#### PHARMACEUTICAL PRODUCT WITHDRAWAL PERIODS IN MONGOLIA:

#### **CURRENT SITUATION AND EFFORTS TO IMPROVE**

#### **KNOWLEDGE AND PRACTICES**

MPH Field Experience Presentation Kansas State University

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#### Outline

- Livestock Rearing and Veterinary Medicine in Mongolia
- V.E.T. Net Mongolia
- Objectives
- Activities
- Withdrawal Period Survey
  - Survey Methods and Limitations
  - o Survey Results
  - Next Steps
- Products
- MPH Coursework & the Field Experience





### Background to the Project

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### Livestock Rearing

- Nomadic lifestyle since before the time of Genghis Khan (12<sup>th</sup> century)
- Diet revolves around meat and milk products





























### Livestock Rearing

- Herds collectivized under Soviet Union
  - Herders told by the government how to manage the herds
  - Veterinary care provided by government
- Independence in 1990 → personal ownership of livestock, private veterinary services
- Current livestock numbers ~50 million head
- Number of animals = wealth, status





# **Veterinary Services**

- Private services
- Deworming (avermectins) and vaccinations paid for by government for the past couple years
   Undermines mindset of livestock as commodity worth investing in
- Veterinary education = 5 years
- 4,500 veterinarians in Mongolia
- Licensing system in process





# Meat and Milk Supply

- Herders: meat & milk harvested from own herd
  Wide variety of milk products
- Urbanites: combination of formal & informal markets
  - Formal markets (via slaughter plants, milk plants, retail outlets, etc.) account for ~20% of urban consumption
  - Informal markets meat or live animals
- Most slaughter occurs Oct-Dec
  Cold weather facilitates meat storage
- Export China, Russia, Middle East





#### Goat Slaughter Herder Style







### Drug Residue Regulations and Testing

- Emphasis at this point on meeting standards for export, especially to Europe
  - Currently unable to meet European requirements
  - Chloramphenicol residues in meat evidence of natural occurrence in plants
- Mongolian standards presently based on Codex Alimentarius Commission
- 2012: national program on drug residues passed, no funding yet





### Drug Residue Regulations and Testing

- Variation in WPs depending on formulation & which market the drug is produced for
- Some testing at slaughter plants
  - o eg, Makh Impex samples 4-5 animals / province / year
  - Thin ewes targeted for testing
  - Test for chloramphenicol, penicillin, ivermectin
- No enforcement mechanism
- Traceability difficult





# Access to Pharmaceuticals & Vaccines

- Licensing and registration system in place
- Since mid-1990's, supply has been growing
- Many products are imported illegally
- Wide variation in quality





### V.E.T. Net Mongolia

- Works with herders and veterinarians in Mongolia
  - Increase veterinary knowledge & expertise
  - Educate herders on various animal husbandry and veterinary topics
  - Registers and imports key high-quality veterinary drugs
- Facilitated my MPH field experience
  - Chose field experience focus perceived need for more attention to drug residues
  - Developed and conducted survey
  - Provided transportation and other support







- Identify knowledge of drug withdrawal periods among herders and rural veterinarians
- Identify herders' adherence to withdrawal periods when slaughtering and using milk products
- Use data to develop appropriate training curriculum to improve knowledge of and adherence to withholding periods





#### Activities

- Conducted surveys regarding knowledge, practices, and attitudes relative to withdrawal periods
  - 237 herders from 19 counties in 7 provinces in Mongolia
  - 63 veterinarians from 35 counties in 15 provinces
- Interviewed key informants
  - Numerous individuals at V.E.T. Net
  - Enkhtuya Tserendorj Head of Food Hygiene and Residue Testing Laboratory
  - Otgontungaa Chultemsambuu General Health Inspector, Makh Impex processing plant
  - Erdenekhuu Shagdarsuren Vice President of the Mongolian Veterinary Medical Association





#### Activities

- Attended training of trainers course (1 week) on participatory learning methods
- Developed Educational Materials on Withdrawal Periods
  - Presented to 3 groups of veterinarians & 1 group of herders
  - All seemed interested and eager to learn about the topic





