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## **Chapter 10**

# **The Future Demand for Food Supply Veterinarians in State/Provincial Government Careers**

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# Introduction

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This study provides a systematic analysis of the likely future demand and potential shortages for food supply veterinary medicine (FSVM) professionals employed in state/provincial level government positions in the US and Canada. Six inter-related questions are addressed:

- I. What are the issues and trends likely to drive the future demand for food supply veterinarians in state/provincial government careers?
- II. Assuming a continuation of currently unfolding trends and the absence of major catastrophic events, what will be the demand for food supply veterinarians in state/provincial roles 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 state/provincial government FSVM area?
- IV. What are the issues and trends likely to drive the future supply of food supply veterinarians entering state/provincial government careers?
- V. Given the pattern of emerging trends and issues influencing supply and demand, and assuming the absence of any major catastrophic events, what will be the surplus or shortage of veterinarians in state/provincial FSVM roles over the next several years?
- VI. Given the answers to the first five questions, how can government institutions and 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. We next offer general conclusions and recommendations based upon the answers to these six questions

# The Delphi Forecasting Technique

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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<sup>1</sup> 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. 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 by thoughtful leaders now 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 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

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<sup>1</sup> 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.

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 state/provincial FSVM 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<sup>th</sup> and 75<sup>th</sup> 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 frequently came from the US and focused on that context, 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 were statistically 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 factors 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 13 demand study Delphi panels. Additional information at the end of this chapter identifies the temporary website links to each of the surveys for this Delphi panel.

# Issues and Trends Driving Future Demand for Food Supply

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## Veterinarians in State/Provincial Careers

The panel responded to both panel-suggested demand-related items that were unique to this panel, as well as items drawn from the general FSVM literature and discussion with veterinarians. This latter 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 state/provincial government sector. Eleven additional items were derived from those open-ended comments for a total of 36 items. In the second survey, the additional 11 items and demand items where there was fair disagreement within the panel on the first survey were repeated. Higher agreement on several items was reached in the second survey and only the items with greater disagreement were repeated a final time in the third survey. The following survey items were seen by the panel as *increasing* future demand (starting with the most influential issues and trends first):

### Trends Increasing Demand

1. Zoonotic disease-related human health concerns (6.12 on a 7-point scale)<sup>2</sup>  
*Note that the Canada-focused sub-group mean of 6.57 was significantly higher than the US-focused sub-group mean of 6.00.*
2. Public concerns over food safety (mean: 6.08)  
*Note that the Canada-focused sub-group mean of 6.57 was significantly higher than the US-focused sub-group mean of 5.88.*
3. Global spread of animal-related diseases (mean: 5.79)
4. Governmental agro-security and bio-terrorism preparedness initiatives (mean: 5.76)
5. Growing need to track animals entering the food chain (mean: 5.76)  
*Note that the Canada-focused sub-group mean of 5.14 was significantly lower than the US-focused sub-group mean of 5.86.*

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<sup>2</sup> 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.

6. Public concerns over bio-terrorism (mean: 5.69)  
*Note that the Canada-focused sub-group mean of 5.14 was significantly lower than the US-focused sub-group mean of 5.80.*
7. Increasing demand for food safety standards and surveillance programs (mean: 5.62)
8. Increasing concern for animal welfare (mean: 5.49)  
*Note that the self-rated forecasting experts' sub-group mean of 5.55 was significantly higher than the less-expert sub-group mean of 4.94.*
9. More access to global markets for food exports (mean: 5.48)
10. Increasing concern for animal health (mean: 5.47)
11. Government certification of animal welfare or production practices (mean: 5.44)  
*Note that the Canada-focused sub-group mean of 4.71 was significantly lower than the US-focused sub-group mean of 5.59.*
12. Expansion of regulatory requirements (mean: 5.40)
13. Veterinary involvement throughout the food supply system (mean: 5.38)  
*Note that the self-rated forecasting experts' sub-group mean of 5.60 was significantly higher than the less-expert sub-group mean of 5.06.*
14. Required third party certification or verification of standards (mean: 5.29)
15. Need to protect indigenous wildlife from exotic diseases (mean: 5.05)
16. Move to integrated team approaches to health and food safety issues (mean: 5.03)  
*Note that the self-rated forecasting experts' sub-group mean of 5.25 was significantly higher than the less-expert sub-group mean of 4.72.*

Note that items with a mean rating of 4.0 to 5.0 (between the “4 No Influence” and “5 Slight Increase” scale anchor points) are not presented. See Exhibit B for a listing of these items as well as the distributions and ratings of all items used in the 1<sup>st</sup>, 2<sup>nd</sup>, or 3<sup>rd</sup> wave surveys. The mean values reported 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 leading to decreases in demand for food supply veterinarians<sup>3</sup>.

The eight survey items noted below are trends rated as *decreasing* future demand for veterinarians in state/provincial government areas starting with the most influential factors first:

### **Trends Decreasing Demand**

1. Curtailment of government support of veterinary services (mean: 2.90)<sup>4</sup>
2. Federal and/or State/Provincial budgetary constraints (mean: 3.15)
3. Declining portion of government budgets for agriculture (mean: 3.33)
4. Non-veterinary specialists doing DVM tasks (mean: 3.33)
5. Agriculture programs moving to non-agriculture agencies (mean: 3.61)
6. Client concerns about veterinary service costs (mean: 3.67)  
*Note that the Canada-focused sub-group mean of 4.00 was significantly higher than the US-focused sub-group mean of 3.65.*
7. Lack of veterinarian's practice management and business skill (mean: 3.77)
8. Use of non-DVMs, such as veterinary technicians (mean: 3.92)

### **The Planning Matrix**

The ratings of the demand-influencing factors 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 “actionable.” In other words, strategic actions can be taken to alter the expected pattern of influence suggested by the panel’s mean score. Others items identify issues that are fairly fixed constraints and not particularly actionable. These items represent general societal concerns or where the cooperation of multiple external

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<sup>3</sup> See Exhibit B for a listing of these items as well as the distributions and ratings of all items used in the 1<sup>st</sup>, 2<sup>nd</sup>, or 3<sup>rd</sup> wave surveys. See the Exhibit B for the items with a mean rating of 4.0 to 5.0 (between the “4. No Influence and “5. Slight Increase” scale anchor points).

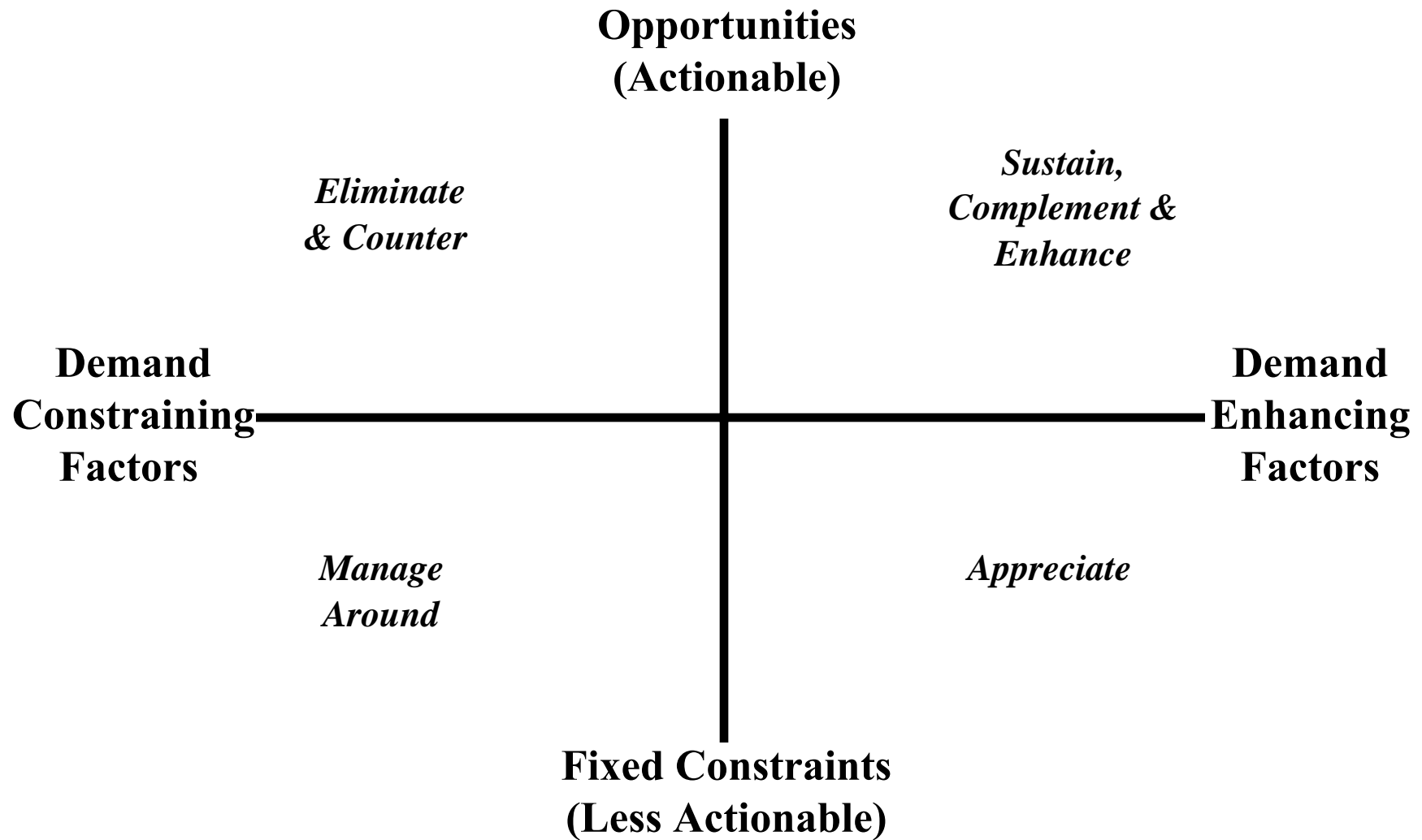
<sup>4</sup> The items were rated on a 7-point Likert-type scale and evaluated based on their influence on future demand. The mean rating for each item is noted in parentheses. The following scale anchor points will help interpret those means: 1. Strong Decrease, 2. Decrease, 3. Slight Decrease, 4. No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

entities beyond the FSVM profession maybe needed to change the expected pattern of influence on future demand.

Figure 1 presents a planning matrix useful in organizing the pattern of results and guiding future strategic action. The better targets for strategic action are on the “actionable” or top-half of the figure. In order to increase future demand, actionable demand-constraining factors (on the top left-hand side of the figure) must be lessened or countered. The top, right-side quadrant represents actionable demand-enhancing trends that can be sustained, complemented, or enhanced in some way. The lower quadrants represent less-manageable trends and factors. Any strategic responses to the challenges uncovered by this research need to be mindful of these constraints.

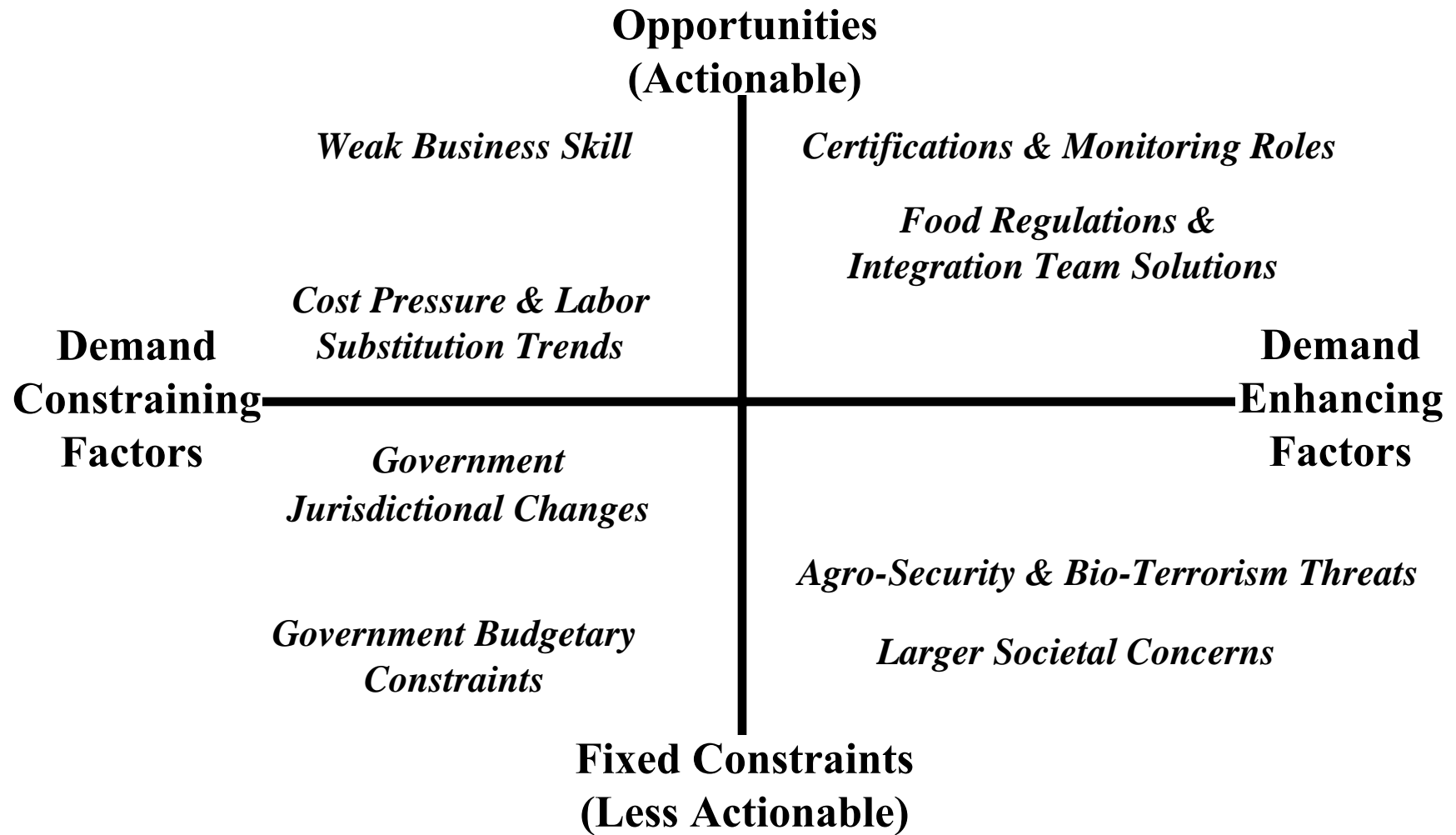
This planning matrix can be used to organize the results of the analysis of the demand related issues and trends. The eight *demand-decreasing* items noted in the first listing above map to the left-side of Figure 1. Figure 2 captures the themes evident in the results. The top three demand-decreasing items, item 1 (curtailment of government support), item 2 (budgetary constraints), and item 3 (declining portion for government budgets for agriculture) all relate to declining government resources. This trend comprises the *Government Budgetary Constraints* theme noted in the lower-left quadrant of Figure 2. This issue is fairly constrained and is less actionable than other trends. Multiple competing interests and politics play out in government allocation decisions. While a little success on this front may go along way, other initiatives focused on more actionable trends should be included in any strategy focused on increasing demand. Item 5 (programs moving to non-agricultural agencies) also involves larger political processes and relates to the *Government Jurisdictional Changes* theme noted in closer to the middle line in the lower-left quadrant of Figure 2. Changing this trend is also fairly constrained but seems more actionable than making large increases in budgetary allocations.

