

Robert Dyar Labrador Memorial Lectureship
in Epidemiology

Improving Global Health in the 21st
Century:

Veterinary Medicine Stepping Up
to the Plate to Protect
Human Health and Well Being

Marguerite Pappaioanou, DVM, MPVM, PhD



"And it was so typically brilliant of you to have invited an epidemiologist."

“And it was so typically brilliant of you to have
invited an epidemiologist.”



Veterinary Medicine is a Human Health Activity.



Acknowledgements

Calvin Schwabe
Richard Tjalma
James Steele
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Kammy Johnson
Kim Blindauer
Kate Glynn
Tracee Treadwell
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Michele Jay



Veterinary Oath

".... I solemnly swear to use my scientific knowledge and skills **for the benefit of society** through the *protection of animal health*, the *relief of animal suffering*, the *conservation of livestock resources*, **the promotion of public health** and the *advancement of medical knowledge*."



Unprecedented Opportunity

- Public awareness and focus on food safety
- Bioterrorism / Biodefense
- West Nile Virus- zoonotic emerging diseases - antibiotic resistance
- Concerns for the environment and biodiversity



Improving Global Health in the 21st
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Public Health

" is what we, as a society, do
collectively to assure the
conditions in which people
can be healthy."

Institute of Medicine, *The Future of Public Health*, 1988



On veterinary medicine and public health.. RA Tjalma, 1959

“Responsibility for the public health is not vested in any one group of individuals.”

“Veterinary medicine.... has certain obvious and well-defined public health responsibilities.”

“The veterinary clinician in practice has, in many instances, a well-defined responsibility for the health of his client as well as the health of his patient.”

The British Veterinary Journal.
215: 265-270.



The Vision of Dr. Richard Tjalma, 1959, Continued

“The future of veterinary public health is limited only by the ability of the profession to recognize its opportunities and accept its responsibilities.”



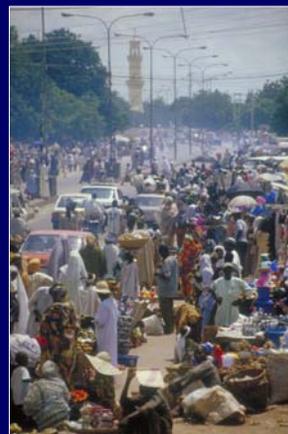
“Human health provides the most logical unifying or apical cause in veterinary medicine’s hierarchy of values”

Calvin Schwabe, Veterinary Medicine and Human Health, 1984

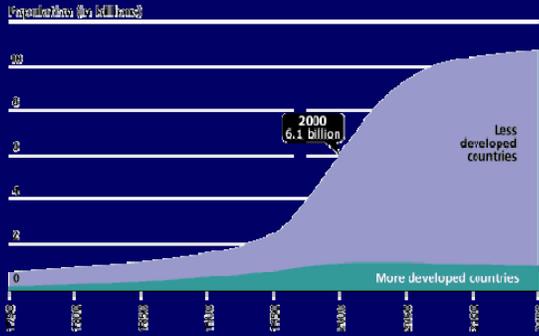


Driving World Forces and Their Impact on Veterinary Medicine

- Rapidly increasing human population and urbanization
- Globalization of trade and movement of people
- Increased access to information



Rapidly Increasing Human Population



- 6.1 Billion people in 2000
- ~9.4 to 11.2 Billion in 2050

Source: United Nations, *World Population Prospects, The 1998 Revision*; and estimates by the Population Reference Bureau.



Rapidly Increasing Urbanization



- 2000
 - 47% world population living in urban areas
- 2030
 - 60% world population living in urban areas



Impact of Human Population Growth and Urbanization

- Human to human relationships are changing
- Human relationships with animals changing
 - Food animals
 - Wildlife
 - Companion animals
- Human health and well being take precedence



Protecting Human Health and Well being

- Food Security
- Safe Food and Water
- Healthy Environment
- Healthy Ecosystems
- Emerging Diseases, Zoonoses
- Bioterrorism/ Defense
- Companion Animals
- Public Health Infrastructure
- Advances in medical science





