Chapter 6

The Future Demand for Food Supply Veterinarians in Mixed Food Animal Careers

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Introduction

This study provides a systematic analysis of the likely future demand and potential shortages for food supply veterinary medicine (FSVM) professionals in mixed food animal careers. Six inter-related questions are addressed:

I. What are the issues and trends likely to drive the future demand for food supply veterinarians in mixed animal careers?

II. Assuming a continuation of currently unfolding trends and the absence of major catastrophic events, what will be the demand for mixed food animal veterinarians over the next several years?

III. What are the specialized activities (e.g., roles, responsibilities, skill areas, clients served, etc.) that will have substantially higher or lower demand relative to the general pattern of demand in the mixed food animal area?

IV. What are the issues and trends likely to drive the future supply of food supply veterinarians entering mixed food animal careers?

V. Given the pattern of emerging trends and factors influencing supply and demand and assuming the absence of any major catastrophic events, what will be the likely surplus or shortage of food supply veterinarians in mixed food animal careers over the next several years?

VI. Given the answers to the first five questions, how can the FSVM profession take action now to create a better future?

This report provides a description of the research method used and then presents the answers to each of these six questions.

The Delphi Forecasting Technique

Food supply veterinarians live in a changing world. Predicting the future is never an easy task and the changing context of the FSVM profession makes the linear extrapolation of historical trends with econometric models, as was used in the KPMG Mega Study, more problematic. The Delphi forecasting method[1] is an expert judgment forecasting method and is the main alternative to historical trend-based methods. It is the best method for identifying emerging trends, the likely patterns of future demand for FSVM professionals, and determining whether there will be shortages or surpluses of food supply veterinarians in the future.

The Delphi method works hand-in-hand with strategic planning processes in that it appreciates that the future is only partly a function of unfolding larger societal forces that cannot be easily managed or changed. It appreciates that the future is largely a function of trends that, if better understood now, can be acted upon before the future arrives. It is designed to identify leverage points that are important to planned change efforts. Strategic action taken now by thoughtful leaders can change the pattern of future demand and shortages/surpluses that experts predict will occur if current trends continue and no catastrophic events occur.

Thirteen different sectors of the FSVM profession were identified and the Delphi forecasting process was used to evaluate each. The FSVM sectors evaluated are: Academe, Dairy, Swine, Poultry, Beef Cattle, Small Ruminants, State/Provincial Public Service, three sectors of US Federal Government Service (Public Health, Animal Health, and Food Safety & Security), Canadian Federal Government Service, Industrial

[1] For a recent review of the scientific literature on this forecasting technique, see Rowe, G., & Wright, G. (1999). The Delphi Technique as a Forecasting Tool: Issues and Analysis, *International Journal of Forecasting, 15*, 353-375.

Veterinarians in Pharmaceuticals, and Mixed Food Animal Practitioners in Rural Settings. Experts for each sector were identified and their participation solicited. In general, panels of 14-25 members for each sector were created.

The Delphi method gathers expert opinion and then provides a structured feedback process where experts have an opportunity to consider the views of other experts. The feedback process is structured so that experts can change their predictions without any dysfunctional group dynamics that can plague interacting groups. It sets up a learning process where one expert has an opportunity to reconsider his or her own judgment in the face of conflicting viewpoints from other experts. This should make the Delphi panel collectively smarter at the end of the process. The Delphi process used had three stages:

1. Panel members completed a first survey on issues relevant to demand forecasting. Specifically, we included potential influence items, identified from the FSVM literature, and asked panel members to rate each item's influence on the future supply or demand for food supply veterinarians in their sector. We also included open-ended questions giving panel members an opportunity to suggest additional relevant issues not included in the initial listing. After getting panel members to think about the trends and issues driving future demand, we then asked them to forecast demand changes over various time periods between 2004 and 2016. Panel members then rated the influence of various supply related trends and suggested additional supply related issues. This was designed to help them think about likely future labor supply inflows and prepared them to forecast whether there would be shortages or surpluses of academic veterinarians over these same time periods.

2. The results of the first survey were incorporated into the second survey. New items were derived from a content analysis of the open-ended replies. Demand and supply influence items where there were higher levels of disagreement within the panel were repeated and the average rating and middle 50% range (between the 25^{th} and 75^{th} percentile) information were presented with each repeated item. A brief report explaining the general patterns in the data, including explanations for disagreement within the panel on future demand and shortage/surplus forecasts, accompanied the second survey. Thus, when panel members re-estimated future demand and shortages/surpluses, they did this while considering panel information from the first survey.
3. The third survey followed a similar design strategy. Items with higher disagreement were repeated and the panel average and middle 50% range information were presented in this last survey. In addition, a brief report summarized the results of the second survey. Finally, items describing 18 different possible solutions to shortages were added to this survey.

Panel members came primarily from the US, but experts that focused on Canada were also included. Panel members identified whether they had focused on the Canadian or the US context, and additional analysis evaluated whether there seemed to be significant differences between the ratings of the US and Canadian sub-groups. While we see all panel members as having good expertise, we appreciate that some may be more knowledgeable than others. Panel members rated their own forecasting expertise, and additional analyses contrasted those higher than the median "expertise" score with those on the less-expert side of the median. This analysis identified items where there were statistically significant differences between those two sub-groups. Whenever Canadian

versus US and expert versus less-expert differences were found, they were noted in the feedback to the panel. Examples of three of the surveys used for the mixed food animal panel are displayed in Appendix A, B, and C. These three surveys are typical of all the questionnaires used in the demand studies. Additional information at the end of theis chapter identifies the temporary website links to each of the surveys for this Delphi panel.

Issues and Trends Driving Future Demand for Mixed Food Animal Veterinarians

The panel responded to both panel-suggested demand-related items that are unique, as well as items drawn from the general FSVM literature. This later set of 25 items was included in the first surveys to all 13 panels included in this study. In addition to rating the 25 general items, panel members provided suggestions on additional issues influencing demand in the mixed food animal FSVM sector. Fourteen additional items were derived from those open-ended comments for a total of 39 items. In the second survey, the 14 new items were asked and items from the original set of 25 were repeated when there was fair disagreement within the panel's ratings. Higher agreement on several items was reached in the second survey and the items with greater disagreement were repeated a final time in the third survey. The following are the survey items seen as *increasing* future demand (starting with the most influential issues and trends first):[2]

Trends Increasing Demand

1. Growing need to track animals entering the food chain (5.83 on a 7-point scale)[3]
   Note that the Canada-focused panel members' mean of 6.38 is significantly higher than the US-focused sub-group mean of 5.53.

2. Need to monitor and document food safety status (mean: 5.81)
   Note that the Canada-focused panel members' mean of 6.25 is significantly higher than the US-focused sub-group mean of 5.54. Note that the self-rated forecasting experts' sub-group mean of 6.25 was significantly higher than the less-expert sub-group mean of 5.50.

[2] Where significant differences exist between those focused on the Canadian context versus the US-focused sub-group mean, they are noted. Similarly, where significant differences between the ratings of the self-rated forecasting experts' sub-group versus the less-expert sub-group exist, those respective means are noted.

[3] The items were rated on a 7-point Likert-type scale and evaluated based on the expected influence on future demand. The mean rating for each item is noted in parentheses. The following scale anchor points will help interpret those means: 4. No Influence, 5. Slight Increase, 6. Increase, 7. Strong Increase.

3. Public concerns over food safety (mean: 5.65)
   Note that the Canada-focused panel members' mean of 6.50 is significantly higher than the US-focused sub-group mean of 5.20.

4. Protection of public health and bioterrorism related concerns (mean: 5.65)
   Note that the Canada-focused panel members' mean of 6.33 is significantly higher than the US-focused sub-group mean of 5.33. Note that the self-rated forecasting experts' sub-group mean of 6.14 was significantly higher than the less-expert sub-group mean of 5.42.

5. Need to monitor and document animal health or disease status (mean: 5.62)
   Note that the Canada-focused panel members' mean of 6.13 is significantly higher than the US-focused sub-group mean of 5.31.

6. Demands to perform surveillance tasks for government agencies (mean: 5.57)
   Note that the Canada-focused panel members' mean of 5.31 is significantly lower than the US-focused sub-group mean of 6.00.

7. Required third-party certification or verification of standards (mean: 5.48)

8. More access to global markets for food exports (mean: 5.33)
   Note that the Canada-focused panel members' mean of 6.25 is significantly higher than the US-focused sub-group mean of 4.77.

9. Increasing concern for animal welfare (mean: 5.33)

10. Increasing concern for animal health (mean: 5.26)

11. Zoonotic disease-related human health concerns (mean: 5.22)
    Note that the Canada-focused panel members' mean of 5.88 is significantly higher than the US-focused sub-group mean of 4.87.

12. Constraints on non-DVMs giving prescription drugs (mean: 5.18)

13. Involvement in interdisciplinary teams solving producer problems (mean: 5.15)

14. Providing specialized technical veterinary services (mean: 5.14)
    Note that the Canada-focused panel members' mean of 6.13 is significantly higher than the US-focused sub-group mean of 5.31.

15. Public concerns over bio-terrorism (mean: 5.14)
    Note that the self-rated forecasting experts' sub-group mean of 4.63 was significantly lower than the less-expert sub-group mean of 5.45.

16. Producers' demand for consulting services (mean: 5.10)
    Note that the self-rated forecasting experts' sub-group mean of 5.08 was significantly lower than the less-expert sub-group mean of 5.71.