# Figure 1 Planning Matrix



# Figure 2

## Demand Diminishing & Enhancing Issues in the State/Provincial Government Sector



The remaining demand-decreasing items noted on the list of eight have fewer external constraints and are more manageable. In fact, success in eliminating or countering these trends may provide help in changing the two political trends noted above. Item 4 (non-veterinary specialists doing DVM task), item 6 (concerns about costs), and item 8 (use of non-DVMs) are relate to a *Cost Pressures & Labor Substitution* theme. This is placed in the upper-right quadrant of Figure 2 close to the middle line. While there are larger economic constraints that are challenging to manage around, there are opportunities for strategic initiatives that will better demonstrate the benefits of using veterinarians and by demonstrating the value added by having a more optimal labor mix (veterinarians and non-veterinary substitutes) for the key state/provincial veterinary task. Finally, item 7 (lack of business skills) is captured by the *Weak Business Skills* theme. While this is a more important issue for private practice veterinarians, better training and the development business acumen will also help state and provincial food supply veterinarians and improve demand.

Listing of the 16 demand-increasing items summarized above as “Trends Increasing Demand” all map to the right-side of the Figure 2 planning matrix. Many relate to larger societal concerns that have traditionally supported the demand for food supply veterinarians in governmental roles. Zoonotic disease-related human health fears (item 1), food safety concerns (item 2), animal welfare concerns (item 8) and animal health concerns (item 10) all provide the basis for a *Larger Societal Concerns* theme that is noted in the lower-left quadrant of Figure 2. A related theme that has grown dramatically in recent years is the *Agro-Security & Bio-Terrorism Threats* theme. This is identified by several items on demand-increasing listing. Item 3 (global spread of diseases), item 4 (agro-security and bio-terrorism initiatives), item 5 (need to track animals entering the food chain), item 6 (concerns over bio-terrorism), item 7 (demand for food safety standards and surveillance), and item 9 (access to global markets) all related directly to this theme.

The last two themes are noted in the lower-left quadrant. These factors increase demand and are the results of larger global political and economic forces.

The panel also noted trends and factors that relate to how governments are regulating and protecting an increasingly global and integrated food supply system. Item 12 (expansion of regulations), item 13 (veterinary involvement throughout the food supply system), and item 16 (integrated team approaches to health and food safety issues) all relate to a *Food Regulation & Integrated Team Solutions* theme. This theme is related with a more general *Certifications & Monitoring Roles* theme that is directly flagged by item 11 (certifications of animal welfare and production practices) and item 14 (certifications and verification of standards). Both of these themes are more actionable opportunities for the FSVM profession and are noted in the upper-left quadrant. These are areas where strategic actions can enhance and sustain these trends in ways that will help the FSVM profession and society.

# **The Future Demand for Food Supply Veterinarians in State/Provincial Careers**

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The Delphi process gave panel members an opportunity to make initial estimates of future demand over several time periods in the first survey. The second survey provided an opportunity 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 feedback report on the second survey results was additional opportunities to reconsider and make final projections of future demand. As is often the case with Delphi panels, the range of estimates from the first survey was quite wide and then narrowed with each successive survey.

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 (the estimates between the 25<sup>th</sup> percentile and 75<sup>th</sup> 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<sup>th</sup> percentile) of the distribution of estimates. The pattern of estimates generally followed the usual Delphi outcome of broader ranged early round estimates, indicating plenty of disagreement, followed by a narrowing of estimates (or more agreement) in later survey rounds. Figures 3 through 5 provide the results of each time period. Figure 6 provides a summary of the results of the final survey for all three time periods.

There is a general consensus that demand is increasing. Only one or two panel members ever predicted a decrease in demand. The middle 50% of the panel projected demand increases over all three time periods in the final survey. The point estimates seen in the means and median scores varied between

+3.0% and +8.9%. In the important long-term forecast, the point estimates are that there will be a demand increase of at least +8.5%. The point estimates for the short-term is a demand increase of +7.0% and +8.1%. While there was general agreement that demand will increase, there remained after the final Delphi round, disagreement on the exact extent that future demand is expected to increase. There was understandably a wider range of projections for the longer-term forecast. Further analysis was done to evaluate the basis for these differing perceptions within the panel.

### **Varying Forecasts of Growing Demand**

Analysis contrasting the demand forecasts of Canada-focused panelists versus US-focused members found that the US-focused forecasts were always lower than the means for the Canada-focused panel members. However, these differences did not achieve statistical significance in the t-test analysis due to the wide variation of forecasts within each sub-group. The means from the final survey for the US versus Canada sub-groups are as follows:

- Short-Term (2004-07) Demand Change: US: +8.0% & Canada: +8.5%
- Medium-Term (2007-10) Demand Change: US: +3.9% & Canada: +5.5%
- Long-Term (2010-16) Demand Change: US: +8.1% & Canada: +12.5%

T-test analysis on the sub-groups based on self-rated forecasting expertise (below versus above the median score for the panel) found that while experts always forecasted higher demand than the less-expert sub-group, these differences also did not reach statistical significance. The difference between the means in each of those sub-groups was at its largest in the long-term forecast. The expert sub-group forecasted a +9.8% demand change, while the less-expert sub-group predicted a +7.9% change in demand over that time period. In summary, differences in forecasts based on country of focus and self-rated forecasting expertise contributed to the range of predictions between the 25<sup>th</sup> and 75<sup>th</sup> percentile ratings (middle 50% range). However, there remain differences of opinion that are explained by other factors.

# Figure 3

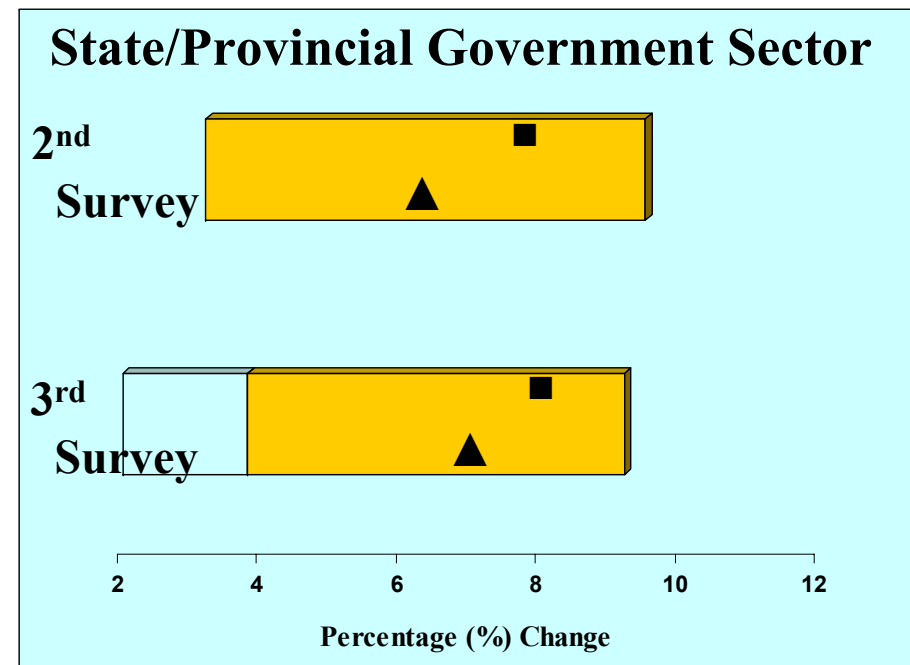
## Short-Term Demand Change (2004-07)

### 2<sup>nd</sup> Survey Results:

- Mid-50% = +3.3% to +10.0%
- Mean = +7.8% (■)
- Median = +6.5% (▲)

### 3<sup>rd</sup> Survey Results:

- Mid-50% = +4.0% to +10%
- Mean = +8.1% (■)
- Median = +7.0% (▲)



# Figure 4

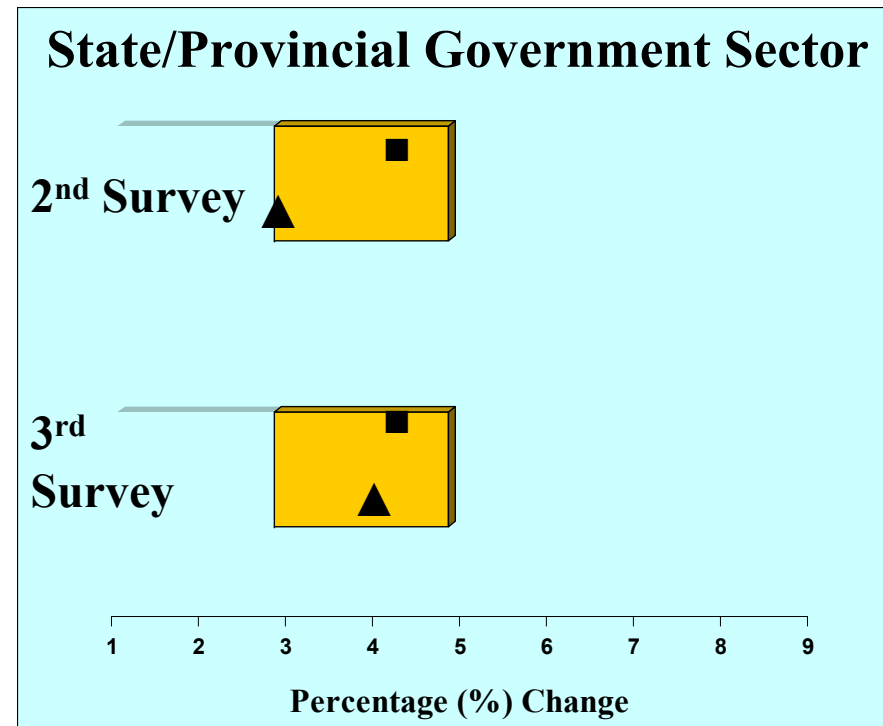
## Medium-Term Demand Change (2007-10)

### 2<sup>nd</sup> Survey Results:

- Mid-50%: +3.0% to +5.0%
- Mean = +4.4% (■)
- Median = +3.0% (▲)

### 3<sup>rd</sup> Survey Results:

- Mid-50%: +3.0% to +5.0%
- Mean = +4.4% (■)
- Median = +4.0% (▲)



# Figure 5

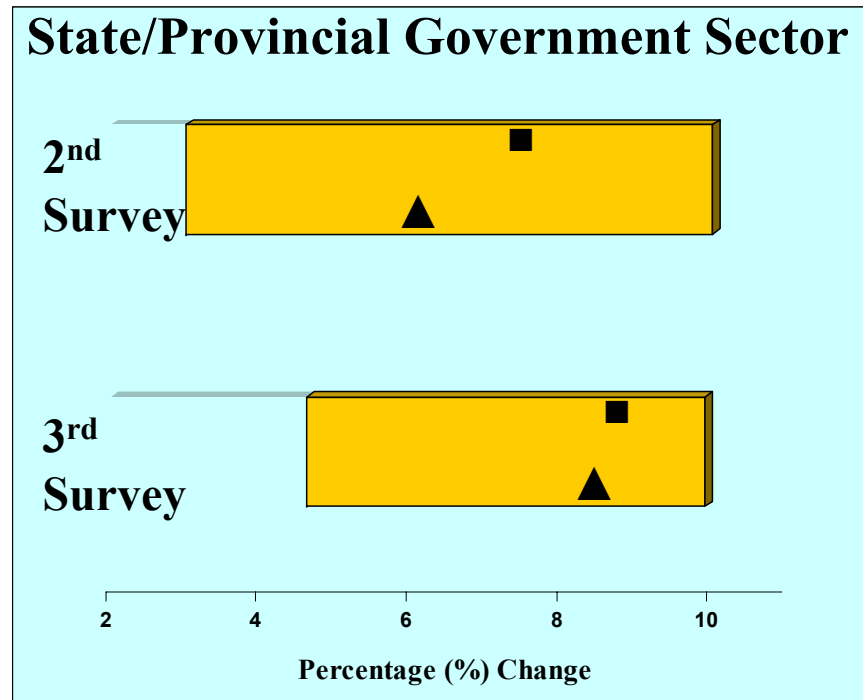
## Long-Term Demand Change (2010-16)

