Veterinary Public Health: Role of Veterinarians in Public Health

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Workshop on Integrating One Health Concept Among Public Health Personnel
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Veterinarians & Medical Practitioners

• Both have biomedical and clinical sciences background
• Vets are familiar with multiple species → trained in comparative medicine
• Both are taught epidemiology, preventive medicine, population / herd / flock health
• Vets are also taught animal production, animal health economics, vet public health
However, Vets are generally perceived as.....

- Vets – focused on pets, farm/food and exotic animals
- Vets – tied to agriculture issues
- Vets – associated with wildlife and conservation issues

→ obscured the view that vets can contribute to human medicine and health
Healthy animals – Healthy man

• Human health is inextricably linked to animal health and production.
• This link between human and animal populations, and with the surrounding environment, is particularly close where animals provide food / proteins (meat, eggs and milk), means of transportation, draught power, fuel, clothing, sources of income, companionship, recreational activities, .....
Public Health & Veterinary Public Health

• Public health refers to all organized measures (whether public or private) to prevent disease, promote health, and prolong life among the (human) population as a whole.

• Veterinary Public Health (VPH) is "the sum of all contributions to the physical, mental and social well-being of humans through an understanding and application of veterinary science“ .....WHO

• the common goal is to promote and protect human health
Veterinary Medicine Is Public Health

Michael J. Blackwell • Rebecca L. Leap

ABSTRACT
The symposium Partnerships for Preparedness: Future Directions of Schools of Public Health and Colleges of Veterinary Medicine documents the importance of further integration between the fields of veterinary medicine and public health to protect our nation from public-health emergencies. Current areas targeted for improved collaboration include academic programs, public policy, workforce training, and research.

Key words: veterinary medicine, public health, veterinary education

THE SYMPOSIUM
The Association of American Veterinary Medical Colleges and the Association of Schools of Public Health recently sponsored the first joint symposium on public health and veterinary medicine, held in April 2007. This event was driven by the mutual understanding that gaps between the two professions impede our ability to improve our nation's preparedness for public-health emergencies. Emerging and re-emerging infectious diseases, as well as threats of bio- and eco-terrorism, can be addressed effectively only through better collaboration among health disciplines. The contents of the papers presented at this symposium and appearing in this issue of the Journal of Veterinary Medical Education represent an important step toward more effective collaboration.

Four general areas for improved collaboration have been identified: academic programs, public policy, workforce training, and research. The symposium shed light on the efforts of current veterinary programs to enhance public-health training by providing joint degree programs and improving public-health instruction within the veterinary curriculum. Additional sessions addressed the advantages of having colleges of veterinary medicine and schools of public health pursuing opportunities to improve public policy in the areas of zoonotic disease surveillance, food safety, and the One Health initiative. In addition, sessions on workforce training highlighted the current shortage of individuals in veterinary medicine and public health as well as current and future employment opportunities in these areas. Lastly, research sessions addressed the contributions of both veterinary medicine and public health in areas such as zoonotic diseases and the One Health initiative.

Over the past century we have learned that many pathogens are shared among animals and humans. Of the diseases of most concern today, especially given the possibility of intentional infection of people and animals, approximately 75% are zoonotic. Clearly, any effort to conduct effective surveillance and monitoring and to diagnose these diseases accurately and rapidly must include veterinarians. The front line of defense of human health is found in most places where veterinarians practice each day, whether as private or as public practitioners. Veterinarians serve as a surveillance system by diagnosing, monitoring, and controlling diseases in animal populations. Approximately 63% of veterinarians are engaged in private clinical practice. Veterinarians in food-animal medicine are more often on the front line of defense because their knowledge and skills are applied directly to safeguarding the supply of animal products. These veterinarians help ensure the production of our vital animal-agriculture economy, which in 2001 constituted 12.3% of the nation's gross domestic product. However, we must also recognize the role of companion-animal veterinarians in the control of numerous zoonotic diseases that potentially threaten human well-being through contact with companion animals.