17. Part-time farmers needing more veterinary services (mean: 5.09)

18. Client use of veterinary herd management services (mean: 5.05)

Note that items with means of 4.0 and 5.0 (between the "4. No Influence and "5. Slight Increase" scale anchor points) are not presented. See Exhibit D for a listing of these items as well as the distributions and mean ratings of all items used in the 1st, 2nd, or 3rd wave surveys. The mean values noted for each of the above (and following) items are from the last survey in which that item appeared. Items with means below 4.0 are seen as trends or issues leading to decreases in demand for mixed food animal veterinarians. The survey items noted below are trends rated as *decreasing* future demand starting with the most influential factors first:

Trends Decreasing Demand

1. Lack of veterinarian's practice management and business skill (mean: 3.20)[4]

2. More veterinary tasks being done by producers and non-DVM employees (mean: 3.33)
   Note that the self-rated forecasting experts' sub-group mean of 3.00 was significantly lower than the less-expert sub-group mean of 3.67.

3. Move to larger sized producer operations (mean: 3.35)

4. Curtailment of government support of veterinary services (mean: 3.67)

5. Use of non-DVMs, such as veterinary technicians (mean: 3.70)

6. More able, educated and self-sufficient farmers/producers (mean: 3.79)

7. Slow adoption of new technologies by veterinarians (mean: 3.83)

8. Federal and/or State/Provincial budgetary constraints (mean: 3.85)

9. Client concerns about veterinary service costs (mean: 3.87)

[4] The items were rated on a 7-point Likert-type scale and evaluated based on their influence on future demand. The mean rating for each item is noted in parentheses. The following scale anchor points will help interpret those means: 1. Strong Decrease, 2. Decrease, 3. Slight Decrease, 4. No Influence.

The Planning Matrix

The ratings of these trends and issues are important to the extent that they can be used to understand and plan for the future. Some items noted above identify issues or trends that are more "actionable," meaning that direct strategic actions can be taken by the profession *without extensive external resources or cooperation of external entities* to alter the expected pattern of influence suggested by the panel's mean score. Other items identify issues that are fairly fixed constraints and are much less actionable. These items represent general societal concerns where the cooperation of other entities beyond the FSVM profession, such as governments, is needed to change the expected pattern of influence on future demand.

Figure 1 presents a general planning matrix useful in organizing the results and guiding future strategic action. The best targets for strategic action are those in the "actionable" or top-half of that figure. In order to increase future demand, actionable demand-constraining factors (on the left-side of the figure) must be eliminated or countered in some fashion. The top, right-side quadrant represents actionable demand-enhancing opportunities that can be sustained, complemented, or enhanced in some way. The lower quadrants are less- manageable trends and factors. Any strategic responses to the challenges uncovered by this research need to be mindful of these constraints. They represent areas where the profession has less influence and may be areas that must be managed around rather than changed. This matrix will be used to interpret and draw strategic action implications for the panel's ratings.

Insert Figure 1. Planning Matrix about here

This planning matrix can be used to organize the results of the analysis of the demand related issues and trends. The listing of the nine demand-decreasing items noted above fit on the left-side of Figure 1. The 18 demand-increasing items logically fit on the right-side of that figure. Figure 2 tracks the major themes apparent in these two lists. Two of the nine demand-decreasing items (items 4 and 8) relate to the *Government Budgetary Constraints* theme noted in Figure 2. These are the least actionable constraints on demand and fit in the lower-left quadrant of this figure. While there is some maneuvering room to help insure that animal agriculture allocations are hurt less, the reality of large deficits represents a fairly fixed constraint that the profession must manage around.

In contrast, item 1 (practice management & business skill) and item 7 (adoption of new technologies), refer to self-imposed constraints on demand that can be acted upon and lessened. With educational initiatives, veterinarians can organize practices that take advantage of better business models and technology resources. This could eliminate the negative influence that this trend has on demand. This issue is captured by the *Business Skill & Use of Technology* theme noted on Figure 2. Since it a highly actionable and can be changed without the resources or cooperation of external entities, it has been noted in the upper-right quadrant.

The remaining five items are related to industry consolidation, cost concerns, and changing client needs. These are items 2 (tasks done by non-DVMs), item 3 (move to larger sized operations), item 5 (use of non-DVMs), item 6 (more able producers), and item 9 (client cost concerns). While these *Business & Economic Trends* partially based in global economic forces and industry consolidation, which are not going to be changed, the profession can respond to these general constraints and better prepare veterinarians to

Insert Figure 2. Demand Diminishing & Enhancing Issues

deal with this trend. For this reason, this theme is placed near the middle line, but is included in the upper-left quadrant of Figure 2. The items ranked at the top of the list of demand-increasing trends and issues noted above frequently included *Larger Societal Concerns* that cannot be directly changed. For this reason, that theme has been placed in the lower-right quadrant of Figure 2. These issues need to be understood and appreciated in the strategic planning process.

For example, item 3 (food safety concerns), item 4 (public health & bio-terrorism concerns), item 9 (animal welfare concerns), item 10 (animal health concerns), item 11 (zoonotic disease concerns), and item 15 (bio-terrorism concerns) all touch on larger societal concerns that benefit the profession by encouraging demand. Similarly, item 8 (global food export access) is another positive demand factor that related to increasingly open global food export markets. *Food Export Opportunities* are beneficial and, while not directly manageable, need to be appreciated and taken advantage of in the planning process. This factor is also noted in the lower-right quadrant. Item 12 (constraints on non-DVMs giving drugs) is a *Drug Regulation* contextual factor. The profession has some collective indirect influence over the FDA and the related regulatory setting processes and for this reason it is place near the middle line in the lower-right quadrant.

The other factors in the listing of top demand-increasing items are more directly manageable with strategic action. One key theme that relates to several items is *Certifications & Monitoring Roles*. It is noted in the upper-right quadrant of Figure 2. Items related to this issue are: item 1 (need to track animals), item 2 (monitor & document food safety), item 5 (monitor & document animal health), item 6 (surveillance tasks for agencies), and item 7 (third-party certifications). *Specialized Technical Expertise* is an additional theme noted in this same "actionable" quadrant. The items that

relate to this are item 14 (specialized technical services), item 16 (consulting services) and item 18 (herd management services). The final two items seems to be related to separate opportunities. Item 13 (involvement in problem solving teams) seems related to veterinarians being able to serving clients with *Broad Expertise* to solve problems and increase the effectiveness of producer operations. While the specialized technical expertise is related to advance veterinary medicine, the *Broad Expertise* theme refers to skills and knowledge that touch on veterinary medicine issues but are linked to other domains, including operational efficiency. To deliver help solved multi-dimensional producer problems a broader set of factors must be integrated. The *Serving Part-Time Farmers* theme is noted by item 17. Both of these themes are noted in the upper-right quadrant of Figure 2. Mixed food animal veterinarians can focus on the four themes noted in that quadrant and, with the direction of available expertise available within the profession, can provide related services which will increase demand for veterinary services in this sector. These themes also have implications for colleges of veterinary medicine and the training of new veterinarians.

Many of these seem to play out differently in the US versus Canada. As noted in the listing of demand-increasing and demand-decreasing items, those focused on Canada had significantly different ratings than those panel members focused on the US setting.

The Future Demand for Mixed Food Animal Veterinarians

The Delphi process provides panel members an opportunity to make initial estimates of future demand over several time periods in the first survey. The second survey and the feedback report that summarized the general patterns seen in the first survey provided panel members a chance to draw on more information to re-estimate future demand. The Delphi methodology encourages panelists to reconsider their estimates in light of the views of other panel members. The third survey and accompanying report on the second survey results was a second opportunity to reconsider and make final projections of future demand.

Demand estimates were grouped into three time periods: Short-Term (fall of 2004 to fall of 2007), Medium-Term (fall of 2007 to fall of 2010) and Long-Term (fall of 2010 to fall of 2016). Demand estimates were stated in the form of the expected percentage increase or decrease from the start to the end of these time periods. Both range and point estimates are provided. The range estimates identify the middle 50% of panel members (i.e., the estimates between the 25^{th} percentile and 75^{th} percentile of the distribution, or inter-quartile range), and the point estimates include both the arithmetic mean and the median (or estimate at the 50^{th} percentile) of the distribution of estimates. Figures 3 through 5 present the results of each time period. The pattern of estimates indicates continuing disagreement within the panel on the nature of future demand. While the means and median values are always positive and indicate between 3% to 6% increases in demand, the middle 50% range (those between the 25^{th} and 75^{th} percentile of the distribution) include a wide range of estimates particularly in the long-term (2010-16)

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period. The middle 50% estimates included estimates of increasing demand as well as negative numbers indicating forecasts of decreasing demand. Figure 6 presents a summary of the forecasts from the final survey.

