



Workforce Needs in Veterinary Medicine

ISBN
978-0-309-25744-2

320 pages
6 x 9
PAPERBACK (2012)

Committee to Assess the Current and Future Workforce Needs in Veterinary Medicine; Board on Agriculture and Natural Resources; Board on Higher Education and Workforce; Division on Earth and Life Studies; Policy and Global Affairs

 Add book to cart

 Find similar titles

 Share this PDF



Visit the National Academies Press online and register for...

- ✓ Instant access to free PDF downloads of titles from the
 - NATIONAL ACADEMY OF SCIENCES
 - NATIONAL ACADEMY OF ENGINEERING
 - INSTITUTE OF MEDICINE
 - NATIONAL RESEARCH COUNCIL
- ✓ 10% off print titles
- ✓ Custom notification of new releases in your field of interest
- ✓ Special offers and discounts

Distribution, posting, or copying of this PDF is strictly prohibited without written permission of the National Academies Press. Unless otherwise indicated, all materials in this PDF are copyrighted by the National Academy of Sciences. Request reprint permission for this book

Executive Summary

The U.S. veterinary medical profession contributes to society in diverse ways, from developing drugs and protecting the food supply to treating companion animals and investigating animal diseases in the wild. In a study of the issues related to the veterinary medical workforce, including demographics, workforce supply, trends affecting job availability, and capacity of the educational system to fill future demands, a National Research Council committee found that the profession faces important challenges in maintaining the economic sustainability of veterinary practice and education, building its scholarly foundations, and evolving veterinary service to meet changing societal needs.

The committee found little evidence of workforce shortages in most fields of veterinary medicine. True personnel shortages are indicated when salaries rise sharply in an attempt to attract qualified candidates to fill persistent vacancies. That is not occurring in any sector of veterinary medicine, except industry, where high salaries are offered to candidates with both a doctoral degree in veterinary medicine (DVM¹) and a PhD, or with advanced training in pathology or laboratory-animal medicine.

Nevertheless, some veterinary colleges have increased enrollment and the American Veterinary Medical Association (AVMA) has accredited additional veterinary schools to accommodate more students, most of whom will likely practice companion-animal medicine. Those actions will increase the supply of companion-animal practitioners, the largest group of veterinary practitioners, at a time of uncertain demand for companion-animal services. The profession's leaders should pay attention to improving the economic value of the DVM, especially given the cost of a veterinary education, which is typically shared by the student and the public. The financial reward for the investment of time and money in obtaining a DVM is lower than that in other medical professions, such as dentists and pharmacists, which have the same or fewer years of training.

A larger consequence of increasing enrollments may be for the veterinary colleges themselves, which have inadequate resources for clinical faculty, specialists, and others needed to train future practitioners. Companion-animal veterinary medicine has come to dominate the curriculum and resources of veterinary schools, sometimes to the detriment of other fields of veterinary medicine, at a time when many veterinary schools are facing a precipitous decline in state support for faculty positions and tuition.

Future actions should be informed by reliable national data on consumer demand for companion-animal care and the economics of private practice (including the work patterns of practitioners and the role of veterinary technicians), by the need to maintain the quality and

¹ The University of Pennsylvania awards the Veterinariae Medicinae Doctoris (VMD), an equivalent to the DVM.

affordability of a veterinary education, and by the need to educate veterinarians for other sectors of the profession. Developing new business models for providing specialty training is part of this challenge. The committee recommends that the Association of American Veterinary Medical Colleges, the American Animal Hospital Association, and the AVMA work together to collect the necessary data and conduct planning.

The committee found that increasing student debt associated with a veterinary education is one factor that undermines the inclination of graduates to pursue PhD research training that would prepare them for academic careers, key jobs in public practice, and some positions in industry. Partnerships between industry and academe to expose DVM students to research and the establishment of joint DVM-PhD programs may increase the pool of potential candidates needed by academe, government, and industry.

Because research is important for the future of the profession, leaders in academe should make a greater commitment to strengthening its scholarly base. It is essential to attract more public and private support for veterinary colleges, but that requires academe to demonstrate the value of investment in veterinary medical research. Hiring DVM-PhDs and PhDs to attract grants, serve as mentors, and provide graduate training of veterinarians at the doctoral level for both biomedical and clinical animal research would keep veterinary schools in the mainstream of research.

An important challenge to the profession is its ability to evolve veterinary services in synchrony with societal needs. For example, to increase the value of veterinary services to large, intensive livestock and poultry producers, the education of food-animal practitioners should be reoriented toward herd health and improving the productivity of farm operations. In rural areas, where primary veterinary care is needed but there are too few farms to support full-time veterinarians, a system of animal health care involving rigorously trained technicians under the supervision of veterinarians could be developed. Such arrangements, which would also strengthen disease surveillance, could be initiated through negotiations by veterinary professional associations with state regulatory officials.