### 2<sup>nd</sup> Survey Results:

- Mid-50%: +3.0% to +10.0%
- Mean = +7.4% (■)
- Median = +6.0% (▲)

### 3<sup>rd</sup> Survey Results:

- Mid-50%: +5.0% to +10.3%
- Mean = +8.9% (■)
- Median = +8.5% (▲)



# Figure 6

## Future Demand Summary

### Short-Term (2004-07):

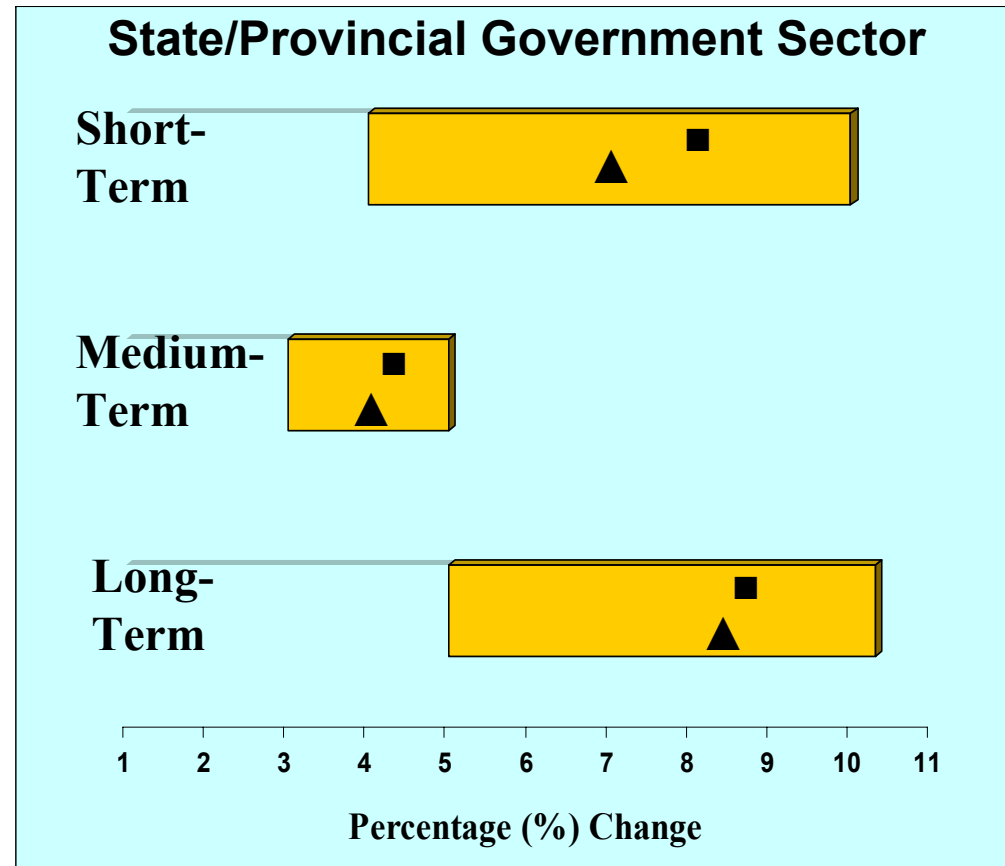
- Mid-50% = +4.0% to +10.0%
- Mean = +8.1% (■)
- Median = +7.0% (▲)

### Medium-Term (2007-10):

- Mid-50%: +3.0% to +5.0%
- Mean = +4.4% (■)
- Median = +4.0% (▲)

### Long-term (2010-16):

- Mid-50%: +5.0% to +10.3%
- Mean = +8.9 % (■)
- Median = +8.5 % (▲)



To better understand the spread of demand forecasts, t-test analyses was done that compared the perceptions of those rating demand increases at or above the panel median score versus those projecting lower increases in demand. The basis for this division was the average demand over all three time periods. Several significant differences ( $p < .05$ ) in their ratings of the demand-influencing factors presented above were found. These collectively relate to each one of the four themes noted on the right-hand side of Figure 2 (*Larger Societal Concerns, Agro-Security & Bio-Terrorism Threats, Food Regulation & Integrated Team Solutions, and Certifications & Monitoring Roles*). The higher-increases sub-group (compared to the lower-increases sub-group) saw significantly *higher demand increases* associated with the following demand-influences:<sup>5</sup>

- Public concerns over food safety (mean is 6.44 in the higher-increases sub-group vs. 5.56 in the lower-increases sub-group)
- Zoonotic disease-related human health concerns (6.4 in the high sub-group vs. 5.8 in the low sub-group)
- Public concerns over bio-terrorism (6.11 in the higher-increases sub-group vs. 5.29 in the lower-increases sub-group)
- Increasing concern for animal welfare (5.78 in the higher-increases sub-group vs. 4.76 in the lower-increases sub-group)
- Increasing concern for animal health (5.69 in the higher-increases sub-group vs. 4.94 in the lower-increases sub-group)
- Global spread of animal-related diseases (6.00 in the higher-increases sub-group vs. 5.44 in the lower-increases sub-group)
- Expansion of regulatory requirements (5.67 in the higher-increases sub-group vs. 4.94 in the lower-increases sub-group)
- Move to integrated approaches to health and food safety issues (5.22 in the higher-increases sub-group vs. 4.72 in the lower-increases sub-group)

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<sup>5</sup> The scale introduced earlier should be used in interpreting the mean values for the high vs. low increasing demand for these and the next set of items: 1. Strong Decrease, 2. Decrease, 3. Slight Decrease, 4. No Influence, 5. Slight Increase, 6. Increase, 7. Strong Increase.

- Increasing demand for food safety standards and surveillance programs (6.00 in the higher-increases sub-group vs. 5.17 in the lower-increases sub-group)

The sub-group seeing higher increasing demand (compared to those seeing lower increasing demand) also rated the following factors as having less influence on *demand decreases* by a statistically significant margin ( $p < .05$ ). These factors relate to the Government Budgetary Constraints and Cost Pressure & Labor Substitution Trends noted on the left side of Figure 2.

- Declining portion of government budgets for agriculture (3.83 in the higher-demand sub-group vs. 2.83 in the lower-demand sub-group)
- Federal and/or state/provincial budgetary constraints (3.72 in the higher-demand sub-group vs. 2.67 in the lower-demand sub-group)
- Use of non-DVMs, such as veterinary technicians (4.11 in the higher-demand sub-group vs. 3.50 in the lower-demand sub-group)

In summary, the higher-demand sub-group is more optimistic about the influence of the demand-increasing factors and less pessimistic about how two of the demand-decreasing themes will play out over time. These differences go far in explaining the range of forecasts provided by this panel.

## Specialized Activities Increasing in Demand

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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 a substantial future increase or decrease in demand. These suggestions were content analyzed and 12 areas received multiple mentions. These were used to form items which panel members rated in the second survey. All of the items were seen, in varying degrees, as having higher demand than the general pattern of increasing demand noted in the previous section. The *higher-demand* activity areas (starting with the highest rated areas) are:

1. Zoonotic disease surveillance and control (mean: 5.79 on a 7-point scale)<sup>6</sup>
2. Epidemiology and analytical assessments (mean: 5.67)
3. Public health roles (mean: 5.67)
4. Food safety and security roles (mean: 5.66)
5. Animal identification and tracking (mean: 5.64)  
*Note that the Canada-focused sub-group mean of 4.57 was significantly lower than the US-focused sub-group mean of 5.86.*
6. Certification of animal health programs (mean: 5.46)
7. Control of foreign animal diseases (mean: 5.41)
8. Terrorism and emergency response roles (mean: 5.40)  
*Note that the Canada-focused sub-group mean of 4.86 was significantly lower than the US-focused sub-group mean of 5.51.*
9. Communicating and leading (mean: 5.21)
10. Specialized laboratory diagnostics (mean: 5.12)
11. Meat and poultry inspection in plants (mean: 4.90)
12. On-farm sampling and testing (mean: 4.69)

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<sup>6</sup> 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. There were no significant differences in the ratings of expert versus less-expert subgroups on these activity areas.

Several of these activity areas relate to the two actionable themes noted in Figure 2, *Food Regulation & Integrated Team Solutions* and *Certifications & Monitoring Roles* themes. Additional items, such as item 8, relate to the *Agro-Security & Bio-Terrorism Threats* theme. Preparing state/provincial food supply veterinarians to competently deliver these activities should help increase demand and help assure those making budget allocation decisions that those budget resources are being well utilized.

# Trends and Issues Driving the Future Supply of Food Supply

## Veterinarians in State/Provincial Roles

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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 in this study. Six additional supply-related influence items were drawn from open-ended comments to the first survey and included in the second survey. Items from the initial set of 17 items were also included in the second survey where there was fair disagreement within the panel on the influence of a factor. The final survey included items with fair disagreement seen in the second survey ratings. The mean value noted below is from the last survey in which that item was asked. The following are the highest-rated trends or issues *increasing* the future supply of veterinarians entering state/provincial government food supply careers:

### Trends Increasing Supply

1. Better lifestyle options in government veterinary jobs (mean: 5.03 on a 7-point scale)<sup>7</sup>
2. Focused recruitment of students to food supply roles (mean: 4.97)  
*Note that the sub-group focused on Canada had mean (4.00) that was significantly lower than mean (5.03) of those focused on the US.*
3. Government incentive programs for entering food supply jobs (mean: 4.84)  
*Note that the sub-group focused on Canada had mean (3.86) that was significantly lower than mean (5.23) of those focused on the US.*

4. Availability of dual degree programs (e.g. MPH) in veterinary colleges (mean: 4.51)

5. More women veterinarians entering the workforce (mean: 4.34)

The panel rated several trends and factors that are leading to a *decrease* in the future supply of food supply veterinarians entering into state/provincial government careers. These are presented starting with the most extreme supply-decreasing factors:

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<sup>7</sup> The items were rated on a 7-point Likert-type scale and evaluated based on their influence on future supply of veterinarians entering dairy practice 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. The t-test analyses of the ratings of the expert versus less-expert sub-groups did not find any significant differences.

## Trends Decreasing Supply

1. Less emphasis on food animal practice in veterinary colleges (mean: 2.35)<sup>8</sup>  
*Note that the self-rated forecasting experts' sub-group mean of 2.25 was significantly lower than the less-expert sub-group mean of 2.76.*
2. Little exposure to food supply career options in college (mean: 2.76)
3. Federal and/or state/provincial budgetary constraints (mean: 2.84)
4. Lack of spousal career options in rural areas (mean: 2.90)
5. Lack of food supply practice-related externships for students (mean: 2.95)  
*Note that the sub-group focused on Canada had mean (3.43) that was significantly higher than mean (2.85) of those focused on the US.*
6. Perceived lack of demand for food animal skills (mean: 2.96)  
*Note that the sub-group focused on Canada had mean (3.57) that was significantly higher than mean (2.81) of those focused on the US.*
7. Poor income opportunities in food supply careers (mean: 2.97)
8. Low salaries in government compared to other food supply careers (mean: 3.00)
9. High debt load of veterinary school graduates (mean: 3.03)
10. Lack of positive role models in veterinary food supply practice (mean: 3.10)
11. Limited lifestyle and career opportunities in rural areas (mean: 3.13)
12. Requirement for education beyond a DVM (mean: 3.16)
13. Schools not selecting food supply oriented students (mean: 3.18)
14. Lack of cultural and recreational opportunities in rural areas (mean: 3.19)
15. Limited capacity of existing veterinary colleges in the US and/or Canada (mean: 3.23)

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<sup>8</sup> The items were rated on a 7-point Likert-type scale and evaluated based on their influence on the future supply of state/provincial government food supply 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.

