

Costs of Living for US Veterinarians in Food Animal Practice Compared to other Practice Categories and the Effect on Adjusted Income

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Abstract

The purpose of this study was to determine whether the cost of living (COL) experienced by veterinarians in the United States varied with their species emphasis. A total of 1191 entries were drawn from the American Veterinary Medical Association directory. A data set consisting of species emphasis category and addresses was systematically collected from the directory, and then cost of living indices (COLI) based on geographic locale were determined for each veterinarian using an internet-based tool. A Kruskal-Wallis analysis of variance on ranks was used to determine whether COL varied among species emphasis categories for veterinarians. Species category was significantly associated with cost of living ($P < 0.001$): companion animal-exclusive veterinarians had significantly higher median cost of living (99) than food animal-predominant (84), food animal-exclusive (89), and mixed animal veterinarians (86). Equine-exclusive veterinarians had significantly higher COLI (94) than food animal-predominant and mixed animal veterinarians. The COLI for companion animal-predominant veterinarians were significantly higher (89) than food animal-predominant veterinarians (84). No other pair-wise comparisons of species category COLI differed significantly. When income was adjusted for COL (\$152,398), food animal-exclusive veterinarians had greater income than all other species-defined categories, and exceeded that of companion animal-exclusive veterinarians by \$48,577 per year. When adjusted for COL, companion animal-exclusive incomes were lower than all other species-defined categories.

Key words: cost of living, income, veterinary practice, food animal practice

Résumé

Le but de cette étude était de déterminer si le coût de la vie des vétérinaires américains variait selon

leur espèce d'intérêt. On a recueilli 1191 noms du bottin de l'American Veterinary Medical Association. Une banque de données concernant l'espèce d'intérêt et l'adresse a été créée à partir du bottin. Par la suite, des indices du coût de la vie basés sur la localisation géographique ont été calculés pour chaque vétérinaire en utilisant un outil virtuel de l'internet. L'analyse des données a été faite avec l'ANOVA de Kruskal-Wallis basée sur les rangs afin de déterminer si le coût de la vie variait chez les vétérinaires selon leur catégorie d'espèces d'intérêt. La catégorie d'espèces d'intérêt était significativement associée au coût de la vie ($P < 0.001$) : le coût de la vie médian des vétérinaires se spécialisant exclusivement dans les animaux de compagnie (99) était significativement plus élevé que celui des vétérinaires se spécialisant surtout dans les animaux de la ferme (84), seulement dans les animaux de la ferme (89) ou qui étaient en pratique mixte (86). Les vétérinaires se spécialisant exclusivement dans les chevaux avaient des indices du coût de la vie plus élevés (94) que ceux des vétérinaires se spécialisant surtout dans les animaux de la ferme et des vétérinaires en pratique mixte. Les indices du coût de la vie des vétérinaires se spécialisant surtout dans les animaux de compagnie étaient significativement plus élevés (89) que ceux des vétérinaires se spécialisant surtout dans les animaux de la ferme (84). Aucune autre combinaison deux à deux des indices du coût de la vie entre catégories d'espèces n'était significativement différente. Lorsque les revenus étaient ajustés au coût de la vie, les vétérinaires se spécialisant exclusivement dans les animaux de la ferme avaient un revenu plus élevé que toutes les autres catégories de vétérinaires excédant par 48,577\$ le revenu annuel des vétérinaires se spécialisant exclusivement dans les animaux de compagnie. Ajusté au coût de la vie, le revenu associé à la pratique exclusive des animaux de compagnie était moins élevé que dans toutes les autres catégories définies à partir d'espèces d'intérêt.

Introduction

The shortage of rural veterinarians has been well documented and extensively reported.^{3,7,10} The apparent shortage not only impacts the delivery of curative and preventive services to livestock producers, but has potential to impact human health and well-being, national security, and economic development. The potentially catastrophic results of the ongoing shortage of food supply veterinarians were well documented in a recent report by the Government Accountability Office and testimony before the United States (US) Congress.¹⁴

Recent reports by Prince, Andrus, and Gwinner have attempted to examine possible causes of the shortage of food supply veterinarians.^{3,7,10} Summarizing these reports and others, it appears that production of adequate numbers of food supply veterinarians depends upon attracting young people to this specific component of the profession, admitting students to veterinary college who are likely to pursue this career path, providing an education which adequately and appropriately prepares students, and finally, providing career opportunities which both attract and retain the interest of veterinarians.^{3,7,10,11} Given the burgeoning debt load of graduate veterinarians, income and earning capacity is clearly a critical factor in our collective efforts to address the national need for more food supply veterinarians. Consequently, the earning capacity of food supply veterinarians is an issue which must be critically examined before we can adequately address the shortages.