In spite of the usual tendency in the Delphi process to reach greater consensus (or narrower ranges ratings) at each successive survey, we see a pattern of continuing disagreement on the expected pattern of future demand even at the last survey. The pattern evident here suggests that the panel is really of at least two minds. Some are optimistic and see increasing demand and other are more pessimistic. Further analyses help us to understand the range of views that the panel has on future demand. In comparing Canada- and US-focused members we see that Canada-focused members see significantly higher future demand. When forecasts over all three periods were averaged, we see that the US median is +4.00% and the Canadian median is +7.67%. Analysis on the forecasts for each time period found significantly lower US means in five of the six data points (from the second and third surveys for each of the three time periods). While the Canadian versus US differences explain part of the disagreement on demand, follow-up analysis on the US-focused members found continuing disagreement and a wide range of forecasts. When the US-focused members are split at the median score (4.0%) for the average forecast over all three time periods and further analyzed, we see more reasons why there is continuing disagreement. The "low demand" sub-group has a median average forecast of -3.3% or decreasing demand and the "high demand" sub-group had a median forecast of +5.5%. Further analyses evaluated how those US-focused sub-groups rated the demand-influencing trends (summarized above) present additional explanation for the pattern of disagreement seen in this panel. The following *demand-increasing*

influences had statistically significantly *higher* ratings by the sub-group projecting higher increasing future demand:[5]

- Public concerns over food safety (mean equals 5.67 on a 7-point scale in the higher demand sub-group versus a mean of 4.50 in the lower demand sub-group)
- Public concerns over bio-terrorism (mean equals 5.69 in the higher demand sub-group versus a mean of 4.33 in the lower demand sub-group)
- Need to understand animal-human health eco-systems (mean equals 5.00 in the higher demand sub-group versus a mean of 4.20 in the lower demand sub-group)

Those seeing lower demand see these three factors as fairly neutral (and rate it close to "4. No Influence") while those seeing higher demand see these factors as leading to demand increases. These two sub-groups also differ in how they rate additional demand-decreasing factors. Those seeing lower demand see the following *demand-decreasing* factors as having significantly more influence leading to demand decreases:

- Move to larger sized producer operations (mean equals 3.67 in the higher demand sub-group versus 2.50 in the lower demand sub-group)
- More veterinary tasks being done by producers and non-DVM employees (mean equals 3.67 in the higher demand sub-group versus 2.67 in the lower demand sub-group)

The consolidation of smaller producers into larger operations and the non-DVM staff in those operations taking over some of the tasks previously done by veterinarians is a reality in many food animal areas (e.g., beef, dairy, and swine). For those more optimistic about future demand, these factors are not seen as strong deterrents to the demand for veterinary services. This implies that those seeing stronger increasing demand also see other ways to serve large producer clients and do not see the *Business & Economic Trends,* noted on the left-side of Figure 2, as necessarily a demand constraining factor.

[5] The scale introduced earlier should be used in interpreting these mean values: 1. Strong Decrease, 2. Decrease, 3. Slight Decrease, 4. No Influence, 5. Slight Increase, 6. Increase, 7. Strong Increase

Specialized Activities Increasing or Decreasing in Demand

Open-ended questions in the first survey invited panel members to identify activity areas (e.g., roles, responsibilities, skill areas, clients served, etc.) where there will be substantial future increases or decreases in demand compared to the general pattern of demand for mixed food animal veterinary services. These suggestions were content analyzed and 16 areas received multiple mentions and were used to form items that panel members rated in the second survey. The activity areas rated as having *higher* future demand (starting with the highest demand areas) are:

1. Animal tracking and identification (mean: 5.71 on a 7-point scale)[6]
2. 3rd party certification of food safety standards (mean: 5.48)
3. Animal welfare auditing (mean: 5.38)
4. Public health support activities (mean: 5.15)
5. Species specific expertise related activities (mean: 5.14)
   Note that the Canada-focused panel members' mean of 5.88 is significantly higher than the US-focused sub-group mean of 4.69.
6. 3rd party certification of animal health standards (mean: 5.14)
7. Preventative medicine and herd health activities (mean: 5.10)
8. Management consulting to producers/farmers (mean: 5.05)
9. Production medicine activities (mean: 4.90)
10. Training producer employees (mean: 4.76)
11. Service to small farms/ranches (mean: 4.55)
12. Monitoring wildlife health issues (mean: 4.30)

[6] The items were rated on a 7-point Likert-type scale and evaluated based on forecasted increase in demand relative to the expected general pattern of demand. The mean rating for each item is noted in parentheses. The following scale anchor points will help interpret those means: 4. No Difference, 5. Slight Increase, 6. Increase, 7. Strong Increase.

Note that the Canada-focused panel members' mean of 4.75 is significantly higher than the US-focused sub-group mean of 4.00.

The activity areas rated as facing *lower* future demand compared to the general pattern mixed food animal veterinary services (starting with the most extreme low demand areas) are:

1. Vaccination related activities (mean: 3.40 on a 7-point scale)[7]
2. Individual "sick" animal medicine (mean: 3.62)
3. Pregnancy examinations (mean: 3.90)
   Note that the Canada-focused panel members' mean of 4.57 is significantly higher than the US-focused sub-group mean of 3.54.
4. Emergency care (mean: 3.90)

These results shed further light on the conflicting views (increasing demand vs. decreasing demand) seen in the panel's future demand projections. Many of these 12 "higher demand" activities correspond to the *Certifications & Monitoring Roles* theme noted in the upper-right quadrant of Figure 2. The items related to this theme are item 1 (animal tracking and identification), item 2 (3rd party food safety certifications), item 3 (animal welfare auditing), item 6 (animal health standards certifications) and item 12 (wildlife health monitoring). These are opportunities for improving demand for services. The *Broad Expertise* theme noted in Figure 2 is also related to item 8 (management consulting) and item 10 (training producer employees). The first three activities noted as decreasing in demand correspond to the *Business & Economic Trends* theme in the upper-left quadrant of Figure 2. Item 1 (vaccinations), item 2 (individual animal medicine), and item 3 (pregnancy exams) are less likely to be done in a large producer operations where non-DVMs are doing more of these types of activities.

[7] The mean rating for areas seen as decreasing in demand are noted in parentheses and the following scale anchor points will aid interpretation: 4. No Difference, 3. Slight Decrease, 2. Decrease, 1. Strong Decrease.

Trends and Issues Driving the Future Supply of Mixed Food Animal Veterinarians

The panel responded to both panel-suggested supply related items as well as items drawn from the general FSVM literature. The latter set of 17 items was included in surveys to all 13 panels included in this study. Nine additional supply-related influence items were drawn from open-ended comments in the first survey and included in the second survey. Items from the initial set of 17 items were repeated in the second survey when there was fair disagreement within the panel on the influence of an item. The final survey included items with fair disagreement seen in the second survey ratings. The mean value of the last rating of an item is used in the summary below. There were seven factors rated as *increasing* the future supply of veterinarians entering mixed food animal careers:

Trends Increasing Supply

1. Government programs that pay for veterinary public service activities (mean: 5.10 on a 7-point scale)[8]
   Note that the Canada-focused panel members' mean of 5.88 is significantly higher than the US-focused sub-group mean of 4.62. Note that the self-rated forecasting experts' sub-group mean of 6.00 was significantly higher than the less-expert sub-group mean of 4.58.

2. Promotion of the positive benefits of a rural lifestyle (mean: 5.00)
   Note that the self-rated forecasting experts' sub-group mean of 5.75 was significantly higher than the less-expert sub-group mean of 4.50.

3. Effective marketing of food animal career opportunities (mean: 4.95)
   Note that the self-rated forecasting experts' sub-group mean of 5.63 was significantly higher than the less-expert sub-group mean of 4.50.

[8] The items were rated on a 7-point Likert-type scale and evaluated based on their influence on future supply of veterinarians entering mixed food animal careers. The mean rating for each item is noted in parentheses. The following scale anchor points will help interpret those means: 4. No Influence, 5. Slight Increase, 6. Increase, 7. Strong Increase.

4. Increasing demand for lucrative small animal services (mean: 4.95)
   Note that the Canada-focused panel members' mean of 5.38 is significantly higher than the US-focused sub-group mean of 4.67.

5. Government funding for Veterinary Medical Services Act (mean: 4.95)
   Note that the self-rated forecasting experts' sub-group mean of 5.50 was significantly higher than the less-expert sub-group mean of 4.67.

6. Selection of veterinary students with an agricultural background (mean: 4.45)

7. Income opportunities in mixed practices (mean: 4.25)
   Note that the Canada-focused panel members' mean of 5.13 is significantly higher than the US-focused sub-group mean of 3.67.

The panel identified several trends and factors that are *decreasing* the future supply of food supply veterinarians entering mixed food animal careers. These are the most extreme supply-decreasing factors:

Trends Decreasing Supply

1. Less emphasis on food animal practice in veterinary colleges (mean: 2.05)[9]

2. Need to work long hours and emergency calls (mean: 2.17)

3. Lack of spousal career options in rural areas (mean: 2.30)

4. Expected high number of food supply veterinarians retiring in the near future (mean: 2.55)

5. Little exposure to food supply career options in college (mean: 2.64)

6. Marginalization of food animal medicine in schools (mean: 2.86)

7. Limited lifestyle and career opportunities in rural areas (mean: 2.87)

8. Physical demands of large animal veterinary work (mean: 2.90)

9. High debt load of veterinary school graduates (mean: 3.00)

10. Lack of food supply practice-related externships for students (mean: 3.00)

[9] The items were rated on a 7-point Likert-type scale and evaluated based on their influence on the future supply of mixed food animal veterinarians. The mean rating for each item is noted in parentheses. The following scale anchor points will help in the interpretation of those means: 1. Strong Decrease, 2. Decrease, 3. Slight Decrease, 4. No Influence.

11. Lack of cultural and recreational activities in rural areas (mean: 3.00)

12. More women veterinarians entering the workforce (mean: 3.15)

13. Perceived lack of demand for food animals (mean: 3.18)

14. Lack of positive role models in veterinary food supply practice (mean: 3.20)
    Note that the Canada-focused panel members' mean of 3.33 is significantly higher than the US-focused sub-group mean of 3.00.