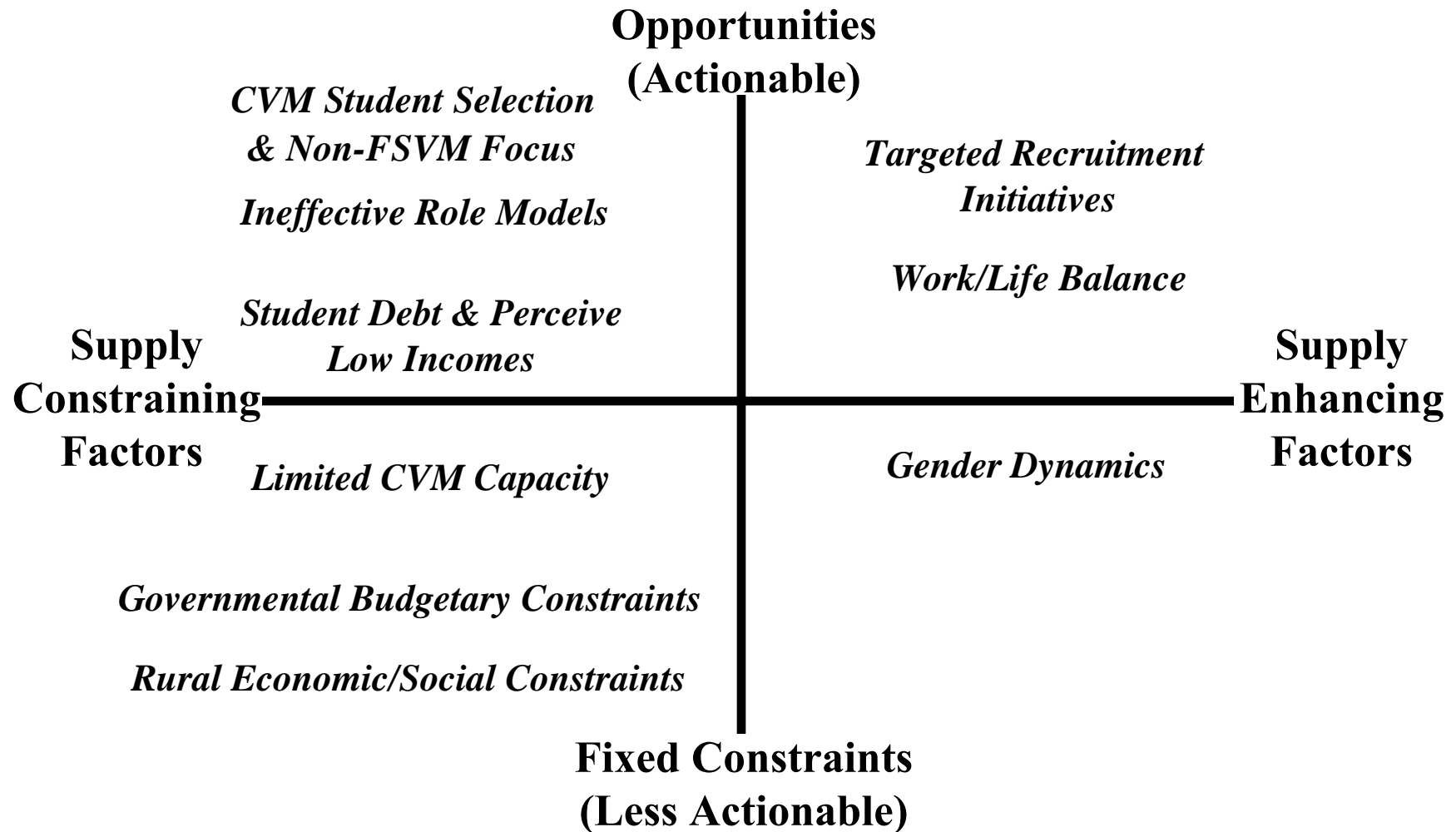
These supply-related factors can also be organized into the planning matrix introduced earlier. Figure 7 captures the general themes seen in the listings of trends increasing and decreasing supply. The list of 15 Trends Decreasing Supply all map to the left side of that figure.

The more extreme impediments to the future entering supply of FSVM labor, such as items 1 (less emphasis on food animal practice), 2 (little exposure to food supply career options), 5 (lack of food supply externships), 6 (perceived lack of demand for food animal skills), and 13 (schools not selecting food supply oriented students) all relate to how Colleges of Veterinary Medicine select and educate, and then send signals to students about food supply career options. This is noted as the *CVM Student Selection & Non-FSVM Focus* theme. Item 10 relates to the view that *Ineffective Role Models* are not attracting students to the profession or providing career support for new DVM graduates. Both of these themes are clearly actionable and are in the upper-left quadrant of Figure 7. Colleges of veterinary medicine and the veterinary profession need to understand and take appropriate actions to change these supply-constraining trends. Those outside of the academic community do not need to provide resources or approvals to make these changes.

*Student Debt & Perceived Low Incomes* is also noted as theme in the upper-left quadrant but is placed near the middle line. This theme is flagged by item 7 (poor income opportunities), item 8 (low salaries in government), and item 9 (high debt load). Item 12 (education beyond the DVM) is also related to this theme. The increasing costs of higher education and the many competing demands on limited public funds are a function of many larger social, political and economic forces. These will not be reversed. The cost of a DVM and post-DVM educational programs is not likely to get less expensive anytime soon. However, there are opportunities to at least partially mitigate this supply constraint. Both government-supported and private scholarship and tuition repayment initiatives provide examples of such mechanisms. Strategic initiatives should be focused on expanding these efforts.

# Figure 7

## Supply Diminishing & Enhancing Issues in the State/Provincial Government Sector



A number of the factors constraining supply reflect larger societal and economic trends and are less actionable. They need to be understood and managed around. Opportunities to influence and lessen the supply constraints noted in the lower-left quadrant of Figure 7 should not be ignored. Strategic initiatives that will make a difference should be considered; however, constrained nature of these factors needs to be appreciated. Initiatives in that focus on the constraints noted in the upper-left quadrant are likely to have a larger and more immediate payoff. The *Governmental Budgetary Constraints* theme is noted by item 3 and is a fairly fixed constraint. The political challenge for state/provincial governments and the FSVM profession is attempt to work within this larger constraint and try to get a reasonable portion of budget allocations. The *Rural Economic/Social Constraints* is also noted in the lower-left quadrant. This theme is identified by items 4 (spousal career opportunities), 11 (lifestyles and career opportunities in rural areas), and item 14 (cultural and recreational opportunities) reflect a larger pattern of urbanization and attendant economic challenges that rural communities face. Initiatives aimed at addressing these problems will help but should certainly not be relied upon to solve all labor supply problems. The remaining supply constraints noted in the lower-left quadrant of Figure 7 is *Limited CVM Capacity* (item 15). This is not a strong factor, as the mean rating approaches the 4.0 “No Influence” midpoint of the scale. It is placed near the middle line indicating that it is less constrained or fixed than the other two themes noted in this quadrant. New colleges of veterinary medicine can be built; however, plenty resources and cooperation from other external entities, such as state/provincial legislatures, are needed to expand CVM capacity.

The five Trends Increasing Supply factors introduced on the first page of this section represent opportunities for promoting the FSVM profession in state/provincial government roles. At the outset, it should be noted that these are not rated as having a high influence on supply. The highest rated item had a mean of 5.03, which is very near the “5. Slight Increase” rating. They build on the good reputation

veterinarians, in general, enjoy in society. Item 1 (better lifestyle options in government) illustrates the *Work/Life Balance* theme noted on the right side of Figure 7. Items 2 (focused recruitment), 3 (government incentives), and 4 (available dual degree programs) all relate to initiatives that can be leveraged to recruit food supply oriented students into FSVM careers in state/provincial government positions. These items relate to the *Targeted Recruitment Initiatives* theme in the upper-right quadrant. These can be continued and extended to attract more high quality students into the FSVM profession.

Item 5 relates to the high number of women now entering into DVM programs. For other FSVM sectors this is sometimes noted as a constraint on the FSVM labor supply. However, for the state/provincial government sector, the general societal trend of more women pursuing professional education is an advantage. The related *Gender Dynamics* theme is placed near the middle line but in the lower-left quadrant of Figure 7. It is very much a function of advantageous larger societal dynamics that cannot be directly controlled or changed. However, there is an opportunity to further enhance and extend the positive influence of this trend on the incoming supply of FSVM labor. This trend, as well as the work/life balance theme should certainly be a focus of any targeted recruitment initiatives.

# **The Future Shortages of Food Supply Veterinarians in State/Provincial**

## **Roles**

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After rating demand and supply related factors, panel members were asked to project the “most likely” estimate of the percent that available supply veterinarians would differ from the expected demand over various time periods. The Delphi process gave 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 considering the views of other panel members. Estimates of shortages were grouped into the same three time periods used to forecast future demand: 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. These estimates are stated in the form of the expected average percentage surplus or shortage over each time period. Negative numbers indicate shortages. 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<sup>th</sup> percentile of the distribution of estimates) are used to summarize these forecasts. Figures 8 through 10 provide the results of each time period. Figure 11 provides the summary of the results from the final survey for all three periods.

# Figure 8

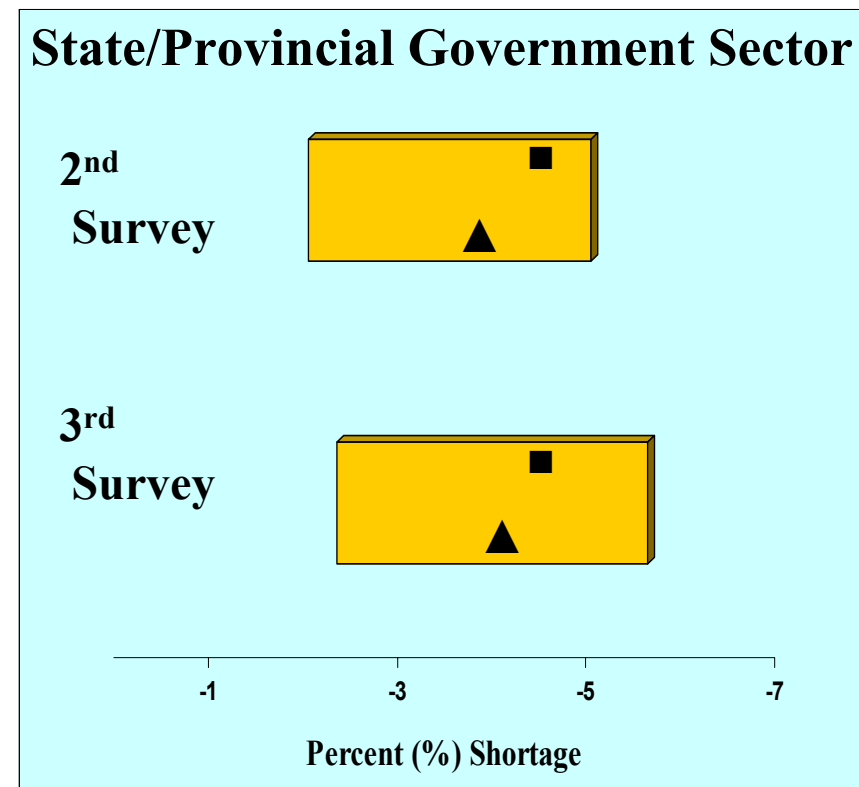
## Short-Term Shortages (2004-07)

### 2<sup>nd</sup> Survey Results:

- Mid-50% = -2.0% to -5.0%
- Mean = -4.5% (■)
- Median = -3.8% (▲)

### 3<sup>rd</sup> Survey Results:

- Mid-50% = -2.3% to -5.6%
- Mean = -4.6%(■)
- Median = -4.0% (▲)



# Figure 9

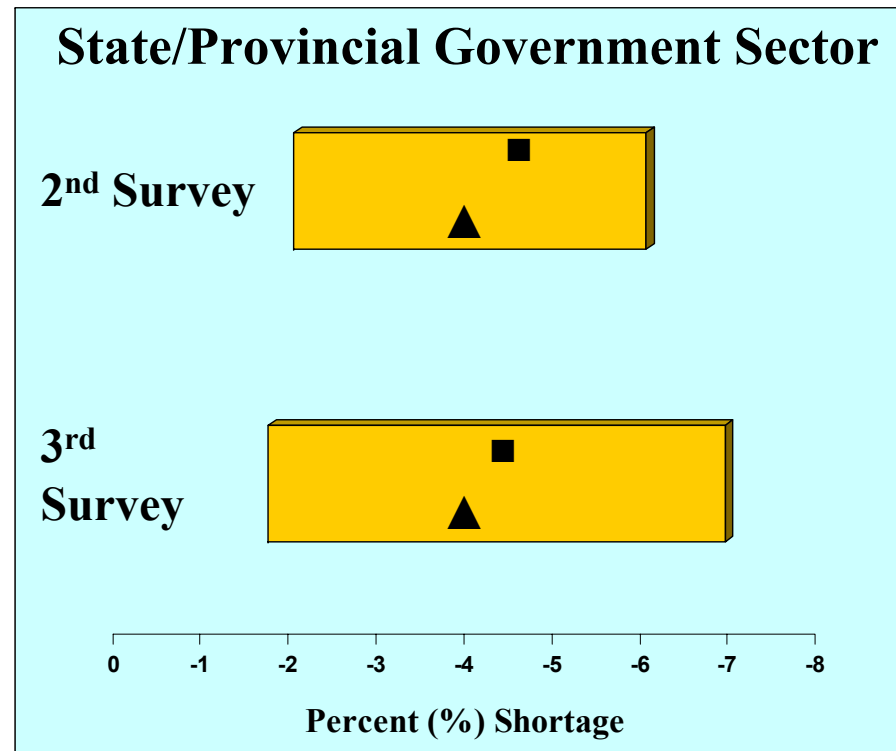
## Medium-Term Shortages (2007-10)

### 2nd Survey Results:

- Mid-50% = -2.0% to -6.0%
- Mean = -4.6% (■)
- Median = -4.0% (▲)

### 3rd Survey Results:

- Mid-50% = -1.8% to -7.0%
- Mean = -4.4%(■)
- Median = -4.0% (▲)



# Figure 10

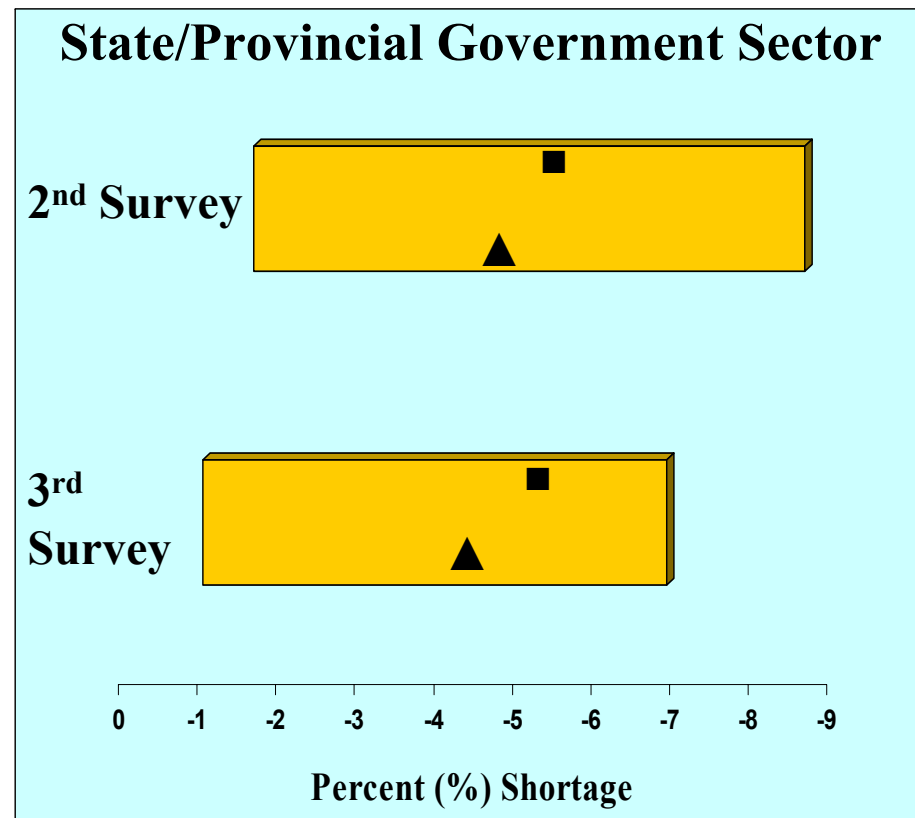
## Long-Term Shortages (20010-16)