A recent report by the American Veterinary Medical Association (AVMA) documents that mean 2007 income for food animal veterinarians (\$139,612/yr) exceeded that for equine (\$131,195/yr), companion animal-exclusive (\$113,373/yr), companion animal-predominant (\$120,462/yr), food animal-predominant (\$107,330/yr), and mixed animal practitioners (\$117,201/yr).¹³ Over the last two years, the greatest increases in income occurred in food animal-exclusive and various categories of mixed animal practice. Although this report was positive, the authors suggested that the reported income disparity underestimated the affluence of food animal veterinarians. We hypothesized that food animal and mixed animal practitioners experience lower living costs due to the historically lower cost of living (COL) in rural areas, and companion animal veterinarians would experience higher COL because they are typically located in more expensive urban and suburban locales.

The purpose of this study was to determine whether COL differed among veterinarians with differing practice species emphasis. Practice-type specific cost of living indices (COLI) were used to adjust reported incomes for veterinarians to permit rational comparisons of affluence among veterinarians by species emphasis.

This adjusted COLI is the calculated cost of maintaining a set lifestyle based on postal zip code.

Materials and Methods

A data set was compiled which included COLI and practice species category for a sample of AVMA member veterinarians. Data relative to postal zip codes and member-provided species categories were extracted from the published 2008-2009 AVMA directory in a systematic manner which, although not random, approached satisfaction of the goals of a random sample.² In the directory all entries are arranged alphabetically by state, alphabetically by city within state, and finally, alphabetically by last name within a given city. Entries within this portion of the directory are arranged in a three-column format. The first entry in each column was included in the initial data set. Data extraction was limited to the 50 states and the District of Columbia, and excluded US territories and commonwealths. Veterinarians provided either one or two species codes; however, the vast majority of veterinarians provided a single species code. Reported species codes included the following:

- 1 = Food animal-predominant (> 50% bovine, porcine, ovine, caprine, camelid, cervid or poultry)
- 2 = Food animal-exclusive (>90% bovine, porcine, ovine, caprine, camelid, cervid or poultry)
- 3 = Companion animal-predominant (> 50% canine, feline, non-poultry avian or exotic)
- 4 = Companion animal-exclusive (>90% canine, feline, non-poultry avian or exotic)
- 5 = Mixed animal ($\geq 25\%$ companion animal and $\geq 25\%$ either food animal or equine)
- 6 = Equine-predominant (>50% equine)
- 7 = Equine-exclusive (>90% equine)
- 8 = Other
- 9 = No species contact
- 0 = No information provided

The number of entries with two species categories was noted and reported. Entries for which two codes were provided were assigned a single logically coherent species code whenever possible. For example, when entries in which food animal-predominant, equine-predominant or companion animal-predominant and mixed animal were reported, the predominant species reported was assigned. Entries which were illogical or mutually exclusive were deleted from the data set. The number of entries reassigned or deleted in this manner was noted and reported.

Initially, COL for each respondent veterinarian was determined on the basis of the five-digit postal zip code using an internet-based tool.⁹ Cost of living was reported as a cost relative to a national average of 100. In cases where the tool failed to provide a COLI, extracted data were rechecked for accuracy. Thereafter, if

the internet-based tool did not provide a COLI, the city and state provided in the directory were entered into the internet-based tool and a second attempt was made to determine the entry COLI. If the COLI could not be calculated after two attempts, the entries were deleted from the final data set. The number of COLI determined by using an address, city, and state, and the number of deleted entries, was noted and reported.