Food Security and Safety

Source: New York Times Magazine, April 1, 2002



Foodborne Infections

- Worldwide
 - > 2 million people die from diarrhea caused by contaminated food and water each year
- U.S.
 - ~ 76 million persons experience foodborne illnesses (1 in 4 people)
 - ~325,000 hospitalizations
 - ~5,000 deaths

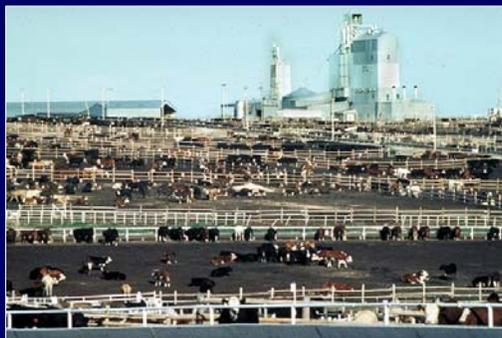


The Paradigm Has Changed

- Outbreaks of E. coli 0157:H7 with serious illness and deaths in young children
- Massive recalls of meat and ice cream
- vCJD and BSE in the UK
- Globalization; massive movement of livestock, poultry, fish across borders
- Zoonotic pathogens in healthy food animals (e.g., E. coli 0157, Campylobacter, Salmonella, Yersinia enterocolitica)



Intensity and Consolidation of Food Animal Production



- More animal protein needed with increasing human population
- Want healthy animals but not at cost of risks to human health



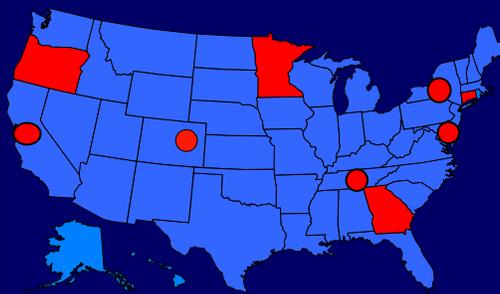
Call for Veterinary Leadership

- HACCP
 - Anticipates foodborne hazards
 - Institutes controls to prevent their occurrence in meat and poultry slaughter and processing plants
- Surveillance in humans and food animals
- Reduce prevalence of pathogens in animal reservoirs
 - Develop and implement effective on-the-farm preventive interventions
- Minimize antibiotic resistance



FoodNet

Active Sentinel Surveillance for Foodborne Infections in the US

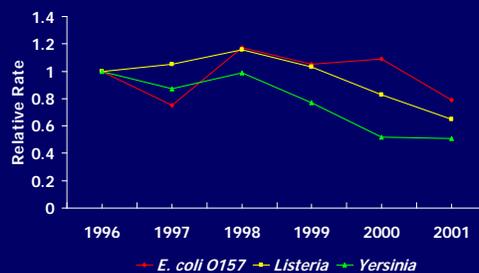
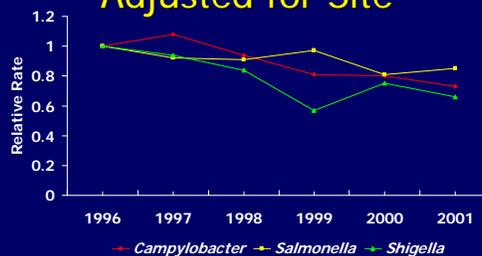


- Campylobacter
- E. coli O157
- Salmonella
- Listeria monocytogenes
- Vibrio
- Shigella
- Yersinia enterocolitica
- Cryptosporidium parvum
- Cyclospora cayetanensis
- Hemolytic Uremic Syndrome

13% of US Population



Preliminary FoodNet Data, 2001 Change in Incidence Relative to 1996, Adjusted for Site



Concerns about Increasing Antimicrobial Resistance

- Increasing treatment failures for invasive salmonella infections in humans
- Few alternative antibiotics of choice for treatment (predominantly children)



Factors Contributing to Antimicrobial Resistance

- Pathogen mutations; genetic exchange
- Selective pressures in hospitals, nursing homes, day care centers, etc.
- Inappropriate and over use of antibiotics in human outpatient settings
- Use of antibiotics in food animals for disease control and growth promotion