The veterinary profession should expand its capacity to address complex global problems, such as those associated with food security, by encouraging interactions between U.S. veterinary graduates and other disciplines and cultures, particularly in the developing world, where the profession has an opportunity to leverage its expertise in One Health² and lead advances in food-animal husbandry and welfare, water safety and security, and the health of wildlife and ecosystems.

² One Health is a holistic concept of health that recognizes and addresses the complex linkages between humans, wild and domestic animals, and their ecosystems.

PREPUBLICATION COPY

Workforce Needs in Veterinary Medicine

Committee to Assess the Current and Future Workforce Needs
in Veterinary Medicine

Board on Agriculture and Natural Resources
Board on Higher Education and Workforce

Division on Earth and Life Studies
Policy and Global Affairs Division

This prepublication version of Workforce Needs in Veterinary Medicine has been provided to the public to facilitate timely access to the report. Although the substance of the report is final, editorial changes may be made throughout the text and citations will be checked prior to publication. The final report will be available through the National Academies Press in summer 2012.

NATIONAL RESEARCH COUNCIL
OF THE NATIONAL ACADEMIES

THE NATIONAL ACADEMIES PRESS
Washington, D.C.
www.nap.edu

PREPUBLICATION COPY

Copyright National Academy of Sciences. All rights reserved.
This summary plus thousands more available at <http://www.nap.edu>

THE NATIONAL ACADEMIES PRESS 500 Fifth Street NW Washington, DC 20001

NOTICE: The project that is the subject of this report was approved by the Governing Board of the National Research Council, whose members are drawn from the councils of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. The members of the committee responsible for the report were chosen for their special competences and with regard for appropriate balance.

This study was funded by Association of American Veterinary Medical Colleges, the American Veterinary Medical Association, the American Animal Hospital Association, Bayer Animal Health, and the Burroughs Welcome Fund under Award No. 1006607.

Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of the organizations or agencies that provided support for the project.

International Standard Book Number (ISBN)-13: 978-0-309-0XXXX-X

International Standard Book Number (ISBN)-10: 0-309-0XXXX-X

Library of Congress Control Number 97-XXXXX

Additional copies of this report are available for sale from the National Academies Press, 500 Fifth Street, NW, Keck 360, Washington, DC 20001; (800) 624-6242 or (202) 334-3313; <http://www.nap.edu>.

Copyright 2012 by the National Academy of Sciences. All rights reserved.

Suggested Citation: National Research Council. 2011. Workforce Needs in Veterinary Medicine. Washington, DC: The National Academies Press.

Printed in the United States of America.

THE NATIONAL ACADEMIES

Advisers to the Nation on Science, Engineering, and Medicine

The **National Academy of Sciences** is a private, nonprofit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare. Upon the authority of the charter granted to it by the Congress in 1863, the Academy has a mandate that requires it to advise the federal government on scientific and technical matters. Dr. Ralph J. Cicerone is president of the National Academy of Sciences.

The **National Academy of Engineering** was established in 1964, under the charter of the National Academy of Sciences, as a parallel organization of outstanding engineers. It is autonomous in its administration and in the selection of its members, sharing with the National Academy of Sciences the responsibility for advising the federal government. The National Academy of Engineering also sponsors engineering programs aimed at meeting national needs, encourages education and research, and recognizes the superior achievements of engineers. Dr. Charles M. Vest is president of the National Academy of Engineering.

The **Institute of Medicine** was established in 1970 by the National Academy of Sciences to secure the services of eminent members of appropriate professions in the examination of policy matters pertaining to the health of the public. The Institute acts under the responsibility given to the National Academy of Sciences by its congressional charter to be an adviser to the federal government and, upon its own initiative, to identify issues of medical care, research, and education. Dr. Harvey V. Fineberg is president of the Institute of Medicine.

The **National Research Council** was organized by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purposes of furthering knowledge and advising the federal government. Functioning in accordance with general policies determined by the Academy, the Council has become the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in providing services to the government, the public, and the scientific and engineering communities. The Council is administered jointly by both Academies and the Institute of Medicine. Dr. Ralph J. Cicerone and Dr. Charles M. Vest are chair and vice chair, respectively, of the National Research Council.

www.national-academies.org

PREPUBLICATION COPY

Copyright National Academy of Sciences. All rights reserved.
This summary plus thousands more available at <http://www.nap.edu>

PREPUBLICATION COPY

Copyright National Academy of Sciences. All rights reserved.
This summary plus thousands more available at <http://www.nap.edu>