#### Interview

#### Enkhtuya Tserendorj Food Hygiene and Residue Testing Laboratory













# Survey Methods

- Herders surveyed during educational sessions in the countryside
  - Demographic information (location, family size)
  - Herd information (number in herd, slaughtered/sold/lost/died)
  - Medicines used in last 6 months
  - Knowledge & practice of withdrawal periods (WPs)
- Veterinarians surveyed during equine continuing education seminar and travel to countryside
  - Demographic information (location, years in practice)
  - What they advise herders regarding WPs
  - Knowledge of WPs





### **Survey Limitations**

- Refusal to take survey or incomplete surveys
  - Often occurred after looking at survey
  - Seeming unfamiliarity with topic, possibly poor comprehension
- Geographical distribution uneven
  - Zavkhan province disproportionately high
- Lack of age in demographic information
  - Older herders may have more understanding of WPs because of Soviet influence
- Unfamiliar terminology
  - "Corticosteroid" on veterinary survey





#### Herder Survey Response Rates

 Of 237 surveys, 30 answered only about herd size or drugs used → excluded from analyses









#### Herder Survey Response Rates by Herd Size

Average Questions Answered by Herd Size







#### Herder Survey Geographic Distribution





http://www.ezilon.com/maps/asia/mongolia-maps.html

#### Herder Survey Geographic Distribution

**Herder Surveys Per Province** 



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#### Herder Survey Q1 - Herd Sizes

**Median Numbers of Animals by Province** 



#### Herder Survey Q2 – Drug Usage

Percent of Herders that have Used in Last 6 Months



#### Herder Survey Q2 – Drug Usage by Herd Size

#### Percent of Herders that have Used in Last 6 Months



#### Herder Survey

#### Q3 – Meaning of "Withholding Period"

| Question: What do you think the withholding period of a drug means?   |    | Including<br>Unanswered | Excluding<br>Unanswered |
|---|----|-------------------------|-------------------------|
| Answer  | #  | % (of 207)              | % (of 133)              |
| The amount of time it takes the drug to start working in the animal   | 9  | 4%                      | 7%                      |
| The amount of time you should wait to eat the meat or drink the milk of an animal that has been treated with a drug | 78 | 38%                     | 59%                     |
| The amount of drug that should be given to the animal based on the disease  | 5  | 2%                      | 4%                      |
| The amount of time that you can safely store the drug before it becomes ineffective                                 | 27 | 13%                     | 20%                     |
| Don't know  | 5  | 2%                      | 4%                      |
| Multiple Answers  | 9  | 4%                      | 7%                      |
| Unanswered  | 74 | 36%                     | V.E.T                   |

### Herder Survey

#### Q3 – Meaning of "Withholding Period"

#### **Factors Related to Correct Answers**

#### **Univariate Logistic Regression**

| Model      | Including Unanswered |                | Excluding Unanswered |                |
|------------|----------------------|----------------|----------------------|----------------|
| Variable   | p-value              | r <sup>2</sup> | p-value              | r <sup>2</sup> |
| Herd Size  | 0.0229               | 0.023          | 0.2096               | 0.010          |
| Drug Usage | 0.0001               | 0.066          | 0.0061               | 0.047          |

#### Multivariate Logistic Regression

| 3          | Including Unanswered   | Excluding Unanswered   |  |
|------------|------------------------|------------------------|--|
|            | r <sup>2</sup> = 0.076 | r <sup>2</sup> = 0.050 |  |
| Variable   | p-value                | p-value                |  |
| Herd Size  | 0.1200                 | 0.4450                 |  |
| Drug Usage | 0.0004                 | 0.0143                 |  |