Veterinarians engaged in public practice currently represent only 20% of all veterinarians in the United States, and even fewer are engaged in research. Veterinarians employed in regulatory medicine are essential to the protection of the nation's food system. Individuals in these positions are involved in the development, implementation, and enforcement of regulations to provide safe and reasonably priced food while also protecting the environment. Although advancements in the nation's health have been due in part to regulatory medicine, improved communication among agencies and diagnostic laboratories is necessary to further decrease the nation's vulnerability. Coupled with these advancements is the urgent need to train more veterinarians in all fields. Yet our veterinary classrooms are at capacity. Limited recruitment and financial support is provided for veterinary colleges and schools, especially through federal funding, the current shortage of veterinarians will grow more serious. Of particular concern is the likely decrease in the number of veterinarians engaged in regulatory and food-animal medicine: at least 40% of graduating veterinarians currently enter companion-animal practice, while only about 14% enter large- or mixed-animal practice and less than 3% pursue regulatory medicine. Without new efforts in recruitment and changes in veterinary medical curricula, this misdistribution is likely to worsen.

The relationship between humans and animals is continually evolving, which places private practice veterinarians in a vital position to influence public health. The One Health initiative promoted by Roger Mahr, president of the American Veterinary Medical Association, is devoted to improving the health of all species through the effective integration of human and veterinary medicine as well as
Veterinary Medicine is Public Health

- AAVMC and ASPH (2007)
- Mutual understanding of gaps between the two professions impede ability to improve the nation’s preparedness for public health emergencies
- Four areas for improved collaboration identified – academic programmes, public policy, workforce training, research
- To improve areas in zoonoses surveillance, food safety and One Health initiative
Dr. Calvin Schwabe’s vision of “One Medicine” has long inspired many in the public health community to strive toward bringing human and veterinary medicine together to improve the public’s health and well-being around the world.

Veterinarians in all aspects of the profession have opportunity and responsibility to protect the health and well-being of people in all that they do, including protecting food security and safety; addressing threats to antibiotic sensitivity; preventing and controlling zoonotic emerging infectious diseases; protecting environments and ecosystem participating in bio- and agro-terrorism preparedness and response; using their skills to confront non-zoonotic diseases (such as malaria, HIV/AIDS, vaccine preventable diseases, chronic diseases and injuries); strengthening the public-health infrastructure; and advancing medical science through research.

This article provides an overview of contributions made by veterinarians in each of these areas, and discusses the challenges to be overcome and the need for strategic thinking and action to achieve the vision of “one medicine.”
Ikrar Veterinawan

....... saya bertekad akan menyumbang segenap daya dan pengetahuan saya bagi kebajikan masyarakat, mengekalkan sumber ternakan dan mengelakkan penderitaan kepada haiwan ......
Veterinary Medicine – Vet Public Health

- The biological relationship between animals and humans has never been more intertwined

- Veterinary medicine is a human-health activity

- In all aspects of the profession, veterinarians are obliged to and must actively, conscientiously, routinely protect and promote the health and well-being of man
“Between animal and human medicine, there is no dividing line – nor should there be. The objective is different but the experience obtained constitutes the basis of medicine” → One Medicine / One Health

(Rudolf Virchow)

“The final objective of veterinary medicine does not lie ..... in the animal species that the veterinarian commonly treats. It lies very definitely in man and above all in humanity”

(Martinez Baez)
Core domains of VPH

Include the following:

- diagnosis, surveillance, epidemiology, control, prevention and elimination of zoonoses in animals;
- food protection / safety of food of animal origin; meat inspection
- management of health aspects of laboratory animal facilities and diagnostic laboratories;
- biomedical research;
- disposal of animal carcasses and wastes
- production and control of biological products and medical devices
The multiple links veterinary medicine provides between medical sciences and agricultural sciences (Schwabe, 1964)
Areas in which veterinarians can contribute to public health

- Ensuring food security and safety, including protecting against development of antibiotic resistance
- Prevention and control of emerging infectious diseases and zoonoses → occupational, foodborne, pet borne and recreational activities related zoonoses
- Prevention and control of non-zoonotic / non-communicable diseases and injuries
- Protection of environment health
- Bioterrorism and agro-terrorism preparedness and response
- Advances in medical science
Zoonoses