COMMITTEE TO ASSESS THE CURRENT AND FUTURE WORKFORCE NEEDS IN VETERINARY MEDICINE

ALAN M. KELLY, *Chair*, University of Pennsylvania School of Veterinary Medicine
(*Emeritus*), Philadelphia

SHEILA W. ALLEN, University of Georgia, Athens

VAL R. BEASLEY, University of Illinois at Urbana-Champaign

BONNIE BUNTAIN, University of Calgary Veterinary Medicine, Alberta, Canada

HENRY E. CHILDERS, Cranston Animal Hospital, Rhode Island

GARY COCKERELL, Cockerell Alliances, Grand Junction, Colorado

HAROLD DAVIS, Amgen, Covington, Georgia (Retired)

JAMES G. FOX, IOM,¹ (through February 2008), Massachusetts Institute of Technology,
Cambridge

MALCOLM GETZ, Vanderbilt University, Nashville, Tennessee

TRACEY S. MCNAMARA, Western University of Health Sciences, Pomona, California

GAY Y. MILLER, University of Illinois at Urbana-Champaign

BENNIE I. OSBURN, University of California, Davis

MARK V. PAULY, IOM,¹ Wharton School of University of Pennsylvania, Philadelphia

FRED W. QUIMBY, The Rockefeller University, New York (Retired)

WILLIE M. REED (through February 2008), Purdue University, West Lafayette, Indiana

JOHN A. SHADDUCK (through October 2007), Shadduck Consulting LLC, Denton, Texas

MICHAEL A. STOTO (through March 2008), Georgetown University, Washington, DC

STEPHEN F. SUTHERLAND, Pfizer Animal Health, Kalamazoo, Michigan

Staff

ROBIN A. SCHOEN, Director, Board on Agriculture and Natural Resources

PETER HENDERSON, Director Board on Higher Education and Workforce

JIM VOYTUK, Senior Program Officer, Board on Higher Education and Workforce

CAMILLA YANDOC ABLES, Program Officer, Board on Agriculture and Natural Resources

PEGGY TSAI, Program Officer, Board on Agriculture and Natural Resources

NORMAN GROSSBLATT, Senior Editor

KAREN L. IMHOF, Administrative Coordinator, Board on Agriculture and Natural Resources

JANET M. MULLIGAN, Research Associate, Board on Agriculture and Natural Resources

KARA MURPHY, Program Assistant, Board on Higher Education and Workforce

¹Institute of Medicine

BOARD ON AGRICULTURE AND NATURAL RESOURCES

NORMAN R. SCOTT, *Chair*, NAE,¹ Cornell University (*Emeritus*), Ithaca, New York
PEGGY F. BARLETT, Emory University, Atlanta, Georgia
HAROLD L. BERGMAN, University of Wyoming, Laramie
RICHARD A. DIXON, NAS,² Samuel Roberts Noble Foundation, Ardmore, Oklahoma
DANIEL M. DOOLEY, University of California, Oakland
JOAN H. EISEMANN, North Carolina State University, Raleigh
GARY F. HARTNELL, Monsanto Company, St. Louis, Missouri
GENE HUGOSON, Global Initiatives for Food Systems Leadership, St. Paul, Minnesota
MOLLY M. JAHN, University of Wisconsin-Madison
ROBBIN S. JOHNSON, Cargill Foundation, Wayzata, Minnesota
A.G. KAWAMURA, Solutions from the Land, Washington, DC
JULIA L. KORNEGAY, North Carolina State University, Raleigh
KIRK C. KLASING, University of California, Davis
VICTOR L. LECHTENBERG, Purdue University, West Lafayette, Indiana
JUNE BOWMAN NASRALLAH, NAS,² Cornell University, Ithaca, New York
PHILIP E. NELSON, Purdue University, West Lafayette, Indiana
KEITH PITTS, Marrone Bio Innovations, Davis, California
CHARLES W. RICE, Kansas State University, Manhattan
HAL SALWASSER, Oregon State University, Corvallis
ROGER A. SEDJO, Resources for the Future, Washington, DC
KATHLEEN SEGERSON, University of Connecticut, Storrs
MERCEDES VAZQUEZ-AÑON, Novus International, Inc., St. Charles, Missouri

Staff

ROBIN A. SCHOEN, Director
CAMILLA YANDOC ABLES, Program Officer
RUTH S. ARIETI, Research Associate
KAREN L. IMHOF, Administrative Coordinator
KARA N. LANEY, Program Officer
AUSTIN J. LEWIS, Senior Program Officer
JANET M. MULLIGAN, Senior Program Associate for Research
KATHLEEN REIMER, Senior Program Assistant
EVONNE P.Y. TANG, Senior Program Officer
PEGGY TSAI, Program Officer