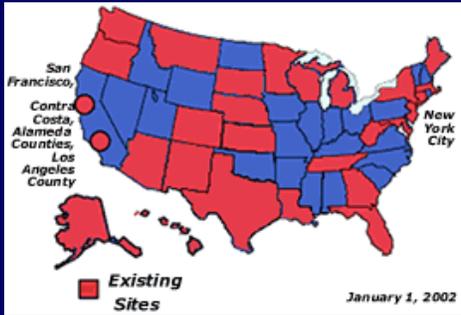


Call for Veterinary Leadership

- Institute veterinary consultation when antibiotics are used
- Develop and implement on-the-farm interventions to reduce need for antibiotics
- Monitor antibiotic resistance, in humans and food animals, for trends over time
 - Evaluate effectiveness of interventions
 - Conduct follow-up studies to add to body of knowledge
- Monitor antibiotic use practices
- Advise on recommendations and guidelines, with human health highest priority



National Antimicrobial Resistance Monitoring System (NARMS)



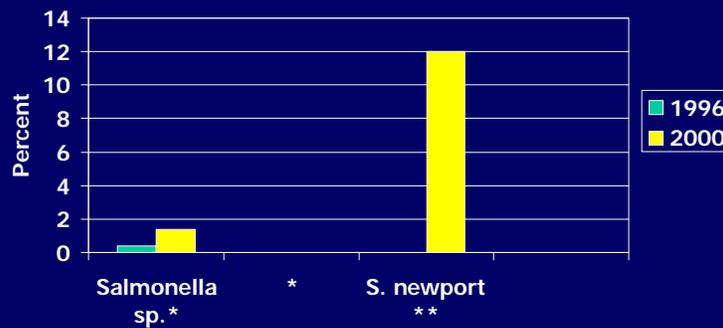
- Human
 - 27 sites; ~50% US population
 - 17 antimicrobials
 - Salmonella, Listeria, E. coli O157, Vibrio, Campylobacter, Shigella
- Animal
 - Cattle, swine, chicken, turkeys, exotics, dogs, horses, cats
 - 17 antimicrobials
 - Salmonella, Campylobacter, E. coli

CDC, FDA/CVM, USDA/NVSL, Selected State Health Departments



Selected Trends, NARMS, 1996-2000

Percent Salmonella Isolates Showing Resistance

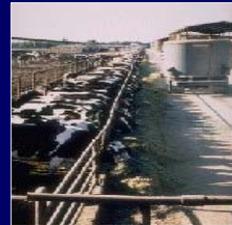


* To Ciprofloxacin

**To multiple agents including ceftriaxone



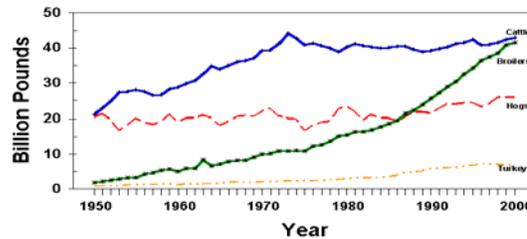
Concentrated Animal Feeding Operations (CAFOs)



Their Impact on Food Safety and Healthy Environments



CATTLE, BROILERS, HOGS, TURKEYS
POUNDS PRODUCED, 1950-2000



USDA-NASS
0401

Number of Farms: 1900 - 1997



Concentrated Animal Feeding Operations

- ~ 450,000 in US
- 132 million metric tons waste (1997)
- Untreated manure applied directly to land as fertilizer or soil amendment, or discharged or leaked from storage lagoons
 - Zoonotic bacteria, viruses, protozoa; chemicals/agents including nitrates; antimicrobials; algae



Poor Outcomes for Human Health and Well Being

- Agricultural runoff greatest source of pollution for ~ 60% of "unfit" waterways in the US
- 40% of US surface water unfit for drinking, fishing, swimming, aquatic life
- Many disease outbreaks caused by contaminated drinking water, recreational water, and food
- Possibly chronic exposure to chemicals and agents via contaminated groundwater – health effects unknown



Veterinarians Protecting Healthy Environments



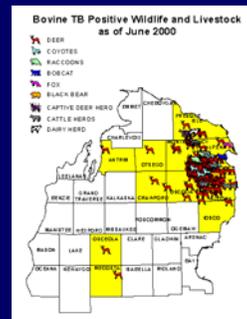
Veterinary Leadership in Responding to Environmental Health Concerns