- 1415 microbial species pathogenic for man
  - 538 bacteria and rickettsiae
  - 307 fungi
  - 217 viruses and prions
  - 353 parasites – 66 protozoa and 287 helminths

- 868 (66%) classified as zoonotic

- 175 are considered to be associated with emerging diseases
  Of these, 132 (75%) are zoonotic

Cleveland et al (2001)
Zoonoses

- Affect well-being of man – morbidity, mortality, anxiety
- Loss of animals – dead, culled / destroyed
- Loss of productivity – in humans; in animals - prevent efficient production of food
- Medical, veterinary costs
- Obstacles to international trade in animals and animal products

Social and economic losses
Modes of Transmission

Contaminated Biological material

- Fluids
  - Blood
  - Foetal Fluids
  - Vesicular Fluid
  - Exudates
  - Pus
- Excretions
  - Faeces
  - Urine
- Secretions
  - Milk
  - Saliva
- Products
  - Hides
  - Hair
  - Wool
  - Feathers
- Food
  - Meat
  - Poultry
  - Fish
  - Eggs
  - Dairy Products

Vector

- Environmental contamination
  - Air
  - Water
  - Pasture
  - Soil
  - Buildings
  - Fomites
  - Ectoparasites
  - Wild life

Modes of Transmission:

- Contact
- Ingestion
- Inhalation
- Inoculation

Human Population

- Contact
- Ingestion
- Projection
- Inhalation
• How does a person acquire plague?

• *Campylobacter* infection in man is frequently foodborne, associated with consumption of raw or undercooked chicken meat, milk ......
Plague from Eating Raw Camel Liver

Abdulaziz A. Bin Saeed,††
Nasser A. Al-Hamdan,† and Robert E. Fontaine†§

We investigated a cluster of 5 plague cases; the patients included 4 with severe pharyngitis and submandibular lymphadenitis. These 4 case-patients had eaten raw camel liver. Yersinia pestis was isolated from bone marrow of the camel and from jirds (Meriones libycus) and fleas (Xenopsylla cheopis) captured at the camel corral.

Human plague is acquired most often from the bites of infected fleas that leave their rodent hosts. Sporadic plague has also been attributed to domestic dogs and cats that may transport either Yersinia pestis in their mouths or infected fleas from rodent hosts to humans (1). Bubonic, pneumonic, or pharyngeal plague may develop in domestic cats and infect humans directly (2). However, humans rarely become infected when handling and preparing the carcases of wild animals (3). Although domestic cats and other carnivores may be infected by eating infected animals, only 1 previous report raises the possibility of human plague infection from eating meat of an infected animal (4).

The Study

In February 1994, we investigated a cluster of 5 plague cases in Goriat, a town of 50,000 persons in a remote desert area in northwestern Saudi Arabia. On February 18, a 26-year-old woman was admitted to the provincial hospital for severe pharyngitis and tonsillitis. Given the striking swelling of her neck, local clinicians suspected diphtheria. Since 2 of the patient’s relatives had also been hospitalized in the previous 2 days with similar illnesses, the hospital called for assistance from the local preventive medicine specialist. He had seen similar cases in 1984 and suspected pharyngeal plague.

Through interviews with physicians and review of hospital admissions, we identified 5 patients, including the index case, who had been hospitalized with suspected plague or plague pharyngitis. The patients included a 9-year-old girl and 4 adults (2 men and 2 women, age range 24–59 years) who developed in 1 patient on (39°C–40°C), chills, malaise, myalgias, vomiting, headache, and delirium. Leukocyte counts ranged from 11,000 to 88,000/μL. Chest radiographs were normal in all 5 patients. Four had severe pharyngitis; 3 of them had dysphagia, tender submandibular lymphadenitis, and tonsillar enlargement. The fourth patient, the 9-year-old girl, had severe abdominal pain and tenderness on abdominal palpation, profound hypotension (blood pressure 60/30 mm Hg), and a generalized hemorrhagic rash. This patient and the 26-year-old index patient (blood pressure 90/60 mm Hg) died. These 4 patients with pharyngitis did not have buboes or lymphadenitis at any other site. The patient without pharyngitis had axillary lymphadenitis and cellulitis of his right arm; he had cut his arm while killing a sick camel on February 13. None of the patients had skin lesions that suggested recent flea bites.