¹National Academy of Engineering

²National Academy of Sciences

BOARD ON HIGHER EDUCATION AND WORKFORCE

WILLIAM E. KIRWAN, Chair, University System of Maryland, Adelphi

F. KING ALEXANDER, California State University, Long Beach

SUSAN K. AVERY, Woods Hole Oceanographic Institution

JEAN-LOU CHAMEAU, NAE,¹ California Institute of Technology, Pasadena

CARLOS CASTILLO-CHAVEZ, Arizona State University, Tempe

RITA COLWELL, NAS,² University of Maryland, College Park and the Johns Hopkins
University Bloomberg School of Public Health, Baltimore

PETER EWELL, National Center for Higher Education Management Systems, Boulder,
Colorado

SYLVIA HURTADO, University of California, Los Angeles

WILLIAM KELLEY, IOM,³ University of Pennsylvania School of Medicine, Philadelphia

EARL LEWIS, Emory University, Atlanta, Georgia

PAULA STEPHAN, Georgia State University Andrew Young School of Policy Studies, Atlanta

Staff

PETER HENDERSON, Director

GAIL GREENFIELD, Senior Program Officer

SABRINA HALL, Program Associate

JIM VOYTUK, Senior Program Officer

¹National Academy of Engineering

²National Academy of Sciences

³Institute of Medicine

PREPUBLICATION COPY

Copyright National Academy of Sciences. All rights reserved.
This summary plus thousands more available at <http://www.nap.edu>

Preface

In 2007, the American Veterinary Medical Association, the Association of American Veterinary Medical Colleges, the American Animal Hospital Association, Bayer Animal Health, and the Burroughs Wellcome Fund asked the National Research Council (NRC) to conduct a comprehensive study of the current and future workforce needs in veterinary medicine. The request was motivated by concerns about how well the veterinary profession was presently meeting its public responsibilities and, in terms of human resources and facilities, how well it could adjust to the complex challenges facing society in the 21st century.

Many of the concerns about the profession came into focus following the outbreak of West Nile fever in 1999: despite the spread of a zoonotic disease, human and veterinary public health agencies acted independently and did not communicate with one another. Subsequent outbreaks of SARS, monkeypox, bovine spongiform encephalopathy, highly pathogenic avian influenza, H1N1 influenza, and a variety of food safety and environmental issues heightened public concerns. They also raised further questions about the directions of veterinary medicine and the capacity of public health services the profession provides both in the United States and abroad. After September 11, 2001, concern about the vulnerability of the food supply, including the American livestock and poultry industries, drew attention to the declining presence of veterinarians serving the animal industries across the nation.

These and other demographic, economic, political, and environmental developments of the 21st century will profoundly change society and the services the veterinary profession must provide in order to remain relevant to the public. Responsibilities will increasingly involve global issues with greater emphasis focused on the interface of human, animal, and ecosystem health. To meet these needs, there are doubts that the present supply of veterinarians are adequate in biomedical research, industry, academia, companion animal practice, food animal medicine, public health, and wildlife health. This report attempts to anticipate some of the needs and measures that are essential for the profession to fulfill given its changing roles in the 21st century.

The study was undertaken at a time when the nation experienced a major economic downturn, which made deciphering the long-term trends in demand for veterinary services very challenging. Some estimates (the number of livestock being raised, for example) will always be in flux due to economic or industry cycles, but in the long term, the number of animals is less important for the profession than the evolution in the care and services needed for those animals.

Under the direction of the NRC Board on Agriculture and Natural Resources and Board on Higher Education and Workforce, a committee was impaneled to address the issues provided in the Statement of Task. The committee was representative of the breadth of interest of the

veterinary profession, and first met in April 2007 to consider the large undertaking the study commissioned. Over the next three years, the committee met on six occasions and participated in numerous conference calls to discuss ways of obtaining the needed information, review manuscripts, and revise the report. As would be expected from a committee with such diverse backgrounds, there were distinct and at times conflicting points of view. Nevertheless, committee members were always willing to learn from each other and in the end came to a consensus on the issues posed by the charge.

Throughout the study the committee was very ably supported by the staff of the National Academies and is indebted to Jim Voytuk, Janet Mulligan, and Kara Murphy for their expert assistance. The committee is especially grateful to Robin Schoen, Director of the Board of Agriculture and Natural Resources, for her encouragement, advice, and for keeping the committee focused on their charge.