#### Herder Survey Q3 – Meaning of "Withholding Period"



Categories with different superscripts are different at p < 0.05





#### Herder Survey Q3 – Meaning of "Withholding Period"



Categories with different superscripts are different at p < 0.05





#### Herder Survey

#### Q4 – Observance of Milk Withdrawal

| When your cow gets mastitis and you give it an injection of penicillin what do you usually do? |    | Including<br>Unanswered | Excluding<br>Unanswered |
|--|----|-------------------------|-------------------------|
| Answer   | #  | % (of 207)              | % (of 157)              |
| Keep milking it and consuming the milk   | 7  | 3%                      | 4%                      |
| Boil all the milk from the cow before consuming  | 47 | 23%                     | 30%                     |
| Only give milk to dogs or the calf for the next few days                                       | 44 | 21%                     | 28%                     |
| Throw the milk away for the next few days  | 37 | 18%                     | 24%                     |
| Other  |    | 3%                      | 4%                      |
| Wait 14 days / use at another time   | 5  | 2%                      | 3%                      |
| Multiple Answers   | 11 | 6%                      | 7%                      |
| Unanswered   | 50 | 24%                     |                         |
| Total Correct  | 86 | 42%                     | 55%                     |





#### Herder Survey Q4 – Observance of Milk Withdrawal

#### **Factors Related to Correct Answers**

**Univariate Logistic Regression** 

| Model      | Including Unanswered |                       | Excluding Unanswered |                |  |
|------------|----------------------|-----------------------|----------------------|----------------|--|
| Variable   | p-value              | <b>r</b> <sup>2</sup> | p-value              | r <sup>2</sup> |  |
| Herd Size  | 0.0786               | 0.012                 | 0.4115               | 0.003          |  |
| Drug Usage | 0.0253               | 0.019                 | 0.2901               | 0.005          |  |




### Herder Survey Q4 – Observance of Milk Withdrawal

**Correct Answers by Number of Drugs Used, Including Unanswered** 





### Herder Survey Q4 – Observance of Milk Withdrawal

**Correct Answers by Number of Drugs Used, Excluding Unanswered** 







## Herder Survey

### Q5 – Observance of Meat Withdrawal

| You have an animal that is wounded and have been giving it<br>antibiotic injections for a week. You gave the last injection yesterday.<br>The last few days the wound has become very bad and you decide to<br>kill the animal. What do you do with the meat? |     | Including<br>Unanswered | Excluding<br>Unanswered |
|---|-----|-------------------------|-------------------------|
| Answer  | #   | % (of 207)              | % (of 156)              |
| Use the meat for your family and friends  | 10  | 5%                      | 6%                      |
| Feed it to the dog but do not eat it yourself   | 43  | 21%                     | 28%                     |
| Try to sell the meat  | 10  | 5%                      | 6%                      |
| Leave the animal where it is and let the wild animals eat it  | 70  | 34%                     | 45%                     |
| Other   | 14  | 7%                      | 9%                      |
| Bury the animal / do not use  | 6   | 3%                      | 3%                      |
| Multiple Answers  | 3   | 1%                      | 2%                      |
| Unanswered  | 51  | 25%                     |                         |
| Total Correct   | 119 | 57%                     | 76%                     |



## Herder Survey

### Q5 – Observance of Meat Withdrawal

#### **Factors Related to Correct Answers**

Univariate Logistic Regression

| Model      | Including Unanswered |                | Excluding Unanswered |                |  |
|------------|----------------------|----------------|----------------------|----------------|--|
| Variable   | p-value              | r <sup>2</sup> | p-value              | r <sup>2</sup> |  |
| Herd Size  | 0.0045               | 0.042          | 0.1500               | 0.016          |  |
| Drug Usage | 0.0887               | 0.011          | 0.9908               | 0.000          |  |





### Herder Survey Q5 – Observance of Meat Withdrawal





### Herder Survey Q5 – Observance of Meat Withdrawal

#### **Correct Answers by Herd Size, Excluding Unanswered**





No differences significant at p =0.05



### Herder Survey

### Q6 – Where to Find WP Information

| Where would you go to find the information about |         | Including  | Excluding  |
|--|---------|------------|------------|
| a drug's withholding period?                     |         | Unanswered | Unanswered |
| Answer   | #       | % (of 207) | % (of 166) |
| A. I don't know                                  | 14      | 7%         | 8%         |
| B. I would ask my veterinarian                   | 94      | 45%        | 57%        |
| C. I would read the label on the bottle          | 40      | 19%        | 24%        |
| B & C  | 10      | 5%         | 6%         |
| D. I would ask my friends                        | 2       | 1%         | 1%         |
| E. Other   | 1       | 0%         | 1%         |
| Multiple Answers                                 | 5       | 2%         | 3%         |
| Unanswered                                       | 41      | 20%        |            |
| Total Correct                                    | 14<br>4 | 70%        | 87%        |