Y. pestis was isolated from the blood of the patient with pharyngitis who died and from the spinal fluid of the patient with abdominal pain. Identification was confirmed by phage lysis and direct fluorescent antibody staining. Indirect hemagglutination for plague was positive in convalescent-phase sera from the 3 survivors from whom Y. pestis was not isolated.

The patients were from 4 related families, 2 from Goriat and 2 from a village 20 km from this town. The adult family members denied seeing rodents around their homes or being bitten by fleas or other biting insects. All families owned camels. The male head of each family traveled to the desert daily to allow his camels to graze. These men reported that several of their camel’s had recently died. We observed 3 camel carcases in the desert near a corral where the camels were fed grain and hay to supplement their grazing.

The meat from the sick camel that had been butchered on February 13 was shared among 11 families (106 members). No other food was shared among these families. The 4 patients with pharyngeal plague were among 37 people who had eaten this camel meat; 1 patient with bubonic plague (the man who slaughtered the camel) was among the 69 people who had not eaten the meat (risk ratio [RR] 7.7, p<0.05, Fisher exact test). Moreover, pharyngeal plague developed in 4 of 6 patients who had eaten raw camel liver, but not in 31 persons who had eaten only cooked camel meat or liver (RR not defined, p<0.01, Fisher exact test).

We isolated Y. pestis from a sample of leftover camel liver from the sick camel, but we were unable to isolate it from the 3 camels seen by the researchers the day after the patient died. The sick camel was butchered and the meat was eaten by the patient, her daughter, and another family member. The 3 camels seen by the researchers the day after the patient died were still alive and healthy, and the harvesters at this corral reported that the sick camel had left the herd 2 days before the patient’s illness began.

We thank Dr. M. Durrani and Dr. R. Al-Arifi for assistance with the study. We are grateful to the contributions of Dr. M. Al-Khodari, Dr. F. Al-Hajleh, Dr. M. Al-Obaidi, Dr. M. Al-Hajleh, and Dr. M. Al-Hajleh, Dr. M. Al-Hajleh, Dr. M. Al-Hajleh.
Campylobacter coli Outbreak in Men Who Have Sex with Men, Quebec, Canada, 2010–2011

Christiane Gaudreau, Melissa Holferty, Jean-Loup Sylvestre, Robert Allard, Pierre A. Pilon, Michel Poisson, and Sadja Bekal

During September 2010–November 2011, a cluster of erythromycin-susceptible, tetracycline- and ciprofloxacin-resistant Campylobacter coli pulsovar 1 infections was documented, involving 10 case-patients, in Montreal, Quebec, Canada. The findings suggested sexual transmission of an enteric infection among men who have sex with men.

Campylobacter coli is the second most common species that causes human Campylobacter infections (1–3). Few studies have characterized the differences between the epidemiology and the disease of C. coli infections in comparison to C. jejuni subsp. jejuni infections (1–3). However, many studies have reported a higher macrolide resistance in C. coli than in C. jejuni (1–3). Few C. coli outbreaks have been reported to date (1–3).

The Study

A retrospective analysis, including the period from January 1, 2010 through December 31, 2011, identified 43 laboratory-confirmed cases of C. coli infections reported to the Montreal Public Health Department; among them, 40 cases with antimicrobial drug susceptibility results were further analyzed. Telephone interviews with the case-patients were conducted by using a standardized questionnaire pertaining to symptomatology of the illness, treatment, exposures, sexual orientation (including practices), and HIV status. The questionnaire was mailed to persons who could not be contacted by phone. Hospital charts for 9 or the 10 outbreak case-patients were reviewed retrospectively.