Alan M. Kelly, *Chair*
Committee to Assess the Current and Future
Workforce Needs in Veterinary Medicine

Acknowledgments

This report has been reviewed in draft form by persons chosen for their diverse perspectives and technical expertise in accordance with procedures approved by the National Research Council Report Review Committee. The purpose of the independent review is to provide candid and critical comments that will assist the institution in making its published report as sound as possible and to ensure that the report meets institutional standards of objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the deliberative process. We wish to thank the following individuals for their review of the report:

L. Garry Adams, Texas A&M University
Burt S. Barnow, George Washington University
Stephen W. Barthold, University of California, Davis
Alicia L. Carriquiry, Iowa State University
Norman F. Cheville, Iowa State University (*Emeritus*)
Linda C. Cork, Stanford University (*Emeritus*)
Arthur L. Lage, Harvard Medical School
Joan M. Lakoski, University of Pittsburg
Thomas R. Lenz, Pfizer Animal Health
Timothy C. McCarthy, Surgical Specialty Clinical for Animals
James D. McKean, Iowa State University
David E. Swayne, USDA Agricultural Research Service
Margaret A. Wild, DOI National Park Service

Although the reviewers listed above have provided many constructive comments and suggestions, they were not asked to endorse the conclusions or recommendations, nor did they see the final draft of the report before its release. The review of the report was overseen by Frederick A. Murphy, University of Texas Medical Branch at Galveston, and George E. Seidel, Jr., Colorado State University. Appointed by the National Research Council, they were responsible for making certain that an independent examination of the report was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of the report rests with the authoring committee and the institution.

PREPUBLICATION COPY

xi

PREPUBLICATION COPY

Copyright National Academy of Sciences. All rights reserved.
This summary plus thousands more available at <http://www.nap.edu>

Contents

EXECUTIVE SUMMARY	1
SUMMARY	3
1 INTRODUCTION	19
2 COMPANION-ANIMAL MEDICINE	25
Companion-Animal Veterinarians, 25	
Lifestyle Benefits of Companion-Animal Medicine, 25	
Demand for Companion-Animal Veterinary Services, 28	
Future Supply of Companion-Animal Veterinarians, 34	
Meeting Future Workforce Demands, 38	
3 EQUINE VETERINARY MEDICINE	43
The Equine Industry, 43	
Equine Veterinarians, 47	
Equine Practices and Earnings, 50	
Future Workforce Needs, 51	
4 FOOD-ANIMAL VETERINARY MEDICINE	55
Introduction, 55	
Industry Consolidation: Changing Demand for Veterinary Services, 58	
The Supply of Food-Animal Veterinarians, 75	
Future Directions in Food-Animal Veterinary Medicine, 84	

5	VETERINARIANS IN INDUSTRY	89
	Introduction, 89	
	Types of Industry Employers, 90	
	Inquiry of Selected Companies, 92	
	Board-Certified Veterinarians: Supply And Demand, 102	
6	VETERINARIANS IN PUBLIC PRACTICE	107
	Introduction, 107	
	Public Practice Veterinarians, 108	
	Federal Agency Employers of Veterinarians, 109	
	Veterinarians in State Government, 113	
	Salaries of Public Practice Veterinarians, 114	
	Future Supply of Public Practice Veterinarians, 116	
	Addressing the Risk of Gaps in the Public Veterinary Workforce, 119	
7	VETERINARIANS IN WILDLIFE AND ECOSYSTEM HEALTH	123
	Introduction, 123	
	Roles of Veterinarians in Wildlife and Ecosystem Health, 127	
	The Future Supply of Veterinarians for Jobs in Wildlife and Ecosystem Health, 141	
8	GLOBAL FOOD SECURITY	149
	Introduction, 149	
	Urbanization in the Developing World, 150	
	Urban Food Security, 151	
	Sustainable Intensification of Food Animal Production, 154	
	The Impact of Infectious Disease on Food Security, 156	
	The Importance of a Global Veterinary Structure, 156	
9	ACADEMIC VETERINARY MEDICINE	161
	Introduction, 161	
	Funding for Veterinarian Education, 163	
	The Evolving Veterinary Curriculum, 163	
	New Concepts in Veterinary Education, 167	
	The Role of Veterinary Faculty, 170	
	Post-DVM Training and Education, 177	
	Research in Academic Veterinary Medicine, 183	
10	AN ECONOMIC PERSPECTIVE ON THE VETERINARY PROFESSION	189
	Introduction, 189	
	The Rate of Return of a DVM Degree, 190	
	Trends in Earnings, 195	

Supply of Graduates, 200
Increasing the Rate of Return of a Veterinary Education, 202

11 CONCLUSIONS AND RECOMMENDATIONS 207
The State of the Veterinary Profession: Another Defining Moment in its History, 207