- Harmful algal blooms
- Chemicals, disinfectants, pharmaceuticals in drinking water
- Exposures to pesticides and toxins
- CAFOs
- Chemical Terrorism Response
- Disaster Epidemiology and Assessment (Human/ Natural)
- Exposures to excessive noise, heat and cold
- Cancer Clusters



Ecosystem Threats

- Human encroachment; movement of people
- Increased human contact with wilderness habitats
- Irrigation, deforestation altering habitats, animal & vector populations
- Human interventions/behaviors affecting patterns of disease transmission



“By Leaps and Bounds, Monkeys Overrun Japan”

Story by James Brooke,
NY Times, April 12, 2002



Manatees Fighting for Survival





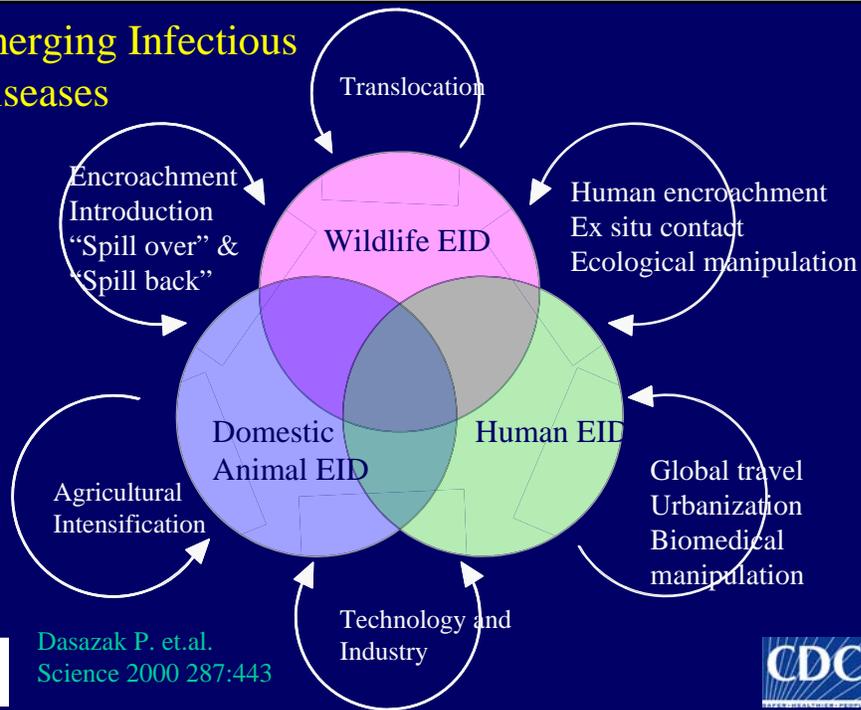
Veterinarians Protecting Healthy Ecosystems



US Fish & Wildlife Service file via AP



Emerging Infectious Diseases



Daszak P. et.al.
Science 2000 287:443



Zoonotic Tuberculosis – A Risk to Rural African Communities?

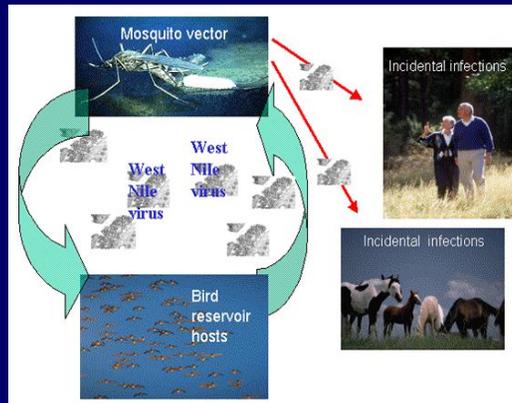
- Community cattle in contact with M. Bovis infected African Buffalo
- Unknown BTB Status
- Human consumption of unpasteurized milk
- Close contact with cattle
- High HIV prevalence
- Limited awareness



Source: Dr. Anita Michel,
ARC-Onderstepoort Veterinary Institute



Emerging Infectious Diseases



Infectious Diseases

- Major cause of death in the world
 - 14 million (25%) global deaths (WHO) annually
- Affect all people, regardless of age, gender, lifestyle, ethnic background, SES
- Cause suffering and death, and financial burdens on societies; affect economic development in poor countries