Statistical analyses, using Fisher’s exact test to calculate the possibilities, were conducted to test for differences in characteristics between case-patients infected with the outbreak etiologic agent, C. coli pulsovar 1, and those infected with nonoutbreak C. coli. In estimating the odds ratio from a 2 × 2 table that included a zero cell, 0.5 was added to the count in each cell. CIs were calculated by using Miettinen’s test-based method. Statistical analyses were conducted using SPSS software (http://www-01.ibm.com/software/analytics/spss/products/statistics/).

Phenotypic identification of Campylobacter isolates at the genus and species levels was confirmed by cmp60 gene sequencing at Laboratoire de Santé Publique du Québec. C. coli strains were identified by direct sequencing of PCR-amplified partial cmp60 sequences as described by Hill et al. (6). DNA sequences were determined with an ABI 3100 sequencer using a BigDye sequencing kit (Applied Biosystems, Foster City, CA, USA). The sequences were subjected to a BLAST analysis and aligned with the ClustalW program. Phylogenetic analysis was performed using the Lasergene software V6.1 (DNAStar, Madison, WI, USA).

Genetic relatedness was investigated by using pulsed-field gel electrophoresis with Smal according to PulseNet Canada procedures. Salmonella enterica serotype Braenderup strain H9812 was used as the marker size in each gel (7). For analysis, band position tolerance and optimization values of 1% were used. Similarity coefficient was obtained with the unweighted pair-group method with arithmetic averages. For strains exhibiting similar patterns with Smal, a second enzyme (KpnI) was used to confirm their pulsed-field gel electrophoresis pattern similarity. The PulseNet Canada Smal and KpnI pattern designations for the C. coli pulsovar 1 isolate are CASAI.0160 and CAKN1.0078, respectively.

Antimicrobial drug susceptibility testing was determined by using the disk diffusion method for erythromycin, tetracycline, and ciprofloxacin (8) and the Etest (AB Biodisk, Solna, Sweden) method for all 12 agents tested (9). β-Lactamase susceptibility was determined as reported (9).

From September 2010 through November 2011, in Montreal, 10 men, 26–57 years of age, were found to be
Convergence model developed to emphasize the complexity of interacting determinants favoring the emergence of pathogens (Smolinski et al., 2003).

Determinants contributing to the emergence of zoonotic disease agents
- Microbial/viral determinants (mutation, natural selection, and evolution).
- Determinants pertaining to the host (natural resistance, innate and acquired immunity).
- Natural determinants (ecologic, environmental, and zoonotic influences).
- Determinants pertaining to human activity (personal behavior, societal, commercial, and iatrogenic factors).
- Accidental or malicious release.

Rarely do these determinants act singly – in the 2003 IOM Report, *Microbial Threats to Health – Emergence, Detection and Response*, a “Convergence Model” was developed to emphasize the complexity of interacting determinants favoring the emergence of pathogens.

Of all these interacting determinants, those that contribute to the emergence of host range extensions, that is “species jumping” events leading to new zoonoses, may be the most important.
Confronting Zoonoses, Linking Human and Veterinary Medicine
Kahn, L.H. , Emerging Infectious Diseases 12 (4) 2006

- Many of the emerging infectious diseases, including those caused by bioterrorist agents, are zoonoses.
- **Since zoonoses can infect both animals and humans, the medical and veterinary communities should work closely together in clinical, public health, and research settings.** In the clinical setting, input from both professions would improve assessments of the risk-benefit ratios of pet ownership, particularly for pet owners who are immunocompromised.
- In public health, human and animal disease surveillance systems are important in tracking and controlling zoonoses such as avian influenza virus, West Nile virus, and foodborne pathogens.
- Comparative medicine is the study of disease processes across species, including humans. Physician and veterinarian comparative medicine research teams should be promoted and encouraged to study zoonotic agent-host interactions.
- These efforts would increase our understanding of how zoonoses expand their host range and would, ultimately, improve prevention and control strategies.
Many resource-limited and transitioning countries have not been able to respond to recent outbreaks of zoonotic diseases.

Control of zoonoses by interventions in animals need to consider societal and economic perspective.