REFERENCES 221

APPENDIXES

A	COMMITTEE MEMBER BIOGRAPHIES	239
B	SURVEY OF COMPANION-ANIMAL PRACTICE OWNERS	247
C	SUPPORTING MATERIAL FOR CHAPTER 4	253
D	INQUIRY TO SELECTED COMPANIES	281
E	FEDERAL RECRUITMENT TOOLS	286
F	INTENSIVE SHORT COURSES THAT HELP PREPARE VETERINARY STUDENTS AND VETERINARIANS FOR CAREERS IN WILDLIFE AND ECOSYSTEM HEALTH	289
G	ACADEMIC SURVEY OF VETERINARY PERSONNEL	295

PREPUBLICATION COPY

Copyright National Academy of Sciences. All rights reserved.
This summary plus thousands more available at <http://www.nap.edu>

List of Tables, Figures and Boxes

TABLES

S-1	Employed U.S. Veterinarians in 2010	4
S-2	Veterinarians in the Federal Government	9
1-1	Number (2010) and Earnings (2009) of Veterinarians Employed in the United States	21
2-1	Companion-Animal Full-Time Equivalents in 2006	32
2-2	Predicted DVM Full-Time Equivalents Needed in 2016 Based on Committee Estimates	33
2-3	An Estimate of Veterinarians Employed in 2008 Expected to be Working in 2016	35
2-4	Projected Number of Graduates of Accredited Colleges of Veterinary Medicine 2008-2016	35
2-5	Projected Career Paths for Graduates 2008-2016	37
2-6	Estimated Number of 2016 Companion-Animal Full-Time Equivalents from New Graduates	37
3-1	Horse Population by Activity	43
3-2	Equine Practices Devoted to Horses	49
3-3	American Association of Equine Practitioners Membership Attrition Rates by Years in Practice	49
4-1	Number of Farms Producing Pigs, 1994-2006	62
4-2	Changes in Size Structure of U.S. Dairy Farms, 2000-2006	65
4-3	Changes in the Size and Location of U.S. Dairy Farms, 1994-2006	67
4-4	California and Wisconsin: Comparison of Operations, Operations Size, and Members in the American Association of Bovine Practitioners	67
4-5	Size Distribution of U.S. Beef Farms	72
4-6	Use of Veterinary Services by Herd Size in Different Sectors of Beef Industry	73
4-7	Number of U.S. Veterinarians in the American Veterinary Medical Association, membership by Category	77
4-8	Starting Salaries and Mean Debt for New Graduates, 1989-2011	83

PREPUBLICATION COPY

xvii

5-1	Number of Companies that Responded to the Committee Inquiry, by Industry Sector	93
5-2	Veterinarians in Six Contract Research Organizations Responding to Committee Questionnaire	95
5-3	Veterinarians in Nine Animal Health Companies Responding to Committee Questionnaire	95
5-4	Distribution and Expertise of Veterinarians in an Animal Health Products Division of a Pharmaceutical Company (Company A)	96
5-5	Veterinarians in the Human Health Division of Company A	97
5-6	Open, Full-Time Positions for Veterinarians Advertised in 2007 by Companies Responding to the Questionnaire	98
5-7	American College of Laboratory Animal Medicine Diplomates by Employment Sector, 2007	103
5-8	American College of Veterinary Pathology Diplomates by Employment Sector, 2007	101
5-9	Number of Active American College of Laboratory Animal Medicine Members, Retirees, and New Diplomates	105
5-10	Number of Active American College of Veterinary Pathology Members, Retirees, and New Diplomates	105
6-1	Veterinarians in the U.S. Government in 2008 and 2010	110
6-2	2009 Average Annual Salaries of Federal Employees	115
6-3	Reported Mean Salary Levels for Federal Veterinarians	115
7-1	States with Wildlife Agencies that Employ Veterinarians, and Numbers of Veterinarians Employed in 2009	131
7-2	Examples of University-based Wildlife Programs	132
8-1	Past and Projected Trends of Consumption of Livestock Products	153
9-1	Current and Anticipated Demand for Faculty in Veterinary Colleges, Departments of Veterinary Science, and Departments of Comparative Medicine that Responded to the Committee Survey	171
9-2	Specialty Boards Recognized by the American Veterinary Medical Association	175
9-3	Funding for Veterinary Research	184
9-4	National Institute of Health Funding to Veterinary Colleges, 2011	185
10-1	Estimated Average Return for Obtaining a DVM	193
C-1	Food-Animal Workforce, 2001-2007, by State	266
C-2a	Food-Animal-Exclusive Veterinarians: Mean Ages and Percentage over age 50, by State	267