Major Disease Outbreaks in Humans, 1990's

- Cryptosporidia, municipal drinking water, Milwaukee WI, 1993
- Hantavirus, rodents, SW U.S., 1993
- Plague, India, 1994
- Ebola, Zaire (DRC), 1996
- vCreutzfeldt-Jacob Disease, Cattle, 1996
- Avian Influenza A, Chickens, Hong Kong, '97
- West Nile Virus, Birds, New York, 1999
- Nipah Virus, Swine, Malaysia, Singapore, 1998
- Anthrax bioterrorism, Florida, New York, New Jersey, 2001



Infectious Organisms Pathogenic to Humans and Percent Zoonotic

Type of Pathogen		# Zoonotic (%)
Viruses & Prions	217	165 (76%)
Bacteria & Rickettsia	538	269 (50%)
Fungi	307	113 (37%)
Protozoa	66	43 (65%)
Helminths	287	278 (97%)
Total	1,415	868 (61%)

Source, Taylor LH et al. 2001; *Phil. Trans. R. Soc. Lond. B.*
Vol. 356:983-989



Emerging Infectious Organisms Pathogenic to Humans, That are Zoonotic

Type of Pathogen		# Zoonotic (%)
Viruses & Prions	77	
Bacteria & Rickettsia	53	
Fungi	16	
Protozoa	19	
Helminths	10	
Total	175	132 (75%)

Source, Taylor LH et al. 2001; *Phil. Trans. R. Soc. Lond. B.*
Vol. 356:983-989



Examples of Veterinary Leadership

- **West Nile Virus**
 - Detection; Surveillance of epidemic in birds; Clarifying role of horses
- **Nipah Virus in Malaysia and Singapore**
 - Epidemiology on farms, in swine, slaughterhouses
- **Pneumonic tularemia, Massachusetts**
 - Identification of new risk factors for human infection
- **Hantavirus, SW U.S.**
 - Epidemiology, surveillance, prevention
- ***Plasmodium falciparum* malaria, Africa, Asia**
 - Effectiveness of antimalarials, national treatment policies



Knowledge and Skills Needed for Veterinary Leadership in Healthy Environments, Ecosystems and Emerging Infectious Diseases

- **Epidemiology, population and comparative medicine**
- **Public health**; environmental toxicology, zoonotic, foodborne, emerging diseases, surveillance, disease prevention and control
- Wildlife disease management, natural resource use, and conservation (Terrestrial and Marine)
- Urban and environmental policy and planning
- Economics, policy analysis
- Communities' relationships with animals
- Counseling in efficient animal production, manure management
- Risk Assessment, Management, Communication



10TH GUARD
GENERAL HOSPITAL
FRENCH PARK NJ 08822

SENATOR LEAHY
433 RUSSELL SENATE OFFICE
BUILDING
WASHINGTON D.C. 20520-4902

Information for Persons
Who May Have Been
Exposed to Anthrax
(*Bacillus anthracis*)

Anthrax Information
for Health Care Providers

RECOGNIZING
INHALATION
ANTHRAX

ANTHRAX
INFORMATION FOR
LABORATORY
PERSONNEL

CDC

Bioterrorism Biodefense Agroterrorism

Veterinary Leadership in Anthrax Bioterrorism Response

- Surveillance for human disease
- Participated in decision making
- Environmental cleanup- Capitol Hill

CDC

Agents of Bioterrorism

Category	Bacteria, Rickettsia, Toxins	Viruses	Total (% Zoonotic)
A	Anthrax; Botulism; Plague; Tularemia	Smallpox Viral Hemorrhagic Fevers	6 (83%)
B	Brucellosis; Epsilon toxin of <i>C. perfringens</i> ; Glanders; <i>Staphylococcus</i> , enterotoxin B; Q Fever		5 (80%)
C	Multidrug-resistant tuberculosis	Hantaviruses; Nipah virus; Tickborne encephalitis viruses; Yellow Fever	4 (80%)



Veterinary Leadership in Preparation, Prevention, Response

- Disease surveillance in humans and animals
 - Participation of veterinary diagnostic and animal health laboratories, zoonotic infections
 - Reporting by wildlife/zoo, food, companion, equine animal practitioners on important vectors, animals with diseases of public health and foreign animal health importance
 - Reporting by veterinary pathologists
 - Syndromic surveillance in humans