15. Use of narrow criteria (GPA and test scores) to select DVM students (mean: 3.20)

These supply-related factors can also be organized into the planning matrix introduced earlier. Figure 7 captures the general pattern seen in the above two listings. The list of 15 supply-decreasing factors identified by the panel all map to the left-side of the planning matrix. Many of the more extreme impediments to the future entering supply of veterinarians are very actionable in that they do not strongly depend on the infusion of resources or the cooperation of entities outside of the veterinary profession. This places them in the upper-left quadrant of Figure 7. Item 1 (less emphasis on food animals), item 5 (little exposure to food supply careers), item 6 (marginalization of food animal medicine), item 10 (lack of food supply externships), item 13 (perceived lack of demand), and 15 (use of narrow selection criteria) all relate to the lack of exposure and opportunity to develop food animal skills in colleges of veterinary medicine. These are referred to as *Non-FSVM Focus & Student Selection in CVMs* theme in Figure 7. Changes that counter these trends will increase the supply of students and DVMs into the mixed food animal sector. The *Negative Role Models* (item 14) and *Student Debt* (item 9) themes are additional supply constraints that can be changed with strategic initiatives. They are placed in the upper-left quadrant.

The *Student Debt* theme is placed near the center line in the upper-left quadrant. The cost of veterinary education can probably not be reduced and relates to larger economic forces

at work. However, different debt repayment initiatives using external resources that lessen student debt and attendant problems have been developed. Therefore, this is seen as fairly actionable. Initiatives related to the other constraints noted above are primarily under the control of the profession, particularly schools of veterinary medicine. Similarly, the *Work Requirements* theme, noted by item 2 (long hours/emergencies) and item 8 (physical demands), note a reality of mixed food animal veterinarians' job requirements. Food animals are often large and have health needs that do not always fit into the 8-to-5 schedule. However, new practice management models and tools at least partially lessened these constraints. For this reason, this theme is also placed near the bottom of the upper-left quadrant.

A number of the items constraining supply noted above reflect larger demographic and social trends and, as such, are hard to change and are less actionable. They need to be understood and managed around by the profession. For example, items 3 (spousal career options), 7 (rural career opportunities), and item 11 (lack of cultural/recreational activities) reflect larger economic and demographic (urbanization) patterns in rural communities. These logically fit in the lower-left quadrant of Figure 7 and are referred to as the *Rural Economic/Social Constraints* and *Gender Dynamics* themes. Item 12 (more women veterinarians) reflects another social pattern of increasing numbers of females being attracted to professional programs in general. This pattern will not change in the foreseeable future and must be better understood and managed in maintaining an adequate supply of DVMs into the mixed food animal sector. While the

Insert Figure 7 about here

related theme of *Gender Dynamics* is placed in the lower-left quadrant, it is placed near the middle line indicating some opportunities to act on this constraint and partially manage the affect of this issue on the supply of veterinarians in this sector. The remaining constraint identified by panel members is item 4, which concerns the expected high number of retirements in the near future. This item was potentially not well understood by many panel members. The item was written to measure the influence on the supply of DVMs entering this sector. Logically, a retirement should create an opportunity for new DVM entering into a practice; however, it appears that several panel members evaluated the effect of retirements on the aggregate supply of mixed food animal veterinarians and foresee a net decline due to retirements. This theme is noted as *Expected Retirements* and is placed in the lower-left quadrant.

The seven supply-increasing trends and issues presented above represent opportunities for promoting the profession and building the supply of mixed food animal veterinarians. Item 1 (government veterinary public service programs) is related to the *Certifications & Monitoring* theme on Figure 2 and several of the increasing skill items noted in the previous section. For example, food safety standards and animal health certifications, animal welfare monitoring, and public health support activities are activities rated as having higher demand. The panel's rating of item 1 indicates that they see *Government Public Health Initiatives* as attracting more veterinarians to the mixed food animal area. This theme is noted in the upper-right quadrant of Figure 7. *Marketing Initiatives* theme is reflected in the ratings of item 1 (promotion of rural lifestyle) and item 3 (marketing food animal careers). Self-rated experts saw these as particularly beneficial in attracting more veterinarians to the mixed food animal sector. Item 6 refers to initiatives underway that facilitate the selection of veterinary students with agricultural

backgrounds. These students are more likely to be attracted into a food animal career and this relates to the *Selecting Ag Students* theme. Such initiatives counter the *Non-FSVM focus & Student Selection* theme that was seen as constraining supply and was noted in the upper-left quadrant. Item 4 notes the lucrative opportunities that mixed food animal practices have in also serving small animal clients. This is noted as the *Serving Small Animal Clients* theme. The final theme noted in the upper-left quadrant of Figure 7 is *Income Opportunities.* This is identified by item 7 (income opportunities). Note that there is a strong US versus Canada difference. Canada-focused panel members see this as a supply increasing factor while US-focused members see it as a neutral to slightly negative (or supply decreasing) factor. Wages are determined by many factors that are not easily managed. For this reason, this theme has been placed near the middle line The remaining item from the list of supply-increasing factors is item 5, which notes the benefits of the Veterinary Medical Services Act. This is noted as the *Debt Assistance* theme and is placed near the middle line but in the lower-right quadrant of Figure 7. Getting adequate funds to implement this legislative act is fairly challenging and will only directly benefit US veterinary students.

After rating demand and supply related factors, panel members were asked the "most likely" estimate of the percent that the future available supply of veterinarians would differ from the expected demand over various time periods (i.e., the expected average percentage surplus or shortage of mixed food animal veterinarians). As is the case with the demand estimates, the Delphi process gives panel members an opportunity to make initial estimates of future shortages or surpluses in the first survey. Second and third survey estimates provided additional opportunities to reconsider earlier estimates after being informed by the collective views of other panel members. Estimates of shortages were grouped into three time periods: Short-Term (fall of 2004 to fall of 2007), Medium-Term (fall of 2007 to fall of 2010) and Long-Term (fall of 2010 to fall of 2016). Panelists were instructed to assume a continuation of current trends and an absence of any catastrophic events in making their forecasts. As was the case with demand estimates, both the range (i.e., the middle 50% of replies) and the arithmetic mean and the median (i.e., the 50^{th} percentile of the distribution of estimates) are used to summarize these forecasts. Figures 8 though 10 provide the results of each period. Figure 11 provides the summary of the results from the final survey for all three periods.

The forecasts even in the third survey rating produced a wide range of estimates. The middle 50% of the panel always forecasts a shortage of food supply veterinarians in mixed food animal veterinarians. This is generally in the -3% to -9% (shortage) range. There was not a tendency for panel members to move to higher agreement as they moved to the second and the third survey. There was a tendency for point estimates and the middle 50% ranges to become less extreme in the third survey compared to the second

Insert figures 8 to 11 here

Insert figures 8 to 11 here

Insert figures 8 to 11 here

Insert figures 8 to 11 here

survey estimates. The point estimates of future shortages are identified with the means and median ratings and the final estimates are between -4.3% to -10.0% shortages.

While there was general consensus that, given current trends and assuming no catastrophic events, consistent shortages will occur over the foreseeable future, there was not high agreement on how high these shortages will be. While the early estimates of the panel members focused on Canada versus the US context consistently suggested more extreme shortages in Canada, these differences were not statistically significant in the final survey estimates. The fact that the panel members do not see demand for services increasing in the US as much as in Canada but still had close to equal estimates of future shortages suggests that the US-focused panel members have more extreme concerns about the future supply veterinarians entering this practice area. This is supported in the pattern of significant differences between Canada- and US-focused panel members' ratings of supply-increasing and supply-decreasing factors summarized in the previous section. On all significant contrasts, the US-focused members were either *less optimistic* about the influence of several demand-increasing influences (e.g., income opportunities, government support programs, lucrative small animal services) and *more pessimistic* about the single significant contrast seen in the listing of supply-decreasing factors (i.e., lack of positive role models). Contrasts between self-rated experts and less-expert forecasters did not reveal significant differences in the estimates of future shortages.

To better understand the disagreement within the panel about the extent of future shortages, additional analyses determined the factors that differentiated those making more conservative estimates versus those projecting more extreme shortages. A median split, based upon the median shortage estimated over all time periods (-6.0%) was used to place panelists into "limited-shortage" and "deeper-shortages" sub-groups. The median

shortage for the deeper-shortage sub-group was -9.17% and the median for the limited-shortages sub-group was -2.83%. Analyses indicate that those seeing deeper future shortages differ from the more conservative panelists in their views of the following *supply-related* factors:

- Lack of food supply practice-related externships for students (mean of 2.56 in the deeper-shortages sub-group versus 3.63 for those seeing limited-shortages)[10]
- Limited capacity of existing veterinary colleges in the US and/or Canada (mean of 3.33 in the deeper-shortages sub-group versus 4.00 for those seeing limited-shortages)

Analyses were also done to identify the *demand-related* factors that are seen differently by the deeper- versus limited-shortages sub-groups:

- Demands to perform surveillance tasks for government agencies (mean of 6.10 in the deeper-shortages sub-group versus 5.10 for those seeing limited-shortages)
- Client use of veterinary herd management services (mean of 5.60 in the deeper-shortages sub-group versus 4.60 for those seeing limited-shortages)
- Producers' demand for consulting services (mean of 5.50 in the deeper-shortages sub-group versus 4.70 for those seeing limited-shortages)
- Providing specialized technical veterinary services (mean of 5.70 in the deeper-shortages sub-group versus 4.60 for those seeing limited-shortages)

Those seeing deeper shortages see supply problems associated with both the capacity of veterinary colleges and the adequacy of students' educational experience in terms of externships in the food supply area. These also are related to the *Non-FSVM Focus* theme noted as a supply-constraint in Figure 7. The four demand-related factors noted above correspond to two demand-enhancing themes noted in Figure 2. Those seeing deeper shortages see more demand increasing potential in the *Certification & Monitoring*

[10] The items were rated on a 7-point Likert-type scale and evaluated based on their influence on the future supply of mixed food animal veterinarians. The mean rating in the parentheses is for the sub-group that sees deeper shortages (those seeing a 5% or higher average shortage) and the second mean is for the limited-shortages sub-group (less than a 5% average shortage). The following scale anchor points will help in the interpretation of those means: 1. Strong Decrease, 2. Decrease, 3. Slight Decrease, 4. No Influence.