Create a new global finance facility similar to Global Fund to fight AIDS, TB and malaria.
The approach aims to solve health problems at human-animal-environment interface

- It calls for strong multisectoral and multidisciplinary collaboration
- The need to develop research, service capacity and infrastructure to promote human-animal-environmental / ecosystem health

- 304 athletes, 189 from US and 26 other countries were contacted
- Multisport endurance race – jungle trekking, prolonged swimming and kayaking, spelunking (caving), climbing, mountain biking
- 10 day event – Aug 21 - Sept 1, 2000
- Sept 7 – 11, Idaho DoH reported 20 cases of febrile illness – high fever, chills, headache, myalgias; diarrhoea, joint aches, calf/leg pain, red eyes
- 80 (42%) met case definition – 29 were hospitalised; no death reported
• Serum collected from 38 → 26 positive to ELISA tests → 20 positive positive for anti-leptospiral antibodies by MAT

• Logistic regression analysis → swimming in Segama River (RR = 2.0) to be an independent risk factor

• Athletes who took doxycycline for malaria prophylaxis were less likely to become ill / doxycycline usage was protective although not significantly (RR = 0.4)

• Persons at high risk or travelling to high risk area for leptospirosis should consider preexposure chemoprophylaxis with doxycycline @ 200mg per oral per week
AWAS!

PENYAKIT
LEPTOSPIROSIS

WARNING!
LEPTOSPIROSIS
HEALTH HAZARD

FRESH WATER STREAMS AND MUD POSSIBLY POLLUTED WITH BACTERIA

SWIM OR HIKE AT YOUR OWN RISK
FOR MORE INFORMATION CALL HAWAII DEPARTMENT OF HEALTH
Toxoplasmosis

Toxoplasmosis is the 2nd leading cause of death from foodborne illness in the United States.

Learn more: www.cdc.gov/parasites/npi/

Toxoplasmosis
Do I Have to Get Rid of My Cat?
Sources of *T. gondii* infection in humans
Toxoplasma gondii and Schizophrenia
Torrey and Yolken, Emerging Infectious Disease, 2003, 9 (11):1375

- Recent epidemiologic studies indicate that infectious agents may contribute to some cases of schizophrenia. In animals, infection with Toxoplasma gondii can alter behavior and neurotransmitter function. In humans, acute infection with T. gondii can produce psychotic symptoms similar to those displayed by persons with schizophrenia.

- Since 1953, a total of 19 studies of T. gondii antibodies in persons with schizophrenia and other severe psychiatric disorders and in controls have been reported; 18 reported a higher percentage of antibodies in the affected persons; in 11 studies the difference was statistically significant.

- Two other studies found that exposure to cats in childhood was a risk factor for the development of schizophrenia. Some medications used to treat schizophrenia inhibit the replication of T. gondii in cell culture.

- Establishing the role of T. gondii in the etiopathogenesis of schizophrenia might lead to new medications for its prevention and treatment.
Cat-astrophic infection

Study finds feline parasite can drive humans to commit suicide

By LOH FOO FONG
foonfong@thestar.com.my

KUALA LUMPUR: Is a certain cat parasite driving people to commit suicide?

A recently published international report has linked women infected with the cat parasite Toxoplasma gondii (T. gondii) with a higher risk of suicide attempts.

A new Universiti Malaya study has also shed some light on the correlation.

Parasitologist Assoc Prof Dr Veeranoot Nissapatorn said that out of 226 mentally-ill patients screened for T. gondii, 76 or 33.6% of those with schizophrenia were infected.

“This figure is quite high,” said Dr Veeranoot, who carried out the study with University Malaya Medical Centre consultant psychiatrist Assoc Prof Jesjeet Singh Gill between 2008 and 2010.

Recently, the Archives of General Psychiatry 2012 reported that out of

There is growing evidence that the infection is closely related to schizophrenia.

- DR JESJEET SINGH

Researchers found a predictive link between the infection and suicide attempts later in life.