Companion Animals



Benefits of Companion Animals

- Friendship
- Emotional support
- Reduce blood pressure
- Promote physical activity
- Eyes for the Blind
- Ears for the Deaf
- Seizure-Alert
- Legs and "hands" for the disabled
- Therapy for the Unwell
- Search and rescue
- Sport and recreation
- Detect meat and agricultural products
- Detect contraband
- Track quarry



Percent Households with Pets in the US



- Owning dogs: 32%
- Owning cats: 27%
- Owning dog or cat: > 50%

Source: AVMA, U.S. Pet Ownership & Demographics Sourcebook, 1997



Utilization of Veterinary Services by Pet Owners



- Owners using services of veterinarian in previous two years:
- Dog: 88.7%
- Cat: 72.9%
- Horse: 66.3%
- Bird: 15.8%



Source: AVMA, U.S. Pet Ownership & Demographics Sourcebook, 1997



Human Diseases and Injuries with Serious Health Consequences Acquired from Dogs and Cats

- Dog bite injuries
- Cat scratch disease
- Toxocaral Larva Migrans
- Congenital toxoplasmosis



An opportunity to promote public health..

Recommendations for Veterinarians



How To Prevent Transmission of Intestinal Roundworms from Pets to People

These guidelines address transmission of intestinal ascariids and hookworms from dogs and cats to people and recommend counseling of dog and cat owners and well-timed preventive anthelmintic treatments for pets.

TERRY FINLEY

CDC/NCID

AAVP
American Association of
Veterinary Parasitologists

- Counsel pet owners about zoonotic infections and how to prevent them
- Treat pets for Toxocara, hookworms, other parasites; immunize pets against rabies and other diseases
- Advocate community measures to reduce the burden of toxocara eggs in the environment
- Reduce numbers of stray, unwanted, rejected animals



Prevention Information on CDC's Web Site

<http://www.cdc.gov/ncidod/diseases/pets/index.htm>



Veterinarian's on the Front Line Can Prevent This from Happening



Dog Bite Injuries

- Estimated 4.7 million bites per year
- 800,000 require medical care
 - 446,000 non-emergency care visits
 - 321,000 emergency room visits
 - 13,000 hospitalizations
 - 20 fatalities
- > \$250 million per year



Call for Veterinary Leadership

- Assist owners on pet selection
- Provide behavioral counseling

www.cdc.gov/safeusa/dogs/dogs.htm



"Good Clinical Practice"



- Thorough history
- Thorough physical exam
- Provide preventive care
 - Vaccinations
 - Fecal examination, de-worming
- Treat as needed
- Counsel on public health

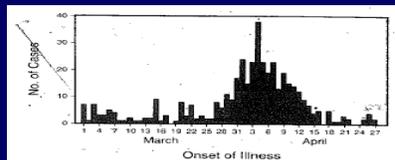


Figure 3. Reported Date of the Onset of Watery Diarrhea during the Period from March 1 through April 29, 1993, in 436 Cases of Infection Identified by a Random-Digit Telephone Survey of the Greater Milwaukee Area.

Public Health Surveillance



Domestic and Global Disease Prevention and Control

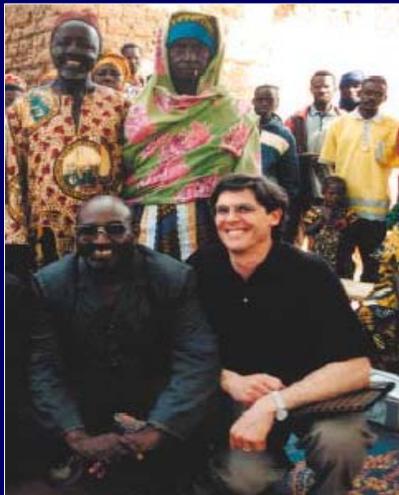


Selected Non-zoonotic Contributions

- Public Health Surveillance and Informatics
- HIV/AIDS Surveillance (Dr. Kate Glynn)
- Vaccine Preventable Diseases
- Data standards, NCHS
- Antimalarial drug effectiveness (Dr. Peter Bloland)