Roles theme related activity of surveillance tasks for government agencies. The other three demand increasing items rated significantly higher by those seeing deeper shortages are related to the *Specialized Technical Expertise* theme (e.g., providing specialized technical veterinary services).

Solutions for the Future Shortage of Mixed Food Animal Veterinarians

How can the FSVM profession prepare for a better future and counter the trends that are going to lead to a consistent shortage of veterinarians available to fulfill the need for these professionals? Finding targets of opportunity to improve the future of the food supply veterinary profession has been the main focus of previous sections. To develop those ideas further, 18 potential general solutions to shortages were developed and evaluated by all 13 panels. Their ratings are based on the extent to which each solution will *eliminate* the expected veterinarian shortages. In interpreting the mean ratings noted below, one should keep in mind that a rating of 7 on the 7-point rating scale indicates that a solution would be "highly effective" at *eliminating* the expected shortage. The mean is the arithmetic average of all panel members. The following are the top 12 rated solutions. These are listed in order of rated effectiveness in eliminating shortages:

1. Student debt repayment and scholarship programs for service in areas of need (mean of 4.60 on a 7-point scale)[11]
2. Mentoring initiatives for students and those starting a food supply career (mean: 4.55)
3. More involvement of food supply practitioners in training veterinary students (mean of 4.40)
4. Expand the Centers of Excellence concept with a nationally recognized focus on different food supply sectors (mean: 4.05)

[11] Panel members rated the extent that each possible solution will lead to an *elimination* of a shortage of veterinarians. This high standard should be noted in interpreting the meaning of the mean rating. The following rating scale was used: 1. Not at all Effective, 3. Slightly Effective, 5, Effective, 7. Highly Effective. Note that there were not any significant differences between Canada-focused and US-focus panel members. Similarly, there also were not significant differences in the ratings of expert and less-expert rating forecaster sub-groups.

5. Increased focus of food supply coverage early in the DVM curriculum (mean of 3.95)

6. Focused recruitment of high school and college students with food supply interests into veterinary colleges (mean of 3.85)

7. Marketing campaigns to increase awareness of food supply career and lifestyle opportunities (mean of 3.80)

8. Reserve class slots for academically qualified students with food supply interests and relevant background (mean of 3.70)

9. Expanded paid work-study programs during the final year of the DVM programs (mean of 3.60)

10. Development and dissemination of Business Best Practices guidance for food supply veterinary enterprises (mean: 3.55)

11. Expanded business and practice management coverage in DVM curriculum (mean: 3.55)

12. Provide expanded job placement services in the food supply veterinary medicine areas (mean of 3.53)

None of the solutions listed above are particularly highly rated as the signal solution that will eliminate shortages. Clearly multiple solutions will be needed to address the shortage problems forecasted for the mixed food animal area. The items represent possible tactics that can be a part of a larger strategy for dealing with future shortages. For example, items 6, 7, 8, and 12 focus on increasing interest of pre-veterinary students in FSVM careers, making sure that academically qualified food animal oriented student are admitted, and then facilitating their later entry into FSVM career positions. These strategies address both the pre-veterinary student population but also make the food supply track more attractive to veterinary students. Other solutions relate to the educational experience that veterinary students receive. The increased coverage of the food supply area earlier in the curriculum (item 5), giving students more

hands on experience (item 9) in their final year, and more involvement of practitioners in their training (item 3) are tactics for developing students and keeping them engaged in a food supply career track. The highest rated item (item 1) is focused on student debt repayment incentives as an additional means to keep students attracted to the food supply area. The introduction of more business and practice management skills into the curriculum, as suggested by item 11, will better prepare graduates for the business realities of mixed food animal careers. Mentoring initiatives (item 2) was a highly rated solution that would ideally start with students and carry over into their first few years in a food supply career. The Centers of Excellence concept (item 3) is a large scale strategy that could build in a number of other highly rated solutions.

Conclusion: A Need for Action

The data from this study reveals a pattern of increasing demand and significant future shortages in the food supply veterinary medicine profession. The Veterinarian's Oath clearly states the obligation of this profession in serving the needs of society. If the projected shortages are allowed to unfold along the currently forecasted course in the mixed food animal area, the profession will not be able to fulfill its professional obligation! Animal health, food safety, and possibly human health are each threatened by the predicted growing shortage of mixed food animal veterinarians.

A clear premise of this research is that the future we will live in tomorrow is created by the actions that we take today. While there are larger trends (such as urbanization) that will not be changed and must be adjusted to and managed around, the future is not a deterministic function of unchangeable large social and economic forces. It is very much created by our choices. Many of the trends and issues shaping the future of the food supply veterinary profession are created by choices that can be thoughtfully reviewed and revised. Strategic actions implemented in the near-term can change the trends that will otherwise shape a future that is not optimal for either mixed food animal veterinarians or society. If action is not taken to address the future shortages then others will likely attempt to fill the void created. This is already being seen. We should not expect, however, that the unplanned responses that will emerge to fill the void caused by shortages will avert the negative economic impact and challenges to society's well-being that the lack of adequate numbers of food supply veterinarians will create. The veterinary profession can do better! Fulfilling its credo and responsibilities to society requires immediate strategic action to counter these trends.

Food animal veterinarians in rural settings are the frontline of defense for animal health and bio-security threats. The panel clearly recognized the growing importance of this food supply sector in monitoring and certifying food safety, and animal health and welfare standards are being adequately satisfied. These public service demands are increasing demand and have the potential for drawing more veterinarians to this food supply sector. If there are not adequate numbers of trained veterinarians in this area, then public health and national economic health is threatened.

The broad range of estimated captured by the middle 50% of panel members suggests a fair degree of uncertainty over just how short we will be. The point estimates suggest increasing shortages for each time period. It must be emphasized that those numbers are conservative. The panel was explicitly instructed to assume that no major disease, agro-terrorism or other severe or catastrophic events will occur. It is one thing to hope for such luck; it is another thing to plan for this rosy scenario! History tells us we must be prepared now to counter such events.

The planning matrix presented with several analyses provides guidance on the opportunities and constraints that must be considered in planning future action. This is, however, only a starting point. The profession must address where its strengths and weaknesses are in moving beyond these starting points. Thoughtful leaders in the larger profession need to identify where they have the best advantage to take effective collective action. All professions have strengths and weaknesses; effective leaders understand how to leverage their strengths while being mindful of their weaknesses. The identified solutions provide a starting point for developing effective elements of an effective coherent strategy of collective action.

Supplemental Information

The following additional information is provided to helping reader understand the results reported in this chapter:

1. Temporary links to the three the mixed food animal surveys are noted, but these will not be available indefinitely. The larger final report, which presents the results of Delphi panels focused on other sectors, includes a sample copy of three surveys for one selected panel. While the first survey was quite similar in all 13 panels, the nature of the Delphi process resulted in questions that formed unique surveys for the second and third rounds of each panel. However, the larger designs of all second- and all third-round survey are very similar. Try these web-links to view a copy of the three surveys completed by the missed food animal panel:
    a. First Survey: http://survey.cba.ksu.edu/prince/mixed1/index.htm
    b. Second Survey: http://survey.cba.ksu.edu/prince/mixed2/index.htm
    c. Third Survey: http://survey.cba.ksu.edu/prince/mixed3/index.htm
2. Exhibit A provides a listing of all members that originally agreed to participate in the Delphi panel.
3. Exhibits B and C provides copies of the interim feedback reports that accompanied the second and third surveys. The first report (Exhibit B) summarizes trends found in the first survey data and provides guidance for interpreting the feedback incorporated into the second survey. The second report (Exhibit C) serves a similar function for the second survey data trend and accompanied the third survey.

4. Exhibit D provides a summary of the data results for major sections of the three surveys completed by the mixed food animal panel.

Exhibit A

Original Mixed Food Animal Delphi Panel Members[12]

1. Mark Armfelt
2. John Berzowski
3. Seanna Brown
5. Derek Brown
6. Ray Butler
7. Les Byers
8. Kelly Collins
9. Warren Crawford
10. Jo Fisher
11. Fred Gingrich
12. Dave Hardin
13. Robert Holt
14. Terry Hunt
15. Brad Jones
16. Pat Kitchen
17. Margo Kunz
18. Duane Landals
19. Jim Lawrence
20. James W. Lloyd
21. Lowell Midla
22. Paul Motter
23. N.O. Nielsen
24. Darren Osborne
25. William Shain
26. Tom Wakefield

[12] Note that not all panel members completed all surveys. This group of individuals originally agreed to participate.

Exhibit B

Mixed Food Animal in Rural Settings Panel
1st Survey Interim Feedback Report

This report summarizes replies to the 1st survey of the Mixed Food Animal Practices in Rural Settings Delphi forecasting panel. *This brief report is focused on helping you be more informed as you complete the 2nd survey.* (A full summary of the panel's data will be provided after you complete the 3rd survey.)