## Herder Survey

### Q6 – Where to Find WP Information

#### **Factors Related to Correct Answers**

Univariate Logistic Regression

| Model      | Including Unanswered |                       | Excluding Unanswered |                       |  |
|------------|----------------------|-----------------------|----------------------|-----------------------|--|
| Variable   | p-value              | <b>r</b> <sup>2</sup> | p-value              | <b>r</b> <sup>2</sup> |  |
| Herd Size  | 0.1903               | 0.008                 | 0.5892               | 0.003                 |  |
| Drug Usage | 0.0169               | 0.026                 | 0.2316               | 0.012                 |  |





### Herder Survey Q6 – Where to Find WP Information

**Correct Answers by Number of Drugs Used, Unanswered Included** 





### Herder Survey Q6 – Where to Find WP Information

**Correct Answers by Number of Drugs Used, Unanswered Excluded** 





### Herder Survey Relationships among WP Answers

| P-values | Unanswered Included |        |        | Unanswered Excluded |        |        |
|----------|---------------------|--------|--------|---------------------|--------|--------|
|          | Q4                  | Q5     | Q6     | Q4                  | Q5     | Q6     |
| Q3       | 0.0000              | 0.0000 | 0.0001 | 0.0547              | 0.0332 | 0.6564 |
| Q4       |                     | 0.0000 | 0.2008 |                     | 0.0498 | 0.3780 |
| Q5       |                     |        | 0.0000 |                     |        | 0.5403 |





## Herder Survey

### Q7 – Adverse Effects of Drug Residues

| What do you think could happen to you if you eat meat<br>and milk from animals that have recently been treated<br>with drugs? (Circle all that you think could happen) |        |         |
|--|--------|---------|
| Answer   | Number | Percent |
| Allergic Reaction  | 38     | 21%     |
| Cancer   | 31     | 17%     |
| Death  | 23     | 13%     |
| Diarrhea   | 15     | 8%      |
| Liver Problems   | 9      | 5%      |
| Nothing will happen  | 11     | 6%      |
| Seizures   | 5      | 3%      |
| Vomiting   | 14     | 8%      |
| Other  | 35     | 19%     |
| Total Correct  | 101    | 56%     |





# Herder Survey

### Q8 – Topics for Further Training

| Which 3 topics would you most like to receive |        |         |
|---|--------|---------|
| training about? (only circle 3)               |        |         |
| Answer  | Number | Percent |
| Increasing production                         | 75     | 18%     |
| Herd management                               | 49     | 12%     |
| Veterinary drug usage                         | 53     | 13%     |
| Business                                      | 45     | 11%     |
| Infectious disease control                    | 45     | 11%     |
| Fast Horse                                    | 41     | 10%     |
| Parasite control                              | 37     | 9%      |
| Neonatal care                                 | 38     | 9%      |
| Zoonotic diseases/public health               | 13     | 3%      |
| Nutrition                                     | 12     | 3%      |
| Other   | 8      | 2%      |
| Marketing                                     | 5      | 1%      |





### Herder Survey Q9 – Sources of Animal Attrition

|             | Median, # | Median,<br>% of herd | Minimum, % | Maximum, % |
|-------------|-----------|----------------------|------------|------------|
| Slaughtered | 10        | 6.1%                 | 0.4%       | 40.0%      |
| Sold        | 10        | 4.9%                 | 0.5%       | 28.2%      |
| Lost        | 2         | 1.6%                 | 0.4%       | 14.1%      |
| Died        | 5         | 2.8%                 | 0.2%       | 40.0%      |





## Summary of Herder Survey Results

- Factors associated with better knowledge & practices regarding withdrawal periods
  - Usage of more kinds of pharmaceutical products
  - More animals
- Relationship often disappears when unanswered questions are discarded
  - Impossible to know whether not answered because don't know or other reasons
- Though the factors are significant, high variation within groups indicates that all subsets of herders need WP education