Statistical analysis was limited to entries with species codes 1, 2, 3, 4, 5, 6, and 7. Entries with species codes 8 (other), 9 (no species contact), and 0 (no information provided) were not considered in the statistical analysis. Means, standard deviations, medians, and quartiles were calculated. Data were screened for normality and equality of variance across groups. The planned analysis was one-way analysis of variance. Pair-wise comparisons were performed using the Tukey method. In the event the assumptions of normality and equal variance were not satisfied, a Kruskal-Wallis one-way analysis of variance on ranks was performed. Pair-wise comparisons then were performed using the Dunn method. Pair-wise comparisons were deemed to differ significantly when $P < 0.05$.

For each species category, mean professional income reported in a recent issue of the Journal of the American Veterinary Medical Association was adjusted for both mean and median COLI using the following formula:

$$\text{Adjusted income} = \frac{\text{(mean professional income of the species-defined category X 100)}}{\text{species category mean or median COLI}}$$

Adjusted income was not reported for the equine-predominant species category because incomes for this category were not provided in the recent AVMA report.¹³

Results

One entry which defined practice species category as both food animal-predominant and companion ani-

mal-predominant was deleted. Another entry identified as both food animal-predominant and mixed animal was redefined as food animal-predominant. Six entries defined as both companion animal-predominant and mixed animal were defined as companion animal-predominant. Eight entries defined as both mixed animal and equine-predominant were defined as equine-predominant. Zip code-based queries failed to produce COLI for 142 entries. For 113 of these entries, COLI were determined using city and state provided by the directory. The remaining 29 with no COLI available were deleted from the final data set. Deleted entries included one for veterinarians with no species category defined, one food animal-predominant, one food animal-exclusive, two companion animal-predominant, 20 companion animal-exclusive, two equine-exclusive, one other, and one no species contact. A total of 1421 (98%) of entries were deemed suitable for further consideration. Of these records, 158 provided no information on species contact and were therefore deleted. Records with a species category of other (n=52) or no species contact (n=20) also were deleted, leaving a total of 1191 (82%) records available for analysis.

Species category means, standard deviations, medians, 25% quartiles, and 75% quartiles are reported in Table 1. The lowest mean COLI were experienced by food animal-predominant (88.55) and food animal-exclusive (91.61) practitioners. Companion animal-exclusive veterinarians had the highest mean COLI (109.20). The data set failed both normality and equal variance assumptions, hence a nonparametric analysis, Kruskal Wallis analysis of variance on ranks, was performed. Species category was significantly associated with COLI ($P < 0.001$). Companion animal-exclusive veterinarians had significantly higher median COLI (99) than food animal-predominant (84), food animal-exclusive (89), and mixed animal veterinarians (86). Equine-exclusive veterinarians experienced significantly higher median COLI (94) than food animal-predominant and mixed animal veterinarians. Companion animal-predominant

Table 1. Mean, standard deviation (SD), median, and quartiles (Q) for cost of living for veterinary practitioners by species category.

	N	Mean	SD	Median	25% Q	75% Q
Food animal-predominant	86	88.55	24.62	84	79	94
Food animal-exclusive	41	91.61	10.69	89	85	95
Companion animal-predominant	125	97.49	22.63	89	83	108
Companion animal-exclusive	798	109.20	37.60	99	88	117
Mixed animal	72	91.71	17.85	86	82	96
Equine-predominant	12	97.33	26.60	88	82	108
Equine-exclusive	57	106.32	30.98	94	87	113

veterinarians had a significantly higher median COLI (89) than food animal-predominant veterinarians (84). No other pair-wise comparisons of species category COLI differed significantly ($P > 0.05$).

Incomes adjusted for mean and median COL are reported for species-defined categories (Table 2). Food animal-exclusive incomes were highest of all species categories considered, regardless of the income adjustment procedure used. Companion animal-exclusive incomes were the lowest of all species categories considered, regardless of the income adjustment procedure used.

Discussion

The data collection process for this report, although rigorous, was not ideal. Not all US veterinarians are included in the AVMA directory; hence, the report is only reflective of those veterinarians included in the directory. Some veterinarians report a work address to the AVMA and other veterinarians choose to report a home address. Participating veterinarians may report incorrect species codes and addresses. Hence, a degree of error is anticipated. The process of manual data extraction was sufficiently laborious that it dictated sampling rather than assessment of the entire population of the AVMA membership. More accurate results might have been obtained if all of the database in the directory had been used in the analysis. Having made this admission, the sample was collected in a manner which virtually assured equal opportunity for inclusion for all veterinarians in the AVMA directory. In addition, only 2% of the data set was deleted due to either inability to generate a COLI or apparent discrepancies in reported species codes.

