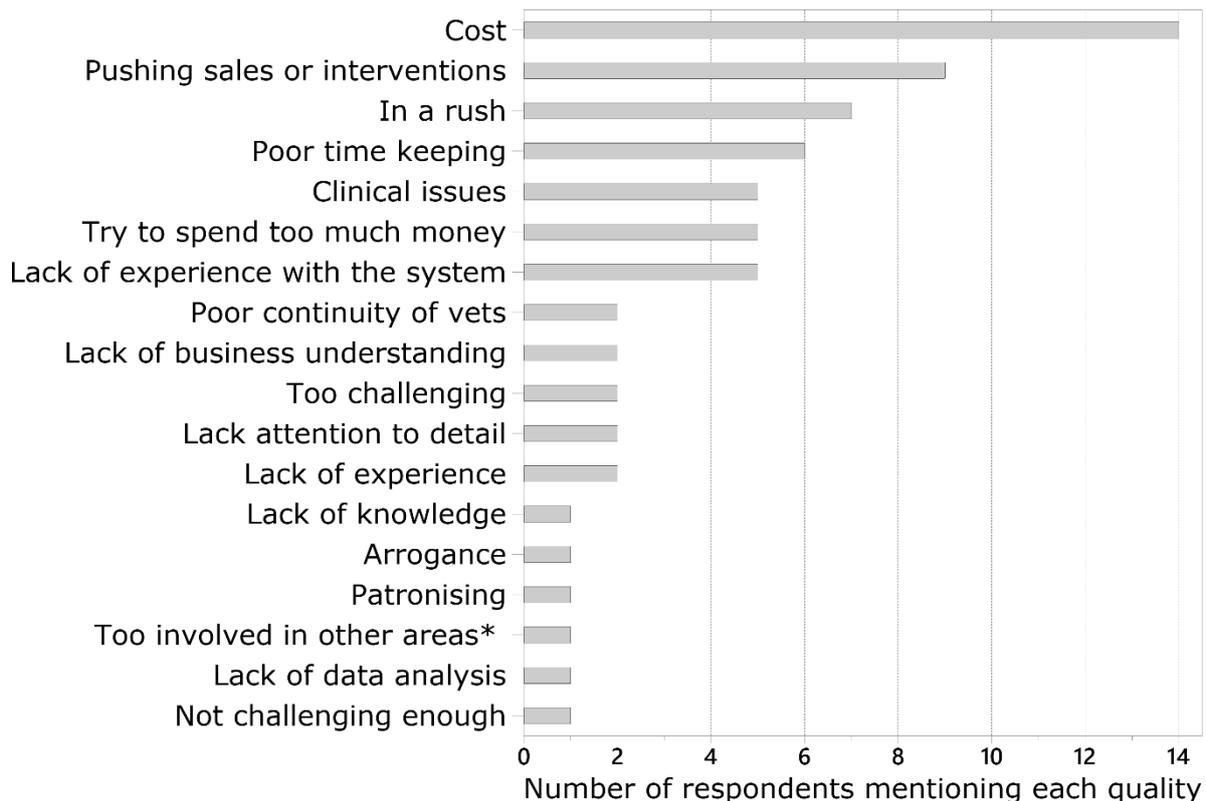


Figure 10: The qualities that respondents least liked in their vet. Number of respondents = 64. Total number of qualities mentioned = 67. *problems or mistakes with clinical work as perceived by the farmer; **of the veterinary business

4. DISCUSSION

To our knowledge, this is the first study to describe the type of veterinary fertility services that are being utilised on UK seasonally calving dairy herds and how different types of veterinary services and attributes of vets are valued by this population of farmers. Improving existing services or further developing new services with added value, is essential for the future success of the veterinary profession and the farming industry in the UK (Lowe, 2009;Ruston et al., 2016). The results of this study can support vets as they seek to make changes.

There appear to be opportunities for further veterinary involvement in seasonal herds, and the four areas that vets were currently least likely to be involved in according to this study were: nutritional management, breeding and genetics, growth rate monitoring and infra-structure changes. In terms of services that vets could offer to farmers, “keeping up to date with nutrition changes on farm” was only rated as “highly or somewhat valuable” by 40% of those surveyed. Moreover, 40% would find it “highly or somewhat valuable” if their vet “initiated a conversation” about grazing management and nutrition. This may reflect less involvement by vets currently, and therefore fewer farmers have actually experienced, or can imagine, the usefulness of veterinary involvement in nutrition. Or it may reflect previous real-life experiences that were not considered valuable. Either way, whilst opportunities for greater involvement appear to exist in several areas, it may require vets to be creative when engaging with farmers. Given that nearly 90% of those surveyed believed it was “highly or somewhat valuable” for their vet to “ask questions to understand where you need assistance”, clearly farmers would like vets to take the initiative in finding out

exactly what their needs are. Interestingly, however, in the specific context of herd health management, previous research suggests that only a relatively small proportion of vets are instigating discussions on farms (Hall and Wapenaar, 2012). In terms of communication, research has shown that asking open ended questions is especially helpful (Lam et al., 2011), but this needs to be coupled with active listening and has a time cost. Practitioners who are interested in further developing their communication strategies could consider gaining training in motivational interviewing (Svensson et al., 2019).