This report identifies a few key patterns and directs you to more specific results from the 1st survey that is provided in the 2nd survey. Questions with more disagreement are repeated in the 2nd survey and panel averages and the ranges of the middle 50% of replies (between the 25% and 75% percentiles) are also noted in the 2nd survey. (Survey items with good consensus are not repeated.) When there is a difference between self-rated forecasting "experts" (i.e., those rating themselves as more confident in their estimates than the panel's median score on question #32 of the 1st survey) *versus* those rating themselves as "less expert" in making forecasts, then those contrasts are noted. Significant differences between Canadian versus US panel members are noted. For example, item #1 in the first section of the 2nd survey ("Use of non-DVMs, such as veterinary technicians") has the following notation:

"*1st Survey:* Average = 4.0 & Mid-50% = 3 to 5"

This indicates that the average rating was 4.0 on a 7-point scale ("4. No Influence") and the middle-50% of panelists (between the 25th and 75th percentiles) rated it from "3. Slight Decrease" to "5. Slight Increase". This indicates high disagreement on the influence of the "use of non-DVMs." About one-third saw it as increasing demand while another third saw it as decreasing demand (and the rest saw no influence). Since no mention is made of Canadian vs. US or expert vs. less expert ratings, this means that the statistical analysis found no differences on this issue between those subgroups. Note that such subgroup differences exist on items #2 and #10 of the first section of the 2nd survey. Statistical information from the 1st survey will be presented in this format throughout the 2nd survey.

Please review this feedback before (or as) you complete the 2nd survey.

I. Factors Influencing Demand for Food Supply Veterinarians

The first section in the 1st survey asked you to rate the influence of 25 different demand related issues. The top-rated influences seen as *increasing* future demand are:

- Growing need to track animals entering the food chain
- Public concerns over food safety
- Required 3rd-party certification or verification of standards
- Increasing concern for animal welfare

- Increasing concern for animal health
- Zoonotic disease-related human health concerns

The top-rated influences seen as *decreasing* future demand are:

- Curtailment of government support of veterinary services
- Lack of veterinarian's practice management & business skills
- Federal and/or State/Provincial budgetary constraints
- Move to larger sized producer operations
- Slow adoption of new technologies by veterinarians

II. Future Demand Estimates for Food Supply Veterinarians in Mixed-Rural Practice

The average value for the general forecast of future demand for the 1st survey was 4.9 on a 7-point scale (just under "5. Increase Slightly"). The middle 50% of panelists (between the 25th to 75th percentiles) rated future demand between "3. Decrease Slightly" to "6. Increase Moderately". There was not a significant difference between self-rated experts and the less-expert sub-group. While the Canadians tended to make stronger ratings of general demand, these are not statistically strong differences. (See question #3 in the 2nd survey.)

Additional questions asked for the "most likely" percentage increase (or decrease) in future demand for several time periods. Panel members saw future demand *increases* (beyond this fall) that averaged between +4.4% and +6.8%. The middle 50% (those between the 25th and 75th percentile) forecasted demand increases ranging between 0% and +20.0%. This indicates fair agreement that demand is increasing but also fairly high disagreement about the extent that it is increasing.

Those seeing stronger future demand increases (vs. those seeing lower demand increases or decreases) rate the following demand influences (from question #1) as having a significantly *higher positive influence* on demand:

- Zoonotic disease-related human health concerns
- Public concerns over food safety
- More access to global markets for food exports
- Need to understand animal-human health eco-systems
- Move to larger sized producer operations

III. Factors Influencing the Supply of Food Supply Veterinarians in Mixed-Rural Practice

The more extreme negative influences on the future supply of food supply veterinarians in mixed practices in rural settings (low ratings on the question #10 items in the 1st survey – see question 8 in the 2nd survey for a related question) are:

- Less emphasis on food animal practice in veterinary colleges
- Need to work long hours and emergency calls
- Lack of spousal career options in rural areas
- Expected high number of food supply veterinarians retiring in the near future
- Little exposure to food supply career options in college

IV. Projected Shortage or Surplus for Food Supply Veterinarians in Mixed-Rural Practice

The general question asking the panel to estimate the degree of surplus vs. shortage over the next 12 years produced an average of 6.0 ("6. Shortage") on a 7-point scale (see question #10 in the 2nd survey) and the middle 50% marked "6. Shortage" or "7. Large Shortage." There were not systematic differences between how experts versus the less-expert group rated this question. Additional questions asked the "most likely" percentage estimates of a surplus or shortage of DVMs for several time periods. The average shortage estimate over all time periods is between -11% and -12% beyond the fall of 2005. The middle 50% always projected shortages within a -21.3% to -1.0% range - never a surplus. This is a large range and indicates a substantial level of disagreement within the panel.

Next Steps…

The patterns that are starting to emerge tell an interesting story for DVMs in Mixed Food Animal Practices in Rural Settings. While there are some similarities to patterns seen in the beef cattle practice panel, it is one that is unique from what I am seeing in other areas of food supply veterinary medicine! Your replies to the 2nd survey will add to and clarify this story even more.

Thank you for your continuing help and involvement!

Dr. J. Bruce Prince
Professor of Management
Kansas State University
785-532-7459
jbprince@ksu.edu

August 30, 2005

Exhibit C

Mixed Food Animal Veterinarians in Rural Practice Delphi Panel
2nd Survey Interim Feedback Report

This report summarizes replies to the 2nd survey of the Mixed-Rural Delphi panel. *This brief report is focused on helping you be more informed as you complete the 3rd survey.* (A full summary of the panel's data will be provided after I analyze the 3rd survey.)

This report identifies a few key patterns and more specific information from the 2nd survey is included in the 3rd survey. Questions with more disagreement are repeated in the 2nd survey and panel averages and the ranges of the middle 50% of replies (between the 25% and 75% percentiles) are noted in the 2nd survey. When there is a difference between self-rated forecasting "experts" (i.e., the half who rated themselves as more confident in their estimates than the panel's median score on question #30 of the 1st survey) versus those rating themselves as "less expert" in making forecasts, then those contrasts are noted. Also, where there is a significant difference between those focused on the Canadian versus the US setting, then their respective means are noted. For example, item #1 in the first section of the 3rd survey ("Use of Non-DVMs, such as veterinary technicians") has the following notation:

"2nd Survey: Average = 4.1 & Mid-50% = 3 to 5; CDN = 4.8 & US = 3.6"

This indicates that the average of the panel was 4.1 on a 7-point scale (just over "4. No Influence") and the middle-50% of panelists (those between the 25th and 75th percentiles) rated it from "3. Slight Decrease" to "5. Slight Increase"). This range indicates that some saw it as a *demand decreasing* factor while others saw it as a *demand increasing* factor. "CDN = 4.8 & US = 3.6" indicates that there is a significant difference between how Canadian versus US panel members rated this questions. US panel member tended to see is as more of a *demand decreasing* factor than Canadians. More of them saw it as a factor that is increasing demand. Since information contrasting "expert" versus "less-expert" forecasters is not provided, there was no statistically significant difference between how these subgroups rated this question. Statistical information from the 2nd survey will be presented in this format throughout the 3rd survey.

Please review this feedback before (or as) you complete the 3rd survey.

V. Factors Influencing Demand for Food Supply Veterinary Careers

The first section in the 1st survey asked you to rate the influence of 25 different demand related issues. Several of these plus new items suggested by the panel were included in the 2nd survey. The top-rated influences seen as *increasing* future demand over both surveys are:

- Growing need to track animals entering the food chain
- Need to monitor and document food safety status

- Protection of public health and bioterrorism related concerns
- Public Concerns over food safety
- Need to monitor and document animal health or disease status
- Demands to perform surveillance tasks for government agencies
- Required 3rd-party certification or verification of standards

The influences seen as *decreasing* future demand are

- Lack of veterinarian's practice management and business skill
- More veterinary tasks being done by producers and non-DVMs
- Move to larger sized producer operations
- Curtailment of government support of veterinary services
- Federal and/or State/Provincial budgetary constraints

VI. Future Demand Estimates for Food Supply Veterinarians

The average value for the general forecast of future demand from the 2nd survey is 4.1 (just over "4. Stay Exactly the Same") and the middle 50% of the panel rating future demand between "3. Decrease Slightly" and "5. Increase Slightly." One-third projected decreasing demand and the other two-third forecasted increasing demand. 52% marked "5. Increase Slightly." Those focused on the Canadian setting tended to make higher rating compared to those focused on the US situation.

Additional questions asked for the "most likely" estimate of changes in future demand for several time periods. The average was between +2.7% to +3.4% increases over these time periods and the middle 50% projected increasing demand for veterinary services between near zero to +5.9% in those time periods. 20% of the panel projected decreases in demand while 75% forecasted increasing demand (5% said zero change in demand).Those focused on the Canadian setting consistently made significantly higher ratings of future demand. The contrasting Canadian versus US means are noted question 4 in the survey.

Panel members seeing *stronger* future demand (compared to those seeing *weaker* future demand) saw a *less negative* influence the "move to larger sized producer operations" by a significant degree. Those forecasting *stronger* demand also rated the following "demand influences" (from question 1 in the 2nd survey) as having a significantly *higher positive* influence on future demand:

- Producers' demand for consulting services
- Need to monitor and document animal health or disease status
- Providing specialized technical veterinary services
- Demand to provide surveillance tasks for government agencies

Selected activities and skills projected to have uniquely higher or lower demand were identified in the 1st survey and rated by the panel in the 2nd survey. The most extreme areas of *decreasing* demand noted are:

- Vaccination related activities
- Individual "sick" animal medicine
- Pregnancy examinations
- Emergency care

The skills and activities seen as having the *highest* increasing demand included:

- Animal tracking and identification
- 3rd party certification of food safety standards
- Animal welfare auditing
- Public health support activities

Those seeing *stronger* future demand increases (compared to those seeing weaker demand) where *less negative* about the decease in "pregnancy examinations" activity and see significantly higher demand increases for (1) public health support activities, and (2) 3rd party certification of food safety health standards.