Our internet-based source for COL data is one of the few possible sources for cost of living data which

permit examination of discrete locales. Unfortunately, these data are proprietary and the methodology of data collection and adjustment are not available to us.¹ The internet-based tool used to calculate COL is provided gratis to users considering relocation, and is intended to permit users to estimate earnings needed to provide equivalent affluence following relocation. In contrast, the interest of most economists has not been on living cost differences among regions, cities, municipalities and locales, but instead the focus of research on COL has been on the measurement of change over time.⁵ The only publicly available micro-level survey data on prices is the database generated by ACCRA (formerly the American Chamber of Commerce Research Associates).¹ Quarterly ACCRA data is available for a few hundred cities nationwide. The internet-based tool used in our study provides COL estimates for many locations not included in ACCRA reports, and provides much more detailed data on COL differences within large metropolitan areas. cursory examination and comparison of the internet-based tool and ACCRA data suggests the internet-based tool is based on ACCRA data, but details regarding how the data is adjusted to arrive at the final COLI are not documented. Using raw (unadjusted) ACCRA data for the purposes of this study was not possible because it would have excluded all rural areas.

Based on our analysis, recent reports describing the earnings of species-defined categories of veterinary practitioners underestimated the degree of income disparity among groups. Food animal-exclusive, food animal-predominant, and mixed animal practitioners have significantly lower living costs than do their companion animal-exclusive colleagues. The conclusions of this study are descriptive of general trends within the profession, and exceptions to these reported trends are expected. A proportion of food animal practices are likely

Table 2. Mean earnings (\$) for veterinarians by species category with adjustments for mean and median cost of living indices (COLI).

Practice type	Income (\$)	Adjustment factor	Adjusted income (\$)
Food animal-exclusive	139,612	Mean COLI = 91.61	152,398
		Median COLI=89	156,867
Food animal-predominant	107,330	Mean COLI = 88.55	121,208
		Median COLI = 84	127,773
Mixed animal	117,201	Mean COLI = 91.71	127,795
		Median COLI = 86	136,280
Companion animal-predominant	120,462	Mean COLI = 97.49	123,563
		Median COLI = 89	135,350
Companion animal-exclusive	113,373	Mean COLI = 109.20	103,821
		Median COLI = 99	114,518
Equine-exclusive	131,195	Mean COLI = 106.32	123,396
		Median COLI = 88	149,085