### 2<sup>nd</sup> Survey Results:

- Mid-50%: -1.8% to -8.9%
- Mean = -5.5% (■)
- Median = -4.8% (▲)

### 3<sup>rd</sup> Survey Results:

- Mid-50%: -1.0% to -7.0%
- Mean = -5.3% (■)
- Median = -4.5% (▲)



# Figure 11

## Future Shortages Summary

### Short-Term (2004-07):

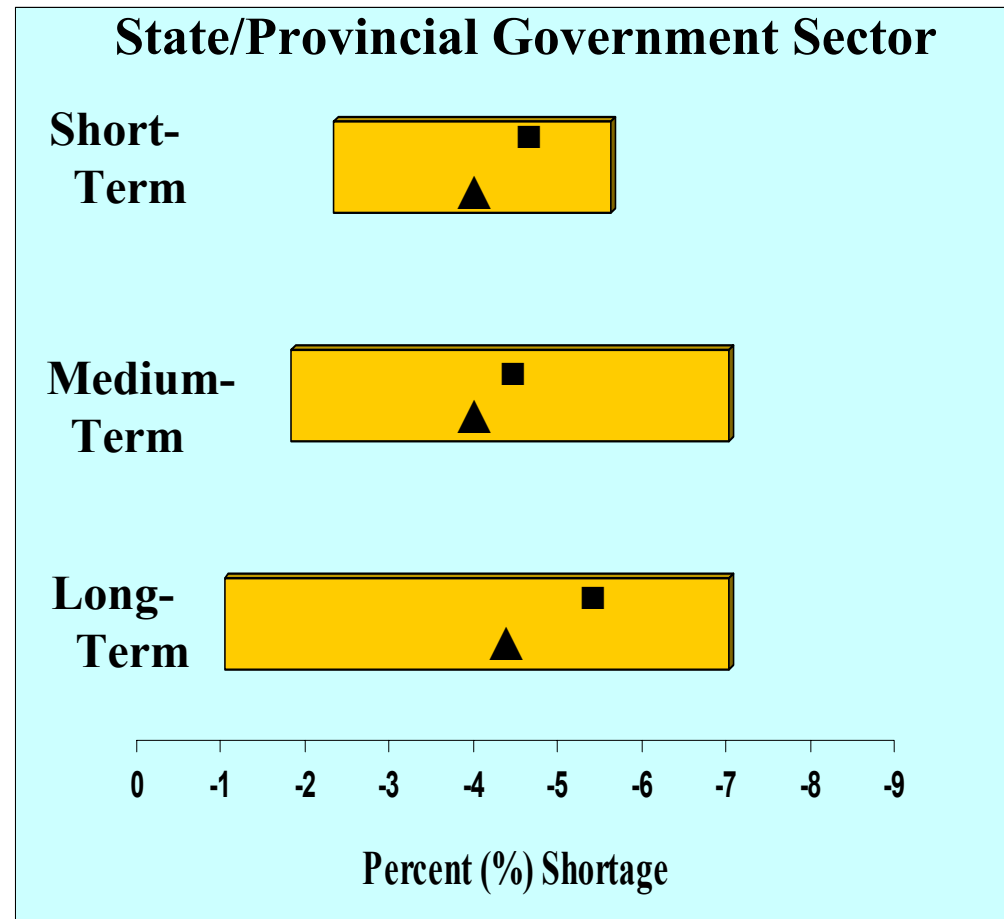
- Mid-50% = -2.3% to -5.6%
- Mean = -4.6% (■)
- Median = -4.0% (▲)

### Medium-Term (2007-10):

- Mid-50%: -1.8% to -7.0%
- Mean = -4.4% (■)
- Median = -4.0% (▲)

### Long-term (2010-16):

- Mid-50%: -1.0% to -7.0%
- Mean = -5.3% (■)
- Median = -4.5% (▲)



The panel reached agreement that, given current trends, there will be a shortage of food supply veterinarians in state/provincial roles over the next several years. The point estimates for all three time periods were in the 4% to 5.5% shortage range. The middle 50% (between the 25<sup>th</sup> and 75<sup>th</sup> percentile of the distribution) for the final survey identified a -2.3% to -5.6% range for the short-term estimate (2004-07), indicating fair agreement. The range widened for later time periods indicating more uncertainty about how current trends will play out over a longer time period and reached a -1.0% to -7.0% range for the long-term time period.

Analysis of Canada- and US-focused panel members, using t-test analyses, indicated that the estimates of those focusing on Canada consistently forecasted numerically higher shortages than those focused on the US for the short- and long-term periods. However, this did not reach a statistically significant difference. T-test analyses between those in the more-expert (above self-rated forecasting expertise panel median score) compared to the less-expert sub-group noted some differences. Some contrasts were statistically significant in the second survey, but the means converged slightly in the final survey. Here are the sub-group means based on country of focus and level of forecasting expertise from the final survey:

- Short-Term (2004-2007): US (-4.3%) & Canada (-5.4%) and Expert (-4.7%) & Less-Expert (-4.4%) sub-groups
- Medium-Term: US (-4.5%) & Canada (-4.1%) and Expert (-4.9%) & Less-Expert (-3.9%) sub-groups
- Long-Term: US (-4.8%) & Canada (-7.2%) and Expert (-6.0%) & Less-Expert (-4.4%) sub-groups

These differences explain some of the spread of opinion in the panel. Additional analyses were conducted to further explore the range of shortage forecasts within the panel. These analyses were used to determine the factors that differentiated those making more conservative estimates versus those projecting more extreme shortages. A median split, based on the median shortage estimated over all time periods was

used to place panelists into “limited-shortages” and “deeper-shortages” sub-groups. The median score for the limited-shortages sub-group was -1.67% and the median score for the deeper-shortages sub-group was -6.50%. T-test analyses indicate that those seeing deeper future shortages versus the more conservative panelists did not rate *supply-related factors* differently. Several significant differences were apparent in the earlier surveys, but those differences were reduced as panel members had an opportunity to reconsider and re-rate those factors.

There were several significant differences seen in the ratings of the *demand-increasing factors* between these two sub-groups. The deeper-shortages sub-group rated the following as having a significantly *higher* influence ( $p < .05$ ) on demand increases:

- Zoonotic disease-related human health concerns (mean: 6.42 on a 7-point scale vs. 5.65 in the limited-shortages sub-group)<sup>9</sup>
- Increasing concern for animal welfare (mean: 5.61 versus 4.94 in the limited-shortages sub-group)
- Increasing concern for animal health (mean: 5.72 versus 4.81 in the limited-shortages sub-group)
- Client use for veterinary herd management services (mean: 5.24 on a 7-point scale vs. 4.53 in the limited-shortages sub-group)
- Need to protect indigenous wildlife from exotic diseases (mean: 5.32 versus 4.53 in the limited-shortages sub-group)
- Growing need to track animal entering the food chain (mean: 6.05 versus 5.29 in the limited-shortages sub-group)
- Government agro-security & bio-terrorism preparedness initiatives (mean: 6.00 vs. 5.41 in the limited-shortages sub-group)
- Global spread of animal-related diseases (mean: 6.05 versus 5.35 in the limited-shortages sub-group)

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<sup>9</sup> The items were rated on a 7-point Likert-type scale and evaluated based on their influence on the future demand for food supply veterinarians in state/provincial roles. The mean rating in the parentheses is for the sub-group that sees deeper shortages (those seeing a 4.25% or higher average shortage) and the second mean is for the limited-shortages sub-group (less than a 4.25% average shortage). The following scale anchor points will help in the interpretation of those means: 7. Strong Increase, 6. Increase, 5. Slight Increase, 4. No Influence.

- Government certification of animal welfare or production practices (mean: 5.68 versus 4.94 in the limited-shortages sub-group)
- Expansion of regulatory requirements (mean: 5.49 vs. 5.00 in the limited-shortages sub-group)<sup>10</sup>
- Increasing demand for food safety standards and surveillance programs (mean: 5.89 versus 5.24 in the limited-shortages sub-group)

The limited-shortages and deeper-shortage also saw several activity areas differently. The following skill or activity areas were rated as facing significantly *higher increasing demand* ( $p < .05$ ) by the deeper-shortages sub-group compared to the limited-shortages sub-group:

- Zoonotic disease surveillance & control (mean: 6.05 versus 5.41 in the limited-shortages sub-group)
- Certification of animal health programs (mean: 5.74 versus 4.88 in the limited-shortages sub-group)
- Public health roles (mean: 6.00 versus 5.18 in the limited-shortages sub-group)
- Control of foreign animal diseases (mean: 5.74 versus 5.74 in the limited-shortages sub-group)
- On-farm sampling and testing (mean: 5.00 versus 4.24 in the limited-shortages sub-group)

The sub-group forecasting more extreme shortages is more optimistic about how key demand-increasing influences and demand for selected activity areas will play out over time. The five activity area items and the several demand-influencing trends where there are significant differences, all relate to the four demand-enhancing themes noted on the right side of Figure 2 (*Larger Societal Concerns, Agro-Security & Bio-Terrorism Threats, Food Regulation & Integrated Team Solutions, and Certifications & Monitoring Roles*). Since there were no significant differences on the ratings of supply-related factors, we conclude that differing opinions on future demand, and how strongly the trends and factors will increase

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<sup>10</sup> The items were rated on a 7-point Likert-type scale and evaluated based on their influence on the future demand for food supply veterinarians in state/provincial roles. 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: 7. Strong Increase, 6. Increase, 5. Slight Increase, 4. No Influence.

future demand, are the principal causes of disagreement about the depth of future shortages of food supply veterinarians entering into state/provincial government careers.

# Solutions for the Future Shortage of Food Supply Veterinarians in State/Provincial Roles

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How can the FSVM profession prepare for a better future and counter the trends that are going to lead to a consistent shortage of state/provincial government FSVM veterinarians? Eighteen different potential solutions were developed and evaluated by all 13 panels. The panel 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 provides the arithmetic average of all ratings from the third survey. The following are the solutions that are rated above the mid-point (4.0) of the scale. 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 5.84 on a 7-point scale)<sup>11</sup>  
*Note that the sub-group focused on Canada had a mean (5.14) that was significantly lower than mean (6.00) of those focused on the US.*
2. Provide expanded job placement services in the food supply veterinary medicine areas (mean of 5.00)
3. Appointment of more food supply faculty at colleges of veterinary medicine (mean: 4.86)
4. Expanded paid work-study programs during the final year of the DVM programs (mean of 4.86)
5. Expanded post-graduate fellowships in food supply areas (mean: 4.84)
6. Paid externship requirement in food supply medicine during the summer (mean: 4.81)
7. Marketing campaigns to increase awareness of food supply career and life style opportunities (mean: 4.63)

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<sup>11</sup> 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. There were not significant differences in the ratings of expert versus less-expert sub-groups.

8. More involvement of food supply practitioners in training veterinary students (mean of 4.59)  
*Note that the sub-group focused on Canada had a mean (3.83) that was significantly lower than the mean (4.74) of those focused on the US.*
9. Mentoring initiatives for students and those starting a food supply career (mean: 4.55)
10. Reserve class slots for academically qualified students with food supply interests and relevant background (mean: 4.49)
11. Development of a government-support Reserve Corps of food supply DVMs for disease surveillance and control activities (mean: 4.41)  
*Note that the sub-group focused on Canada had mean (2.67) that was significantly lower than the mean (4.74) of those focused on the US.*
12. Increased focus of food supply coverage early in DVM curriculum (mean: 4.35)
13. Expand the "Centers of Excellence" concept where veterinary colleges provide a professional program with a nationally recognized focus on different food supply sectors. (mean: 4.32)
14. Focused recruitment of high school and college students with food supply interests into veterinary colleges (mean: 4.24)

These actions represent possible tactics that can be integrated into a larger strategy for dealing with future shortages. Several tactics relate to enhancing the interest of pre-veterinary students. For example, items 1 (debt repayment/scholarships), 7 (marketing campaigns), 10 (reserve class slots), and 14 (focused recruitment) should have the effect of increasing the supply of students who are interested in food supply careers applying to veterinary colleges. The first item (debt repayment/scholarships) should also have the effect of keeping FSVM-tracked students focused on food supply careers. Many items focus on changing the experience that veterinary students will have over their DVM experience. The appointment of more food supply faculty (item 3) will facilitate students getting more early exposure to food supply careers (item 12). Using more practitioners (item 8) represents an additional resource for educating students. Item 4 (paid work-study programs), item 5 (postgraduate fellowships), item 6 (paid externship requirement), and item 12 (increased food supply coverage early in the curriculum) are strategies for giving those pursuing a food supply track a more hands-on educational experience. Item 2 (expanded job placement

services) and item 9 (mentoring initiatives) both focus on providing career support for those pursuing a food supply career path. Finally, items 11 (Reserve Corps) and 13 (Centers of Excellence) represent large-scale, governmental initiatives that will address both larger societal needs and deliver more resources that will help educate and employ food supply veterinarians.