Eliciting farmers needs could be operationalised at the level of an individual person, the farm team, or at the level of the veterinary practice. For the latter, we suggest that one option would be for vet practices to consider conducting their own farmer satisfaction surveys, which could provide more specific, local insight, into service provision. It is worth noting that enabling farmers to answer anonymously may facilitate more frank responses, compared to asking directly in person. This may also be helpful if the vet practice is considering investing in new services or expertise, or considering ways to add value to existing ones. On this note, it was encouraging that the top-rated answer concerning barriers to more veterinary involvement in herd fertility was “nothing, we are open to as much input from our vet as possible”, although perhaps this response was subject to some social desirability bias (Bergen and Labonté, 2020).

Although it was encouraging that 20% of farmers rated their current veterinary input as excellent value, 21% rated it either neutral or poor. This suggests that there is significant room for improvement, in terms of highlighting to farmers the full value of veterinary services. Furthermore, cost was the top item respondents “least liked” in their vet, and the third most frequent barrier to vets having greater involvement in herd fertility management was “not enough cost benefit of vet involvement” whilst the sixth was “vet involvement is too expensive”. Overall, these findings emphasise the critical importance of ensuring that the *cost-benefit* of veterinary input is clearly articulated, as well as having transparent pricing structures per se. Previous research concerning the value dairy farmers derived from taking part in an ‘intensive dairy herd health management program’ suggested that vets “appear to focus too much on financial performance and increased production” when what many dairy farmers “really wanted to buy” was “teamwork and animal welfare” (Kristensen and Enevoldsen, 2008). Therefore, it is worth not overlooking highlighting to farmers all the non-production benefits.

With regards to taking a preventative approach to fertility management, while approximately 70% of those surveyed rated “monitoring the fertility status by using data analysis” as either “highly or somewhat valuable”, this still means that 30% of farmers in this study were either neutral or did not perceive this as valuable. Similarly, nearly 30% of those surveyed were either neutral or would not find it valuable, if their vet “initiated a conversation” about a planned approach to fertility. Given the importance of this type of approach for pre-empting problems, and with all the benefits it can bring, it appears that shifting farmers perceptions of the value of this type of veterinary involvement is needed.

The information reported here regarding two key fertility performance metrics for this sample of seasonal calving dairy herds, may also provide some useful insight for vets, farmers and others advisors. For example, these figures may help to contextualise current UK fertility performance in seasonal calving dairy herds to other countries such as New Zealand who have established fertility targets for seasonal producers (McDougall et al., 2014). However, this should be done with caution, as the figures are self-reported, and there could be variations between herds in the denominator populations of animals included in the 6-week in calf rate and empty rate at the end of the breeding season, depending on, for example, how do not breed animals are accounted for. The findings that 19% of respondents reported not knowing their 6-week in calf rate and 11% did not know their empty rate at the end of the breeding season, is potentially a concern as they are important performance metrics, and could be a barrier to improving herd fertility. It also represents an opportunity for vets to become more involved.

A barrier to veterinary involvement was described by farmers as their vet not “understanding their system”. This has implications for providers of veterinary education at both undergraduate and postgraduate levels, and it is worth educators reviewing whether their provision sufficiently covers fertility aspects and other nuances of seasonal calving herds. This is especially important given the apparent recent increase in dairy farmers reporting they operate a seasonal system (CHAWG, 2020).

In terms of future work, it would be interesting to explore the topics investigated here from the perspective of vets, and to investigate in more depth what “proactive” as a concept really means to farmers, as this appeared in the top 3 attributes that farmers mentioned they “most liked” in their vet and was also a common reason given for why farmers used their current veterinary provider. Previous research in the context of herd health management has also highlighted that there is opportunity for vets to take a more proactive approach (Hall and Wapenaar, 2012). A richer understanding of this construct could help vets to improve their services.

4.1 Generalizability and limitations

We were unable to find demographic data relating only to UK seasonal calving herds, and instead compared characteristics of our sample (see Results Section 3.1) to UK dairy farms in general. The proportion of UK dairy farms in 2020 was split: 57% England, 14% Wales, 7% Scotland and 22% Northern Ireland (AHDB, 2021). Therefore, in our sample, England and Wales were over represented, and Scotland and Northern Ireland, under represented. UK mean dairy herd size is 148 cows, however, given only 11% of participants in our sample reported having < 150 cows, our sample may have been biased towards larger herds. Government data reports 84% of UK ‘grazing livestock farm managers’ as male, with 16% female (Defra, 2016) which is in keeping with our sample (86% male). Median age of UK farm managers is 58 years (Defra, 2016) and given 85% of those surveyed were < 54 years, this suggests our sample was biased towards younger farmers. Whilst the questionnaire was distributed both electronically and via hard copy, the majority of responses were online. Hence the sample may be biased towards farmers with good internet access, or who engage more with social media. Bias may also have occurred as this was a convenience sample (not random sampling) and it is acknowledged that people who participate in surveys may differ from the population at large. As a result, caution should be exercised when trying to make inferences to wider populations.