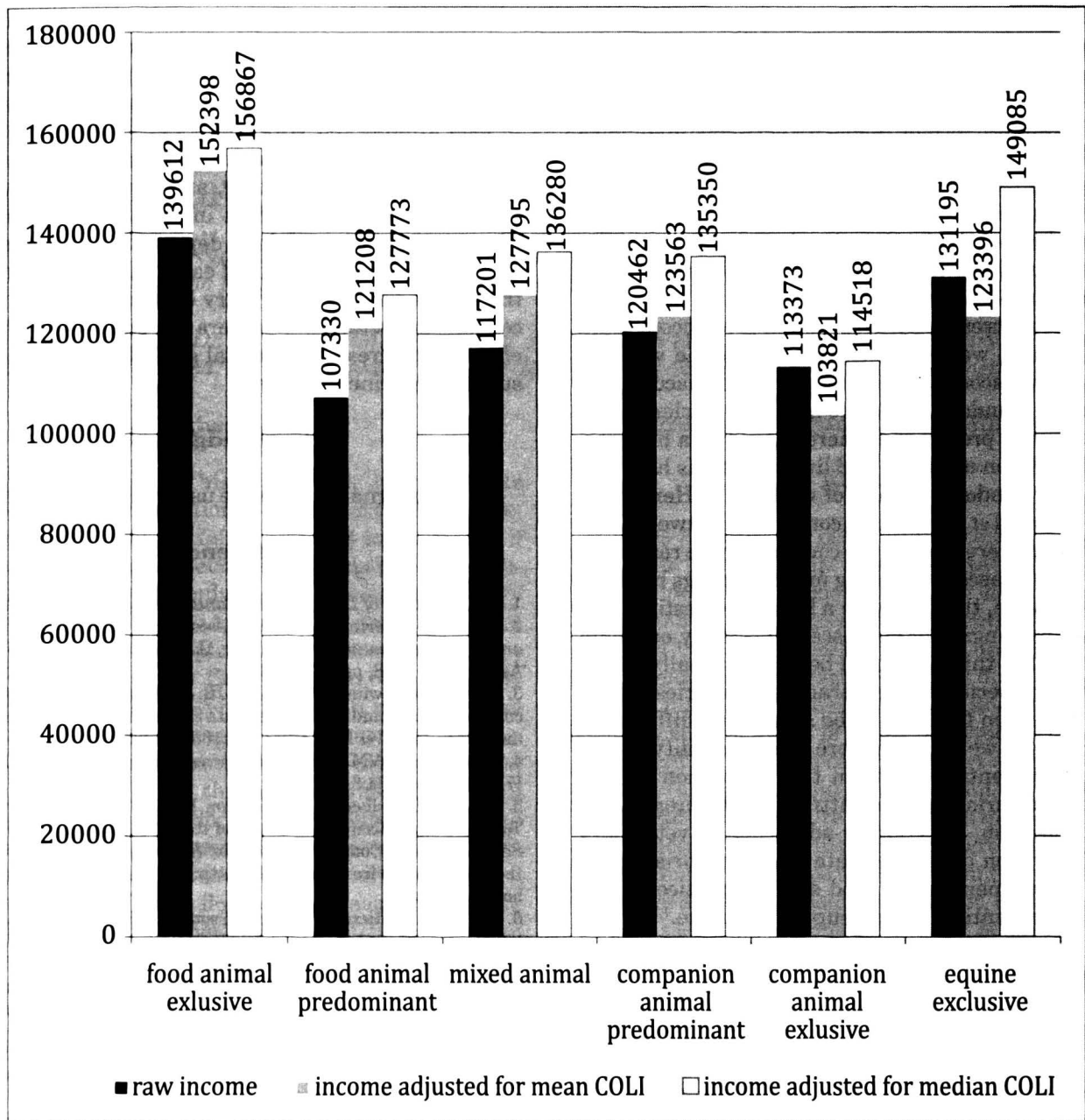


Figure 1. Raw incomes (US \$/yr), incomes adjusted using mean cost of living indices (COLI) and incomes adjusted using median COLI for veterinarians in various species-defined categories.

sited in areas with high COLI, and some companion animal practices are located in areas with low COLI.

If mean COLI are used in the adjustment procedure, food animal-exclusive adjusted income exceeded companion animal-exclusive adjusted income by \$48,577 per year; if median COLI are used, food animal-exclusive adjusted income exceeded companion animal-exclusive adjusted income by \$42,349 per year. When only raw income is considered, food animal-predominant incomes lag behind those for companion animal-exclusive practi-

tioners.¹³ When incomes were adjusted for either mean or median COLI, this pattern was reversed and companion animal incomes were lower than all other categories considered. It should be noted that the species-defined category with the lowest income adjusted for COLI is the most common employment venue for veterinary practitioners; over two-thirds of our sample population were companion animal-exclusive veterinarians.

The income for general practitioners within the companion animal-exclusive category may in fact be

lower than we observed. The authors hypothesize there is an increased number of diplomate specialists in private practice concentrated within the companion animal-exclusive category. A recent AVMA report documented dramatic income disparity between diplomates (\$167,862) and non-diplomates (\$111,674 per year).⁴ If only general practitioners were included in the income calculations, we hypothesize that raw income for companion animal-exclusive veterinarians in non-specialty practice would be lower than the \$113,373 per year cited in preceding AVMA reports.⁴

Without access to both individual-level income data and COL data, we cannot critically examine whether the provided income adjustments create inaccuracies or biases. A standard economic model of efficient labor markets would predict that there should be a high correlation between earnings and living costs, as has been reported for random samples of workers by Henderson and by Dumond *et al.*^{6,8} If this correlation between COL and earnings were perfect, we could estimate real earnings without biases by dividing mean earnings by mean COL; otherwise, there may be a bias in our estimate of mean real earnings. For purposes of this study, our main concern is that this bias could be proportionally different between species-defined practice categories. While we see no reason for there to be systematic differences among groups, we cannot ignore this possibility.