List of Tables, Figures, and Boxes

xix

C-2b	Food-Animal-Exclusive Veterinarians: Mean Ages and Percentage over age 60, by State	268
C-3a	Food-Animal-Predominant Veterinarians Over Age 50	269
C-3b	Food-Animal-Predominant Veterinarians Over Age 60	270
C-4a	Mixed-Food-Animal Veterinarians Over Age 50	271
C-4b	Mixed-Food-Animal Veterinarians Over Age 60	272

FIGURES

S-1	Student debt and mean starting salary for new DVM graduates	5
2-1	1997-2009 Associate mean income by practice sector	27
2-2	Numbers of pets in American households	29
2-3	Average annual expenditure per pet-owning household	29
2-4	Impact of veterinary technicians and assistants on practice revenue	40
3-1	American Quarter Horse Association registrations, 1995-2008	44
3-2	Number of Thoroughbred races in the United States and Canada/Puerto Rico, 1998-2009	45
3-3	Registered Thoroughbred stallions, 2000-2008	46
3-4	Thoroughbred mares bred, 2000-2008	46
3-5	Years in which current American Association of Equine Practitioners members joined the Association	48
4-1	The value of livestock products relative to corn from 2000-2012	58
4-2	Number of hog operations, 1984-2008, in thousands	61
4-3	New members of American Association of Swine Veterinarians, 1966-2006	64
4-4	Number and average size of dairy farms in the United States, 1970-2006	65
4-5	Dashboard analysis tool: How many dairy vets?	69
4-6	Recruitment to the American Association of Bovine Practitioners 1975-2005	71
4-7	Number of all U.S. cattle and beef-cow operations, 1998-2008	71
4-8	United States sheep and lamb population, 1998-2009	74
4-9	U.S. sheep and goat operations in 2007 and 2008	75
4-10	Changes in the composition of the food animal workforce	79
4-11	Age Groups within food-animal-exclusive practice, 2001 and 2007	80
4-12	Age Groups within food-animal-predominant practice, 2001 and 2007	80
4-13	Age Groups within mixed-food-animal practice, 2001 and 2007	80
4-14	Career selection of veterinary graduates entering food animal practice	82
4-15	2009 median incomes of practice owners and associates by category	83
5-1	Average number of veterinarians employed per company by sector	93
7-1	Locations and sponsorship of U.S. and Canadian programs devoted to disease investigations involving free-ranging fauna (state, federal, and university cooperative programs)	129

8-1	Urban and rural fresh dairy product consumption	153
9-1	Survey respondents need for faculty in the basic sciences: number of vacant positions in 2007 and anticipated vacancies in 2010 and 2016 due to retirements, by discipline	174
9-2	Survey respondents need for faculty in the clinical sciences: number of vacancies and openings due to retirements in large and food-animal clinical positions, by discipline	174
9-3	Survey respondents need for faculty: number of vacancies and openings due to retirements in small-animal clinical positions, by discipline	175
9-4	Residency and internship position notifications submitted to the American Association of Veterinary Clinicians, 1988-2009	178
9-5	Total numbers of DVM/VMD and post-graduate students in 2007 and projected for 2010 and 2016, as reported by institutions responding to committee survey	181
9-6	Total numbers of DVM/VMD and post-graduate students in 2007 and projected for 2010 and 2016, as reported by institutions responding to committee survey	182
10-1	Mean incomes in small animal practice	192
10-2	Mean DVM income (in 2006 dollars) in private practice, 1965-2007	195
10-3	Mean starting DVM salaries (in 2006 dollars)	197
10-4	Positions taken immediately after earning DVM, by percentage of DVM respondents	198
10-5	Median career earnings in the health profession	199
10-6	New DVM graduates by year in the United States	201
11-1	Student debt and mean starting salary for new DVM graduates	213
C-1	Food-animal concentrations in counties that have no veterinarians	253
C-2	Changes in population growth between 1990 and 2000 for the 3,141 counties and equivalent areas in the United States	254
C-3	Distribution of the 1,011 food-animal-exclusive veterinarians in the United States, 2007	255
C-4	Distribution of the 3,861 food-animal-predominant veterinarians in the United States, 2007	250
C-5	Distribution of the 4,200 mixed-food-animal veterinarians in the United States, 2007	257
C-6a	Distribution of egg-laying industry in the United States, 2007	258
C-6b	Distribution of broiler industry in the United States, 2007	259
C-7	Changes in the U.S. hog and pig inventory, 1992-1997	260
C-8	The changing pork industry in Iowa, 1987 and 2002	261
C-9	Milk-cow population, change in inventory, 2002-2007	262
C-10	Beef-cows inventory, 2007	263
C-11a	Meat-goat and other goat inventory	264
C-11b	Dairy-goat inventory, 2007	265
C-12a	Distribution of food-animal-exclusive veterinarians over age 50	273
C-12b	Distribution of food-animal-exclusive veterinarians over age 60	274