5. Competing Interests Statement

Author George Giles is a director of Giles & Parsons Farm Vets, which some respondents to the questionnaire use as their veterinary provider. Participants who wished to enter the prize draw were asked to provide contact details, these were used solely for the purpose of awarding the prize and then destroyed. This study was completed in partial fulfilment of a postgraduate qualification (Diploma in Bovine Reproduction at the University of Liverpool) by George Giles. The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Acknowledgements

We would like to thank all the seasonally calving UK dairy herds that participated in the questionnaire. Thanks also go to the vets, farmers, breeding companies and other people who helped to publicise the questionnaire and to MSD Animal Health for their financial assistance. This work was carried out by George Giles in partial fulfilment of the requirements for the Diploma in Bovine Reproduction, University of Liverpool. Project costs were kindly provided by a ruminant research bursary awarded to George Giles by

MSD Animal Health, along with sponsorship from Giles & Parsons Farm Vets Ltd. MSD Animal Health did not have any involvement in the research design, implementation, analysis or reporting.

6. References

- AHDB (2019). *The InCalf guide for GB farmers with block calving herds* [Online]. Available at <https://ahdb.org.uk/knowledge-library/the-incalf-guide-for-gb-farmers-with-block-calving-herds> [Accessed 17/08/2021].
- AHDB (2021). *UK producer numbers* [Online]. Available at <https://ahdb.org.uk/dairy/uk-producer-numbers> [Accessed 18/08/2021].
- Bergen, N., and Labonté, R. (2020). "Everything Is Perfect, and We Have No Problems": Detecting and Limiting Social Desirability Bias in Qualitative Research. *Qual Health Res* 30, 783-792.
- CHAWG (2020). *Fifth Report GB Cattle Health and Welfare Group* [Online]. Available at <https://ahdb.org.uk/knowledge-library/gb-cattle-health-welfare-group-fifth-report-2020>. [Accessed 23/08/2021].
- DEFRA (2016). *Agricultural labour in England and the UK: Farm Structure Survey 2016* [Online]. A National Statistics publication by Department for Environment, Food and Rural Affairs, UK Government. Available at <https://www.gov.uk/government/statistics/farm-labour-profiles-from-the-england-and-uk-farm-structure-survey> [Accessed 18/08/2021].
- Hall, J., and Wapenaar, W. (2012). Opinions and practices of veterinarians and dairy farmers towards herd health management in the UK. *Veterinary Record* 170, 441.
- Kristensen, E., and Enevoldsen, C. (2008). A mixed methods inquiry: How dairy farmers perceive the value(s) of their involvement in an intensive dairy herd health management program. *Acta Veterinaria Scandinavica* 50, 50.
- Lam, T.J.G.M., Jansen, J., Van Den Borne, B.H.P., Renes, R.J., and Hogeveen, H. (2011). What veterinarians need to know about communication to optimise their role as advisors on udder health in dairy herds. *New Zealand Veterinary Journal* 59, 8-15.
- Lowe, P. (2009). *Unlocking Potential: A report on veterinary expertise in food animal production 2009* [Online]. Available at <https://www.vetfutures.org.uk/resource/unlocking-potential-a-report-on-veterinary-expertise-in-food-animal-production-2009/>. [Accessed 16/08/2021].
- McDougall, S., Heuer, C., Morton, J., and Brownlie, T. (2014). Use of herd management programmes to improve the reproductive performance of dairy cattle. *Animal* 8 Suppl 1, 199-210.
- Ruston, A., Shortall, O., Green, M., Brennan, M., Wapenaar, W., and Kaler, J. (2016). Challenges facing the farm animal veterinary profession in England: A qualitative study of veterinarians' perceptions and responses. *Preventive Veterinary Medicine* 127, 84-93.
- Sharma, A., Minh Duc, N.T., Luu Lam Thang, T., Nam, N.H., Ng, S.J., Abbas, K.S., Huy, N.T., Marušić, A., Paul, C.L., Kwok, J., Karbwang, J., De Waure, C., Drummond, F.J., Kizawa, Y., Taal, E., Vermeulen, J., Lee, G.H.M., Gyedu, A., To, K.G., Verra, M.L., Jacqz-Aigrain, É.M., Leclercq, W.K.G., Salminen, S.T., Sherbourne, C.D., Mintzes, B., Lozano, S., Tran, U.S., Matsui, M., and Karamouzian, M. (2021). A Consensus-Based Checklist for Reporting of Survey Studies (CROSS). *Journal of General Internal Medicine*.
- Svensson, C., Emanuelson, U., Bard, A.M., Forsberg, L., Wickström, H., and Reyher, K.K. (2019). Communication styles of Swedish veterinarians involved in dairy herd health management: A motivational interviewing perspective. *Journal of Dairy Science* 102, 10173-10185.