## Conclusion: A Need for Action

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This study finds a clear pattern of increasing demand and future shortages of state/provincial FSVM professionals. The forecasted shortages will make it unlikely that the food supply veterinarians in this sector will be able to satisfy the demands that will be placed on them. The Veterinarian's Oath clearly states the obligation of the veterinary profession to address the needs of society and veterinarians in public service roles clearly understand this societal responsibility. If the shortages are allowed to unfold along the currently forecasted course, the profession will not be able to fulfill its professional obligation to society!

While all sectors play important roles in addressing food safety, animal health and public health related veterinary demands, state/provincial government food supply veterinarians are *both* on the front lines of preventing and controlling problems, *and* are key to making sure that others, including private sector veterinarians, understand and implement important regulatory requirements and report key information, such as disease outbreaks. State and provincial veterinarians must work in partnership with those in federal government roles and integrate emerging data into a coherent picture of risks and threats. Vacancies and the resulting over-extension of a limited corps of state/provincial food supply veterinarians will lead to problems. These problems have the potential of being catastrophic to public health and our economic well-being.

The pattern of results also underscore that the future that we will live in tomorrow is created by the collective actions we take today. While there are larger trends, such as budgetary deficits that limit our options, that will not likely be changed in the near-term and must be adjusted to and managed around, the future is not simply 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 within the profession. These choices can be thoughtfully

reviewed and revised. Veterinarians in state and provincial roles live in a world where deficits, unfunded federal mandates, and a tax-adverse electorate will likely continue to leave them short of financial resources. Well thought out strategies need to be pursued that will expand the resource base where possible; however, there is also a need to focused on making rational and prudent allocations of inadequate state and provincial budgets. Decisions must incorporate what can be done in other FSVM sectors, including private practice, and at the federal government level to shore up the challenges faced at state/provincial levels of government.

Strategic actions implemented in the near-term can change key trends that will otherwise continue to shape a future that is not good for food supply veterinarians in state/provincial roles or society. We should not expect that unplanned or localized responses to shortages add up to optimal solutions. Unnecessary negative economic impacts and challenges to societal well-being will be the natural consequence to such non-strategic responses. The veterinary profession can do better! Fulfilling its Oath and responsibilities to society requires immediate strategic action to counter these trends.

The shortages forecasted for food supply veterinarians in state/provincial roles are conservative. The estimates are based on the explicit assumption 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! Recent history tells us we must be prepared to counter such events. Recent disease outbreaks in North America, as well as other countries, provide case examples that illustrate the critical role that veterinarians in local government roles must play to identify, quickly contain, and counter such threats in order to avert major economic and public health disasters.

The planning matrix and supporting 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 also address where its *strengths* and *weaknesses* are located to move beyond this starting

point. Thoughtful leaders in the larger profession need to identify where they have the best advantage to guide effective collective action. All professions have strengths and weaknesses; effective leaders understand how to leverage strengths while being mindful of their weaknesses. The solutions identified in the previous section provide a starting point for developing effective elements of an effective coherent strategy of collective action. This will change the profession and enable it to better fill its obligations to society.

## Supplemental Information

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

1. Temporary links to the three the State/Provincial Government panel 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 general designs of all second- and third-round surveys are similar. Try these web-links to view a copy of the three surveys completed by the State/Provincial Government panel:
  - a. First Survey: <http://survey.cba.ksu.edu/prince/ps-state1/index.htm>
  - b. Second Survey: <http://survey.cba.ksu.edu/prince/ps-state2/index.htm>
  - c. Third Survey: <http://survey.cba.ksu.edu/prince/ps-state3/index.htm>
2. Exhibit A provides a listing of all members who originally agreed to participate in the State/provincial government 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) summarized trends found in the first survey data and provides guidance for interpreting the feedback incorporated into the second survey. The second report (Exhibit C) served 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 State/Provincial Government Delphi panel.

Exhibit A

Original State/Provincial Government Delphi  
Panel Members<sup>12</sup>

- |                       |                          |
|-----------------------|--------------------------|
| 1. Alain Alain        | 16. Christopher Hannafin |
| 2. Michael Auslander  | 17. Gerald Hauer         |
| 3. Connie Austin      | 18. Bob Hillman          |
| 4. Larry Barrett      | 19. Michael Hockman      |
| 5. Henrietta Beaufait | 20. Sam Holland          |
| 6. Kristy Bradley     | 21. Rex Holt             |
| 7. Tony Caver         | 22. Tomas Holt           |
| 8. Wayne Cunningham   | 23. Lee Jan              |
| 9. Paul Dieterlen     | 24. Robert Kerr          |
| 10. Cherie Drenzek    | 25. Daniel LaFontaine    |
| 11. Robert Ehlenfeldt | 26. Mira Leslie          |
| 12. Paul Ettestad     | 27. Ron Lewis            |
| 13. Gord Findley      | 28. Thomas Linfield      |
| 14. Andrea Grondahl   | 29. Mary Lis             |
| 15. Rick Hackenbrack  | 30. Jim Logan            |

Continued...

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<sup>12</sup> Note that not all panel members completed all surveys.  
These individuals originally agreed to participate.

31. Brett Marsh
32. Nicole Neeser
33. Allen Preston
34. Kerry Rood
35. Joni Scheftel
36. Clarence Siroky
37. Kathleen Smith
38. Faye Sorhage
39. Mary Stobierski
40. Rober Stout
41. Evan Sumner
42. Ben Sun
43. George Teagarden
44. Harold Treese
45. Steven Wells
46. Mervyn Wetzstein
47. Hugh Whitney
48. Ronald Wilson
49. Taylor Woods
50. Edwin Odor
51. Colleen O'Keefe
52. Michael Marshall
53. Clifford McGinnis
54. Wyatt Frampton
55. Anthony Frazier

## State & Provincial Public Service Panel 1<sup>st</sup> Survey Interim Feedback Report

This report summarizes replies to the 1<sup>st</sup> survey of the State & Provincial Public Service Delphi forecasting panel. *This brief report is focused on helping you be more informed as you complete the 2<sup>nd</sup> survey.* (A full summary of the State & Provincial Public Service panel's data will be provided after you complete the 3<sup>rd</sup> survey.)

This report identifies a few key patterns and directs you to more specific information from the 1<sup>st</sup> survey that is included in the 2<sup>nd</sup> survey. Questions with more disagreement are repeated in the 2<sup>nd</sup> survey and panel averages and the ranges of the middle 50% of replies (between the 25% and 75% percentiles) are noted in the 2<sup>nd</sup> survey. The averages reported in the 2<sup>nd</sup> survey are based on the ratings of panel members who focused on the ***whole state/provincial public service sector***. Averages from those panelists who focused on *Animal Health (AH)*, *Food Safety & Security (FS/S)* - sometimes called food inspection, and *Public Health (PH)* sub-areas are also reported. When there is a significant difference between a sub-group average and the average of those focused on the whole sector, then that is noted with an asterisk (\*) by the sub-group mean. 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 1<sup>st</sup> survey) versus those rating themselves as “less expert” in making forecasts, then those contrasts are noted. Where Canadian & US members had a rating difference of .5 or more (on the 7-point scale), those respective means are noted. For example, item #1 in the first section of the 2<sup>nd</sup> survey (“Use of non-DVMs, such as veterinary technicians”) has the following notation:

*“1<sup>st</sup> Survey: Average = 4.9 (AH = 3.8\*, FS/S = 3.5\*, PH = 4.3) & Mid-50% = 4 to 6;  
Experts = 5.3 (vs. 4.7)”*

This indicates that the average of those *focused on the whole sector* was 4.9 on a 7-point scale (just below “5. Slight Increase”) and the middle-50% of panelists (between the 25<sup>th</sup> and 75<sup>th</sup> percentiles) rated it from “4. No Influence” to “6. Increase”. “AH = 3.8\*” indicates that the animal health focused panel members average was 3.8 (just below “4. No Influence”) and this was significantly lower than the whole sector average (4.9). “FS/S = 3.5” notes the Food Safety & Security subgroup had an average rating mid-way between “3. Slight Decrease” and “4. No Influence”. That is also significantly lower than the whole sector average (4.9). “PH = 4.3” indicates that those focused solely on the Public Health sub-area had an average rating of 4.3. “Experts = 5.3 (vs.4.7)” indicates that those most confident in their ratings (self-rated “experts) had a significantly higher average (5.3) than the less-expert group average of 4.7. This indicates that experts saw the “use of non-DVMs, such a veterinary technicians” as having a more positive (or less negative) influence on demand compared to those less confident in their forecasts. Since there was not a difference of .5 or more between Canadian and US means, those respective averages are not reported. Statistical information from the 1<sup>st</sup> survey will be presented in this format throughout the 2<sup>nd</sup> survey.

***Please review this feedback before (or as) you complete the 2<sup>nd</sup> survey.***

### **I. Factors Influencing Demand for Food Supply Veterinarians in State/Provincial Public Service Careers**

The first section in the 1<sup>st</sup> survey asked you to rate the influence of 25 different demand related issues. For those focused on the whole of state/provincial public service FSVM careers, the top-rated influences seen as *increasing* future demand are:

- Zoonotic disease-related human health concerns
- Public concerns over food safety
- Public concerns over bio-terrorism
- Growing need to track animals entering the food chain
- Increasing concerns for animal welfare
- Increasing concerns for animal health

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

- Curtailment of government support of veterinary services
- Federal and/or State/Provincial budgetary constraints
- Lack of veterinarian's practice management & business skills
- Slow adoption of new technologies by veterinarians
- Client concerns about veterinary service costs

## II. Future Demand Estimates for State/Provincial Public Service FSVM Veterinarians

The average value for the general forecast of future demand for the 1<sup>st</sup> survey was 5.7 on a 7-point scale (below "6. Increase"). The middle 50% of panelists (between the 25<sup>th</sup> to 75<sup>th</sup> percentiles) rated future demand with either "5. Slightly Increase" and "6. Increase". The averages for the animal health (AH), Food Safety & Security (FS/S) and Public health (PH) sub-groups tended to be lower, but not by a statistically significant margin. There were no systematic differences in contrasts between self-rated experts vs. less-expert panelists or between Canadian vs. US panelist members. (See question #3 in the 2<sup>nd</sup> survey.)

Additional questions asked for the "most likely" increase (or decrease) in future demand for several time periods. The panel members focused on the whole sector saw average demand increases between 3% to 5% and the middle 50% of forecasted demand change estimates ranged between +2% to +10% (increases). The various subgroups (AH, FS/S and PH) estimated generally lower, but still positive, increases in demand. However, these were not statistically strong differences. Self-rated experts tended to make higher estimates of increasing demand and these sometimes reached statistical significance. Canadians reported higher demand increases but these were not statistically strong.

For those focused on the whole of state/provincial public service FSVM careers, panel members seeing *stronger* future demand (compared to those seeing *weaker* demand) saw the following "demand influences" as having significantly *more positive* influences on demand:

- Client use of veterinary herd management services
- Limited understanding of food quality and safety issues
- Zoonotic disease-related human health concerns
- Public concerns over food safety

- Availability of highly technical or specialized services
- Need to understand animal-human health eco-systems

### **III. Factors Influencing the Supply for State/Provincial Public Service FSVM Veterinarians**

For those focused on the whole sector, the more extreme negative influences on the future supply of FSVM veterinarians (low ratings on the question #10 items in the 1<sup>st</sup> survey) are:

- Less emphasis on food animal practice in veterinary colleges
- Little exposure to food supply career options in college
- Poor income opportunities in food supply careers
- Lack of food supply practice-related externships for students
- Federal and/or State/Provincial budgetary constraints

### **IV. Projected Shortage or Surplus for State/Provincial Public Service FSVM Veterinarians**

Those focused on the whole sector, see a future shortage of DVMs. The general question asking them to estimate the degree of surplus vs. shortage over the next 12 years had an average of 6.0 (“6. Shortage”) on a 7-point scale (question #10 in the 2<sup>nd</sup> survey) and experts say higher demand (6.3). Additional questions asked the “most likely” estimates of a surplus or shortage of DVMs for several time periods. The average shortage estimate was between -10.0% to -5.0% (shortage). The middle 50% always projected shortages and the range was fairly large (e.g., -10% to -2%). These numbers are a little more extreme than the projected demand increases noted above. This implies that in addition to demand increases, supply constraints will further extenuate future shortage problems. Canadians saw shortages, but these were less extreme compare to panel members focused on the US setting. Experts tended to see deeper shortages but these differences were not statistically strong.

#### **Next Steps...**

The patterns that are starting to emerge tell an interesting story for DVMs in state/provincial public service FSVM careers. It is one that is unique from what I am seeing in other panels! Your replies to the 2nd survey will add and clarify this story even more.

Thank you for your continuing help and involvement!

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June 13, 2005

## **State/Provincial Public Service Panel** 2<sup>nd</sup> Survey Interim Feedback Report

This report summarizes replies to the 2<sup>nd</sup> survey of the State/Provincial Public Service Delphi panel. *This brief report is focused on helping you be more informed as you complete the 3<sup>rd</sup> survey.* (A full summary of the State/Provincial panel's data will be provided after I analyze the 3<sup>rd</sup> survey.)