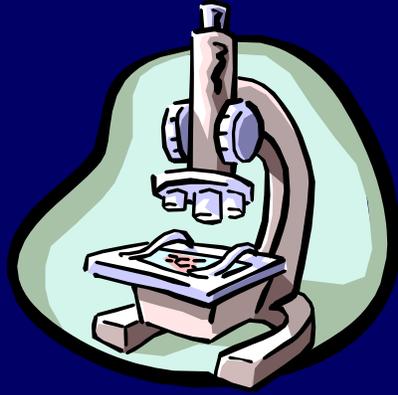


NGOs – Global Health



- Dr. Jim Zingeser, Carter Center, Atlanta
- Chief Technical Officer on Trachoma Control Program





Advances in Medical Science



Advancing Medical Research

- Principal and co- investigators in research for all areas mentioned
- Animal Models, collaboration with other health sciences
- Development of vaccines
- Nutrition and chronic diseases
- Xenotransplantation
- Genomics
- Diagnostic tools
- Other
- Laboratory animal veterinarians





How Are We Doing, as a Profession, in Stepping Up to the Plate?



Numbers, Distribution, Commitment

- Too few working in public health right now
- Too few upcoming veterinarians interested in disciplines outside of companion animal medicine (we need more!)
 - ~ 75,000 veterinarians in the US
 - ~ 75% in private clinical practice (6-8% interested in food animal)
 - > 6% are in teaching and research
 - Regulatory medicine, Public Health, Private Industry, Uniformed Services



U.S. Veterinarians in Public Health

- Private practitioners
- Local/County Health Departments
- State Health Departments
- Federal Government
 - DHHS: CDC, FDA, NIH
 - USDA: APHIS and FSIS
 - EPA
 - DoD
- Colleges of Veterinary Medicine, Medicine, Schools of Public Health
- Industry/Drug Companies (Human/Animal)
- NGOs



State Public Health Veterinarians



- Main link between human, agriculture, wildlife health
- Surveillance for zoonotic diseases
- Prevention and control of zoonotic diseases



California Public Health Veterinarian Veterinary Public Health Section

- Rabies prevention and control
- Bacterial (brucellosis, leptospirosis, tularemia), Parasitic, Viral and Rickettsial (West Nile surveillance)
 - Psittacosis Control Program
 - Turtle salmonellosis
- Animal bites
- Food safety
- Wild Animal Importation Program



Veterinarians at CDC

- ~ 80 veterinarians currently at CDC (~2% of professional workforce)
 - Epidemiologists/Programs/Management ~ 70
 - Laboratory Animal Medicine ~ 3-5
 - Epidemic Intelligence Service Officers~8
- 189 (9%) of 2,104 EIS Officers, 1951-2002
- 118 since 1977: 80% employed by federal and state governments; 20% academic positions, industry, other



Where Veterinarians Are Employed at CDC

- National Center for Infectious Diseases
 - Bioterrorism
 - Foodborne and Diarrheal Diseases
 - Food Safety
 - Meningitis and Special Pathogens
 - Bacterial Zoonoses
 - Viral and Rickettsial Diseases
 - Vector-Borne Infectious Diseases
 - Parasitic Diseases
 - Global Migration and Quarantine



Where Veterinarians are Employed at CDC

- Environmental Health
- Injury Prevention and Control
- National Immunization Program
- HIV/STD/TB Prevention
- National Center for Health Statistics
- Occupational Safety and Health
- Chronic Disease Prevention and Promotion
- Epidemiology Program Office, Office of Global Health



Developing Leaders for Tomorrow Innovative Programs at US Veterinary Colleges

- Preventive Veterinary Medicine and Public Health Degree Programs
- Food Safety
- Environmental Toxicology
- Healthy Ecosystems and Emerging Diseases
- International Programs



Challenges



- Our own limited and narrow perception of what "veterinarians do"
- Our lack of confidence in multidisciplinary settings
- Our tendency to communicate solely within the profession
- Our hesitation to provide leadership on controversial issues, speak out, take risks
- Our tendency to wait to be invited by others
- Letting demand for veterinary services be shaped by others rather than develop and implement our vision



Current and Future Market for Veterinarians and Veterinary Medical Services, U.S., 1999, KPMG Mega Study

“Some growth is expected in the small but important areas of public health, environment, and food safety...”