VII. Factors Influencing the Supply of Food Supply Veterinarians

The more extreme *negative* influences on the future supply of food supply veterinarians into mixed-rural practices noted in the two previous surveys are:

- Less emphasis on food animal practice in veterinary colleges
- Need to work long hours and emergency calls
- Lack of spousal career options in rural areas
- Expected high numbers of food supply veterinarians retiring in the near future
- Little exposure to food supply career options in college

The more extreme *positive* influences on the future supply of food supply veterinarians noted are:

- Government programs that pay for veterinary public service activities
- Promotion of positive benefits of a rural lifestyle
- Effective marketing of food animal career opportunities
- Government funding of the Veterinary Medical Services Act

VIII. Projected Shortage or Surplus of Food Supply Veterinarians

The question on the general forecast of shortages versus surpluses (see question #9, 3rd survey) produced an average of 5.8 (just under "6. Shortage." The middle 50% rated "5. Slight Shortage" or "6. Shortage" and 68% of the panel members selected

"6. Shortage." The specific average shortage estimates over all time periods projected ranged from -3.5% to -8.9% shortages and the middle 50% (between the 25th and 75th percentile) always projected shortages (from -1.0% to 13.8%). Approximately 20% of the panel projected a coming surplus and the rest see a shortage of food supply veterinarians in this area.

Next Steps…

The patterns flagged in the 1st survey have become clearer in the 2nd survey. This presents a unique and interesting story for DVMs in mixed food animal practices in rural settings. Your replies to the third and final survey will add to and clarify this story even more. Besides making the final estimates to some previously seen questions, you will evaluate several potential solutions for the shortage problem noted by the majority.

Thank you for your continuing help and involvement! The final survey will have a large influence on the conclusions we will reach about this important area of food supply veterinary medicine.

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Exhibit D

Section I. Factors Influencing Future Demand for Veterinarians in the Mixed Rural FSVM Careers

Survey Item	Survey Wave[14]	% Decrease[15]	% No Influence	% Increase	Mean	Standard Deviation	Middle 50% Range	N
1. Public concern over food Safety	1st	0	21.7	78.3	5.7	1.07	5 to 6	23
2. Use of non-DVMs, such as veterinary technicians	1st	34.8	30.4	34.8	4.0	1.19	3 to 5	23
2. Use of non-DVMs, such as veterinary technicians	2nd	42.9	23.8	33.3	4.1	1.24	3 to 5	21
2. Use of non-DVMs, such as veterinary technicians	3rd	50	25	25	3.7	1.26	3 to 4.8	20
3. Public concern over bio-terrorism	1st	0	31.8	68.2	5.1	.99	4 to 6	22
4. Zoonotic disease-related human health concerns	1st	0	26.1	73.9	5.2	.95	4 to 6	23
5. Required third party certification or verification of standards	1st	0	4.8	95.2	5.5	.68	5 to 6	21
6. Limited public understanding of food quality and safety issues	1st	11.1	38.9	50	4.5	1.04	4 to 5	18
7. More meat consumption in the US and Canada	1st	4.5	40.9	54.5	4.7	1.08	4 to 5.3	22
7. More meat consumption in the US and Canada	2nd	0	28.6	71.4	5.3	1.02	4 to 6	21
8. More access to global markets for food exports	1st	4.3	34.8	60.9	5.0	1.04	4 to 6	23
9. Changing dietary habits in third-world countries	1st	0	40	60	5.0	.95	4 to 6	20
10. Need to protect indigenous wildlife from exotic diseases	1st	0	50	50	4.6	.73	4 to 5	22
11. Federal and/or state/provincial budgetary constraints	1st	47.4	36.8	15.8	3.7	1.16	3 to 4	19
11. Federal and/or state/provincial budgetary constraints	2nd	40	45	15	3.9	1.09	3 to 4	20
12. Curtailment of government support of veterinary services	1st	65	20	15	3.3	1.46	2.3 to 4	20
12. Curtailment of government support of veterinary services	2nd	52.4	33.3	14.3	3.7	.86	3 to 4	21
13. Increasing concern for animal wildlife	1st	0	14.3	85.7	5.3	.80	5 to 6	21
14. Increasing concern for animal health	1st	0	17.4	82.6	5.3	.81	5 to 6	23
15. Need to understand animal-human health eco-systems	1st	0	36.8	63.2	4.8	.77	4 to 5	19
16. Availability of highly technical or specialized services	1st	13	4.3	82.6	5.0	1.24	5 to 6	23
16. Availability of highly technical or specialized services	2nd	23.8	4.8	71.4	5.0	1.43	3.5 to 6	21
16. Availability of highly technical or specialized services	3rd	30	5	65	4.5	1.32	3 to 5	20

[14] The "1st" refers to the 1st Delphi survey. The "2nd" refers to the 2nd Delphi survey, while the "3rd" refers to the 3rd Delphi survey.

[15] The "% Decrease" is the percentage that marked 1, 2 or 3. This ranges from a "Strong Decrease" to "Slight Decrease" on the 7-point scale. The "% No Influence" is the percentage marking "No Influence." It is the mid-point of the scale. The "% Increase" is the percentage marking 5, 6 or 7, which ranged from "Slight Increase" to "Strong Increase." Those marking "no trend" or "no opinion" are excluded.

17. Veterinary services agreements required for agri-business loans	1st	0	28.6	71.4	5.0	.74	4 to 5.5	21
18. Growing need to track animals entering the food chain	1st	0	8.7	91.3	5.8	.89	5 to 6	23
19. Constraints on non-DVMs giving prescription drugs	1st	4.5	27.3	68.2	5.2	1.18	4 to 6	22
19. Constraints on non-DVMs giving prescription drugs	2nd	5	35	60	4.9	.99	4 to 5.8	20
20. Slow adoption of new technologies by veterinarians	1st	44.4	33.3	22.2	3.8	1.10	3 to 4.3	18
21. Move to larger sized producer operations	1st	56.5	8.7	34.8	3.8	1.51	3 to 5	23
21. Move to larger sized producer operations	2nd	61.9	14.3	23.8	3.6	1.16	3 to 4.5	21
21. Move to larger sized producer operations	3rd	60	30	10	3.4	1.23	3 to 4	20
22. Client use of veterinary herd management services	1st	13	8.7	78.3	5.1	1.28	5 to 6	23
22. Client use of veterinary herd management services	2nd	0	28.6	71.4	5.1	.81	4 to 6	21
23. Client concerns about veterinary service costs	1st	34.8	52.2	13	3.9	.87	3 to 4	23
24. Lack of veterinarian's practice management and business skill	1st	54.5	18.2	27.3	3.6	1.14	3 to 5	22
24. Lack of veterinarian's practice management and business skill	2nd	60	40	0	3.2	.77	3 to 4	20
25. Part-time farmers needing more veterinary services	1st	9.1	18.2	72.7	5.1	1.23	4 to 6	22
25. Part-time farmers needing more veterinary services	2nd	19	9.5	71.4	4.9	1.39	4 to 6	21
25. Part-time farmers needing more veterinary services	3rd	5	35	60	4.6	.88	4 to 5	20
150. Demands to perform surveillance tasks for government agencies	2nd	0	14.3	85.7	5.6	.87	5 to 6	21
151. Producers' demand for consulting services	2nd	9.5	0	90.5	5.1	1.00	5 to 6	21
152. Need to monitor and document food safety status	2nd	0	4.8	95.2	5.8	.68	5.5 to 6	21
153. Need to monitor and document animal health or disease status	2nd	0	4.8	95.2	5.6	.74	5 to 6	21
154. Providing specialized technical veterinary services	2nd	9.5	9.5	81	5.1	1.28	5 to 6	21
155. The profitability of client concerns	2nd	5.3	26.3	68.4	5.1	.97	4 to 6	19
156. Protection of public health and bioterrorism related concerns	2nd	0	10	90	5.7	.88	5 to 6	20
157. Involvement in interdisciplinary teams solving producer problems	2nd	5	10	85	5.2	1.04	5 to 6	20
158. More able, educated and self-sufficient farmers/producers	2nd	52.4	9.5	38.1	4.0	1.55	3 to 5.5	21
158. More able, educated and self-sufficient farmers/producers	3rd	42.1	31.6	26.3	3.8	1.08	3 to 5	19
159. More veterinary tasks being done by producers and non-DVM employees	2nd	57.1	33.3	9.5	3.3	.91	3 to 4	21
160. The marketing and business skills of veterinarians	2nd	35	25	40	4.1	1.19	3 to 5	20
160. The marketing and business skills of veterinarians	3rd	30	20	50	4.4	1.23	3 to 5	20

Section II. Specialized Activities Increasing or Decreasing in Demand Relative to the General Pattern (Mixed Rural FSVM Careers)

Survey Item	Survey Wave	% Lower[16]	% No Difference	% Higher	Mean	Standard Deviation	Middle 50% Range	N
1. Third party certification of food safety standards	2nd	0	14,3	85.7	5.5	.87	5 to 6	21
2. Animal tracking and identification	2nd	0	4.8	95.2	5.7	.64	5 to 6	21
3. Monitoring wildlife health issues	2nd	5	55	40	4.3	.98	4 to 5	20
4. Third party certification of animal health standards	2nd	0	23.8	76.2	5.1	.91	4.5 to 6	21
5. Management consulting to producers/farmers	2nd	4.8	4.8	90.5	5.1	.87	5 to 5.5	21
6. Training producer employees	2nd	9.5	19	71.4	4.8	.83	4 to 5	21
7. Preventative medicine and herd health activities	2nd	0	23.8	76.2	5.1	.77	4.5 to 6	21
8. Public health support activities	2nd	0	20	80	5.2	.81	5 to 6	20
9. Producer medicine activities	2nd	9.5	19	71.4	4.9	1.14	4 to 6	21
10. Animal welfare auditing	2nd	0	4.8	95.2	5.4	.67	5 to 6	21
11. Species specific expertise related activities	2nd	9.5	9.5	81	5.1	1.01	5 to 6	21
12. Individual “sick” animal medicine	2nd	42.9	42.9	14.3	3.6	1.20	3 to 4	21
13. Pregnancy examinations	2nd	25	45	30	3.9	1.25	3.3 to 5	20
14. Service to small farms/ranches	2nd	20	25	55	4.6	1.05	4 to 5	20
15. Vaccination related activities	2nd	55	30	15	3.4	1.23	3 to 4	20
16. Emergency care	2nd	38.1	42.9	19	3.9	1.30	3 to 4	21

[16] The “% Lower” is the percentage that marked 1, 2 or 3. This ranges from “Significantly Lower” to “Slightly Lower” on the 7-point scale. The “% No Difference” is the percent that marked 4. This is the mid-point of the scale. The “% Higher” is the percentage marking 5, 6 or 7, which ranged from “Slightly Higher” to Significantly Higher.”