This report identifies a few key patterns and more specific information from the 2<sup>nd</sup> survey is included in the 3<sup>rd</sup> survey. Questions with more disagreement are repeated in the 2<sup>nd</sup> survey and panel averages and the ranges of the middle 50% of replies (between the 25% and 75% percentiles) are noted in the 2<sup>nd</sup> survey. The averages reported in the 2<sup>nd</sup> survey are based on the ratings of panel members who focused on the ***whole state/provincial public service sector***. Averages from those panelists who focused on *Animal Health (AH)*, *Food Safety & Security (FS/S)* - sometimes called food inspection, and *Public Health (PH)* sub-areas are also reported. When there is a significant difference between a sub-group average and the average of those focused on the whole sector, then that is noted with an asterisk (\*) by the sub-group mean. 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 1<sup>st</sup> survey) versus those rating themselves as "less expert" in making forecasts, then those contrasts are noted. Where Canadian & US members had a rating difference of .5 or more (on the 7-point scale), those respective means are noted. For example, item #1 in the first section of the 3<sup>rd</sup> survey ("Use of non-DVMs, such as veterinary technicians") has the following notation:

*"Average=4.5 (AH = 4.0, FS/S = 4.6, PH = 4.2) & Mid-50% = 3 to 6"*

This indicates that the average of the panel was 4.5 on a 7-point scale ("4. No Influence") and the middle-50% of panelists rated it 3 to 6 (from "3. Slight Decrease" and "6. Increase"). This range suggests plenty of disagreement about the influence of this factor on demand. "AH = 4.0" indicates that the animal health focused panel members average was right at "4. No Influence" on the seven-point scale. "FS/S = 4.6" notes the Food Safety & Security subgroup had an average rating mid-way between "4. No Influence" and "5. Slight Increase". "PH = 4.3" indicates that those focused solely on the Public Health sub-area had an average rating of 4.3. There were not significant differences between self-rated "experts" (versus the "less expert" subgroup) or the sub-group of panel members focused on the Canadian situation (versus the US) so these contrast are not presented. Statistical information from the 2<sup>nd</sup> survey will be presented in this format throughout the 3<sup>rd</sup> survey.

***Please review this feedback before (or as) you complete the 3<sup>rd</sup> survey.***

### **V. Factors Influencing Demand for Veterinarians in State/Provincial Careers**

The first section in the 1<sup>st</sup> 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 2<sup>nd</sup> survey. The top-rated influences seen as *increasing* future demand from both surveys are:

- Zoometric disease-related human health concerns

- Public concerns over food safety
- Public concerns over bio-terrorism
- Growing need to track animals entering the food chain
- Global spread of animal-related diseases
- Increasing concerns for animal welfare

The top-rated influences seen as *decreasing* future demand (from both surveys) are:

- Curtailment of government support of veterinary services
- Declining portion of government budgets for agriculture
- Non-veterinary specialist doing DVM tasks
- Agricultural programs moving to non-agriculture agencies
- Federal and/or State/Provincial budgetary constraints

## VI. Future Demand Estimates for State/Provincial Food Supply Veterinarians

The average value for the general forecast of future demand from the 2<sup>nd</sup> survey is 5.5 (between “5. Increase Slightly” and “6. Increase Moderately”). The middle 50% of the panel rating future demand with these same two ratings. Self-rated experts made significantly higher ratings (5.7) than less-expert forecasters (5.2).

Additional questions asked for the “most likely” estimate of changes in future demand for several time periods. The average was between +5.0% and +7.0% (increases) over these time periods and the middle 50% always projected increasing demand veterinary services. Self-rated experts tended to see higher demand increases compared to those in the less-expert group.

Panel members seeing *stronger* future demand (compared to those seeing *weaker* demand) rated each of the following “demand influences” (from question 1 in the 2<sup>nd</sup> survey) as having a significantly *more positive* influence on demand:

- Government agro-security & bio-terrorism preparedness initiative
- Global spread of animal-related diseases
- Availability of highly technical or specialized services
- Growing need to track animals entering the food chain
- Expansion of regulatory requirements
- Veterinary involvement throughout the food supply system

Those seeing stronger demand also had uniquely differing views from those seeing weaker demand in that they see a *less negative* influence on demand:

- Vertical (farm-to-fork) integrations of food companies
- Move to larger sized producer operations
- Agricultural programs moving to non-agricultural agencies

Selected activities and skills where there was uniquely higher or lower demand were identified in the 1<sup>st</sup> survey and rated in the 2<sup>nd</sup> survey. Areas of *lowest* increasing demand are: meat and poultry inspection in plants, and on-farm sampling and testing. The areas of the *highest* increasing demand included:

- Zoometric disease surveillance & control
- Public health roles
- Epidemiology & analytical assessments

## VII. Factors Influencing the Supply for State/Provincial Food Supply Veterinarians

The more extreme *negative* influences on the future supply for State/Provincial Public Service food supply veterinarians noted in the two previous surveys are:

- Little exposure to food supply career options in college
- Less emphasis on food animal practice in veterinary colleges
- Federal and/or State/Provincial budgetary constraints
- Poor income opportunities in food supply careers
- Lack of food supply practice-related externships for students

The more extreme positive influences on the future supply of state/provincial veterinarians noted are:

- Government incentive programs for entering food supply jobs
- Focused recruitment of students to food supply roles
- Better lifestyle options in government veterinary jobs

## VIII. Projected Shortage or Surplus of State/Provincial Food Supply Veterinarians

The panel continues to see a general shortage of State/Provincial Public Service veterinarians. The question on the general forecast (see question #9, 3<sup>rd</sup> survey) produced an average of just over “5. Slight Shortage” (mean=5.1). Over half of the panel members marked “6. Shortage.” The specific shortage estimates over all time periods projected shortages of -5.3% to -7.0% and the middle 50% (between the 25<sup>th</sup> and 75<sup>th</sup> percentile) always predicted a shortage. Those seeing more extreme shortages (compared to those seeing less of a shortage) saw the following factors as having a *higher positive* influence on demand:

- Global spread of animal-related diseases
- Government certification of animal welfare or production practices
- Increasing demand for food safety standards & surveillance programs
- Vertical (farm-to-fork) integration of food companies

## Next Steps...

The patterns flagged in the 1<sup>st</sup> survey have become clearer in the 2<sup>nd</sup> survey. This presents a unique and interesting story for DVMs in state/provincial public service careers. 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 above.

Thank you for your continuing help and involvement!

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August 12, 2005

Exhibit D

Section I. Factors Influencing Future Demand for Veterinarians in the State/Provincial FSVM Careers

Survey Item	Survey	%	% No	%	Standard	Middle	N	
	Wave	Decrease	Influence	Increase				
1. Public concern over food Safety	1 <sup>st</sup>	0	0	100	6.1	.82	5 to 7	51
2. Use of non-DVMs, such as veterinary technicians	1 <sup>st</sup>	16.3	34.7	49	4.6	1.27	4 to 6	49
2. Use of non-DVMs, such as veterinary technicians	2 <sup>nd</sup>	26.2	31	42.9	4.4	1.21	3 to 5	42
2. Use of non-DVMs, such as veterinary technicians	3 <sup>rd</sup>	41	35.9	23.1	3.9	.98	3 to 4	39
3. Public concern over bio-terrorism	1 <sup>st</sup>	0	8	92	5.8	.94	5 to 7	50
3. Public concern over bio-terrorism	2 <sup>nd</sup>	0	7.1	92.9	5.7	.84	5 to 6	42
4. Zoonotic disease-related human health concerns	1 <sup>st</sup>	0	3.9	96.1	6.1	.82	6 to 7	51
5. Required third party certification or verification of standards	1 <sup>st</sup>	0	21.4	78.6	5.3	.94	5 to 6	42
6. Limited public understanding of food quality and safety issues	1 <sup>st</sup>	25.5	29.8	44.7	4.4	1.33	3 to 5	47
6. Limited public understanding of food quality and safety issues	2 <sup>nd</sup>	11.9	26.2	61.9	4.7	1.09	4 to 5	42
6. Limited public understanding of food quality and safety issues	3 <sup>rd</sup>	15.8	34.2	50	4.6	1.20	4 to 5	38
7. More meat consumption in the US and Canada	1 <sup>st</sup>	2.2	43.5	54.3	4.7	.79	4 to 5	46
8. More access to global markets for food exports	1 <sup>st</sup>	0	16.7	83.3	5.5	.92	5 to 6	48
9. Changing dietary habits in third-world countries	1 <sup>st</sup>	2.2	51.1	46.7	4.7	.97	4 to 5	45
10. Need to protect indigenous wildlife from exotic diseases	1 <sup>st</sup>	0	20.8	79.2	5.3	.98	5 to 6	48
10. Need to protect indigenous wildlife from exotic diseases	2 <sup>nd</sup>	2.4	29.3	68.3	5.1	.95	4 to 6	41
11. Federal and/or state/provincial budgetary constraints	1 <sup>st</sup>	61.2	16.3	22.4	3.5	1.66	2 to 4	49
11. Federal and/or state/provincial budgetary constraints	2 <sup>nd</sup>	66.7	16.7	16.7	3.5	1.38	3 to 4	42
11. Federal and/or state/provincial budgetary constraints	3 <sup>rd</sup>	79.5	10.3	10.3	3.2	1.27	2 to 3	39
12. Curtailment of government support of veterinary services	1 <sup>st</sup>	65.2	15.2	19.6	3.5	1.59	2 to 4	46
12. Curtailment of government support of veterinary services	2 <sup>nd</sup>	78	9.8	12.2	3.1	1.44	2 to 3	41
12. Curtailment of government support of veterinary services	3 <sup>rd</sup>	92.3	2.6	5.1	2.9	1.10	2 to 3	39
13. Increasing concern for animal wildlife	1 <sup>st</sup>	0	14.3	85.7	5.5	.92	5 to 6	49
14. Increasing concern for animal health	1 <sup>st</sup>	0	16.3	83.7	5.5	.94	5 to 6	49
15. Need to understand animal-human health eco-systems	1 <sup>st</sup>	0	32	68	5.2	1.02	4 to 6	50
15. Need to understand animal-human health eco-systems	2 <sup>nd</sup>	4.8	31	64.3	4.9	.99	4 to 5	42
16. Availability of highly technical or specialized services	1 <sup>st</sup>	8.5	17	74.5	5.3	1.22	4 to 6	47
16. Availability of highly technical or specialized services	2 <sup>nd</sup>	7.1	23.8	69	5.0	1.02	4 to 6	42
16. Availability of highly technical or specialized services	3 <sup>rd</sup>	5.1	35.9	58.9	4.8	.93	4 to 5	39
17. Veterinary services agreements required for agri-business loans	1 <sup>st</sup>	0	38.2	61.8	4.9	.98	4 to 5	34
18. Growing need to track animals entering the food chain	1 <sup>st</sup>	0	16	84	5.7	1.06	5 to 7	50
18. Growing need to track animals entering the food chain	2 <sup>nd</sup>	0	4.8	95.2	5.8	.88	5 to 6.3	42
19. Constraints on non-DVMs giving prescription drugs	1 <sup>st</sup>	2.3	38.6	59.1	5.0	1.03	4 to 6	44
19. Constraints on non-DVMs giving prescription drugs	2 <sup>nd</sup>	2.5	50	47.5	4.7	.83	4 to 5	40

20. Slow adoption of new technologies by veterinarians	1 <sup>st</sup>	20.6	47.1	32.4	4.1	1.25	4 to 5	34
20. Slow adoption of new technologies by veterinarians	2 <sup>nd</sup>	30.8	43.6	25.6	4.0	1.11	3 to 5	39
20. Slow adoption of new technologies by veterinarians	3 <sup>rd</sup>	21.6	64.9	13.5	4.0	.96	4 to 4	37
21. Move to larger sized producer operations	1 <sup>st</sup>	38.3	19.1	42.6	4.3	1.50	3 to 6	47
21. Move to larger sized producer operations	2 <sup>nd</sup>	38.1	21.4	40.5	4.2	1.37	3 to 5	42
21. Move to larger sized producer operations	3 <sup>rd</sup>	41	17.9	41	4.2	1.36	3 to 5	39
22. Client use of veterinary herd management services	1 <sup>st</sup>	6.8	27.3	65.9	4.9	1.03	4 to 5.8	44
23. Client concerns about veterinary service costs	1 <sup>st</sup>	47.7	31.8	20.5	3.9	1.37	3 to 4	44
23. Client concerns about veterinary service costs	2 <sup>nd</sup>	47.6	35.7	16.7	3.7	1.15	3 to 4	42
23. Client concerns about veterinary service costs	3 <sup>rd</sup>	36.8	55.3	7.9	3.7	.61	3 to 4	38
24. Lack of veterinarian's practice management and business skill	1 <sup>st</sup>	35.9	51.3	12.8	3.8	1.22	3 to 4	39
25. Part-time farmers needing more veterinary services	1 <sup>st</sup>	12.8	46.8	40.4	4.5	1.10	4 to 5	47
75. Government agro-security and bio-terrorism preparedness initiatives	2 <sup>nd</sup>	0	4.8	95.2	5.8	.85	5 to 6	42
76. Global spread of animal-related diseases	2 <sup>nd</sup>	0	7.1	92.9	5.8	.81	5 to 6	42
77. Government certification of animal welfare or production practices	2 <sup>nd</sup>	2.4	7.3	90.2	5.4	.98	5 to 6	41
78. Move to integrated team approaches to health and food safety issues	2 <sup>nd</sup>	9.8	14.6	75.6	5.1	1.10	4.5 to 6	41
78. Move to integrated team approaches to health and food safety issues	3 <sup>rd</sup>	2.6	20.5	77	5.0	.81	5 to 6	39
79. Veterinary involvement throughout the food supply system	2 <sup>nd</sup>	4.8	9.5	85.7	5.4	1.08	5 to 6	42
79. Veterinary involvement throughout the food supply system	3 <sup>rd</sup>	2.6	2.6	94.9	5.4	.78	5 to 6	39
80. Expansion of regulatory requirements	2 <sup>nd</sup>	0	14.3	85.7	5.4	.89	5 to 6	42
81. Increasing demand for food safety standards and surveillance programs	2 <sup>nd</sup>	4.9	7.3	87.8	5.5	.98	5 to 6	41
81. Increasing demand for food safety standards and surveillance programs	3 <sup>rd</sup>	2.6	0	97.5	5.6	.85	5 to 6	39
82. Declining portion of government budgets for agriculture	2 <sup>nd</sup>	73.8	16.7	9.5	3.3	1.13	3 to 4	42
82. Declining portion of government budgets for agriculture	3 <sup>rd</sup>	74.4	17.9	7.7	3.3	1.06	3 to 4	39
83. Agriculture programs moving to non-agriculture agencies	2 <sup>nd</sup>	40.5	47.6	11.9	3.7	1.03	3 to 4	42
83. Agriculture programs moving to non-agriculture agencies	3 <sup>rd</sup>	43.4	44.7	7.9	3.6	.95	3 to 4	38
84. Non-veterinary specialists doing DVM tasks	2 <sup>nd</sup>	65	27.5	7.5	3.4	1.01	3 to 4	40
84. Non-veterinary specialists doing DVM tasks	3 <sup>rd</sup>	77	12.8	10.3	3.3	.77	3 to 3	39
85. Vertical (farm-to-fork) integration of food companies	2 <sup>nd</sup>	24.4	31.7	43.9	4.3	1.13	3.5 to 5	41
85. Vertical (farm-to-fork) integration of food companies	3 <sup>rd</sup>	25.6	28.2	46.1	4.4	1.12	3 to 5	39