We learned that the veterinarians' role in these areas is not generally recognized or understood by consumers.”



Public Awareness of Veterinarian's Role, KPMG Report, 1999

Awareness that Veterinarian's Work in	Non-pet Owners	Pet Owners	Horse Owners	DVMs/ VMDs
Food Safety	11%	17%	37%	?
Environmental Health	28%	33%	47%	?
Public Health	17%	24%	34%	?



WHO/FAO Expert Committee on Veterinary Public Health, 1975

"... because veterinarians are not involved in the care of human patients in the hospital or the clinic, the veterinarian's health science role is not fully understood by many of those who visualize the health sciences as functioning almost exclusively in that setting."



Challenges



- Our own limited and narrow perception of what we do
- Our lack of confidence in multidisciplinary settings
- Our tendency to communicate solely within the profession
- Our hesitation to provide leadership on controversial issues, speak out, take risks
- Our tendency to wait to be invited by others
- Letting demand for veterinary services be shaped by others rather than develop and implement our vision



Composition of Selected Institute of Medicine Committees

IOM Report	# Committee Members	# Veterinarians
Future of Public Health, 1988	22	0
Emerging Infections, 1992	19	0
Biological Threats and Terrorism, 2002	27	0
The Emergence of Zoonotic Diseases: Understanding the Impact on Animal and Human Health, 2002	18	0 (8 of 24 speakers)
Assuring the Health of the Public in the 21 st Century, 2003	15	0



Challenges



- Our own limited and narrow perception of what we do
- Our lack of confidence in multidisciplinary settings
- Our tendency to communicate solely within the profession
- We have not earned the trust of other partners to put public health first
- Our hesitation to provide leadership on controversial issues, speak out, take risks
- Letting demand for veterinary services be shaped by others rather than develop and implement our vision



"The Best Way to Predict the
Future is to Create It."

Source, Poster on Innovation



".....What are you veterinarians
going to do for the public health?"

Dr. Joseph Mountin, Assistant Surgeon
General, US Public Health Service, to Dr.
James Steele, 1947



We will--

- Protect human health and well being in all that we do
- Demonstrate by deed as well as by word that public health is our highest priority.
- Say YES, when asked to contribute
- Prove that we can be trusted to come through when needed



We will

- With confidence and commitment, share what we know, speak up, participate, lead!
- Participate in national, international **multidisciplinary** meetings
- Publish manuscripts in cross-disciplinary journals; address public health implications of findings.



We will....

- Seek positions of responsibility, influence, and authority
- Bring expertise in human, agriculture, and wildlife together to solve problems important to human and animal health



We will

- Recruit and accept larger number of students into veterinary colleges expressing interest in different options; support and reward them.
- Communicate with veterinary students at the earliest time possible that there are different fields to consider, all of equal value
- Provide basics in epidemiology and public health in curricula such that graduates can fulfill our responsibility to promote public health



We will....

- Recruit veterinarians for graduate work in special programs and public health.
- Recruit veterinarians to apply and enter CDC's Epidemic Intelligence Service.
- Recruit qualified veterinarians to apply for positions in local, State, Federal agencies, Academia, Industry, NGOs.



We will...

- Broaden the view of the profession as to what veterinarians do
- Bring stakeholders together, develop and implement strategic plan, with realistic objectives, outcomes, activities defined.
 - Accreditation
 - Licensing
 - Specialty Boards and Colleges
 - Practice Standards
 - Continuing Education



Fundamental knowledge and skills needed for success

- Clinical skills, comparative medicine
- Epidemiology, public health, population medicine.
- Problem solving
- Interpersonal skills
- Work effectively in multidisciplinary teams
- CONFIDENCE
- Communication skills
- Leadership, Management, Flexibility/Change
- Political skills



Final Thoughts

- Veterinary Medicine is a human health activity
- Human health and well being must be our highest priority, we must act unwaveringly on that commitment in all that we do
- Veterinary medicine protects human health and well being through several pathways, all valuable
- We must broaden the perspective of what veterinarians do



Final Thoughts

- Talented veterinarians are providing leadership in all aspects of our profession
- Substantial opportunities exist for veterinarians to step up to the plate and make a difference
 - We need greater numbers of veterinarians to work in all these fields



Step Up to the Plate and
"Just Do It"