On whether the parasite had any influence on schizophrenic conditions in the local study, Dr Veeranoot said it could not be determined yet as the study was still at an early stage.

Dr Veeranoot said that blood screened from 226 patients showed the infection among those with bipolar disorder and major depression was extremely low - 0.13% and 0.18% respectively - while there was no infection found in cases of anxiety and organic brain syndrome.

Dr Jesjeet said “there is growing evidence that the infection is closely related to schizophrenia” and studies had shown that it might worsen the symptoms of the mental illness.

"For this reason, screening may be beneficial," he said, adding that such screenings were already available to pregnant women and those less capable of battling infections because their immune response was not functioning properly.

He said those with mental health problems, particularly schizophrenia, might have higher rates of toxoplasma infection compared to the general population because if their mental condition was untreated, they tend to have poor hygiene and nutrition and could develop infections.

UM Parasitology Department head Prof Dr Rohela Mahmud said the parasite concentrated mostly in the brain and eye and hence might interfere with brain functions.

She said treatment for the infection and vaccination of cats were available, adding that cats should be given cooked food instead of being allowed to eat mice as they too, might be infected with the parasite.

She said people should also ensure they washed their hands after touching cats.
A study done in Denmark 2012 showed an “alarming” finding that there was a possible relationship between schizophrenics and toxoplasmosis.

A newspaper reported a study conducted among schizophrenia patients in a university hospital in Petaling Jaya found 33.6% of 226 patients were infected by *Toxoplasma gondii*.

A similar study conducted in a hospital in Kajang found 51% of 88 schizophrenics were seropositive.
Hardy, free-living *Toxoplasma gondii* oocysts can be transported in freshwater runoff (blue arrow); they likely play a significant role in environmental transmission of *T. gondii* in terrestrial and aquatic systems. Domestic and wild felids are the only known source (red arrow) of *T. gondii* oocysts. Light gray arrows indicate possible routes of *T. gondii* transmission by exposure directly to oocysts or indirectly through food sources.

*VanWormer et al (2013)*
<table>
<thead>
<tr>
<th>Reporting period</th>
<th>Location</th>
<th>Predominant habitat type</th>
<th>Implicated source</th>
<th>Cases</th>
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<tbody>
<tr>
<td>1972</td>
<td>Panama</td>
<td>Rain forest</td>
<td>River</td>
<td>32</td>
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<tr>
<td>1977</td>
<td>Georgia, USA</td>
<td>Horse stable</td>
<td>Soil</td>
<td>37</td>
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<td>1980</td>
<td>Alabama, USA</td>
<td>Urban</td>
<td>Soil</td>
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<td>1995</td>
<td>Victoria, Canada</td>
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<td>Municipal water supply</td>
<td>100 (3000–7000 suspected)</td>
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<td>French Guiana</td>
<td>Rain forest</td>
<td>Unknown</td>
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<td>Urban</td>
<td>Municipal water supply</td>
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<td>2004–2005</td>
<td>Lublin, Poland</td>
<td>Farm</td>
<td>Well water</td>
<td>1 clinical (24 exposed)</td>
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<td>2004–2005</td>
<td>Coimbatore City, India</td>
<td>Urban</td>
<td>Municipal drinking supply</td>
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<td>1998–2006</td>
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<td>Surface water</td>
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<tr>
<td>Reporting period</td>
<td>Location</td>
<td>Implicated source</td>
<td>No. infected (percent of tested)</td>
<td></td>
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<tr>
<td>2001</td>
<td>Iauareté, Brazil</td>
<td>Unfiltered water</td>
<td>191 (73.5)</td>
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<td>2002</td>
<td>Rondonia, Brazil</td>
<td>Well or river water</td>
<td>195 (73.3)</td>
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<td>2003</td>
<td>Cascavel, Brazil</td>
<td>Homemade ice</td>
<td>161 (69.7)</td>
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<td>2003</td>
<td>Guatamala</td>
<td>Well water</td>
<td>215 (43)</td>
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<td>2003–2004</td>
<td>Democratic Republic of São Tomé and Príncipe</td>
<td>Unboiled water</td>
<td>375 (75.2)</td>
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<tr>
<td>2004</td>
<td>Aydin, Turkey</td>
<td>Non bottled water</td>
<td>185 (30.1)</td>
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<td>2004</td>
<td>Nunavik, Canada</td>
<td>Municipal and environmental waters</td>
<td>548 (59.8)</td>
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<td>2005</td>
<td>Fortaleza, Brazil</td>
<td>Homemade ice</td>
<td>666 (69.1)</td>
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<td>Thailand</td>
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</tr>
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• Free-range poultry (chickens, ducks, geese) are one of the best indicators for soil contamination with *T. gondii* oocysts