List of Tables, Figures, and Boxes

xxi

C-13a	Distribution of food-animal-predominant veterinarians over age 50	275
C-13b	Distribution of food-animal-predominant veterinarians over age 60	276
C-14a	Distribution of mixed-food-animal veterinarians over age 50	277
C-14b	Distribution of mixed-food-animal veterinarians over age 60	278

BOXES

1-1	Statement of Task	22
2-1	Pet Insurance	30
2-2	Calculation of Companion-Animal, Full-Time Equivalent Veterinarians	31
4-1	Changes in American Veterinary Medical Association Membership Data	76
5-1	Perceived Factors that Drive the Demand for Veterinarians in Industry	99
7-1	Excerpts from the Executive Summary of <i>One Health - A New Professional Imperative</i>	125
7-2	The Manhattan Principles on “One World, One Health”	126
7-3	Defining the Role of the Wildlife Veterinarian	132
7-4	Cross-Sectorial Approach to Emerging Infectious Diseases	143
7-5	Knowledge and Career Competencies in Wildlife and Ecosystem Health	145
8-1	Rinderpest Eradication: A Success Story	157
9-1	Standards for Accreditation from the American Veterinary Medical Association	163
9-2	Increasing Number of Masters Programs	183
10-1	Possible Reasons for Differences in the Earnings of Male and Female DVMs	194
10-2	Accreditation of Veterinary Medical Colleges	204
10-3	Addressing Vacancies in Government Service	205

PREPUBLICATION COPY

PREPUBLICATION COPY

Copyright National Academy of Sciences. All rights reserved.
This summary plus thousands more available at <http://www.nap.edu>

Acronyms

AABP	American Association of Bovine Practitioners
AAEP	American Association of Equine Practitioners
AASV	American Association of Swine Veterinarians
AAVC	American Association of Veterinary Clinicians
AAVMC	Association of American Veterinary Medical Colleges
AAWV	American Association of Wildlife Veterinarians
AAZV	American Association of Zoo Veterinarians
ACLAM	American College of Laboratory Animal Medicine
ACPV	American College of Poultry Veterinarians
ACVP	American College of Veterinary Pathologists
AHC	American Horse Council
AHI	Animal Health Institute
ASLAP	American Society of Laboratory Animal Practitioners
APHIS	Animal and Plant Health Inspection Service (U.S. Department of Agriculture)
AVMA	American Veterinary Medical Association
BSE	bovine spongiform encephalopathy
CDC	U.S. Centers for Disease Control and Prevention
CPDF	Central Personnel Data File (Office of Personnel Management)
CRO	Contract Research Organization
DHS	U.S. Department of Homeland Security
DOI	U.S. Department of the Interior
DVM	Doctor of Veterinary Medicine
ECFVG	Educational Commission for Foreign Veterinary Graduates
EPA	U.S. Environmental Protection Agency
FAD	foreign-animal disease
FAO	Food and Agriculture Organization of the United Nations
FDA	U.S. Food and Drug Administration
FMD	foot-and-mouth disease
FSIS	Food Safety and Inspection Service (U.S. Department of Agriculture)
FSVMC	Food Supply Veterinary Medicine Coalition
FTE	full-time equivalent
FWS	Fish and Wildlife Service (U.S. Department of the Interior)
GAO	Government Accountability Office
GCP	good clinical practice

GLP	good laboratory practice
HHS	U.S. Department of Health and Human Services
HPAI	highly pathogenic avian influenza
H1N1	influenza A (H1N1) 2009 (“swine flu”)
IAAAM	International Association for Aquatic Animal Medicine
LA	large-animal
LAE	large-animal exclusive
LAP	large-animal predominant
MPH	Master of Public Health
NCRR	National Center for Research Resources (National Institutes of Health)
NGO	non-governmental organization
NIFA	National Institute of Food and Agriculture (U.S. Department of Agriculture)
NIH	National Institutes of Health
NPS	National Park Service
NRC	National Research Council
NWHC	National Wildlife Health Center (U.S. Geological Survey)
NWRA	National Wildlife Rehabilitators Association
OSHA	Occupational Safety and Health Administration (U.S. Department of Labor)
SARS	severe acute respiratory syndrome
SETAC	Society of Environmental Toxicology and Chemistry
STP	Society of Toxicologic Pathology
T-MAC	Talent Management Advisory Council
USAID	U.S. Agency for International Development
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
VMCAS	Veterinary Medical College Application Service
VMD	Veterinariae Medicinae Doctoris
VMO	Veterinarian Medical Officer
WCS FVP	Wildlife Conservation Society’s Field Veterinary Program
WDA	Wildlife Disease Association
WHO	World Health Organization