Section III. Factors Influencing Future Supply for Veterinarians in the Mixed Rural FSVM Careers

Survey Item	Survey Wave	% Decrease[17]	% No Influence	% Increase	Mean	Standard Deviation	Middle 50% Range	N
1. Less emphasis on food animal practice in veterinary colleges	1st	95.5	4.5	0	2.1	.72	2 to 2	22
2. More women veterinarians entering the workforce	1st	65.2	34.8	0	2.9	1.00	2 to 4	23
2. More women veterinarians entering the workforce	2nd	66.7	23.8	9.5	3.2	1.22	2.5 to 4	21
2. More women veterinarians entering the workforce	3rd	65	30	5	3.2	.88	2.3 to 4	20
3. Physical demands of large animal veterinary work	1st	73.9	26.1	0	2.7	.97	2 to 4	23
3. Physical demands of large animal veterinary work	2nd	76.2	23.8	0	2.9	.83	2 to 3.5	21
4. Need to work long hours and emergency calls	1st	91.3	8.7	0	2.2	.89	2 to3	23
5. Little exposure to food supply career options in college	1st	86.4	13.6	0	2.6	.79	2 to 3	22
6. Lack of food supply practice-related externships for students	1st	73.7	21.1	5.3	3.0	.94	2 to 4	19
7. Lack of positive role models in veterinary food supply practice	1st	65	25	10	3.0	1.23	2 to 4	20
7. Lack of positive role models in veterinary food supply practice	2nd	65	25	10	3.2	1.01	3 to 4	20
8. Poor income opportunities in rural areas	1st	66.7	28.6	4.8	2.8	1.25	1.5 to 4	21
8. Poor income opportunities in rural areas	2nd	50	50	0	3.2	.95	2.3 to 4	20
8. Poor income opportunities in rural areas	3rd	57.9	36.8	5.3	3.2	.98	3 to 4	19
9. Lack of cultural and recreational opportunities in rural areas	1st	69.6	26.1	4.3	3.0	1.00	2 to 4	23
10. Lack of spousal career options in rural areas	1st	95.7	4.3	0	2.3	.88	2 to 3	23
11. Limited lifestyle and career opportunities in rural areas	1st	78.3	17.4	4.3	2.9	.92	2 to 3	23
12. Federal and/or state/provincial budgetary constraints	1st	40.9	54.5	4.5	3.5	.86	3 to 4	22
13. High debt load of veterinary school graduates	1st	69.6	30.4	0	3.0	.85	2 to 4	23
14. Expected high number of food supply veterinarians retiring in the near future	1st	72.7	22.7	4.5	2.6	1.18	2 to 4	22
14. Expected high number of food supply veterinarians retiring in the near future	2nd	57.1	14.3	28.6	3.5	1.47	2 to 5	21
14. Expected high number of food supply veterinarians retiring in the near future	3rd	55	10	35	3.6	1.31	2.3 to 5	20
15. Limited capacity of existing veterinary colleges in the US and/or Canada	1st	26.1	69.6	4.3	3.7	.83	3 to 4	23

[17] The "% Decrease" is the percentage that marked 1, 2 or 3. This ranges from a "Strong Decrease" to "Slight Decrease" on the 7-point scale. The "% No Influence" is the percentage marking "No Influence." It is the mid-point of the scale. The "% Increase" is the percentage marking 5, 6 or 7, which ranged from "Slight Increase" to "Strong Increase." Those marking "no trend" or "no opinion" are excluded.

16. Perceived lack of demand for food animals	1st	59.1	36.4	4.5	3.2	1.10	2 to 4	22
16. Perceived lack of demand for food animals	2nd	50	40	10	3.6	.88	3 to 4	20
17. Requirement for education beyond a DVM	1st	27.3	72.7	0	3.7	.57	3 to 4	22
101. Selection of veterinary students with an agricultural background	2nd	14.3	28.6	57.1	4.5	1.03	4 to 5	21
101. Selection of veterinary students with an agricultural background	3rd	5	50	45	4.5	.69	4 to 5	20
102. Promotion of the positive benefits of a rural lifestyle	2nd	4.8	19	76.2	5.0	.84	4.5 to 6	21
103. Income opportunities in mixed practices	2nd	23.8	19	57.1	4.5	1.08	3.5 to 5	21
103. Income opportunities in mixed practices	3rd	25	35	40	4.3	1.16	3.3 to 5	20
104. Effective marketing of food animal careers opportunities	2nd	9.5	9.5	81	5.0	.87	5 to 5.5	21
105. Government funding for Veterinary Medical Services Act	2nd	5.3	21.1	73.7	5.0	.91	4 to 5	19
106.Government programs that pay for veterinary public service activities	2nd	4.8	23.8	71.4	5.1	1.09	4 to 6	21
107. Increasing demand for lucrative small animal services	2nd	66.7	9.5	23.8	3.4	1.69	2 to 4.5	21
107. Increasing demand for lucrative small animal services	3rd	5	10	85	5.0	.69	5 to 5	20
108. Use of narrow criteria (GPA and test scores) to select DVM students	2nd	55	45	0	3.2	.89	3 to 4	20
109. Marginalization of food animal medicine in schools	2nd	85.7	14.3	0	2.9	.66	2 to 3	21

Section IV. SOLUTIONS for Shortages of Veterinarians in the Mixed Rural FSVM Careers

Survey Item	Survey Wave	% Less Effective[18]	% Effective	% Highly Effective	Mean	Standard Deviation	Middle 50% Range	N
1. Reserve class slots for academically qualified students with food supply interests and relevant background	3rd	45	45	10	3.7	1.72	2.3 to 5	20
2. Expand the Centers for Excellence concept where nationally recognized focus on different food supply sectors	3rd	42.1	31.6	26.3	4.1	1.96	3 to 6	19
3. Focused recruitment of high school and college students with food supply interests into veterinary colleges	3rd	45	50	5	3.9	1.57	2.3 to 5	20
4. Increased focus of food supply coverage early in DVM curriculum	3rd	45	45	10	4.0	1.54	3 to 5	20
5. Expanded business and practice management coverage in DVM curriculum	3rd	55	30	15	3.6	1.70	2 to 5	20
6. Expanded postgraduate fellowships in food supply areas	3rd	65	10	25	3.5	1.93	2 to 5.5	20
7. Expanded paid work-study programs during the final year of DVM	3rd	50	40	10	3.6	1.79	2.3 to 5	20
8. More involvement of food supply practitioners in training veterinary students	3rd	30	50	20	4.4	1.57	3 to 5	20
9. Provide expanded job placement services in the food supply veterinary medicine areas	3rd	47.4	47.4	5.3	3.5	1.47	3 to 4	19
10. Appointment of more food supply faculty at colleges of veterinary medicine	3rd	52.6	42.1	5.3	3.4	1.61	2 to 5	19
11. Paid externship requirement in food supply medicine during the summer	3rd	60	40	0	3.4	1.27	2.3 to 5	20
12. Marketing campaigns to increase awareness of food supply career and lifestyle opportunities	3rd	55	40	5	3.8	1.40	3 to 5	20
13. Student debt repayment and scholarship programs for service in food supply areas of need	3rd	20	60	20	4.6	1.14	4 to 5	20
14. Development of a government-supported Reserve Corps of food supply DVMs for disease surveillance and control activities	3rd	60	30	10	3.4	1.88	2 to 5	20
15. Low cost (subsidized) consulting in business and practice	3rd	55	40	5	3.4	1.50	2 to 5	20

[18] The "% Less Effective" is the percentage that marked 1, 2 or 3. This ranges from "Not at all Effective to Slightly Effective" on the 7-point scale. The "% Effective is the percentage marking 4 or 5 where 5 is "Effective." The "% Highly Effective" is the percentage marking 6 or 7 where 7 is "Highly Effective."

management for new food supply DVMs								
16. Mentoring initiatives for students and those starting a food supply career	3rd	35	30	35	4.6	1.85	3 to 6	20
17. Focused recruitment of women students in food supply areas	3rd	63.2	31.6	5.3	3.1	1.62	2 to 5	19
18. Development and dissemination of Business Best Practices for food supply veterinary enterprises	3rd	45	50	5	3.6	1.54	2.3 to 5	20