### Veterinarian Survey Response Rates

- Of 65 surveys, 2 veterinarians were surveyed twice
  - Only first survey from each used



#### **Response Rate**





## Veterinarian Survey Geographic Distribution

#### **Veterinarian Surveys per Province**







### Q1 - Veterinary Advising on Milk WP

| You visit one of your herders that has a sick cow and<br>you give it an injection of Norocillin (penicillin). They<br>ask you if they should keep milking the cow and<br>drinking the milk. How do you respond? | Number | Percent |
|---|--------|---------|
| A. Keep milking it and consuming the milk   | 2      | 3%      |
| B. Boil all the milk from the cow before consuming  | 12     | 19%     |
| C. Only give milk to the calf for the next few days   | 13     | 21%     |
| D. Throw the milk away for the next few days  | 29     | 46%     |
| C & D   | 1      | 2%      |
| Unanswered  | 1      | 2%      |
| Other   | 5      | 8%      |
| 3 days milk withdrawal  | 2      |         |
| 7 days milk withdrawal  | 3      |         |
| Total Correct   | 48     | 76%     |

### Q2 – Proportion of Herders Following WPs

Percent of Veterinarians (n =62)



What percent of your herders do you think follow the withholding periods of drugs when consuming meat and milk products from treated animals?





### Q3 – Knowledge Base on Milk Withdrawal





Do you know what the withholding period is for drinking milk from animals that have been treated with Alamycin injection? \_\_\_\_ Days

### Veterinarian Survey Q4 – Drugs Most Commonly Used







## Drug Usage Comparison Between Surveys

#### Percent of Veterinarians Reporting Drug is Among 3 Most Common



#### Percent of Herders that have Used in Last 6 Months





### Q5 – Adverse Effects of Drug Residues

| What do you think could happen to you if you eat meat<br>and milk from animals that have recently been treated<br>with drugs? (Circle all that you think could happen) |        |         |
|--|--------|---------|
| Answer   | Number | Percent |
| Allergic reaction  | 22     | 23%     |
| Cancer   | 20     | 21%     |
| Death  | 3      | 3%      |
| Diarrhea   | 8      | 8%      |
| Liver problems   | 24     | 25%     |
| No problems  | 3      | 3%      |
| Seizures   | 2      | 2%      |
| Vomiting   | 6      | 6%      |
| Other  | 8      | 8%      |
| Total Correct  | 69     | 72%     |





## Veterinarian Survey Q6 – Importance of Teaching WPs

How important do you think it is to teach herders withdrawal times of drugs? (1-not important, 5-very important). Please honestly give your opinion.







### Next Steps Herder Education

- Herders key to implementing WPs
- Relatively more emphasis on milk withdrawal periods
  - Milk WPs observed less than meat WPs
  - Boiling milk is not enough need to discard it / feed to animals
- Treatment records
  - Including individual animal ID
  - Boost buyer confidence in quality of meat





### Next Steps Veterinarian Education

- Veterinarians key to consistently reminding herders of WPs
  - More frequent contact than any other single entity
  - More connected with most herders in an area
- Train veterinarians to consider WPs when deciding on treatment plan
- Address misconception that boiling milk is adequate





## Next Steps Regulation & Enforcement

- Progress is being made on regulations
- Reduce variation in WP's for each drug
- Creative solutions needed to address largely decentralized & informal marketing of meat and milk
  - Work towards more formalized markets
  - Develop reasonable protocols for sampling
- Appropriate enforcement
  - Improve traceability
- Needed for giving motive to educational efforts





### Products

 PowerPoint for veterinarians – why WPs are important

#### Penicillin (Norocillin)

Norocillin Desire to the Waracillin Desire to the Unit to the Unit

- Allergic reactions
  - 10 IU (0.6  $\mu g)$  / person can cause a reaction
  - 3-10% of individuals are allergic
  - Anaphylactic reactions have occurred from meat residues
    - Itching, severe difficulty swallowing & breathing
- Antibiotic resistance
  - Withdrawal period
    - Meat: 14 days
    - Milk: 3 days







### Products

Insert for Herder Handbook & Drug Catalog

#### Basic information about withdrawal periods

#### Table of WPs for drugs from V.E.T. Net

Drug residues in meat and milk can harm your health!