• Tissues of infected chickens, rodents are considered a good source of infections for cats

• Seroprevalence studies in Malaysia:

  humans (21-51% / 49%),
  **goats (35.5%)**, ducks (14.5%), cats (14.5%),
  chickens (10%), dogs (9.6%), cattle (6.3%),
  pigs (0%)

• Soil, water, meat, milk???
Antibiotic resistant bacteria
In most industrialized countries, pets are becoming an integral part of households, sharing human lifestyles, bedrooms, and beds. The estimated percentage of pet owners who allow dogs and cats on their beds is 14%–62%. However, public health risks, including increased emergence of zoonoses, may be associated with such practices and by being licked or kissing pets.

- a series of 23 cases of plague related to cat exposure
- a few documented cases of cat-scratch diseases have been associated with sleeping or being licked by a household pet.
- several reports describe human infections by Pasteurella spp. that were acquired after close contact with pets, including sharing a bed, being licked by, or kissing the pets.
- Capnocytophaga canimorsus infections in humans have been associated with being licked by or sleeping with a dog or cat.
- Others include Staphylococcus intermedius infection, methicillin-resistant Staphylococcus aureus Infections, a number of parasitic infections
Cases of TB in cats and cat-to-human transmission: risk to public is very low (2014; www.gov.uk)

Bartonella henselae in cats associated with cat-scratch disease.
B.h. in cats in:
- S’pore - 47.5%
- Thailand - 22.9%
- M’sia - 16.9%

Zoonotic Helicobacter in pet and food animals.
Cats – 16.6%
Chickens – 24.7%

H.felis, H. canis, H. suis, H. heilmannii, H. pullorum

H.pylori have been isolated from salivary secretions, gastric fluid and faeces of cats (Fox, 1999)

Increased occurrence of zoonotic sporotrichosis, Rhodococcus equi infections in cats and also in humans
Animal welfare – “The Five Freedoms”

→ Prevent animal cruelty

- Freedom from hunger and thirst
- Freedom from discomfort (i.e., having shelter)
- Freedom from pain and suffering from disease
- Freedom to express its normal behaviour
- Freedom from fear and distress

→ Is it not similar to human welfare and social well-being?

What's Missing From Your Patient's History?
Animal Abuse is Domestic Violence
• for certain agents, pets, wildlife, livestock could provide early warning
• for other agents, humans would manifest symptoms before detection in animals
• after attack, active surveillance could identify ongoing exposure risks
• if agents found their way into animal populations, they could spread rapidly and difficult to control → the need for active surveillance and intervention efforts
• “Zoonoses are among the most important animal and public health problems that affect the well-being of societies worldwide, yet they are too often forgotten or neglected.

• Most zoonoses go unrecorded, they call for a rethinking of research and control efforts and the economic consequences. The example of brucellosis demonstrates that interventions in livestock against zoonoses, which would never be cost-effective when uniquely assessed from a public health sector point of view, may become cost-saving when considered from a societal perspective.

• Creating a new global finance facility for the control of zoonoses, similar to or linked with the Global Fund to Fight AIDS, Tuberculosis and Malaria, is timely, is of global interest, and represents a further contribution to successful attainment of the Millennium Development Goal”

Involvement of Vets in medical world?

• VPH division in CDC as of 1947
• CDC has 89 vets to address not only infectious diseases but also entire spectrum of public health challenges

• MoH?
• IMR?
• Medical schools / faculties?
Thank you