## Section II. Specialized Activities Increasing or Decreasing in Demand Relative to the General Pattern in State/Provincial FSVM Careers

Survey Item	Survey Wave	% Decrease	% No Difference	% Increase	Mean	Standard Deviation	Middle 50% Range	N
1. Communication and leading	1 <sup>st</sup>	2.4	21.4	76.2	5.2	1.00	4.8 to 6	42
2. Epidemiology and analytical assessments	1 <sup>st</sup>	0	7.1	92.9	5.7	.85	5 to 6	42
3. Zoonotic disease surveillance and control	1 <sup>st</sup>	0	0	100	5.8	.68	5 to 6	42
4. Animal identification and tracking	1 <sup>st</sup>	2.4	16.7	81	5.6	1.25	5 to 7	42
5. Certification of animal health programs	1 <sup>st</sup>	0	22	78	5.5	1.00	5 to 6	41
6. Public health roles	1 <sup>st</sup>	0	4.8	95.2	5.7	.82	5 to 6	42
7. Control foreign animal diseases	1 <sup>st</sup>	2.4	17.1	80.5	5.4	1.02	5 to 6	41
8. Food safety and security roles	1 <sup>st</sup>	0	4.9	95.1	5.7	.79	5 to 6	41
9. Specialized laboratory diagnostics	1 <sup>st</sup>	2.4	36.6	61	5.1	1.27	4 to 6	41
10. Terrorism and emergency response roles	1 <sup>st</sup>	0	11.9	88.1	5.4	.86	5 to 6	42
11. On-farm sampling and testing	1 <sup>st</sup>	9.5	38.1	52.4	4.7	1.12	4 to 5	42
12. Meat and poultry inspection in plants	1 <sup>st</sup>	11.9	16.7	71.4	4.9	1.10	4 to 6	42

### Section III. Factors Influencing Future Supply for Veterinarians in the State/Provincial FSVM Careers

Survey Item	Survey	%	% No	%	Standard	Middle	N	
	Wave	Decrease	Influence	Increase				
1. Less emphasis on food animal practice in veterinary colleges	1 <sup>st</sup>	90.2	9.8	0	2.4	.84	2 to 3	51
2. More women veterinarians entering the workforce	1 <sup>st</sup>	47.1	25.5	27.5	3.4	1.52	2 to 5	51
2. More women veterinarians entering the workforce	2 <sup>nd</sup>	32.5	25	42.5	4.2	1.35	3 to 5	40
2. More women veterinarians entering the workforce	3 <sup>rd</sup>	31.5	26.3	42.1	4.3	1.30	3 to 5	38
3. Physical demands of large animal veterinary work	1 <sup>st</sup>	58	22	20	3.2	1.42	2 to 4	50
3. Physical demands of large animal veterinary work	2 <sup>nd</sup>	51.2	31.7	17.1	3.5	1.10	3 to 4	41
3. Physical demands of large animal veterinary work	3 <sup>rd</sup>	57.9	26.3	15.8	3.6	.76	3 to 4	38
4. Need to work long hours and emergency calls	1 <sup>st</sup>	70	2	28	3.1	1.74	2 to 5	50
4. Need to work long hours and emergency calls	2 <sup>nd</sup>	61	7.3	31.7	3.5	1.55	2 to 5	41
4. Need to work long hours and emergency calls	3 <sup>rd</sup>	63.2	13.2	23.7	3.5	1.18	3 to 4.3	38
5. Little exposure to food supply career options in college	1 <sup>st</sup>	88.2	7.8	3.9	2.5	1.21	2 to 3	51
5. Little exposure to food supply career options in college	2 <sup>nd</sup>	90	5	5	2.8	.87	2 to 3	40
5. Little exposure to food supply career options in college	3 <sup>rd</sup>	89.2	8.1	2.7	2.8	.90	2 to 3	37
6. Lack of food supply practice-related externships for students	1 <sup>st</sup>	77.6	16.3	6.1	2.7	1.20	2 to 3	49
6. Lack of food supply practice-related externships for students	2 <sup>nd</sup>	85	12.5	2.5	3.0	.82	3 to 3	40
7. Lack of positive role models in veterinary food supply practice	1 <sup>st</sup>	70.2	23.4	6.4	2.7	1.19	2 to 4	47
7. Lack of positive role models in veterinary food supply practice	2 <sup>nd</sup>	75	22.5	2.5	3.1	.81	3 to 3.8	40
8. Poor income opportunities in rural areas	1 <sup>st</sup>	84	12	4	2.4	1.19	2 to 3	50
8. Poor income opportunities in rural areas	2 <sup>nd</sup>	80.5	9.8	9.8	2.8	1.32	2 to 3	41
8. Poor income opportunities in rural areas	3 <sup>rd</sup>	81.6	5.3	13.2	3.0	1.17	2 to 3	38
9. Lack of cultural and recreational opportunities in rural areas	1 <sup>st</sup>	60.4	29.2	10.4	3.2	1.16	3 to 4	48
10. Lack of spousal career options in rural areas	1 <sup>st</sup>	77.6	12.2	10.2	2.9	1.21	2 to 3	49
11. Limited lifestyle and career opportunities in rural areas	1 <sup>st</sup>	71.4	18.4	10.2	3.1	1.17	2.5 to 4	49
11. Limited lifestyle and career opportunities in rural areas	2 <sup>nd</sup>	65	22.5	12.5	3.3	1.21	2 to 4	40
11. Limited lifestyle and career opportunities in rural areas	3 <sup>rd</sup>	73.7	18.4	7.9	3.1	.96	3 to 4	38
12. Federal and/or state/provincial budgetary constraints	1 <sup>st</sup>	84	10	6	2.5	1.25	1.8 to 3	50
12. Federal and/or state/provincial budgetary constraints	2 <sup>nd</sup>	85	12.5	2.5	2.6	1.03	2 to 3	40
12. Federal and/or state provincial budgetary constraints	3 <sup>rd</sup>	86.9	10.5	2.6	2.8	.72	2 to 3	38
13. High debt load of veterinary school graduates	1 <sup>st</sup>	74	16	10	2.6	1.49	1 to 4	50
13. High debt load of veterinary school graduates	2 <sup>nd</sup>	73.2	17.1	9.8	2.9	1.13	2 to 4	41
13. High debt load of veterinary school graduates	3 <sup>rd</sup>	70.2	16.2	13.5	3.0	1.12	2 to 4	37
14. Expected high number of food supply veterinarians retiring in the near future	1 <sup>st</sup>	44.9	16.3	38.8	3.9	1.92	2 to 6	49
14. Expected high number of food supply veterinarians retiring in the near future	2 <sup>nd</sup>	38.1	16.7	45.2	4.1	1.53	3 to 5	42
14. Expected high number of food supply veterinarians retiring in the near future	3 <sup>rd</sup>	43.2	16.2	40.5	4.0	1.65	3 to 5	37

15. Limited capacity of existing veterinary colleges in the US and/or Canada	1 <sup>st</sup>	44.7	55.3	0	3.2	1.01	3 to 4	47
16. Perceived lack of demand for food animals	1 <sup>st</sup>	70.2	25.5	4.3	3.0	1.00	2 to 4	47
17. Requirement for education beyond a DVM	1 <sup>st</sup>	59.2	36.7	4.1	3.2	1.01	3 to 4	49
54. Availability of dual degree programs (e.g. MPH) in veterinary colleges	2 <sup>nd</sup>	10	30	60	4.7	1.06	4 to 5	40
54. Availability of dual degree programs (e.g. MPH) in veterinary colleges	3 <sup>rd</sup>	8.6	40	51.5	4.5	1.04	4 to 5	35
55. Better lifestyle options in government veterinary jobs	2 <sup>nd</sup>	7.5	10	82.5	5.1	.92	5 to 6	40
55. Better lifestyle options in government veterinary jobs	3 <sup>rd</sup>	10.5	7.9	81.7	5.0	.97	5 to 6	38
56. Schools not selecting food supply oriented students	2 <sup>nd</sup>	70	22.5	7.5	3.2	1.24	2.3 to 4	40
56. Schools not selecting food supply oriented students	3 <sup>rd</sup>	68.5	23.7	7.9	3.2	1.11	3 to 4	38
57. Low salaries in government compared to other food supply jobs	2 <sup>nd</sup>	69	19	11.9	3.1	1.33	2 to 4	42
57. Low salaries in government compared to other food supply jobs	3 <sup>rd</sup>	84.2	10.5	5.2	3.0	1.07	2 to 3	38
58. Government incentive programs for entering food supply jobs	2 <sup>nd</sup>	9.5	7.1	83.3	5.1	1.17	5 to 6	42
58. Government incentive programs for entering food supply jobs	3 <sup>rd</sup>	13.5	8.1	78.4	4.8	1.01	5 to 5	37
59. Focused recruitment of students to food supply roles	2 <sup>nd</sup>	4.8	14.3	81	5.1	.95	5 to 6	42
59. Focused recruitment of students to food supply roles	3 <sup>rd</sup>	10.5	7.9	81.6	5.0	.92	5 to 5.3	38

## Section IV. Solutions to Shortages in State/Provincial FSVM Careers

Survey Item	Survey	%	% No	%	Standard	Middle	N	
	Wave	Decrease	Difference	Increase				
1. Reserve class slots for academically qualified students with food supply interests and relevant background	3 <sup>rd</sup>	29.7	43.2	27	4.5	1.74	3 to 6	37
2. Expand the Centers for Excellence concept where nationally recognized focus on different food supply sectors	3 <sup>rd</sup>	29.7	56.7	13.5	4.3	1.49	3 to 5	37
3. Focused recruitment of high school and college students with food supply interests into veterinary colleges	3 <sup>rd</sup>	34.2	50	15.8	4.2	1.70	3 to 5	38
4. Increased focus of food supply coverage early in DVM curriculum	3 <sup>rd</sup>	27	64.9	8.1	4.4	1.36	3 to 5	37
5. Expanded business and practice management coverage in DVM curriculum	3 <sup>rd</sup>	47.1	45.5	8.4	3.4	1.81	2 to 5	36
6. Expanded postgraduate fellowships in food supply areas	3 <sup>rd</sup>	10.5	18.4	71.1	4.8	1.35	4 to 5	38
7. Expanded paid work-study programs during the final year of DVM	3 <sup>rd</sup>	13.5	64.9	21.6	4.9	1.29	4.5 to 5	37
8. More involvement of food supply practitioners in training veterinary students	3 <sup>rd</sup>	21.6	64.9	13.5	4.6	1.19	4 to 5	37
9. Provide expanded job placement services in the food supply veterinary medicine areas	3 <sup>rd</sup>	13.1	60.5	26.3	5.0	1.36	5 to 6	38
10. Appointment of more food supply faculty at colleges of veterinary medicine	3 <sup>rd</sup>	10.8	70.3	18.9	4.9	1.13	4.5 to 5	37
11. Paid externship requirement in food supply medicine during the summer	3 <sup>rd</sup>	16.2	64.9	18.9	4.8	1.39	4 to 5	37
12. Marketing campaigns to increase awareness of food supply career and lifestyle opportunities	3 <sup>rd</sup>	21.1	60.5	18.4	4.6	1.26	4 to 5	38
13. Student debt repayment and scholarship programs for service in food supply areas of need	3 <sup>rd</sup>	5.3	36.8	57.9	5.8	1.10	5 to 7	38
14. Development of a government-supported Reserve Corps of food supply DVMs for disease surveillance and control activities	3 <sup>rd</sup>	21.6	62.1	16.2	4.4	1.28	4 to 5	37
15. Low cost (subsidized) consulting in business and practice management for new food supply DVMs	3 <sup>rd</sup>	49.9	41.6	8.4	3.5	1.61	2 to 5	36
16. Mentoring initiatives for students and those starting a food supply career	3 <sup>rd</sup>	21	68.4	10.6	4.6	1.25	4 to 5	38
17. Focused recruitment of women students in food supply areas	3 <sup>rd</sup>	50	50	0	3.3	1.30	2 to 4	38
18. Development and dissemination of Business Best Practices for food supply veterinary enterprises	3 <sup>rd</sup>	57.2	40	2.9	3.2	1.37	2 to 4	35