Critical control points in the production of food supply veterinarians include attraction of young people to the profession, selection or admission to veterinary school, provision of an adequate and appropriate education, recruitment into a food supply practice venue, and finally retention in food supply medicine.^{7,11,12} The ongoing trend of consistently higher earnings in food animal practice and near parity for earning by mixed animal practitioners relative to companion animal practitioners, plus lower COL for food animal-exclusive, food animal-predominant, and mixed animal practitioners, suggests the private sector has attempted to address rural veterinary recruitment and retention issues. It should be noted that income and COL are likely not the only predictors of recruitment and retention. Other factors, including non-salary benefits, work environment, and quality of life are likely of equal importance.³ A reasonable strategy for employers when trying to hire a new associate(s) is to capitalize on the higher income and lower COL, while at the same time addressing these non-salary issues.

Given the clear response of the private sector to the ongoing shortage of food supply veterinarians, the other control points (attraction, admission, and education of veterinary students) seem to be logical targets for intervention. Hence, our collective efforts to address ongoing shortages should probably focus on the actions

and responses of the collective veterinary profession and the veterinary colleges. The AVMA can be instrumental in our collective efforts to disseminate information regarding financial rewards and career opportunities in food animal and rural practice. Veterinary colleges face the challenge of recruiting students with an interest in food supply medicine, and providing them with an education which fosters interest in these careers. Clear presentation of data demonstrating the species category-related disparity of earnings and COL by both the AVMA and the veterinary colleges to young people considering veterinary careers is a critical factor in our efforts to address the societal goal of an adequate food supply medicine workforce.

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References

1. ACCRA: *Cost of Living Index Manual*. Arlington, VA, 2003.
2. American Veterinary Medical Association: *Membership Directory and Resource Manual*. Schaumburg, IL, American Veterinary Medical Association, 2008, pp 557-1041.
3. Andrus DM, Gwinner KP, Prince JB: Job satisfaction, changes in occupational area, and commitment to a career in food supply veterinary medicine. *J Am Vet Med Assoc* 228:1884-1893, 2006.
4. Anonymous: AVMA survey measures income trends to 2007. *J Am Vet Med Assoc* 234:8-10, 2008.
5. Boskin M, Dulberger ER, Gordon RJ, Griliches Z, Jorgenson D: Toward a more accurate measure of the cost of living. Report to the Senate Finance Committee from the Advisory Commission to Study the Consumer Price Index, 1996. <http://www.ssa.gov/history/reports/boskinrpt.html>
6. Dumond JM, Hirsch BT, Macpherson DA: Wage differentials across labor markets and workers: does cost of living matter? *Economic Inquiry* 37:577-598, 1999.
7. Gwinner KP, Prince JB, Andrus DM: Attracting students into careers in food supply veterinary medicine. *J Am Vet Med Assoc* 228:1693-1704, 2006.
8. Henderson JP: An intercity comparison of differentials in earnings and the city worker's cost of living. *The Review of Economics and Statistics* 37:407-411, 1955.
9. <http://realestate.yahoo.com/neighborhoods>, accessed March 1-19, 2009.
10. Prince JB, Andrus DM, Gwinner KP: Future demand, probable shortages, and strategies for creating a better future in food supply veterinary medicine. *J Am Vet Med Assoc* 229:57-69, 2006.
11. Tyler JW, Larson RL: Assessing veterinary medical education with regard to the attraction, admission and education of students interested in food supply veterinary medicine and retention of student interest in the food supply sector. *J Am Vet Med Assoc* 229:922-927, 2006.
12. Tyler JW, Larson RL: A proposal for the assessment of the quality of food supply veterinary medical education. *J Am Vet Med Assoc* 229:1240-1243, 2006.
13. Shepherd AJ: Income of US veterinarians, 2007. *J Am Vet Med Assoc* 234:754-756, 2008.
14. US Government: Veterinarian workforce actions are needed to ensure sufficient capacity for protecting public and animal health. US Government Accountability Office, February 2009, 88 pages.