Possible health effects include:

- Allergic reactions
- Cancer
- Liver disease
- Infections that cannot be treated with antibiotics
- Bone marrow destruction
- Birth defects
- Death
- To avoid these effects, always observe the withdrawal period listed on the medicine or vaccine.
- The withdrawal period is the amount of time you should wait to eat the meat or drink the milk of an animal that has been treated with a drug. This time allows the animal to remove the medicine from their body.
- During the withdrawal period, throw away any milk from a milking animal (boiling it is not enough), and do not kill the animal for meat until after the withdrawal period.
- If you have any questions, ask your veterinarian.
- Some medicines do not have a withdrawal period, but always check.

#### Withdrawal Periods (# of Days) for V.E.T. Net Drugs

| Drug                |      | Cattle / Yaks | Sheep   | Goats   | Horses           | Camels | Pigs |
|---------------------|------|---------------|---------|---------|------------------|--------|------|
| Ecomectin 1%        | Milk | 14            | 14      | 14      |                  | 14     |      |
| Ivermeetin          | Meat | 35            | 42      | 42      | 21 (horse paste) | 42     | 28   |
| Ecomintic 100       | Milk | 5             | 5       | 5       |                  |        |      |
| Penbendesele        | Meat | 14            | 7       | 7       |                  |        |      |
| Ecotraz Plus        | Milk | 0             | 0       | 0       |                  |        |      |
| Four-on             | Meat | 7             | 7       | 7       |                  |        |      |
| Ecotraz 250         | Milk | 8 hours       | 8 hours | 8 hours |                  |        |      |
| Amitas              | Meat | 7             | 7       | 7       |                  |        | 1    |
| Ecotel 2.5%         | Milk | 0             | 0       | 0       |                  |        |      |
| Presiguentel        | Meat | 1             | 1       | 1       |                  |        |      |
| Norocillin LA       | Milk | 3             | 3       | 3       | 3                | 3      | 3    |
| Penicillin          | Meat | 14            | 14      | 14      | 14               | 14     | 14   |
| Alamycin LA         | Milk | 7             | 7       | 7       | 7                | 7      | -    |
| Oxytetracycline     | Meat | 28            | 21      | 21      | 28               | 28     | 14   |
| Norodine            | Milk | 7             | 7       | 7       | 7                | 7      |      |
| Trimethoprim Sulfa  | Meat | 21            | 21      | 21      | 21               | 21     |      |
| Tylbian 20%         | Milk | 3             | 2       | 2       |                  |        | -    |
| Tylosin, Фермалия   | Meat | 14            | 14      | 14      |                  |        | 21   |
| Kreolin<br>Crossole | Meat |               | 25      | 25      |                  |        | 15   |
| Elupixip            | Milk | 2             | 2       | 2       | (2)              | 2      |      |
| T IGHIAIN           | Meat | 14            | 14      | 14      | 28               | 14     |      |
| Phenylhutzana       | Milk | 14            | 14      | 14      | 14               | 14     |      |
| Phenyibutazone      | Meat | 40            | 40      | 40      | 40               | 40     |      |





## MPH Coursework & The Field Experience

- Understanding Withdrawal Period Issues
  - DMP 806 Environmental Toxicology
  - DMP 816 Trade and Agricultural Health
    - Trade issues surrounding drug residues
  - DMP 770 Fundamental Concepts in Emerging Pathogenic Diseases
    - Antibiotic resistance issues
  - DMP 895 Topics in Pathobiology (MS) Diagnostic Laboratory
    - Testing protocols
- Survey Data Analysis
  - STAT 704 Analysis of Variance
  - STAT 705 Regression & Correlation Analysis
  - DMP 830 Quantitative Analysis in Food Production Veterinary Medicine
  - o DMP 854 Intermediate Epidemiology





## MPH Coursework & The Field Experience

- Developing Educational Materials
  - KIN 818 Social and Behavioral Principles of Public Health
- Little perceived application
  - HMD 720 Administration of Health Care Organizations





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## Thank You! / Questions?







